
Welfare and Quantity of Life

Nuno H Franco*, Manuel Magalhães-Sant'Ana* and I Anna S Olsson.

Originally published in *Dilemmas in Animal Welfare*, CABI 2014

*These authors have contributed equally to this paper

1. ABSTRACT

The Animal welfare science is mostly focused on evaluating and improving the quality of life of animals that actually exist. This leaves out a range of ethically relevant issues regarding the quantity of life – in terms of number of animals living and the longevity of each animal. In many cases quantity and quality are related, and often there is a tension between the two. In this chapter, we develop a discussion around four practical cases presenting quality-quantity dilemmas: a) the issue of dairy cow longevity, b) the early slaughter of male dairy calves, c) the killing of newly-hatched male layer chicks and d) the conflict between reduction and refinement in animal research. The practical, economic and animal welfare aspects characterizing each case are presented together with relevant stakeholders' perspective. We discuss the cases in light of the most relevant currents of thought in animal ethics, highlighting the main values at stake and which possible solutions may be sought according to each perspective.

2. INTRODUCTION

Most of the attention in animal welfare science, be it in practical research or in theoretical discussion, is given to how animals live their lives, that is the quality of life. But dilemmas around the killing of animals also involve considerations of the value of life. This kind of discussion is perhaps most visible in companion animal medicine, where euthanasia may relieve a severely ill animal from further suffering but at the same time breaks a strong human-animal bond and leaves a grieving owner alone. It is the companion animal angle that Sandøe and Christiansen (2007) take as a starting point for their

analysis of the ethical issues at stake. However, related dilemmas arise in all fields of animal use. In this paper we rely on cases from farming and animal experimentation to widen the discussion.

In particular when moving outside of the companion animal field, the concept of quantity takes on two possible meanings: Quantity as lifespan (longevity) of individual animals and Quantity as the number of animals (at a given moment in time or accumulated numbers over time). Both of these aspects are relevant for a discussion on the value of animal life in farm and laboratory animals. In this chapter, we consider them both in discussing the following four dilemma cases:

- Dairy cow longevity where concern is arising over the decreasing lifespan of dairy cows, which seems to present a choice between more cows living less time (and possibly with worse welfare) or fewer cows living more time (and supposedly a better life)
- Male dairy calves which may be slaughtered at less than a week of age (thus having extremely short lives) or fattened for a few months under questionable conditions to produce veal (longer lives but of debatable quality)
- Male layer chicks that are typically killed at hatching and where the most plausible alternative to be developed seems to be a further shortening of this extremely short existence.
- Laboratory animals where the re-use of animals in multiple experiments and the principle of reduction of animal numbers give rise to dilemmas between quality of life and quantity of animals.

These dilemmas involve issues having to do with the quality and duration of the lives of animals that will be born and live, and the discussion will focus on these issues. However, some issues of whether or not certain animals would be brought into existence will also be addressed.

There are some more fundamental philosophical issues that are relevant for life and death decisions affecting animals but which go beyond the scope of this paper. These include the challenge of deciding whether the life of another individual of a different species is worth living, and questions having to do with whether animals have a will to live or a notion of the future and how having or lacking these concepts interacts with the harm caused by death. Others (e.g. Bruijn et al., 2012; Yeates, 2011) have addressed these questions in detail and we refer the interested reader to these texts.

To shed light on the four situations we consider the practical issues involved – such as the existence and feasibility of alternatives – in combination with the ethical issues at stake. We develop the discussion against the background of the major theoretical considerations around balancing quality and quantity, which implies considering the value of animal life, and also in the light of relevant surveys and focus group discussions.

3. FOUR PRACTICAL CASES

3.1 Longevity of dairy cows

There is widespread concern over a decrease in longevity of dairy cattle (although reversing trends have been reported (Farm Animal Welfare Council, 2009)). Before the intensification of farming practices during the second half of the 20th century there were records of Jersey cattle living more than 25 years (Odlum, 1950) but today it is common for Holstein cows to be culled at four years of age. The reasons for this dramatic decrease in life expectancy are multiple. It has been argued that they derive from the genetic selection of dairy cows for increased milk yield: high-producing dairy cows suffer from production diseases such as lameness, mastitis,

ketosis and reduced fertility (Oltenu and Broom, 2010) (and may also have other welfare problems: Figure 1). These diseases have great impact on the health and the welfare of animals and on their productivity. It is often the low economic viability that supports the decision of (early) culling. In a recent analysis of cattle mortality in France between 2003 and 2009 (and relying on a database of 75 million animals), Perrin and colleagues (2011) identified a peak of mortality in both beef and dairy cows at around three years of age. In beef cattle, killing the animal is a requirement for getting the product. In contrast, milk is produced by living animals, and the mortality peak at three years requires a different explanation; however, the cited study does not distinguish between different reasons for mortality. There is also a complex interaction between genetic progress, the availability of replacement heifers and decision-making over culling. A farmer may keep most or even all healthy heifers to ensure sufficient replacement, and for each heifer ready to calve the least productive cow in the herd will be culled. Considering genetic progress, the heifer can be assumed to be 'genetically superior' to the cow she replaces, so at the time point culling and replacement will be a sensible decision, even though in a larger perspective the decline in longevity driven by such decisions may be questionable (Erling Strandberg, personal communication).



Figure 1. Holstein-Friesian dairy cow conformation has changed over years of selective breeding, resulting in taller, longer and thinner cows. Note that the lying cow in this photo from a UK dairy farm is longer than the bedded stall. **Photo:** Manuel Magalhães-Sant'Ana.

The high-yield systems have a somewhat contradictory effect on the number of existing lactating cows: fewer animals are needed to produce the same amount of milk, but there is an increased need of replacement heifers to renew the short-lived animals. In Europe, the total volume of milk production has been constant for several decades, despite a gradual decline in the number of dairy cows that exist at any given time (Hocquette and Chatellier, 2011), a trend that can also be found in other developed countries (FAOSTAT, 2012). This has other consequences outside the dairy industry because, after slaughter, dairy cows provide meat and leather. The dairy sector represents 57% of global cattle meat production (FAO, 2010), although this figure includes bull calves of dairy breeds raised specifically for meat production.

Although duration of life is rarely considered an animal welfare issue, longevity can be used as an indicator of welfare. Bruijnjs and co-workers use the case of dairy cow lameness as a proxy to consider longevity as a constitutive element of animal welfare. They argue that an animal should be allowed to live long enough to have the opportunity to perform species-specific behaviours and to flourish, an important part of “natural living”, a concept they include in animal welfare (Bruijnjs et al., 2012). Natural living is a concept particularly pertinent within the context of organic farming, but Vonne Lund does not seem to include longevity as an element of natural living in her seminal paper (Lund, 2006). As we shall discuss later in this chapter, from an ethical perspective it makes a difference whether increased longevity means a longer life with the same health and welfare issues that (now, at least) partly motivate early culling, or a long life as a consequence of an improved health status.

The dairy cow longevity question and the male dairy calf question, discussed below, are related. Increasing cow longevity reduces the need for replacement heifers. This may make it economically viable for farmers to inseminate cows with the most desirable phenotype with sexed dairy breed semen to obtain replacement heifers and use semen from beef breeds for the remaining cows. With this approach, only those calves purposely bred to become replacement heifers would be of a full dairy type, whereas those that would go into meat production would be crossbred. However, the price for sexed semen is

roughly double that of normal semen, and many cows require multiple inseminations (reduced fertility being a production-related disorder). Therefore, as long as most female calves born are considered to be needed as replacement heifers, sexed semen is unlikely to be the preferred option and the problem of male calves of a dairy genotype is likely to persist.

3.2 The male dairy calf

With the increasing specialization of cattle breeds into dairy and meat production, the value of rearing dairy calves for meat production has decreased. This phenomenon has long been known in breeds with a traditional pronounced dairy phenotype such as Jersey, but is now increasingly also affecting the originally more dual-purpose Holstein-Friesian cattle. The practical consequences of this have not been taken to such extremes as in poultry production (see below), as male Holstein-Friesian calves are still being raised and slaughtered, but at least in some countries a considerable proportion of calves are killed during the first week of age, as raising them for later slaughter is not considered economical.

Contrary to many of the ethical issues in animal production, the birth of unwanted bull calves of dairy breeds is not a problem exclusive to large-scale modern intensive animal production. To produce milk, a dairy cow must give birth to a calf about once every year. Despite the changes in milk yield, growth rate and food turnover, ‘one lactation = one calf’ has remained unchanged since the beginning of dairy farming. To generate the same amount of milk from cows with a lower milk yield, more calves would have to be born. In her book *Animal Machines* (1964, p62), Ruth Harrison pointed out the problematic consequences of this dependency and gave figures for her era (in which the average UK dairy cow produced approximately half the amount of milk produced by an early 21st century cow (Oltenacu and Broom, 2010)):

An unavoidable characteristic of the rearing of animals is that approximately the same number of male and female off-spring will be produced. It follows that where cows are kept for milk there is the problem of what to do with male calves, many of which are not suitable for rearing as beef

because the strain has been developed primarily for its milking potential. It has been estimated that the surplus of unwanted calves, 'bobby calves', in this country amounts to some 800,000 to 1,000,000 yearly.

Not very different from 50 years ago, these calves go into one of three possible routes. They may be slaughtered as bob(by) calves, at only a few days of age, or they may be fattened for slaughter for production of veal (up to 8 months of age, according to European marketing regulations) or beef / young beef / rosé veal. To produce the characteristic, light coloured meat, veal calves are raised mainly on milk products, whereas calves slaughtered at an older age are fed a cereal-based diet (AVMA, 2008; Sans and de Fontguyon, 2009)

Of the estimated 30 million dairy calves born in 2008 in EU-27, just under 6 million (i.e. over 40% of male dairy calves) went into veal calf production. In Europe, this production is greatly dominated by two countries, The Netherlands and France. In other European countries, male dairy calves that are not slaughtered shortly after birth are either fattened until 8-12 months of age or exported to one of the veal production countries (Sans and de Fontguyon, 2009). In the USA, in terms of animal numbers veal production is fairly equally split between calves slaughtered a few days after birth and calves formula-fed until 16-20 weeks of age, with a slight majority of bobby calves (e.g. USDA, 2011).

Veal calf production is controversial because it is associated with a range of animal welfare issues, starting with the transport and comingling of week-old calves from different dairy farms, and followed by the specific rearing conditions and diet designed to produce the typical white veal meat. Whereas the most extreme housing conditions in which calves were crated or tethered in permanent darkness are now outlawed in Europe (European Union, 1997), single-housing and tethering throughout the fattening period is still widespread in the USA (AVMA, 2008). Across the world, veal calf production implies prolonging the period that calves are fed mainly liquid food (milk replacement) beyond what would be physiologically normal, and maintaining the animals with a low iron status. Even though present European legislation requires minimum provision of fibrous food, a

recent epidemiological study showed that poor rumen development and abomasal lesions are still frequent in calves from European white veal production (Brcsic et al., 2011)

Whereas the issue at stake in veal calf production is primarily feeding and housing conditions, slaughtering calves shortly after birth is controversial on the grounds of the extremely short life these animals are given. In combination, these issues motivated the RSPCA and Compassion in World Farming to convene a stakeholder forum to discuss actions to change the future of UK dairy calves. The early 21st century UK situation very clearly illustrates several aspects of the dilemma. As described by Ruth Harrison, there is a tradition of exporting bobby calves for veal production in continental Europe. During the years when this market was unavailable as a result of the BSE-motivated export ban on UK cattle, on-farm killing of male new-born calves increased, to the point that it had practically doubled by 2006, the year in which the ban was lifted. Nevertheless, even then an estimated 138,700 of the 438,000 male dairy calves born in the UK were killed on the farm (Beyond Calf Exports Stakeholder Forum, 2008). Such early on-farm killing of calves is usually combined with destruction of the carcass, thus the meat is not used for human consumption. Contrary to practice in Europe, the main route (91%) for Australian non-replacement dairy calves is commercial slaughter at 5-7 days: an estimated 700,000 calves a year are slaughtered this way (Animal Health Australia, 2011).

3.3 The male layer chick

Today's poultry production is highly specialized, to the extent that all commercial production is dominated by lines genetically selected for meat or egg-laying presented by a few multinational companies. The sex of the birds is an issue for production considerations in both meat and egg production, but while a female broiler chicken is still useful albeit slightly less productive than her male counterpart, male layer chicks are of no commercial value; they do not lay eggs and their slender bodies and slow growth make them unable to compete with broilers for meat production (even though this has

been tried¹). Day-old male chicks of layer lines are presently killed, either by exposure to CO₂ gas (after which carcasses can be used as animal feed) or by maceration (instant death but more limited use of the carcasses; see Leenstra et al., 2011 for a discussion of these alternatives).

Leenstra and collaborators (2011) investigated the view of Dutch citizens on how to manage male layer chicks in poultry production, using a combination of focus group interviews and an internet-based survey. Participants were asked to choose between and comment on ten alternative approaches divided into three main groups (Table 1).

The participants were unaware of the practice of killing day-old male chicks and were initially shocked to learn about it. When discussing the issue and the list of alternatives in focus groups, people considered a number of aspects, including animal-friendliness, naturalness, risks for human and animal safety but also practical considerations such as feasibility as well as resource and financial economics. No clear preferred option was evident, but “the study indicated that most people would support the pursuit of technological alternatives”, with the preferred technological alternatives being “i) looking into the fresh egg (to determine the sex of the egg and not incubate male eggs); ii) influencing the laying hens such that they produce fewer male eggs; and iii) using genetic modification to facilitate sexing fresh eggs”. Participants were also favourable to the idea of a dual-purpose type chicken, even though they recognized that this was not a very realistic option.

Of the alternatives presented by Leenstra and co-workers, only one is actually being considered for practical use: examining samples of incubating embryos in order to destroy male embryos. It is not yet in commercial use, but there seem to be only relatively

¹ Leenstra et al. (2011, pp37-8) report that “Experiments have been performed in a number of countries to rear layer-type males to a live weight of approximately 600 g and market them as an alternative for quail, or to a live weight of approximately 2,000 g and market them as an alternative to broiler chickens ... [but they] require virtually twice the amount of feed and three times as much time to reach the required bodyweight, compared to broilers.”

minor practical obstacles left before it would be feasible to implement this practice (Michael Clinton, personal communication, May 2012).

Technological solutions

Looking into the egg

1. Determining the sex of freshly laid eggs and not incubating male eggs
2. Determining the sex of early embryos and destroying the male embryos
3. Determining the sex of late embryos and destroying the male embryos

Changing the hen

4. Environmentally influencing the hens to produce fewer male eggs
5. Crossing the parents in such a way that male embryos are not viable

Genetic modification

6. To facilitate sexing of freshly laid eggs and not incubating male eggs
7. To make sex reversal of male embryos into female chickens possible
8. Such that male embryos die during early development

Other solutions

9. Accepting the current practice of killing day-old chickens
10. Less specialized chickens, so that the males can be used for meat production (dual purpose chicken)

Table 1. Potential ways to manage the problem of male chicks of layer breeds, which have no commercial or production value and are currently killed as day-old. After Leenstra et al. (2011)

3.4 Reducing, re-using and refining in animal experimentation

The use of animals for scientific purposes raises specific issues in regards to the value of life vs. quality of life. The restrictive conditions under which laboratory animals are housed are not worse (and sometimes better) than those in which production animals live, but the fact that animals in biomedical research are often intended to model disease presents particular challenges when it comes to providing “freedom from pain, injury or disease”. Therefore, it is sometimes not possible to provide laboratory animals with ‘a life worth living’ (see Yeates, 2011, for an overview of the origin of the concept). In such situations, early killing may be the most effective way to relieve welfare problems.

Fortunately, in most cases there are effective measures to reduce such distress and improve the wellbeing of animals used in research ("Refinement", one of the 3 Rs proposed by Russell and Burch, 1959) without compromising research results (Figure 2).



Figure 2. Repeated use of animals is not always in conflict with animal welfare. Dogs used in pharmacokinetic studies in which low doses of drugs are administered are an example of how research animals can be given long and healthy lives within the research setting.
Photo: Understanding Animal Research.

Some such refinements imply sharing the burden by several animals so that each animal is exposed to less accumulated distress. This is sometimes described as the "fairness to the individual" approach (Tannenbaum, 1999), but it conflicts with another of the 3Rs, "Reduction" (of animal numbers), as improving the wellbeing of each individual animal is done at the cost of using more animals (Olsson et al., 2012; de Boo et al., 2005). The practical situation in which this dilemma is most evident is in the choice between re-using animals from a previous experiment or using new animals. Another case where refinement and reduction collide is the choice between group housing and single housing of animals in

experiments requiring data at the cage level, such as in dietary research (Festing and Altman, 2002). Group housing of social animals is a refinement, but in this case the cage becomes the experimental unit and group housing will hence result in more animals used.

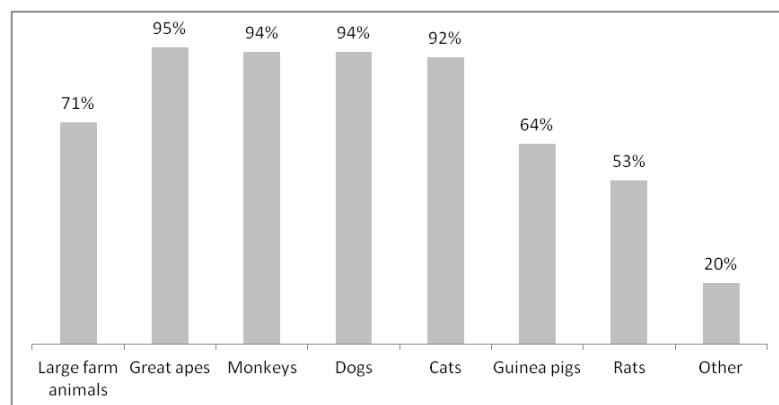
We presented such reduction-refinement dilemmas to 195 participants in eight laboratory animal science courses held in four different institutions; most (83% overall) would rather house mice in pairs than individually (Franco and Olsson 2014). Biology undergraduate students (n=71) with no experience in using animals in research responded in a similar way, with 85% favouring refinement and 15% favouring reduction (own unpublished data).

A more drastic reduction/refinement dilemma was presented to participants in 11 laboratory animal science training courses (n=235), who were asked to choose between two hypothetically equally valid approaches for a given experiment: (i) conducting twenty considerably painful procedures – but with no permanent damage – on the same mouse across 20 days, or (ii) conducting one single procedure per mouse on 20 mice. In both options, animals would be euthanized at the end of the experiments. This could be a realistic albeit drastic representation of the re-use situation. Answers to this dilemma were more evenly distributed (49% for using twenty mice; 51% for twenty trials with the same mouse). When asked what their approach would be for other species, regardless of their previous answer, almost every respondent chose the same approach for rabbits (99% of those who had chosen 20 trials on one mouse and 91% of those who had chosen to use 20 animals). However, when it came to dogs and primates, many of

Figure 3. Distribution of answers to the question: "Animals used in experiments are sometimes transferred to "sanctuaries", or even given for adoption – instead of being euthanized – when their research purpose ends and rehabilitation is possible. However, that is not the case for most species."

In your opinion, for which animal species should this kind of measure be considered, whenever possible?"

(From Franco and Olsson, 2014)



those who had previously opted for using 20 mice changed their approach, namely 31% for dogs, 21% for rhesus macaques and 38% for chimpanzees (32, 56 and 48% for biology undergraduate students). For these respondents, the way one values the life of a given animal versus the quality of life for each animal, appears to depend on which species the animal belongs to. Using large numbers of animals to avoid cumulative suffering is seen as a more acceptable approach for mice and rabbits than for primates and dogs. This was further substantiated by answers to a question about whether animals should be adopted or moved to sanctuaries after the experiment; rehabilitation was considered most important for companion animal species and non-human primates (Figure 3).

4. PHILOSOPHICAL PERSPECTIVES ON PRACTICAL CASES

After having introduced the central issues regarding the four case-studies, we move to an appraisal of each one in light of the animal ethics theories of more relevance for these cases. These include utilitarianism, animal rights theory, virtue ethics, relational perspective, contractarianism, Judeo-Christian morals and environmental ethics.

Utilitarian theory relies on the aggregate consequences of actions, i.e. the right action is the one that produces the best overall good. While hedonistic utilitarians like Bentham and Mill held that we should act to maximize net happiness (Singer, 2011), Peter Singer (2011, p13) has proposed that our actions should aim to do what on balance “furthers the interests of those affected.” In the utilitarian take on animal ethics, the capacity to experience suffering and pleasure is usually taken as the basis of interest (Singer, 1975). While quality of life certainly is central to utilitarian theory, that this line of thinking does not consider each individual life as valuable in itself has consequences for its view on killing as well as for bringing individuals into existence. Therefore, the short life-span of dairy cows can be seen as posing little ethical concern in itself as long as the life of one cow is replaced by the life of another milk producing cow. In this way the life of a sentient being is replaced by the life of an equivalent one and the end result is no more or no less

pleasure or suffering than if the same cow had been maintained for a longer life. Or in fact, there may even be a net gain, if the cow to be culled has health problems which imply pain and suffering such as lameness or mastitis (typical production-related diseases in dairy cows), whereas the heifer to replace her is healthy. However, this is not to say that a dairy production system in which cows only last one or two lactations is always unproblematic in utilitarian terms. If the health and welfare problems develop as the result of how cows are bred, fed or managed, this is clearly an issue of utilitarian relevance. A similar argument can be made in the case of male dairy calves. The consumer demand for white veal could (at least theoretically²) either be satisfied through slaughtering a greater number of dairy calves at a very early age (and consequently low weight), as in Australia, or by rearing these calves for longer as in Europe. And given the particular welfare problems associated with veal production, it may actually from the utilitarian perspective be better for a calf to live a very short but relatively painless life than to have to undergo first transport, often for long distances, and then rearing with an inappropriate diet. Interestingly, the proposed solution to avoid killing of day-old male layer chicks may actually remove this case from the realm of utilitarian moral preoccupation, at least if the arguments of Mellor and Diesch (2007) are accepted that chicks have very limited or even no conscious neural activity before hatching. As for the refinement-reduction conflict in laboratory animals, there is really no dilemma for the utilitarian; a greater number of animals living a less distressful life is clearly preferable to a smaller number of animals enduring more individual suffering.

In contrast to the utilitarian outlook, the value of animal life is central to animal rights theory. This approach is based on an extension of the Kantian concept of intrinsic value to all sentient beings, a view that inherently affords animals the right to be treated always as an end in themselves (Regan, 1989). Built into this right is the right to life, and therefore killing an animal is only acceptable under some very special circumstances: under extreme

² To test the practical feasibility would require simulations (taking into account the number of animals potentially available and considerable differences in slaughter weight of bobby calves and veal calves) that go beyond the scope of this chapter.

situations of self-defence when two rights to life stand against each other or when being killed is in the rights-holder's own interest. This view presents us with what appears to be the most compelling argument for favouring long lives. However, the animal-rights view would a priori reject both farming and experimentation on the grounds that animals are ends in themselves and cannot be used as means to an end. That is, from the animal rights perspective, maintaining a production animal is inadmissible, independently of its longevity. Still, having no dairy cows works for future cows but fails to address the lives of the existing ones; in order to preserve their rights, these animals would have to be housed in sanctuaries, with minimum human interference till the moment they would die from old age. Interestingly, this is what a recent UK initiative to produce Ahimsa milk, or slaughter-free milk proposes to do (www.ahimsamilk.org).

A second set of theories focuses primarily on the role of the human actor rather than on the animal as subject of the act. Virtue ethics proposes that moral conduct is based on the practice of fundamental virtues and the avoiding of vices, essentially seen from an anthropocentric perspective. Through a relational perspective on ethics, the moral status of animals is affected by the type of relationship humans establish with these (types of) animals. According to a relational point of view, we have much stronger moral responsibility towards animals in our care or to which we can closely relate than towards others (Sandøe and Christiansen, 2008; Palmer and Sandøe, 2011).

Good animal husbandry is essential in a virtue ethics perspective. A virtuous, responsible farmer provides his or her cows with the best possible care. The relational aspects are particularly important: animal husbandry implies a bond between the farmer and the animals. This bond is usually greater the longer it endures. In practical terms this means that a compassionate farmer would only break the bond for the benefit of the cows (e.g. enduring suffering) or because of the prospect of economic loss. The research animal issue may lead to very different conclusions, starting from a virtue ethics point of view, depending on one's overall view of the value of animal research. For a person who seriously questions that animal research is useful, supporting it would not be

virtuous, because if no good comes out of the research it must be considered unnecessary harm (Hursthouse, 2006). If one sees animal research as a sound means to develop therapies to cure or ease the burden of disease, than it becomes a moral imperative to carry on using animals, albeit as humanely as possible. The killing of animals used in experiments may be seen as a compassionate attitude if this is the best measure to avoid unacceptable suffering or if the scientific objectives are already met and the animals cannot be rehabilitated for re-use or re-homing. On the other hand, whenever the conditions so permit, allowing animals to go on living a life worth living may be seen as the virtuous thing to do.

The relational perspective gives humans moral duties primarily (or even exclusively) towards animals in human care or to which humans can in any way closely relate (like primates) but much less so (or not at all) towards others (Palmer and Sandøe, 2011; Sandøe and Christiansen, 2008). This explains why only 18% of European citizens disapprove of the use of mice in biomedical research, but 37% disapprove of the use of dogs and primates for the same purpose (Crettaz von Roten, 2012). This differentiation seems to have consequences also for determining the value of life – at least that seems a plausible interpretation of why researchers consider non-human primates and companion animals much more appropriate for rehabilitation (thus avoiding killing) than rodents. As the relational perspective also gives value to the human-animal relationship, it would also support keeping the same dairy cow for longer rather than replacing her. It is unlikely that such a relationship exists for newly hatched chicks or newborn dairy calves.

One influential approach going back to Hobbes is contract theory. In this, and in more contemporary versions of contractarianism such as defended by Jan Narveson and others, animals have no moral standing. The underlying idea of contractarian ethics is that moral obligations derive from the mutual agreement between different parties. As animals can neither claim their rights nor demand any duties from humans, the classical contractarian perspective on animals is that any animal's life and welfare are relevant only in so far as they matter to other humans. However, some animal ethicists have

described the human relationship with farm animals in terms of a contract (Lund et al., 2004; Rollin, 2008) in which the animals are actually partners. Such a tacit partnership could also fit into a contemporary Christian perspective on animals. The Judeo-Christian tradition assigns humans dominion over creation (from Genesis 1:26-30), but there are different interpretations of how this dominion should be exerted (Fellenz, 2007). The despotic perspective rests on the assumption that nature, including animals, was created by God to serve humans, whereas the stewardship perspective emphasizes the human responsibility to take care of Creation (Barad-Andrade, 1991). The official standing of the Catholic Church today is much closer to the stewardship view, in stating that “animals, by their mere existence ... bless [man] and give him glory. Thus men owe them kindness” (The Holy See, 1993. Part Three, Section Two, Chapter Two, Article 7:2416). Moreover, although the use and killing of animals for food, clothing and research is seen as legitimate – and therefore not sinful – the Church clearly points out that this must be done within limits and in such a way as to avoid unnecessary suffering (The Holy See, 1993). The best option in a quantity-quality dilemma will again depend on the situation; these theories give no standard recommendations either way.

A concrete example of how a classical contractarian attitude may affect the issue of longevity is patent in article 26 of the 63/2010/EU directive, which states that “animals such as dogs and cats should be allowed to be rehomed in families as there is a high level of public concern as to the fate of such animals” (European Commission, 2010). Thus, to meet the implicitly contracted obligations towards citizens and voters, governmental agencies grant special protection to specific groups of animals, in virtue of their value in the eyes of the public. As regards dairy farming, the acceptable life span of the animal is a direct result of its productivity, from a classic contractarian point of view. If increasing the turnover of their livestock is in the interests of farmers, then that is the right thing to do. Maintaining the profit margins and obligations towards retailers and consumers are arguments used by farmers to justify farming practices with high turnovers. On the other hand, such obligations towards consumer demands can be drivers for less intensive animal farming regimes, as a

result of increasing public concern for animal welfare, of which the biological (organic) dairy and meat are an example. Contract theories that include animals as partners would rather favour allowing these animals to live longer, at least if their health and welfare would permit it, in a similar way as in virtue ethics (see above).

From a modern Judeo-Christian perspective, cruel treatment of animals is of more ethical concern than the sacrificing of animal lives. Humans are entitled to use animals, but inflicting unjustified, avoidable suffering is morally condemnable. Some factory farming practices – such as the artificial fattening of geese for foie gras production and battery caging of laying hens – have even been explicitly condemned by theologian Joseph Ratzinger, later pope Benedict XVI (Ratzinger and Seewald, 2002). Industrializing animal production to the extent that animals are treated as mere instruments is a degradation of the animals’ nature and place in Creation and hence an abuse of the stewardship granted to humans. Such instrumentalization may correspond to the dairy cow case when production means that cows are regularly culled after only one or two lactations, possibly because they are no longer considered sufficiently productive to be maintained in the herd. As for male dairy calves, their birth is a natural and unavoidable consequence of dairy production, and thus slaughter of bobby calves for food is ethically preferable to rearing them under conditions which are detrimental to their welfare. Veal production, however, if conducted in such a way that animals are provided a good life, is not in itself immoral. As regards laying hens, industrialized practices for sorting and destroying male chicks may be seen as a degradation of animals to mere disposable commodities. Early identification of male embryos or, alternatively, rearing of males for food despite their low productivity, seem to be more in line with modern Christian standing on the ethical treatment of animals and respect for the animals’ nature and purpose. Following the same rationale, the Christian view on the use of animals in biomedical research is that it is justified as long as it is conducted humanely and directed towards the benefit of human health (Pacholczyk, 2006). In that sense, animal welfare takes precedence over longevity or whatever number of animals is used, and thus our actions should favour refinement, when in conflict with reduction.

Environmental ethics suggest that we should take into consideration more global issues of nature and not only the particular aspects of life and welfare of individuals. Such considerations rarely give a direct answer to the question of quantity versus quality, but may have indirect implications. It could be argued that the present approach of genetic selection of cattle with strong focus on milk yield fails in respecting the nature of the cow: cows are very different from their ancestors (taller and thinner, with larger udders) and less fit to live natural lives. The loss of gene pool diversity also means that the species may have lost valuable traits needed to adapt to changes in the environment. Dual-purpose breeds and breeds with greater genetic diversity would be preferable from this perspective as regards both cattle and poultry. However, some environmental ethicists consider domesticated species so dependent upon humans and detached from nature that they are more of an artefact than rightful members of the natural world (Palmer and Sandøe, 2011). From this perspective, measures to improve production efficiency may actually be an advantage if this lessens the negative environmental impact on production. Within an environmental perspective, issues such as sustainability and resource management also need to be taken into account. Animal production has a substantial impact in global water footprint (Mekonnen and Hoekstra, 2010) and carbon footprint (Flysjö et al., 2012; FAO, 2010), and some have suggested that increasing the longevity in dairy cows could lessen the environmental footprint by reducing “the replacement rate and the number of non-productive animals” (Boichard and Brochard, 2012, p 548). However, an overall evaluation must also include the environmental consequences of shifting meat production from dairy to beef herds. It is unclear whether such an assessment is possible with existing methods for assessing environmental impact of livestock products (see de Vries and de Boer, 2010 for a review of life cycle assessments of livestock products).

5. DISCUSSION

In this paper we have discussed four real-life cases in which there is some sort of conflict between the quality and the duration of life. We have used different philosophical theories to shed light on the issues at stake, providing different answers to what the best solution may

be to the different dilemmas. Similarly, studies of public perception show a diversity of views both among the general public and among specialists. Whereas there may be some “wrong” answers, it is less likely that there will be a single “right” answer to any of the dilemmas. In fact, this is exactly what characterizes a moral dilemma: there is no answer to it which does not carry its own ethical cost.

Traditionally, research and practical efforts in animal welfare have been focused on avoiding suffering, and the importance of positive experiences have really only been highlighted during the last decade (e.g. Boissy et al., 2007; Yeates and Main, 2008). This is probably reflected in some bias towards anti-suffering considerations in the analysis presented in this paper, with relevant consequences for how the quantity-quality dilemma is approached. In its most extreme form, focusing on avoiding suffering may make it “morally right to kill off everybody to prevent them from suffering” (Sandøe and Christiansen, 2007, p548). In contrast, much of the moral concern over calves and chicks being killed shortly after birth / hatching is probably derived from the notion that these animals were never given the opportunity to live and to experience the good things of life.

There is also some bias towards the (more concrete) question of how to handle existing animals, as opposed to the (more abstract) question of which animals should come into existence. In many cases, the concrete question could have been avoided if the abstract question had actually been addressed. This is true for two of our four cases: with existing technology (sexed semen) dairy farmers can be sure that mostly heifers are born and technology may also (at least in the future) prevent the conception of male layer-type chicks. Of course, whether this distinction is at all relevant depends on whether there is a fundamental difference between terminating a life early and not allowing a life to start (c.f. Bateson, 2013 for a related debate). Society certainly seems to distinguish between terminating a life and not allowing it to start if the life is human: people are generally free to choose whether to have children but are not allowed to kill each other. There are also important differences in terms of resources needed to generate a full-term young and, at least in the case of mammals, in the pain and distress

associated with birth and separation of mother and young.

6. CONCLUSIONS

There are real-life cases in which there is some conflict between the quality and the duration of life.

In dairy cows, the increase in milk production has been accompanied by an increase in production-related diseases; both longevity and quality of life are decreasing. Male dairy calves are of little value for rearing as beef; these calves are typically killed during the first week of life, experiencing very little life at all, or are reared for veal production under conditions of low quality of life.

Dairy cow longevity and male dairy calves raise interconnected questions. Improved cow longevity would potentially make it economically viable for farmers to combine insemination with sexed dairy semen to generate replacement heifers, with meat breed insemination for the remaining reproduction, thus ensuring that only those calves that would become replacement heifers were of a full dairy type, whereas those that would go into meat production would be crossbred.

Male layer chicks have no commercial value. They are killed as soon as the sex can be determined, presently as day-old. Several alternative approaches have been discussed but the only economically realistic alternative under consideration seems to be killing at an even earlier time, i.e. before hatching.

In research using animals, there is sometimes a dilemma between striving to reduce total numbers of animals and to reduce the impact on individual animals, highlighted by the potential to re-use animals in different procedures. Among scientists, there is no consensus of which of these principles should be given priority.

7. QUESTIONS FOR DISCUSSION

1. Imagine that you are responsible for running a zoo. A choice must be made between letting the lions have cubs every summer (and later euthanizing the surplus) or using reproductive control so that the lions only have offspring when needed to renew the population. Which policy would you prefer and why?
2. Is there something like a minimum appropriate duration of life – how long a life needs to be to be meaningful?
3. Cow longevity seems to be affected both by selective breeding (genotype) and by management practice. What can farmers do to influence the longevity of their cows? Are there other relevant actors?
4. Laboratory rodents are usually euthanized at the end of experiments, whereas more efforts are made to keep larger animals for longer periods of time. What are the advantages and disadvantages for the animals? What reasons are there to make a difference between species?

ACKNOWLEDGMENTS

Thanks to Michael Clinton, Roslin Institute, for providing information on the feasibility of different technological alternatives to the killing of day-old chicks, to Eddie Bokkers, Wageningen University, for input on veal calf production and welfare, to Erling Strandberg, Swedish University of Agricultural Sciences, for input on dairy cow longevity, and to Jean-Baptiste Perrin, Institut National de la Recherche Agronomique, for the additional information on mortality of dairy cattle. Thanks also to the editors as well as to the authors of other chapters of this book that participated in the workshop held in Vienna in August 2012 for constructive criticism. The data on researcher attitudes come from Nuno Franco's PhD project funded by the Fundação para a Ciência e a Tecnologia (SFRH/BD/38337/2007). Manuel Sant'Ana is in receipt of a doctoral grant from Fundação para a Ciência e a Tecnologia (SFRH/BD/ 46879 / 2008).

REFERENCES

- Animal Health Australia (2011) Australian Animal Welfare Standards and Guidelines - Land Transport of Livestock. Proposed Amendment to the Land Transport of Livestock Standards (SB4.5). Bobby Calves Time Of Feed Standard. Decision Regulation Impact Statement (As at 6/7/2011) Edition 1.0. R
- AVMA. (2008) Welfare Implications of the Veal Calf Husbandry [online]. Available: <https://www.avma.org/KB/Resources/Backgrounders/Pages/Welfare-Implications-of-the-Veal-Calf-Husbandry-Backgrounder.aspx> Accessed 14 January 2013.
- Barad-Andrade, J. (1991) Stewardship: Whose Creation Is It Anyway? *Between the Species* 7, 102-109.
- Bateson, P. (2013) Debate: 'Is it Better to Have Lived and Lost than Never to Have Lived at All?'. In: Wathes, C., Corr, S., May, S., McCulloch, S. and Whiting, M. (eds.) *Veterinary and Animal Ethics: Proceedings of the First International Conference on Veterinary and Animal Ethics*. Wiley-Blackwell, London, pp. 286-299.
- Beyond Calf Exports Stakeholder Forum (2008) Report on conclusions and recommendations. <http://calfforum.rspca.org.uk/web/calfforum/reports> Accessed 7 June 2013.
- Boichard, D. and Brochard, M. (2012) New phenotypes for new breeding goals in dairy cattle. *Animal* 6, 544-550.
- Boissy, A., Manteuffel, G., Jensen, M.B., Moe, R.O., Spruijt, B., Keeling, L.J., Winckler, C., Forkman, B., Dimitrov, I., Langbein, J., Bakken, M., Veissier, I. and Aubert, A. (2007) Assessment of positive emotions in animals to improve their welfare. *Physiology & Behavior* 92, 375-397.
- Brcsic, M., Heutinck, L.F.M., Wolthuis-Fillerup, M., Stockhofe, N., Engel, B., Visser, E.K., Gottardo, F., Bokkers, E.A.M., Lensink, B.J., Cozzi, G. and Van Reenen, C.G. (2011) Prevalence of gastrointestinal disorders recorded at postmortem inspection in white veal calves and associated risk factors. *Journal of Dairy Science* 94, 853-863.
- Brujinis, M.R.N., Meijboom, F.L.B. and Stassen, E.N. (2012) Longevity as an Animal Welfare Issue Applied to the Case of Foot Disorders in Dairy Cattle. *Journal of Agricultural and Environmental Ethics*. (Online First)
- Crettaz von Roten, F. (2012) Public perceptions of animal experimentation across Europe. *Public Understanding of Science*. (Online First)
- de Boo, M.J., Rennie, A.E., Buchanan-Smith, H.M. and Hendriksen, C.F.M. (2005) The interplay between replacement, reduction and refinement: considerations where the Three Rs interact. *Animal Welfare* 14, 327-332.
- de Vries, M. and de Boer, I.J.M. (2010) Comparing environmental impacts for livestock products: A review of life cycle assessments. *Livestock Science* 128, 1-11.
- European Commission (2010) Directive 2010/63/EU of the European Parliament and of the Council of 22 September 2010 on the protection of animals used for scientific purposes. *Official Journal of the European Union* L 276 Vol. 53, 33-79.
- European Union (1997) Council Directive 97/2/EC of 20 January 1997 amending Directive 91/629/EEC laying down minimum standards for the protection of calves. *Official Journal of the European Communities* L 025, 24-25.
- FAO (2010) Greenhouse Gas Emissions from the Dairy Sector - A Life Cycle Assessment. Food and Agriculture Organization of the United Nations, Rome.
- FAOSTAT (2012) Trends in the livestock sector. *FAO Statistical Yearbook 2012*. Food and Agriculture Organization of the United Nations, 198-201.
- Farm Animal Welfare Council (2009) Opinion on the welfare of the dairy cow. <http://www.fawc.org.uk/pdf/dcwelfar-091022.pdf>
- Fellenz, M.R. (2007) Broader Philosophical Considerations. *The Moral Menagerie: Philosophy And Animal Rights*. University of Illinois Press, Illinois, pp. 33-56
- Festing, M.F. and Altman, D.G. (2002) Guidelines for the design and statistical analysis of experiments using laboratory animals. *ILAR J* 43, 244-258.
- Flysjö, A., Cederberg, C., Henriksson, M. and Ledgard, S. (2012) The interaction between milk and beef production and emissions from land use change - critical considerations in life cycle assessment and carbon footprint studies of milk. *Journal of Cleaner Production* 28, 134-142.
- Franco, N. and I. Olsson (2014). "Scientists and the 3Rs: attitudes to animal use in biomedical research and the effect of mandatory training in laboratory animal science." *Laboratory animals* 48(1): 50-60.
- Harrison, R. (1964) *Animal machines*. Vincent Stuart Ltd, London.
- Hocquette, J.-F. and Chatellier, V. (2011) Prospects for the European beef sector over the next 30 years. *Animal Frontiers* 1, 20-28.
- Hursthouse, R. (2006) Applying Virtue Ethics to Our Treatment of the Other Animals. In: Welchman, J. (ed.) *The Practice of Virtue: Classic and Contemporary Readings of Virtue Ethics*. Hackett Publishing Co., Indianapolis, pp. 136-154.
- Leenstra, F., Munnichs, G., Beekman, V., van den Heuvel-Vromans, E., Aramyan, L. and Woelders, H. (2011) Killing day-old chicks? Public opinion regarding potential alternatives. *Animal Welfare* 20, 37-45.
- Lund, V. (2006) Natural living—a precondition for animal welfare in organic farming. *Livestock Science* 100, 71-83.
- Lund, V., Anthony, R. and Rocklinsberg, H. (2004) The ethical contract as a tool in organic animal husbandry. *Journal of Agricultural & Environmental Ethics* 17, 23-49.
- Mekonnen, M.M. and Hoekstra, A.Y. (2010) *The green, blue and grey water footprint of farm animals and animal products. : volume 1: main report*. UNESCO-IHE, Delft.
- Mellor, D.J. and Diesch, T.J. (2007) Birth and hatching: Key events in the onset of awareness in the lamb and chick. *New Zealand Veterinary Journal* 55, 51-60.
- Odlum, G. (1950) Longevity in dairy cattle. *Farmers' Weekly* 32, 54.
- Olsson, I.A.S., Franco, N.H., Weary, D.M. and Sandøe, P. (2012) The 3Rs Principle - Mind the Ethical Gap! *ALTEX* 29, 333-336
- Oltenu, P.A. and Broom, D.M. (2010) The impact of genetic selection for increased milk yield on the welfare of dairy cows. *Animal Welfare* 19, 39-49.
- Pacholczyk, T. (2006) Animal Rights vs Human Rights. *Making Sense out of Bioethics* [Online]. Available: <http://www.ncbcenter.org/Page.aspx?pid=288> Accessed 14 January 2013.
- Palmer, C. and Sandøe, P. (2011) Animal ethics. . In: M. C. Appleby, J. A. Mench, Olsson, I.A.S. and Hughes, B.O. (eds.) *Animal Welfare. 2nd edition*. Cambridge University Press, Cambridge, pp. 1-12.
- Perrin, J.-B., Ducrot, C., Vinard, J.-L., Hendrikx, P. and Calavas, D. (2011) Analyse de la mortalité bovine en France de 2003 à 2009. *Inra Productions Animales* 24, 235-244.
- Ratzinger, J. and Seewald, P. (2002) *God and the World: Believing and Living in Our Time : a Conversation with Peter Seewald*. Ignatius Press, San Francisco.
- Regan, T. (1989) The case for Animal Rights. *Animal Rights and Human Obligations - Second Edition*. Prentice Hall, New Jersey, pp. 105-114.

- Rollin, B. (2008) The ethics of agriculture: the end of true husbandry. In: Dawkins, M.S. and Bonney, R. (eds.) *The future of animal farming: renewing the ancient contract* Blackwell Publishing, Oxford, pp. 7-20.
- Russell, W.M.S. and Burch, R.L. (1959) *The principles of humane experimental technique* Methuen & Co. Ltd, London.
- Sandøe, P. and Christiansen, S.B. (2007) The value of animal life: how should we balance quality against quantity? *Animal Welfare* 16, 109-115.
- Sandøe, P. and Christiansen, S.B. (2008) *Ethics of Animal Use*. Blackwell Publishing, Oxford.
- Sans, P. and de Fontguyon, G. (2009) Veal calf industry economics. *Revue de Médecine Vétérinaire* 160 420-424.
- Singer, P. (1975) *Animal liberation: a new ethics for our treatment of animals*. New York review: distributed by Random House, New York.
- Singer, P. (2011) About Ethics. *Practical Ethics (Third Edition)*. Cambridge University Press, Cambridge, pp. 1-15.
- Tannenbaum, J. (1999) Ethics and pain research in animals. *ILAR Journal* 40, 97-110.
- The Holy See (1993) *Catechism of the Catholic Church*. Libreria Editrice Vaticana, Vatican City.
- USDA (2011) Estimated Calf Slaughter Under Federal Inspection. *Annual Meat Trade Review*, Livestock and Grain Market News Service, Des Moines, pp 12.
- Yeates, J.W. (2011) Is 'a life worth living' a concept worth having? *Animal Welfare* 20, 397-406.
- Yeates, J.W. and Main, D.C.J. (2008) Assessment of positive welfare: A review. *The Veterinary Journal* 175, 293-300.