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GENOME EDITING FOR FARM ANIMAL WELFARE IN A NON-IDEAL WORLD

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ABSTRACT
The welfare of factory farm animals is deplorable. Animal ethicists have been criticising this for years, but the question of how to make livestock farming a more animal-friendly practice – especially on a global scale – remains unanswered. The technological 'improvement' of farm animals through genome editing techniques is being discussed as an option to protect animals from suffering, stress and impairment. However, this approach raises serious ethical questions. It is not just a morally problematic "technological fix". Worse, even if the projects do improve animal welfare, they will not change the situation in any significant way. Continuing with such breeding practices would most likely result in its perpetuation.This raises the question of how to evaluate actions that contribute to the perpetuation of a morally problematic practice, but which in some respects represent an improvement on the status quo. To answer this question, we propose a position of pragmatic reformism drawing on John Rawls' distinction between ideal and non-ideal theory.

KEYWORDS
Pragmatic Reformism, Non-Ideal Theory, Welfare, Principle of Equal Consideration of Interests (PECI), Agricultural Change

1. INTRODUCTION

Most farm animals are kept in industrial conditions. Their lives are almost entirely determined by production interests. They are unable to move and interact properly. Their social lives are restricted. Production conditions put them at high risk of injury or infectious diseases. In addition, some procedures performed on them by humans cause pain and distress. Cattle are dehorned, birds have their

beaks cut off, piglets are castrated, chicks are shredded or gassed. The list could easily go on. Factory farm animals suffer in many ways and their lives are short.

Animal ethicists have been criticising this for a long time (Singer, 1975; 2023; Regan 1983). According to (almost) all positions in animal ethics, animals' lives matter, and it is recognised that we are doing something seriously wrong when we do the things, we do to farm animals. As a consequence, we should at least fundamentally change current practices. Some – so-called abolitionists – even argue that we should abolish animal agriculture altogether (Regan, 2005; Francione, 2008). However, such change is not on the horizon. While there may be a trend towards greater consideration of animal welfare in livestock farming (cf. Deutscher Ethikrat, 2020), it is more than likely that the practice of using animal products and killing animals for food on an industrialised scale will continue.

Against this backdrop, the question of how a more animal-friendly practice of livestock farming can be realised becomes all the more urgent. In this context, technical options for animal enhancement (or animal disenhancement) have been discussed (Ferrari et al., 2010; Bateman et al., 2015). Some of these may also be suitable for minimising or even avoiding, at least in part, the negative effects of animal husbandry on the animals concerned. The technical "improvement" of livestock could and should therefore be aimed not only at satisfying the human interest in increased product quantities and improved product quality, but also at protecting animals from suffering, stress and impairment.

This is particularly true of genome editing techniques, which some believe can make a contribution– potentially significant – to improving the welfare of farm animals (Shriver & McConnachie, 2018). As part of a biotechnological breeding process, this technique has several advantages. Compared to conventional breeding methods, it is an attractive way to breed animals because it can produce animals with desirable traits without being tied to other (possibly undesirable) traits. Breeding cycles can be shortened. Changes in nucleotide sequences can be achieved more effectively than with older molecular biology methods. Unwanted effects (especially on-target effects) can be detected more easily. The CRISPR/Cas system even allows multiplexing i.e., the simultaneous modification of several genes.

As mentioned above, gene-editing based breeding can potentially help to minimise animal suffering and improve farm animal welfare. There are now quite a few research projects on this topic. For example, gene editing has been used to create cattle without horns (Carlson et al., 2016). This could make the painful dehorning of cattle, which has been common up to now, superfluous in the future. Other projects aim to produce male pigs without the so-called boar taint (Sonstegard et al., 2016; Kurtz et al. 2021) or to produce animals resistant to certain infectious diseases (Liu et al., 2014; Whitworth et al., 2014; Wu et al., 2015; Shantalingam et al., 2016; Lee et al., 2017; Hübner et al., 2018; Whitworth et al., 2019).

Disease resistance, the avoidance of painful procedures and tolerance to harmful husbandry and environmental conditions are breeding goals that are clearly in the interest of production, but also in the interest of animal welfare. However, there are serious ethical issues involved. The diseases to which "improved" animals are said to be resistant, for example, are predominantly (if not exclusively) so-called production diseases. In other words, diseases for which animal, barn, feeding, and herd management play a major role in their occurrence and spread. The same applies to the dehorning of cattle. The fact that cattle with horns pose a risk of injury to their conspecifics or to the people who handle them is essentially due to the conditions under which they are kept.

The idea of using genome editing techniques to improve animal welfare is ultimately aimed at eliminating or at least minimising the problems of current production conditions through biotechnology. This is not only a good example for a morally problematic "technological fix". Worse still, even if the above projects actually did improve animal welfare, the practice of industrialised farm animal husbandry would remain reprehensible. They will not change the situation in any significant way. In fact, the implementation of such breeding projects would most likely result in the perpetuation of a morally highly problematic practice. The idea of improving animal welfare through the production of genome-edited animals is essentially based on the idea that it is easier to change the genetic make-up of animals and adapt them to modern production conditions than to change the production conditions themselves and the current form of animal use.

This raises the question of how to evaluate actions that contribute to the perpetuation of a morally problematic practice, but which in some respects represent an improvement on the status quo. What should be the normative basis for the ethical evaluation of genome editing projects aimed at improving animal welfare?

To answer this question, we will argue in favour of what Haynes calls *pragmatic reformism*. In doing so, we refer to the distinction between ideal and non-ideal theory proposed by Rawls (Rawls, 1971; 1999). Rawls introduces this distinction in the context of his reflections on political theory. However, it can also be applied to ethical considerations and, of course, to animal ethics (cf. Garner, 2013; Ladwig, 2020; 2021). Following this idea, we will first briefly introduce the distinction and outline in general terms what it means to speak of an ideal or non-ideal ethical theory. Second, we will relate these considerations to the specific issue of animal ethics mentioned above. Finally, we propose criteria for the evaluation of genome editing breeding projects.

A brief clarification should be made at the outset. We will develop our approach on the basis of two assumptions: 1. Research and development are carried out in a morally acceptable manner. 2. The application of genome editing is sufficiently safe. In fact, neither one nor the other requirement is currently met.Although genome editing methods are much more precise and efficient than conventional methods for producing genetically modified animals, even these

methods cannot reliably exclude the possibility of unexpected negative effects on the animals.These include on-target effects (unwanted effects at the target site itself) and off-target effects (unwanted effects at other sites in the genome that were not intended to be altered).

2. PRAGMATIC REFORMISM, IDEAL AND NON-IDEAL THEORY

Why can't you just use a theory of animal ethics to judge the animal breeding projects outlined above? The reason for this, in our view, is that almost all theories of animal ethics place very high demands on our treatment of animals, and they have very good reasons for doing so. If you apply a moral principle such as the principle of equal consideration of interests, to take just one example, it quickly becomes clear that in most cases our treatment of farm animals is simply wrong and should be fundamentally and radically changed. However, such a principle is unlikely to be widely accepted in the world as we know it; and few people will agree to the radical demands that can be derived from it. Thus, the normative ethical principle – although a principle that ethicists may consider to be well-founded – may well turn out to be too demanding and to be too little adapted to real conditions and therefore ineffective as a guide to action.

Therefore, what should we do? Since we believe that something should be done about the appalling conditions of industrialised livestock farming, we propose a path of *pragmatic reformism*. Richard Haynes distinguishes between "humanist reformists" on the one hand and "pragmatic reformists" on the other. Humanist reformists, Haynes says, "find that suitably reformed practices, though they compromise the welfare of the animals involved in them, are nevertheless ethically acceptable." According to Haynes, humanistic reformism is problematic because the proponents of this approach "either [...] embrace an ethical position that warrants oppressive use of animals or [...] conceptualize animal welfare in a way that legitimizes what I consider to be oppressive uses." Pragmatic reformists, on the other hand, "want to liberate animals from uses that compromise their welfare" but accept that they must work to improve existing conditions "even if the improvements fall short of this ideal." (Haynes, 2008, p. xi)

To unfold such a position, the distinction between an ideal and a non-ideal theory – introduced by John Rawls – seems helpful to us (Rawls, 1971; 1999). An ideal theory, as Rawls understands it, prescribes what should be done in happy circumstances, while a non-ideal theory prescribes – with that ideal in mind – what should be done in less happy circumstances.

Normative theories therefore should keep both in mind: Both what should ideally be done if the world were a better place, and what is realistic in a non-ideal world. The world we live in is anything but an ideal world, a world as it should be. Rather, it is a world in which a lack of adherence to normative standards and un-

fortunate circumstances prevents the things that should be done from being done. The principles of the ideal theory would therefore be too abstract and too far removed from real-life circumstances to be accepted and followed. That is why, in the non-ideal world, we need principles that pave the way for what Rawls calls a "realistic utopia". We need a transition theory (cf. Valentini, 2012).

This theory asks how the long-term goals can be achieved or how they can be promoted. It therefore asks for political programmes and courses of action that meet certain criteria: First, they must be *politically possible*. That is, recommendations and prescriptions should address soft constraints, such as social, cultural, or economic conditions, so that change is highly likely to be implemented (cf. Gilabert & Lawford-Smith, 2012). Second, they must be likely to be *effective* i.e., they should actually bring us closer to our goal, the realistic utopia. Third, they must be *morally permissible* (Rawls, 1999, p. 89). This is usually taken to mean that the most pressing grievances must be addressed first and foremost.

Non-ideal theory, as we've said, is a theory of transition.In order to fulfil this function, an ideal theory or principle is required to set the goal. In what follows we suggest the *principle of equal considerations of interests* (PECI) (Singer, 2011, p. 20) as an ideal principle. Why is PECI a viable candidate?We believe there are at least three good reasons for this.

First, it is an interest-based or welfarist moral principle. It seems most plausible to us to think that having interests implies moral consideration (DeGrazia, 2021). Despite all the differences in detail, most current approaches to animal ethics accept the idea that beings whose welfare can be negatively or positively affected by our treatment of them are morally important. This includes many non-human animals, whose interests and concerns must be morally considered accordingly.

Second, it is a principle that is not confronted with arguments from speciesism. Speciesism is the view that the mere fact of belonging to a particular biological species (i.e., *homo sapiens*) confers on a being a moral status, or at least a higher moral status than the moral status of members of all other species. This view has been widely criticised by various animal ethicists (Pluhar, 1988; Ach, 1999; Singer, 2011). Fortunately, PECI is impartial as to species membership. Whether an action is right or wrong is considered independent of species membership: The equal interests of all those affected by the action in question must be treated equally – that is the point of the principle.

Thirdly, the principle is not only sound, but also capable of providing the necessary guidance. Since it does not violate hard constraints, it can be understood as a principle of a "realistic utopia" in the Rawlsian sense. It is "utopian" in the sense that it is very demanding and far from being realised and followed in the world we live in. But it is also "realistic" in the sense that it is feasible. Feasibility here means that, it is "compatible with human psychology, human capacities generally, the laws of nature, and the natural resources available to human beings." (Buchanan, 2004, p. 61) That is, the principle does not conflict with permanent or hard con-

straints (Carey, 2015, p. 148), which, unlike soft constraints, are not malleable and changeable.

3. POLITICALLY POSSIBLE, LIKELY EFFECTIVE, MORALLY TOLERABLE

In the following, we accept the first two criteria mentioned by Rawls. Unlike Rawls, however, we will speak of moral tolerability instead of moral permissibility (Hiekel, 2023: 127).

Political possible. The reality is far from respecting PECI when it comes to the treatment of animals, particularly farm animals. Many cultural or social traditions in which people live and with which they identify are inherently speciesist, particularly in terms of animal husbandry and eating habits. For very many or even most people in the world, it is quite normal to give animal interests little or no consideration. For example, the circumstances in which intelligent, sentient, social animals with high sensitivities such as pigs are kept are in most cases and almost entirely dictated by production interests. This means a life in which most of the interests that pigs have are frustrated. The same is also true of all other industrially farmed animals as well. The intensive debate on animal ethics in recent years has done little or nothing to change this situation. From 2001 to 2021, 51% more meat will be produced worldwide: 34% more pork, 94% more poultry and 28% more beef (Federal Statistical Office, 2023). This means much more factory farming, more exploitation, and more harm. However, we believe that a non-ideal theory that would directly prohibit these practices – albeit ideally desirable – is not politically feasible[1].

Fortunately, the cultural and social traditions of using animals and their products are not hard constraints but soft ones; they are malleable and changeable (Joy, 2020). Changing these conditions will of course be a long and difficult process aiming at a fundamental agricultural and food turn (Neussel, 2021; Schmitz, 2020) or a post-lethal agriculture (Mann, 2022). A non-ideal theory should encourage and establish such a process. Reforms could be initiated in a number of ways,

[1]There are currently two proposals for a non-ideal theory in animal ethics. These are the "sentient position" proposed by Garner (2013) and the "radicalised animal protection position" proposed by Ladwig (2020). The sentient position calls for strict protection of the interests of animals not to suffer. This implies demanding obligations for humans: "Whatever the benefit that might accrue to humans, or other animals for that matter, practices that inflict suffering on animals are prohibited." (Garner, 2013, p. 124; Garner, 2020, p. 202). According to the radicalised animal protection position, the violation of a morally significant animal interest is only permitted if a third party's interest, which is also morally significant, is satisfied and the third party's interest outweighs the morally significant animal interest (Ladwig, 2020, pp. 383f). So, both proposals morally rule out current practices. It is therefore at least questionable whether they are viable candidates.(cf. Hiekel, 2023,pp. 132ff).

ranging from economic incentives that make it attractive for the food industry to consider more animal-friendly production methods (Pelluchon, 2020, p. 98f), to the implementation of animal advocates or proxy-representatives in political institutions (Ladwig, 2021) and democratic reforms (Garner, 2016; Parry, 2016), to so-called species mainstreaming (Wild, 2019; Ladwig, 2020, pp. 296–304).Such measures could trigger or set in motion a change in motivation to give more weight to the interests of the animals, as well as a change in obstructive conditions.

Effective. The second of Rawls's criteria is that our actions or political programmes should be effective: they should move society towards the long-term goal. They should initiate and implement a transition to the ideal. On the one hand, this means demanding what is ideal and politically feasible. On the other hand, it means formulating norms that are likely to be respected and that aim to bring us closer to the ideal. The criterion of effectiveness ensures that one is not satisfied with what seems possible at the moment. Ideal requirements should be given appropriate weight alongside what is possible. So, "a viable nonideal theory [...] should try [...] at achieving a reasonable balance. That is, it should try to combine the rigor and imagination of ideal theory with the realism of nonideal theory" (Garner, 2013, p. 90).

Moral tolerability. The third criterion excludes principles, which, although politically possible and effective, make the ideal attainable but in an intolerable way. Unlike Rawls we will speak of *moral tolerability* rather than moral permissibility (Hiekel, 2023, p. 127). One reason for this is that Rawls' criterion seems to us to be too narrow. It may well be justified in the context of a theory that aims at a just overall state (and especially in a deontological theory). For the moral judgement of individual actions, however, this criterion is less appropriate. Another reason is that the criterion of moral tolerability seems to take good account of the ambivalence that characterises the pragmatic reformism we intend. To tolerate something is to believe that there are good reasons to accept something (a belief or an action), even if you think it is problematic or even wrong. Tolerance therefore includes both an acceptance and an objection component (Forst, 2017, p. 34). Nonideal theory therefore formulates principles that allow actions that would be criticised as morally wrong under ideal conditions to be judged as morally tolerable in the non-ideal world.Finally, a third reason is that the criterion of moral tolerability can easily be used not only by deontological but also by non-deontological approaches to ethics, such as, for example, consequentialism.

4. AN OUTLINE FOR JUDGING GENOME EDITING FOR FARM ANIMAL WELFARE

We are now in a position to outline how genome editing for the welfare of farm animals could be assessed using this ethical framework.

Under the (counterfactual) assumption that the development of genome editing methods can be carried out in a morally acceptable manner and that their application is sufficiently safe, the first step is to examine whether a breeding project can achieve an improvement in animal welfare compared to the parent generation. If it does not represent a change towards better welfare i.e., if it is not effective in this respect, then we are not moving towards the ideal. It must therefore be morally rejected.

If it is a project that promises to improve animal welfare, the second step is to decide whether the breeding activity is morally tolerable. Based on the principle of equal consideration of the interests of humans and animals, the economic, political, or cultural obstacles that stand in the way of equal consideration must be identified and removed as far as possible. Unequal consideration of interests of humans and nonhuman animals must be minimised as far as possible and as long as it is unavoidable.

Consider, for example, projects aimed at improving the temperature tolerance of animals. Some of these projects appear to improve welfare. Others do not. Projects are welfare enhancing if they give animals temperature tolerance without other negative effects. However, if the introduction of heat tolerance has additional negative effects that outweigh the positive effects of the genetic engineering, then it is not an improvement. Breeding chickens without feathers to make them more heat-tolerant is an example. This "improved" chickens may be able to tolerate more heat, but they will be extremely sensitive to cold, rain and sunlight, and poorly protected against injury. So, such projects are ruled out morally from the outset.

Projects that fulfil the first condition and genuinely promote welfare need to be further assessed. It needs to be considered whether the project in question is a tolerable way of directly addressing an unequal consideration of interests. This, for example, seems to be the case with projects that aim to genome-edit disease resistance in farm animals. From both a human and an animal perspective, disease is something to be prevented and fought. Disease resistance is therefore in the interest of both humans and animals. After all, disease is associated with considerable suffering or even death. It is very difficult to breed disease-resistant animals using conventional methods. At the same time, it is unlikely that animal husbandry will change to eliminate the risk of (infectious) diseases. Genetically engineered disease-resistant animals seem to be better off, and even better off in the long run, because they will still benefit from breeding if we manage to improve our treatment of animals.

Consider, on the other hand, breeding projects to avoid painful procedures such as dehorning or castration. In this case, GE-breeding can only be seen as a measure to minimise unequal consideration of interests. Assuming that painful procedures cannot be avoided, it is necessary to consider which of the available options is the least bad. For example, dehorning cows is a painful procedure that

can also lead to chronic pain. Painful dehorning of cows therefore appears to be worse than genetically modified cows without horns, assuming that the simple presence or absence of horns has no effect on the welfare of cows.

Castrating a piglet or breeding boar taint free males is a different matter. Genetic engineering programmes to produce boar taint free pigs have produced genotypically male but phenotypically female pigs (Kurtz, 2021). The welfare implications of such a sex change in pigs – e.g., whether the pigs are more susceptible to disease, etc. – are as yet unknown. Presumably, in this case, an approach that changes the circumstances (specific husbandry management of male piglets or at least anaesthesia of piglets prior to castration) would have a better chance of minimising unequal consideration of interests.

5. CONCLUSION

From the perspective of abolitionist theories, which typically attribute rights to (at least some) animals, including the right to be protected from any form of instrumentalisation, the use of genome editing methods to improve the welfare of farm animals cannot be justified (or at least is difficult to justify) (Ferrari, 2012, p. 74). From this point of view, the adaptation of animals to the conditions in which they are used and kept through biotechnology perpetuates or even exacerbates the scandal that exists in the use of animals. However, even if there may be some arguments in favour of the abolitionist argument: in our opinion, ethics should not only have something to say about what is unjust, but also how we could come closer to greater justice (Ladwig, 2020, p. 370). This is why we advocate pragmatic reformism.

As we have seen, what this means in regard to genome-editing of farm animals depends on a variety of factors, not least what the intervention means for the subjective welfare of the genome-edited animals and what realistic alternatives are available to effectively address the problem that genome editing is intended to "solve". In general, the production of genome-edited animals can be morally justified if it can be shown to be morally tolerable, politically possible, and likely to be effective. The effectiveness is measured by the extent to which the production of genome-edited animals is likely to contribute to a more animal-friendly livestock industry – and ultimately is a step towards a radical change in agricultural culture and our food habits.Against this background, the pragmatic demands mentioned above can only be justified on a transitional basis if the breeding and handling of genome-edited animals is supported by the serious will and willingness of all those responsible to reform the existing practice in the long term and to work towards animal-free or post-lethal agriculture.

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