Viewpoint

On the limited appeal of human engineering as a response to climate change

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If bioethics should care about the environment, this could be, among other ways, by reflecting on certain radical solutions that have been proposed to cope with environmental issues. The solution we have in mind here is biomedical human engineering. In a recent article, Liao, Sandberg and Roache consider reducing human size through biomedical treatments in order to mitigate climate change [1][2]. We shall discuss this example and point out that the various methods used to reduce human height, be they sophisticated technologies or mere undernutrition, seem all subject to highly undesirable consequences. This is to show that one of the problems with Liao et al.'s account is that it does not provide us with an ethical framework comprehensive enough to balance these consequences with the problematic effects of climate change. In sum, we wish to draw from the discussion of this specific example a more general claim. This claim is that, even if we accept that human engineering *per se* is not problematic, we nevertheless need a more comprehensive ethical theory than the mere claim that climate change should be mitigated in order to assess the desirability of human engineering. We need, for instance, a theory of intergenerational justice. So we do not contest here the consequentialist approach Liao et al. adopt (hence we will not address issues such as interference with human nature [3], autonomy [4] or authenticity [5]). We contest their choice not to provide a criterion, or a set of criteria, to evaluate the desirability of the solutions they propose with respect to other concerns.

Making humans smaller to mitigate climate change

The increasing human impact on the environment is due to the conjoint increase of population and of *per capita* resource consumption. The world population is expected to reach 9.6 billion by 2050 [6]. Average *per capita* consumption of energy has been multiplied by ten since 1800 [7]. The International Panel on Climate Change agrees that climate change phenomena are mostly due to human activities [8]. Agenda 21, the United Nations' non-binding action plan for sustainable development, urges us to change our consumption patterns [9].

The current generation must probably scale down its consumption if it wants the next generation(s) to enjoy the same resources and opportunities it has enjoyed itself. But there are many institutional and psychological obstacles to consumption reduction [10] [11]. In this context, human engineering seems to be a promising solution.

This is the stance Liao et al. take. Their argument goes the following way:

1. Climate change must be mitigated.
2. This requires some behavioural changes.
3. Biomedical human engineering is an effective way to change human behaviours.
4. Therefore, we should consider biomedical engineering as an effective – hence desirable – solution to climate change.

While discussing objections, they add that:

5. The negative effects of biomedical human engineering should be balanced with the negative effects of climate change.

Liao et al. also anticipate some worries by insisting that they only claim human engineering deserves consideration, and that it should remain a voluntary activity, possibly encouraged by incentives and sponsored healthcare. The methods they describe include pharmacological meat intolerance, making humans smaller, cognitive enhancement as a way to lower birth rates and moral enhancement to develop altruism. We will focus on making humans smaller. As Liao et al. put it, there is a correlation between human ecological footprint and human size. But we can reduce human size, by reducing height through the genetic selection of shorter children, hormone treatments or the provoked reduction of birth weight.

Let us note that the reduction of human size must be significant to be an efficient measure against climate change. The concerned individuals must become really shorter, and the size of a significant number of people must be reduced. If this solution were to be adopted, preimplantation genetic diagnosis or hormone treatments would be thus used at a much larger scale than what they are now. But the techniques Liao et al. describe are risky and costly. Embryos selection is risky. Since height is a highly inheritable trait, Liao et al.'s proposal would imply that taller and otherwise fertile parents should turn to assisted reproduction and the

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2 See also Persson and Savulescu's book on moral enhancement, *Unfit for the Future* [2].

implantation of embryos produced by other, shorter genitors. Widespread genetic selection of shorter people would alter the genetic diversity of the human population. Reduction of genetic diversity could be risky. Hormone treatments are risky too. High-dose sex steroid administration to tall children have undesirable complications (including weight gain and fertility issues) [12]. Epiphysiodesis, a surgical intervention that destroys the growth plates around the knee, may lead to leg-length discrepancy [13] and remains controversial [14]. Treatment with octreotide, a synthetic analogue of somatostatin, which inhibits growth hormone, has caused gastrointestinal problems, glucose intolerance [14] and the development of gallstones [15]. Moreover, these techniques are costly. They require biomedical technologies only wealthy countries can afford. And their numerous side-effects could turn out to be highly costly in terms of healthcare – not to mention the obvious costs in terms of quality of life.

Making humans smaller through diet?

Liao et al. concede that the high financial cost of human engineering could be a good reason to give it up. They also take into account the objection that it is not very appealing. But, to this, they respond that, (i) even if it is not appealing to some of us, this is not a reason for not making it available to those who find it appealing; (ii) our attitude to human engineering and to size could change; (iii) judging this solution unappealing is a cognitive error due to status quo bias. Let us focus on the status quo bias. What Liao et al. may mean is that we are reluctant to use biomedical human engineering because it is new. And they mean this reluctance is not justified. We should not care about the kind of means we use as long as they efficiently mitigate climate change. Let us take this stance and see whether it is ethically acceptable, from a consequentialist perspective, to use any available technology to mitigate climate change, whatever the other consequences of this technology, be it new or old, are. So it is worth discussing another method to reduce human size, that is, childhood undernutrition. Undernutrition is neither costly nor novel, though it is unappealing as well. This should make it obvious that what matters is the normative evaluation of the consequences of the available techniques to reduce human size.

We know adult short height is related to childhood *undernutrition*, that is, insufficient food intake [16]. Undernourished children turn out to be smaller adults, and undernourished mothers give birth to smaller children (which means that we can perpetuate human size reduction through generations). This is because, in order to survive, the organism stops growing and uses the available nutrients to preserve vital functions. Therefore, it appears that the goal of reducing human size can be achieved in a very inexpensive way, by limiting food intakes during childhood. If undernutrition only affects height, then, as Liao et al. put it, this ought to be balanced with the tragic consequences of climate change. As Liao et al. put it, being tall is a contingent advantage in our societies, and we can thus imagine people's attitudes to size could change.

But undernutrition does not only affect growth. Data show it affects negatively educational achievements and adult earnings [16]. Undernutrition could also have long-term effects on immune changes, blood lipids and mental illness [16]. And, importantly, it is undernutrition *by itself* that causes lower educational achievements and income prospects (it is not just a side-effect of the contingent social attitude to size for example). There is a scientific consensus to say that undernutrition quite probably causes damages to the brain, hence affecting cognitive development and then educational outcomes [16–19]. We thus have good evidence that, if we undernourish our children in order to make them smaller, so that their carbon footprint diminishes, this will have as an undesirable effect that they will be less intelligent.

But perhaps our attitude about the appealing character of intelligence could change in the same way as our attitude towards height. Is a desire for intelligent kids superfluous with regard to the worrying consequences of climate change? Not really. Intelligence may be crucial for social as well as technological improvements. A society of cognitively disabled people will be less able to understand the reasons to reduce our carbon footprint. And it will be less able to find solutions to the complex environmental, economic and social problems climate change causes. In other words, if we adopt the currently only realistic method to render our children smaller, we also render them unable to deal with climate change issues.

Ethical theory and policy solutions to climate change

The ethical framework Liao et al. endorse is summed up by the premise "Climate change must be mitigated". This is an intuition many of us share, because climate change harms and will harm people. But the solution to make humans smaller will also harm those who choose it (especially since it is more likely to be chosen by the poor, as Liao et al. suggest promoting it by financial incentives). The limited appeal of this specific solution is not only due to prejudices or to a status quo bias, but to the incompatibility of the consequences of this solution with other ethical concerns. We do not mean that biomedical human engineering *as such* is an unethical solution. We mean that, at least nowadays, biomedical human engineering has consequences that could be undesirable. But are these consequences undesirable according to Liao et al.? The problem is that their ethical framework is too incomplete to say such a thing.

If, as they say, it is of primary normative importance to mitigate climate change, whatever the consequences of the solutions adopted to do it are, then, nothing prevents us from undernourishing our children. Nothing in their account allows us to think that they attach a special value to children's well-being in general or to their cognitive development (except that they suggest cognitive enhancement could have the instrumental value to reduce fecundity). So, in order to assess whether a solution is desirable or not, and to choose a solution, we need a more comprehensive ethical framework than the one Liao et al. propose. In order to balance the undesirable effects of climate change with the undesirable effects of hormone treatments or undernutrition, we need – at least – a theory which states which states of affairs are desirable and which are not. We need a theory that tells us, first, what exactly is valuable (intelligence? the environment?), second, how the valuable "things" should be distributed among individuals and among generations and, third, which sacrifices are permissible and which are not. For instance, a theory of intergenerational justice can tell us what we do owe to next generations [20] and answer some of these questions.

To conclude, as Greg Bognar puts it, "philosophers shoot themselves in their leg" by proposing "a solution in search of a problem" [21]. Perhaps, instead of reducing our children's size, we could rather make them more frugal [22]. And this could be done through a reasonably costly and reasonably risky method of human engineering, that is, education.

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