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][1]. 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 is not based on 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 its desirability. 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 a 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

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

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. 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 implantation of embryos produced by other, shorter genitors. Widespread genetic selection of shorter people would alter the genetic diversity of the human population, which 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][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 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. But this is to forget that, nowadays, we are perfectly justified in finding unappealing a solution with highly undesirable consequences. Of course, the status quo bias might be also due to the mere novel character of preimplantation diagnosis and of hormone treatments. 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. 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 could be achieved in a very inexpensive way, by limiting food intakes during childhood. If undernutrition only affected height, then, this effect 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 height. 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 a contingent social attitude to height). 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.

One might wonder whether our attitude to the appealing character of intelligence could change in the same way as our attitude towards height. But, contrary to height, intelligence may be crucial for social and 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. The problem is that Liao et. al's ethical framework is too incomplete to say such a thing. If 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 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 of these are not. We need a theory that tells us, first, what exactly is valuable, second, how the valuable "things" should be distributed between individuals and generations and, third, which sacrifices are permissible and which are not. A theory of intergenerational justice could tell us what we do owe to next generations [20]. A complete theory of intergenerational justice would determinate the pattern and the metric that are relevant to calculate just intergenerational savings. The pattern defines how valuable things should be distributed among generations, and therefore how much we should save for future people. In the case discussed above, this would help us determine to what extent it is permissible for human activities and climate change to affect the quantity of intergenerational savings. This might mitigate Liao et. al's assumption that climate change should be stopped at *all* costs. The metric of intergenerational justice defines the way to evaluate the things to be distributed between generations. Those "things" could be valuable as resources, or because they secure future generations' welfare. The metric allows us to say whether environmental resources or cognitive capacities, or both, should be part of what we owe to our descendants. Such reflection is aimed at providing guidance when we face trade-offs like the one we have discussed above.

Perhaps, instead of "a solution in search of a problem" [21], we could start by making our children more frugal [22] through a reasonably risky method of human engineering, that is, education.

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