

Population Engineering and the Fight against Climate Change

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Abstract: Contrary to political and philosophical consensus, we argue that the threats posed by climate change justify *population engineering*, the intentional manipulation of the size and structure of human populations. Specifically, we defend three types of policies aimed at reducing fertility rates: (1) choice enhancement, (2) preference adjustment, and (3) incentivization. While few object to the first type of policy, the latter two are generally rejected because of their potential for coercion or morally objectionable manipulation. We argue that forms of each policy type are pragmatically and morally justified (perhaps even required) tools for preventing the harms of global climate change.

Keywords: population control; climate change; public policy; fertility; procreation

Two uncontroversial ideas set the stage for this article. First, climate change is among the most significant moral problems contemporary societies face, in terms of its urgency, global expanse, and the magnitude of its attending harms.² Second, population plays an important role in determining just how bad climate change will be.³

On the basis of these claims, we will argue that what we call *population engineering*, the intentional manipulation of the size and structure of human populations, is a practical and morally justifiable means to help ameliorate the threat of climate change.⁴ Policymakers and moral theorists alike have been reluctant to wade into discussions of population policy.⁵

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²See, for instance, IPCC 2014, “Summary for Policymakers,” in Christopher B. Field et al. (eds.), *Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* (Cambridge: Cambridge University Press, 2014), pp. 1-32, http://www.ipcc.ch/pdf/assessment-report/ar5/wg2/ar5_wgII_spm_en.pdf. (This and all other web sources were last accessed 18 December 2015).

³There are other reasons to be concerned with our growing numbers, such as food production, water scarcity, depletion of resources, and so on, but we will focus on the role population plays in producing the greenhouse gases that cause dangerous climate change.

⁴Along with the standard repertoire of broader policy efforts to fight climate change, which will include reducing consumption-related waste, switching to renewable energy sources, funding adaptation efforts, and so on.

⁵See Martha Campbell, “Why the Silence on Population?” in Philip Cafaro and Eileen Crist (eds.), *Life on the Brink: Environmentalists Confront Overpopulation* (Athens:

We think that this reluctance is unjustifiable and, ultimately, irresponsible.

We will identify four types of practices and policies (henceforth simply “interventions”) that could effectively reduce human fertility rates: (1) clearly noncoercive choice-enhancing interventions; (2) possibly coercive preference-adjusting interventions; (3) possibly coercive incentivizing interventions; and (4) clearly coercive interventions.⁶

Although we tend to agree with widespread judgments that the clearly coercive interventions are immoral and the clearly noncoercive choice-enhancing interventions are permissible, we will further defend the moral justifiability of a network of preference-adjusting and incentivizing interventions. These interventions can be designed and implemented as part of a global population engineering program while minimizing the possibility of coercion, and should be further investigated by ethicists, social scientists, and policymakers.

1. The Climate Change Crisis

Increasing concentrations of greenhouse gases (GHGs) in Earth’s atmosphere are raising mean surface temperatures and altering our climate. These changes already imperil human well-being and will only get worse without intervention. The most frequently cited harms of climate change include those associated with extreme weather, changing disease vectors, rising sea levels, biodiversity loss, and severe food and water shortages.⁷ Experts agree that climate change is at best dangerous, and at worst catastrophic, both for current and future generations.⁸

University of Georgia Press, 2012), pp. 41-55. Even if population engineering has been largely overlooked in the climate change debate (unlike its etymological cousin, geoengineering), many societies have policies and practices aimed at manipulating the size and structure of their populations for different ends. Immigration policies, for example, are often deployed in order to grow, shrink, or stabilize a national population for economic reasons. We thank an anonymous reviewer for this helpful observation.

⁶These categories somewhat follow those used by Bernard Berelson, “Beyond Family Planning,” *Studies in Family Planning* 1 (1969): 1-16, and Robert M. Veatch, “An Ethical Analysis of Population Policy Proposals,” in Robert M. Veatch (ed.), *Population Policy and Ethics: The American Experience* (New York: Irvington, 1977), pp. 445-76.

⁷IPCC 2014, “Summary for Policymakers” (WGII), pp. 4-8. Beyond the obvious harms of, say, disease or drought is a second layer of less well-understood harms. For instance, geopolitical and security impacts from the mass movement of potentially hundreds of millions of climate refugees—destitute citizens forced or pressured to abandon entire regions or even nations due to climate change.

⁸IPCC 2014, “Summary for Policymakers” (WGII), p. 12. Philosophers might here raise what Derek Parfit calls the “non-identity problem” (*Reasons and Persons* (Oxford: Oxford University Press, 1984)). Parfit himself thinks there are plausible responses to the non-identity problem, as do John Broome (*Climate Matters: Ethics in a Warming World* (New

It is widely accepted that avoiding these dangerous changes to Earth's climate requires limiting the rise in average global temperature to a 2°C increase over preindustrial averages.⁹ This target requires keeping atmospheric concentrations of GHGs under 450 parts per million (ppm), which amounts to an all-time global budget for anthropogenic carbon-equivalent emissions of about one trillion tons, of which humanity has already used nearly 60%.¹⁰ Recent models predict that levels of atmospheric GHG concentrations will reach the 450 ppm threshold in 2030 if business-as-usual emissions continue.¹¹ Unless significant reductions in GHG emissions begin soon, it is likely that Earth will be locked into a catastrophic 4°C rise in average surface temperature by 2100.¹² The consensus among scientists and policy experts is that averting the harms of climate change requires that we act quickly and decisively to *mitigate* climate disruption by changing our carbon practices (reducing consumption, switching to renewable energy sources, and so on) and to *adapt* to those changes in climate that are already occurring (by building seawalls, relocating climate refugees, and so on).

Population growth is one of the most significant drivers of the projected growth in GHG emissions.¹³ Total human production of GHGs depends not only on the carbon-intensity of individuals' activities, but also *the number of individuals* engaged in those activities.¹⁴ Indeed, there is a nearly 1:1 correlation between population growth and increasing GHG emissions in

York: W.W. Norton, 2012), pp. 61-64), Simon Caney ("Human Rights, Responsibilities, and Climate Change," in Charles Beitz and Robert Goodin (eds.), *Global Basic Rights* (Oxford: Oxford University Press, 2009), pp. 227-47), and a host of other philosophers. Since we lack the space to solve the non-identity problem here, we will assume that there is an obligation to avoid dangerous climate change, and we address our arguments to those who agree.

⁹Article 2 of the Paris Agreement [**explain since COP21 is no longer mentioned??**] would, if ratified, commit all states subject to the United Nations Framework Convention on Climate Change to "pursue efforts to limit the temperature increase to 1.5 °C" (<http://unfccc.int/resource/docs/2015/cop21/eng/109r01.pdf>, p. 22). Although we endorse the more ambitious 1.5°C goal, our argument focuses on the more conservative 2°C mark used by the IPCC. See IPCC 2014, "Summary for Policymakers," in Ottmar Edenhofer et al. (eds.), *Climate Change 2014: Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* (Cambridge: Cambridge University Press, 2014), p. 10, https://www.ipcc.ch/pdf/assessment-report/ar5/wg3/ipcc_wg3_ar5_summary-for-policymakers.pdf.

¹⁰For a running calculator of global GHG emissions, see <http://trillionthtonne.org/>. Atmospheric concentration reached 400 ppm in 2014.

¹¹IPCC 2014, "Summary for Policymakers" (WGIII), p. 8.

¹²Ibid., p. 13 n. 2.

¹³Ibid., p. 8.

¹⁴Since the 1970s, environmental scientists have been familiar with the IPAT equation. Environmental impact (I) is a function of population (P), affluence (A), and technology (T). See Marian R. Chertow, "The IPAT Equation and Its Variants," *Journal of Industrial Ecology* 4 (2000): 13-29.

both the U.S. and Europe.¹⁵ In the increasingly urgent moral and political arguments concerning climate change, however, these striking facts about the causal role of population growth fade into the background. The standard climate change argument goes like this: Our current carbon-producing practices have us on a path to dangerous climate change. Population projections put us on track to add 2-3 billion more GHG emitters by 2050, which raises the urgency of mitigating and adapting to climate change. Therefore, population growth *must be compensated for* by policies that more decisively address GHG emissions or adaptation practices. Notice that population size and growth are presented purely descriptively, as if they were merely natural variables to be predicted, rather than human variables subject to alteration. While not everyone in the climate change debate treats the population variable this way,¹⁶ many do, especially those with political authority. In the next section, we will detail why this is unjustified.

2. Addressing the Crisis without Addressing Population

There are two important considerations that favor including population engineering as part of the global policy response to the threat of dangerous climate change. First, the current consensus approach to mitigating climate change, which does not include population engineering, falls short of offering a clear and reasonably certain pathway to avoiding dangerous climate change. Second, reducing global population growth over the next century would have a truly massive effect on global GHG emissions.¹⁷

According to the most recent estimates from the Intergovernmental Panel on Climate Change (IPCC), in order to meet the 450 ppm target mentioned above, global GHG emissions must steadily decline until they are 40-70% lower in 2050 than they were in 2010, and then continue to decline to near zero (or less) by 2100.¹⁸ These figures entail “further sub-

¹⁵William Ryerson, “Population: The Multiplier of Everything Else,” in Richard Heineberg and Daniel Lerch (eds.), *The Post Carbon Reader: Managing the 21st Century’s Sustainability Crises* (Healdsburg, Cal.: Watershed Media, 2010), p. 3.

¹⁶The essays in Cafaro and Crist (eds.), *Life on the Brink*, are a welcome exception. See also Philip Cafaro, “Climate Ethics and Population Policy,” *Wiley Interdisciplinary Reviews: Climate Change* 3 (2012): 45-61; and Monica Das Gupta, “Population, Poverty, and Climate Change,” *World Bank Research Observer* 29 (2014): 83-108.

¹⁷In addition to reducing emissions and thereby helping to mitigate dangerous climate change, population engineering in the form of fertility reduction also eases adaptation to any climate changes that will occur by reducing the number of future climate refugees. To capitalize on this advantage, a comprehensive population engineering program should include a *migration management* component in addition to a *fertility reduction* component; we explore migration management in a currently unpublished manuscript.

¹⁸IPCC 2014, “Summary for Policymakers” (WGIII), p. 10. As the IPCC notes, these

stantial reductions” beyond what has been pledged already in international treaties.¹⁹

The IPCC assessed about 900 mitigation scenarios in order to determine the mitigation pathways most likely to accomplish these reductions without being so expensive as to seriously compromise economic development.²⁰ They arrived at what we will call the *consensus approach* to fighting global climate change: a network of policy initiatives aimed at fully decarbonizing the energy supply, increasing energy and GHG efficiency in other economic sectors, properly taxing and pricing GHG production, altering consumer behaviors and lifestyles, and better planning of settlement patterns and transportation systems.²¹ According to the IPCC, implementing these policies will not severely impact global economic growth and indeed will very likely save money as compared to unabated GHG emissions growth or insufficient reductions.²²

One might think this is cause for optimism, but the consensus approach to mitigating dangerous climate change is layered with assumptions and uncertainties that should give pause. The first thing to note is that there are live controversies about, first, whether restricting average global temperature increases to 2°C is enough to avoid the more dangerous effects of climate change, and second, whether restricting atmospheric GHG con-

reductions must be achieved despite projected increases in GHG emissions across economic sectors.

¹⁹Ibid., p. 12. At the time of this article’s publication, it remains to be seen whether the Paris Agreement will enter into force following ratification by the required 55 nations representing at least 55% of global annual GHG emissions. But as recent empirical analysis shows, even if the Paris Agreement were ratified and all states were to follow through on their (non-binding) Intended Nationally Determined Contributions (INDCs) under the treaty, humanity would nonetheless still be on track to see between 2.6°C and 3.1°C of warming by 2100 (Joeri Rogelj et al., “Paris Agreement Climate Proposals Need a Boost to Keep Warming Well below 2 °C,” *Nature* 534 (2016): 631-39). All of the arguments below concerning the inadequacy of the consensus approach to achieving the 2°C target (and even more so the 1.5°C aspirational target) would still apply following ratification of the Paris Agreement. Thus, the arguments in this article support the view that states should investigate population engineering in order to accomplish and to exceed their INDCs.

²⁰IPCC 2014, “Summary for Policymakers” (WGIII), p. 10.

²¹Ibid., pp. 10-29.

²²The IPCC predicts the consensus approach would cause “an annualized reduction of consumption growth by 0.04 to 0.14 (median: 0.06) percentage points over the century” (IPCC 2014, “Summary for Policymakers” (WGIII), p. 16). See also Global Commission on the Economy and Climate, “The New Climate Economy,” <http://newclimateeconomy.report/>; Ian Parry, Chandra Veung, and Dirk Heine, “How Much Carbon Pricing is in Countries’ Own Interests? The Critical Role of Co-Benefits,” IMF Working Paper WP/14/174 (2014), <http://www.imf.org/external/pubs/ft/wp/2014/wp14174.pdf>; and Paul Krugman, “Errors and Emissions: Could Fighting Global Warming Be Cheap and Free?” *The New York Times*, 19 September 2014, <http://www.nytimes.com/2014/09/19/opinion/paul-krugman-could-fighting-global-warming-be-cheap-and-free.html>.

centrations to 450 ppm would be sufficient to achieve that goal.²³ But even if we assume these are the correct targets, the IPCC itself recognizes that carrying out all of its policy recommendations to the letter would still leave as much as a 33% chance of temperature increases beyond 2°C.²⁴ More worrisome still, the IPCC hardly considers scenarios for keeping atmospheric carbon below the 450 ppm mark, which would improve humanity's chances of avoiding an increase of 2°C or greater.²⁵

But even if one is satisfied with having as high as a 33% chance of crossing the critical 2°C threshold, the models undergirding the consensus approach still require some bold assumptions. First, in order to meet the necessary benchmarks in time, humanity needs to start reducing GHG emissions *now*. Models indicate that even if international actors follow through on their current pledges to reduce GHG emissions over the next 15 years, delaying additional reductions beyond 2030 would significantly increase the risk that we will be locked into a dangerous 2°C increase by 2100. Indeed, “many models *could not achieve* atmospheric concentration levels of about 450 ppm CO₂eq by 2100 if additional mitigation is considerably delayed.”²⁶

Second, many of these models assume the widespread availability of key technologies, such as bioenergy and carbon capture and storage (CCS),²⁷ or expanded use of currently available technologies with significant known risks, such as nuclear energy.²⁸ Unfortunately, we do not yet have scalable CCS technology. Each sector the IPCC looks at, from energy to industry to transport and buildings, is riddled with uncertainties (in how steep required reductions and their costs are) and requires questionable assumptions about the technological innovations and behavioral changes needed in order to meet their respective mitigation targets. Further, there is little wiggle room within each sector, as meeting overall targets is highly contingent on meeting targets for each sector.²⁹ Third, credible expert analysis and reports from those involved with the IPCC Working Group III's drafting process suggest that the final policy recommendations are overly

²³Some have argued that 1.7°C and 350 ppm are the necessary targets. See James Hansen et al., “Target Atmospheric CO₂: Where Should Humanity Aim?” *Open Atmospheric Science Journal* 2 (2008): 217-31; and Johan Rockström et al., “A Safe Operating Space for Humanity,” *Nature* 461 (2009): 472-75. The aspirational target of 1.5°C in Article 2 of the Paris Agreement indicates significant consensus that 2°C is too conservative a goal for our mitigation efforts.

²⁴IPCC 2014, “Summary for Policymakers” (WGIII), pp. 4 (n. 2), 10, 13 (Table SPM.1).

²⁵Ibid., p. 16.

²⁶Ibid. (emphasis added); see also pp. 12, 14. In the context of the Paris Agreement, see Rogelj et al., “Paris Agreement Climate Proposals Need a Boost,” p. 636.

²⁷IPCC 2014, “Summary for Policymakers” (WGIII), p. 16.

²⁸Ibid., pp. 12, 14, 15.

²⁹Ibid., pp. 17-26.

optimistic, a consequence of political pressure from drafters with vested economic interests in delaying action on climate change.³⁰

3. Addressing the Crisis with Population Engineering

Given the high stakes of dangerous climate change and the demands, uncertainties, assumptions, and risks built into the mitigation pathways that do not address population, it seems worth giving serious consideration to population engineering policies, if such policies could have a significant effect on global GHG emissions. And there is good reason to think that they could.

According to a recent study, reducing fertility rates to match the UN's "low fertility" projections rather than the "medium fertility" projections, which corresponds to an average difference of 0.5 children per woman,³¹ would likely result in a yearly reduction in GHG emissions of 5.1 billion tons of carbon by 2100.³² (To put that number in perspective, consider that in 2013, humans emitted 9.9 billion tons total.³³) In the near-term future, these reductions are as large as, or larger than, the annual emissions that could be saved from doubling the fuel efficiency of cars, increasing wind energy 50-fold, or tripling nuclear energy.³⁴ Indeed, the study's authors estimate that following the low rather than the medium fertility projections would account for "between 16% and 29% of required emissions reductions by 2050."³⁵ A relatively modest reduction in fertility rates, then, could get us roughly one fifth of the way toward the GHG emissions reductions needed by mid-century in order to prevent dangerous climate change.

³⁰Kevin Anderson and Alice Bows, "Beyond 'Dangerous' Climate Change: Emission Scenarios for a New World," *Philosophical Transactions of the Royal Society A* 369 (2011): 20-44; Nafeez Ahmed, "IPCC Reports 'Diluted' under 'Political Pressure' to Protect Fossil Fuel Interests," *The Guardian*, 15 May 2014, <http://www.theguardian.com/environment/earth-insight/2014/may/15/ipcc-un-climate-reports-diluted-protect-fossil-fuel-interests>.

³¹UN DESA, *World Population Prospects: The 2012 Revision, Key Findings and Advance Tables* (New York: United Nations, 2013), pp. 1-2, http://esa.un.org/unpd/wpp/Publications/Files/WPP2012_HIGHLIGHTS.pdf.

³²Brian C. O'Neill et al., "Global Demographic Trends and Future Carbon Emissions," *Proceedings of the National Academy of Sciences* 107 (2010): 17521-26. O'Neill et al. use the UN's 2003 "low fertility" projection of 6.7 billion and "medium fertility" projection of 10.8 billion by 2100. These figures are slightly lower than more recent projections (see UN DESA, *World Population Prospects*).

³³CO₂Now.org, "Global Carbon Emissions," <http://co2now.org/Current-CO2/CO2-Now/global-carbon-emissions.html>.

³⁴O'Neill et al., "Global Demographic Trends," p. 17525; Stephen Pacala and Robert Socolow, "Stabilization Wedges: Solving the Climate Problem for the Next 50 Years with Current Technologies," *Science* 305 (2004): 968-72, p. 970, Table 1.

³⁵O'Neill et al., "Global Demographic Trends," p. 6 of supplemental information.

These results should not be all that surprising. After all, in procreating, one makes a whole new person who will emit GHGs. But in fact, it is more than that. By creating a new person, one makes it possible that he or she will go on to create more people, who are then able to go and create even more people. At least over the next few generations, during the timespan that matters most for averting dangerous climate change, it is likely that any people who exist will be net GHG emitters. For illustrative purposes, consider a study by climate scientists Paul Murtaugh and Michael Schlax: They calculated that even if we are able to make the kind of radical cuts to our emissions hoped for by the IPCC, the total of CO₂ emissions saved by refraining from having one additional child is larger than the summed lifetime savings from six common “green” activities (such as lowering one’s transportation-related GHG emissions, increasing the energy efficiency of one’s home, and so on).³⁶ They also calculated a less optimistic scenario, in which we continue emitting business-as-usual. Troublingly, one’s total CO₂ emissions per additional child in that scenario could run as high as 9,441 tons, swamping all of one’s non-procreative activities and raising one’s total lifetime carbon emissions by *nearly six times*.³⁷

The arguments in the previous section showed that avoiding dangerous climate change cannot be responsibly assured by policy proposals that exclude population-related interventions. The arguments in this section show that the ameliorative effects of population engineering in the form of fertility reduction are so powerful as to warrant giving them serious consideration. As a technologically feasible and highly effective means of cutting GHG emissions, reducing human fertility could go a long way toward addressing the shortcomings of the consensus approach to climate change mitigation. The question, it seems, is not *whether* we should implement

³⁶Paul A. Murtaugh and Michael G. Schlax, “Reproduction and the Carbon Legacies of Individuals,” *Global Environmental Change* 19 (2009): 14-20, p. 18, Table 3 (“Optimistic Scenario”).

³⁷*Ibid.*, pp. 14-20. Of course, there are reasons to question these numbers. After all, in order to make their calculations, Murtaugh and Schlax had to determine how much of one’s descendants’ emissions one is responsible for. They settled on what they took to be an intuitive formula, which is that someone is responsible for $(1/2)^n$ of her descendants’ emissions, where n is the number of generations the descendant is removed from the procreator. So, one is responsible for his offspring’s emissions broadly to the degree that he shares his genes with that offspring. A second reason to question these numbers is that it is highly unlikely that the global community will continue business-as-usual emissions for the entire century, or that it will make the necessary emission reductions to meet the “optimistic” scenario; the truth will likely lie somewhere in between. However, the study is instructive for showing that having a child likely increases one’s carbon emissions by more than many other activities that we think we ought to refrain from, and may increase one’s emissions by so much as to swamp all nonprocreative activities. That would seem to make it an environmentally serious activity, indeed.

some sort of fertility-reducing population engineering program, but rather *which* interventions such a program should include.

4. Population Engineering Policies: Coercion and Choice Enhancement

As with other types of policy interventions, including those aimed at growing or stabilizing a population, population engineering interventions aimed at reducing fertility can be categorized according to their position on a “coercion spectrum.”³⁸ As Figure 1 illustrates, the further to the left a policy type falls on the spectrum, the lower the likelihood that an instance of that policy type will result in coercion. The further to the right a policy type falls on the spectrum, the more likely an instance of that type will result in coercion.

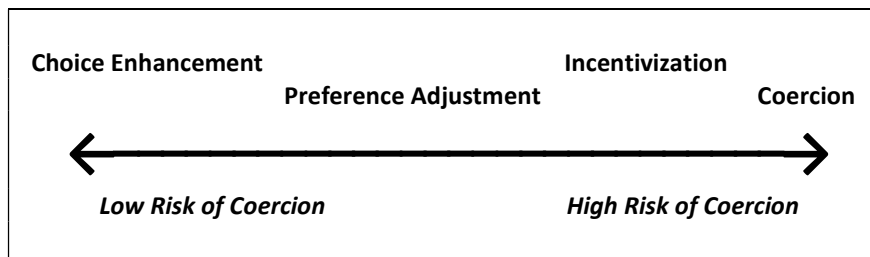


Figure 1

In this and the next few sections, we will consider four types of fertility-reducing population engineering interventions. We will defend the efficacy and general moral justifiability of the first three: choice-enhancing, preference-adjusting, and incentivizing.

For the moment, however, let’s consider the policy type that lies at the far right of the coercion spectrum. This includes policies that involve straightforward violations of citizens’ autonomy or bodily integrity. Cases from history and dystopic fiction involving practices like forced abortions and sterilizations come to mind. Coercive fertility-reducing interventions

³⁸Inspiration for this idea comes from Robert M. Veatch, who observes that incentivizing policies can be placed “on a continuum between fully voluntary choice and total coercion” (“Governmental Population Incentives: Ethical Issues at Stake,” *Studies in Family Planning* 8 (1977): 100-108, p. 100). Further, the general idea of an “intervention” or “coercion spectrum” was utilized by the Nuffield Council on Bioethics in its *Public Health: Ethical Issues* (Cambridge: Cambridge Publishers, 2007), pp. 41-42. In the council’s version, interventions were arrayed on a “ladder,” ranging from those that “eliminate choice” to those that “do nothing, or monitor the situation.”

typically involve biomedical interventions on the body without informed consent, and constitute clear human rights violations.³⁹ They cause significant harms and their wrongfulness has often been exacerbated by their regular targeting of, and disproportionate effect on, vulnerable and oppressed populations. Straightforwardly coercive interventions to reduce human population growth are almost always wrong, and we will not defend them here.

The wrongness of coercive policies does not, however, militate against *all* population engineering interventions. As has been argued elsewhere,⁴⁰ simply providing adequate education and healthcare to the poorest citizens in our world (especially women) has a striking effect on fertility rates.⁴¹ As a result of this well-documented link between these important services and fertility, we suggest that a category of interventions focusing on improving education and healthcare may also be a form of population engineering, but one which involves no coercion at all.

Just as we agree that the interventions at the far right of the coercion spectrum are prohibited, we agree with others who have written on the subject that choice-enhancing interventions (those on the far left of the spectrum) are not only permissible, but obligatory, as they are means of ensuring equal access to basic goods. Further, we want to argue that there are other interesting positions more toward the middle of the coercion spectrum that are worth serious consideration and require moral analysis. Doing so, however, places us under additional argumentative burdens. The

³⁹For some examples of such policies, see Jonathan Glover, "Eugenics: Some Lessons from the Nazi Experience," in John Harris and Søren Holm (eds.), *The Future of Human Reproduction: Ethics, Choice, and Regulation* (Oxford: Clarendon Press, 1998), pp. 57-65; Don Weeden and Charmayne Palomba, "A Post-Cairo Paradigm," in *Life on the Brink*, p. 246; Neil Thomas, "The Ethics of Population Control in Rural China, 1979-92," *International Journal of Population Geography* 1 (1995): 3-18; Anastasia Maloney, "Peruvian Women Haunted by Forced Sterilization Seek State Apology," *Reuters*, 3 June 2015, <http://www.reuters.com/article/2015/06/03/us-peru-women-rights-idUSKBN00J2FN20150603>; and Natalia Antelava, "Uzbekistan's Policy of Secretly Sterilising Women," *BBC News*, 12 April 2012, <http://www.bbc.com/news/magazine-17612550>.

⁴⁰John Bongaarts and Steven Sinding, "Population Policy in Transition in the Developing World," *Science* 333 (2011): 574-76; Das Gupta, "Population, Poverty, and Climate Change," pp. 95-100; Cafaro, "Climate Ethics," pp. 47-48.

⁴¹Recent evidence from the Middle East and North Africa (MENA) strongly suggests how improving family planning services, economic development, and gender justice lead to a predictable decline in fertility. The fertility rate for MENA has gone from about 7 in 1960 to around 3 in 2006. This is largely due to "delayed marriage, wider acceptance of and access to family planning services, and increased education of girls and young women. In some countries, the laws that have restricted women's rights and participation in the wider society are being relaxed" (Farzaneh Roudi-Fahimi and Mary Mederios Kent, "Challenges and Opportunities—The Population of the Middle East and North Africa," *Population Bulletin* 62, no. 2 (Washington, D.C.: Population Reference Bureau, 2007)).

first of these is: why make the case for interventions that even moderately increase the risk of coercion, when the clearly noncoercive interventions are so successful?

5. Moving Beyond Choice Enhancement

The first reason for looking beyond choice-enhancing interventions is simply *urgency*. As we noted earlier, effectively mitigating dangerous climate change requires that our policy solutions begin working quickly; we don't have the luxury of solving this problem at a leisurely pace. Choice-enhancing interventions such as education and improved healthcare access have historically taken decades to have a substantial impact on fertility, but that is too long a time horizon for fertility reduction to have a significant impact on near-term GHG emissions. Recent demographic models indicate that even if we were to universally deploy choice-enhancing fertility-reducing interventions within a few years, the human population would closely approximate current moderate projections of 10.9 billion by 2100, with significant reductions occurring only in the following century.⁴² In order to help avert a 2°C increase in global average temperatures this century, we must reduce population growth faster than choice-enhancing policies are capable of doing on their own.⁴³

The second reason for looking beyond choice-enhancing interventions is that they will likely have their largest effect in developing nations (and some pockets of poorer demographics within developed nations). Fertility rates and unmet need for family planning are highest in Asia and Africa, and lowest in Europe and North America.⁴⁴ In the near term, however, citizens of developing nations are the smallest contributors of GHG emissions.⁴⁵ While reducing fertility in developing nations is important, since their per capita GHG emissions are projected to increase significantly (and should be allowed to do so) over the next several decades, it is not nearly as critical as near-term reductions in the numbers of the world's wealthy. Although it would be difficult to lower the fertility rate in the United States

⁴²Corey J.A. Bradshaw and Barry W. Brook, "Human Population Reduction Is Not a Quick Fix for Environmental Problems," *Proceedings of the National Academy of Sciences* 111 (2014): pp. 16611-12.

⁴³For other limitations of choice-enhancing interventions, see Campbell, "Why the Silence on Population?" p. 49.

⁴⁴UN DESA, *The World Population Situation in 2014: A Concise Report* (New York: United Nations, 2014), pp. 7-8, <http://www.un.org/en/development/desa/population/publications/pdf/trends/Concise%20Report%20on%20the%20World%20Population%20Situation%202014/en.pdf>.

⁴⁵World Bank, World Development Indicators, "CO₂ Emissions (Metric Tons Per Capita)," <http://data.worldbank.org/indicator/EN.ATM.CO2E.PC/countries>.

from 1.9 to, say, 1.4, such a reduction would have a massive impact on both near-term and long-term global GHG emissions—much more even than proportionally larger fertility reductions in sub-Saharan Africa.⁴⁶

But this raises a question: Why bother to reduce fertility in developing nations at all? If the United States and other developed nations are the real problem, then our efforts, surely, ought to focus exclusively on reducing *their* numbers. But this is also too simplistic. Many of the world's poor are becoming richer, and all of the rest *ought* to become richer. That is, it is both descriptively true that many of the world's poor will have higher per capita GHG emissions as a result of economic development over the next century, and normatively true that they ought to be allowed to develop this way.⁴⁷ But the details concerning climate change and demographics in the previous sections make clear that Earth cannot sustain a significantly larger population of wealthier individuals. Although a reduction in the number of new people with small carbon footprints makes less of a difference in the *near-term* future than fewer new people with large carbon footprints, the former's carbon footprints are projected to grow significantly in the *long-term* future (over the next century or so). Moreover, the point about *carbon legacy* from above still holds, such that reductions in fertility anywhere now will result in significant reductions in GHG emissions later.

As individuals become wealthier, they need to have fewer children. We therefore conclude that we need to investigate the defensibility of additional fertility-reducing population engineering interventions, especially for use in developed nations, but that this does not undermine the strong need for choice-enhancing interventions as well.

6. Procreative Liberty: A Preliminary Objection

Even though we have already rejected the most egregiously coercive fertility-reducing interventions, some might worry that anything beyond choice-enhancing interventions will violate people's procreative liberties and impose objectionable burdens on exercising the freedom to choose the shape of one's reproductive life.⁴⁸ International bodies, courts, and constitutions the world over recognize adults' moral right to procreative freedom, as in

⁴⁶Consider, for instance, that Niger has a fertility rate of 7.6 but per capita CO₂ emissions of only 0.1 metric tons.

⁴⁷In an ideal world, that development would be carbon-neutral, but absent a miraculously swift technological revolution, much of it predictably won't be.

⁴⁸John A. Robertson, *Children of Choice: Freedom and the New Reproductive Technologies* (Princeton: Princeton University Press, 1994); Dan W. Brock, "Shaping Future Children: Parental Rights and Societal Interests," *Journal of Political Philosophy* 13 (2005): 377-98.

the Proclamation of Teheran: “Parents have a basic human right to determine freely and responsibly the number and the spacing of their children.”⁴⁹

In response to this objection, we must point out that procreative rights are almost certainly *limited* in their scope and strength. “Procreative liberty,” as a *moral right*, cannot mean freedom from *any* kind of influence on one’s reproductive choices, and is only plausible when interpreted (like most liberties) as constrained by a number of factors, including the well-being of the children one would create, or the costs imposed on others by one’s exercises of procreative liberty.⁵⁰ It is plausible that societies are justified in taking some steps to prevent violations of these constraints on the moral right to procreate, even if they are not justified in exercising coercive power to do so.

Whatever procreative liberty rights amount to, given that they fall short of rights against any kind of influence on one’s reproductive choices, the burden is on objectors to show that the preference-adjusting and incentivizing interventions we will lay out below actually infringe on such rights.⁵¹ We expect that will be difficult. In other contexts, we readily accept similar preference-adjusting or incentivizing interventions in order to advance public interests or protect others from harm. We attempt to influence people’s sexual behavior and diet in order to minimize public health costs, but this does not necessarily infringe on their rights to self-determination and privacy. We offer various incentives to make certain careers more or less attractive, but this does not seem to infringe on one’s right to live according to one’s own conception of the good.⁵² In the next few sections, we will show how interventions such as these can be permissibly used to reduce human fertility.

⁴⁹United Nations, *Final Act of the International Conference on Human Rights: Teheran: 22 April to 13 May 1968*, sect. II, item 16, http://legal.un.org/avl/pdf/ha/fatchr/Final_Act_of_TehranConf.pdf.

⁵⁰Brock, “Shaping Future Children,” pp. 384-97.

⁵¹Many societies even have policy interventions aimed at persuading or incentivizing their citizens to produce *more children* than they would otherwise. Tragically, these policies even include coercive measures, such as laws restricting access to abortion on pain of criminal sanction (see Center for Reproductive Rights, “The World’s Abortion Laws 2015,” <http://worldabortionlaws.com/map/>). Those who object to our proposal on the grounds of procreative liberty should have similar concerns even with noncoercive pronatalist policies. We thank an anonymous reviewer for this helpful observation.

⁵²To be clear, we do believe that having the freedom to determine how many children one will have, and when, is a good thing. In a different world, where our procreative decisions did not have an impact on issues of justice like climate change, it might be morally unacceptable to impose on would-be procreators even the modest interventions beyond choice enhancement that we will propose. But just because something is of great value does not mean that it is of overriding value.

7. Population Engineering through Preference Adjustment

Sitting to the right of choice-enhancing interventions on the coercion spectrum is a category of interventions aimed at adjusting preferences to encourage people to have fewer children. The policies in this category work by changing cultural norms and influencing individuals' beliefs and desires, with the ultimate goal of changing procreative behaviors in the direction of lower fertility. These changes could be achieved through mass media such as radio and TV content, billboards, poster campaigns, leaflet distribution, folk theater or other artist sponsorship, campaigns or assemblies in public schools, funding for public lectures, and so on.

Of course, there are different ways of adjusting preferences and using mass media to influence behavior, and they are not all morally on a par. Some might use purely rational persuasion. They might deliver objective information about risks or harms attached to behaviors for viewers to respond to with their rational capacities. Rational persuasion is often seen as a wholly unproblematic means of altering people's beliefs and desires.⁵³

Other types of preference-adjusting interventions, however, would use traditional advertising or rhetorical tactics that influence behavior without triggering rational deliberation in the targets, such as the power of celebrity endorsement, narrative suggestion, emotional appeal, and so on. There is a range of historical examples of such preference-adjusting fertility-reducing interventions that push beyond rational persuasion. Poster campaigns featuring images of small, happy families and national slogans have been used widely.⁵⁴ In the 1970s and 1980s, Mexico's Televisa produced shows based on psychological data on how role models influence behavior. That format traveled to India, where population-values-based drama *Hum Log* had 60-90% shares of the TV viewing audience. Similar radio programs were launched in places like Kenya and Tanzania, using local and culturally appropriate norms and customs to depict similar values.⁵⁵ Empirical research on these interventions showed significant shifts in audience beliefs about the acceptability and practicality of family planning as well as ideal family size, which in many cases led to increased use of family planning and reduced or delayed childbearing.⁵⁶

⁵³Some interventions that aim at rational persuasion might be more appropriately classified as choice-enhancing, since they might merely help individuals carry out their authentic preferences amid information deficits.

⁵⁴In Singapore, the slogans included "Small Families—Brighter Future: Two is enough," "Please stop at two," or "The second can wait." For more examples, see <http://www.pbs.org/wgbh/nova/earth/population-campaign.html>.

⁵⁵William Ryerson, "How Do We Solve the Population Problem?" in *Life on the Brink*, pp. 244-48.

⁵⁶Arvind Singhal and Everett Rogers, *India's Information Revolution* (New Delhi:

William Ryerson claims that “in terms of birth averted per dollar spent, mass media communications are probably the most effective strategy for reducing fertility rates.” He estimates that a mere \$35 million per year could fund persuasive and motivationally effective programming in all of the major developing countries of the world.⁵⁷ Even if one is skeptical about the precise ordinal ranking or dollar estimate, the general point stands that preference adjustment through media is a promising policy tool for lowering global fertility rates.

Preference-adjusting interventions such as these are best conceptualized as *nudges*.⁵⁸ Borrowing from Yashar Saghai’s formal interpretation of the concept, “A nudges B when A makes it more likely that B will ϕ , by triggering B’s automatic cognitive processes, while preserving B’s freedom of choice.”⁵⁹ Many of the kinds of narrative fiction mentioned above used nudging tactics as simple as sympathetically showing characters change their views about ideal family size. Such programming shows family planning and restrained childbearing in a positive light and emphasizes the hardships of having too many children too quickly. The programming’s aim is to subrationally influence citizens by suggesting ideas, role models, and narratives that emphasize and de-emphasize certain risks, costs, and benefits of procreative decisions; but these influences do not alter an individual’s choice set, and preserve his or her freedom to emulate those narratives and role models or not.

8. The Psychological Manipulation Objection to Preference Adjustment

Because of their nudging structure, preference-adjusting interventions are unlikely to constitute rights violations by being coercive or liberty-restricting; they transparently leave options open and do so without directly altering the cost of any option.⁶⁰ But even if such interventions are not obviously

Sage, 1989); Everett Rogers, et al., “Effects of an Entertainment-Education Radio Soap Opera on Family Planning Behavior in Tanzania,” *Studies in Family Planning* 30 (1999): 193-211.

⁵⁷Ryerson, “How Do We Solve the Population Problem?” p. 248.

⁵⁸Richard H. Thaler and Cass R. Sunstein, *Nudge: Improving Decisions about Health, Wealth, and Happiness* (New Haven: Yale University Press, 2008).

⁵⁹Yashar Saghai, “Salvaging the Concept of Nudge,” *Journal of Medical Ethics* 39 (2013): 487-93.

⁶⁰See Robert L. Arrington, “Advertising and Behavior Control,” *Journal of Business Ethics* 1 (1982): 3-12; Tom L. Beauchamp, R.M. Hare, and Barry Biederman, “Manipulative Advertising [with Commentaries],” *Business and Professional Ethics Journal* 3 (1984): 1-30; and Roger Crisp, “Persuasive Advertising, Autonomy, and the Creation of Desire,” *Journal of Business Ethics* 6 (1987): 413-18.

coercive, some might worry about influencing preferences, values, and behavior by cultural pressure and other mechanisms that act on subpersonal psychological systems and circumvent rational deliberation. It might seem to be an objectionable form of *psychological manipulation* that runs afoul of the autonomy rights of individuals, even if people are not made worse off because their values and conception of the good adjust to be consistent with having fewer children.

There are a number of things to say in response to such worries. First, it is important to note that the interventions we are talking about don't have to be covert or present false information, and as such it seems less likely that their influence would rise to the level of objectionable manipulation, which often requires deceit and trickery. Second, we accept this way of shaping values and opinions all the time—in public health contexts, in advertising, in personal relationships, and even in putting a positive spin on procreation—so it is unclear why it would be particularly problematic in the service of reducing fertility.

In fact, rather than being manipulative violations of autonomy rights, such interventions might actually be *autonomy-enhancing*. Most people live in pro-natalist cultures, in which the social value of having children has been reinforced over centuries by any number of contingent practices and ideologies.⁶¹ Additionally, many of these societies already provide incentives in the form of tax breaks or other benefits for producing larger families. These pro-natalist cultural influences condition people's reproductive preferences in a way that should raise doubts about how informed, autonomous, and rationally endorsed they really are. Adding countervailing influences in the form of anti-natalist preference-adjusting messaging would serve to counteract these nonrational influences, just as preference-adjusting anti-smoking ads or campaigns encouraging people to get tested for stigmatized diseases often do. These interventions do not appear to inhibit (and in fact might enhance) people's abilities to make informed, autonomous decisions about their lives. Given the cultural dominance of pro-natalism, we think that preference-adjusting tactics are defensible for similar reasons.

Granted, there might be token instances of interventions aimed at adjusting preferences that would violate autonomy rights. Those that use outright *misinformation*, *deception*, or *manipulation* to accomplish their goals are likely candidates. This could involve anything from concealing informational sources, exaggerating data, withholding important information, preying upon morally problematic biases, and so on. Instances of this sort

⁶¹For helpful discussions of the cultural and psychological dominance of pro-natalism, see Christine Overall, *Why Have Children? The Ethical Debate* (Cambridge, Mass.: MIT Press, 2012); and Travis N. Rieder, "Procreation, Adoption, and the Contours of Obligation," *Journal of Applied Philosophy* 32 (2015): 293-309.

will have the flavor of something closer to propaganda. In addition, subtle forms of manipulation in such campaigns might raise moral concerns if they result in shaming or stigmatization. We take all of these worries seriously, and would not endorse just any token preference-adjusting intervention to reduce fertility. Certainly it matters what shape the messaging takes.⁶² What we want to note, however, is that these problems are not essential to the category of preference-adjusting population engineering interventions. If we are sensitive *to whom* such preference-adjusting messaging is directed, and are thoughtful about its content and delivery, these troubling possibilities can be avoided.

9. Population Engineering through Incentivization

Whereas preference-adjusting interventions attempt to influence reproductive behaviors by altering people's beliefs and other attitudes about ideal family size, incentivizing interventions attempt to influence fertility by directly altering the costs and benefits associated with certain reproductive behaviors. Although incentives share this mechanism with threats of coercion, the two types of intervention are importantly different. To incentivize a behavior is to offer "a benefit designed as a motive or incitement to action,"⁶³ where the target actor is free to accept or decline the benefit. On this definition, a *merely* incentivizing offer would not be coercive, since an essential feature of a coercive "offer" is that the consequences of the recipient's refusal to accept its terms are severe enough to undermine the recipient's genuine freedom to refuse. Admittedly, interventions designed to be merely incentivizing can in fact be coercive, or run the risk of being so (hence their placement on the coercion spectrum to the right of preference-adjusting interventions), but there are a number of ways to significantly reduce this risk.

One might think that the intuitive difference between *positive* incentives, such as giving tax credits for contributing to charity, and *negative* incentives, such as adding a surcharge to cigarette purchases, is a helpful way to track which incentivizing interventions carry an unacceptable risk

⁶²So that, e.g., latent prejudices along gender, racial, or class distinctions do not end up stigmatizing, marginalizing, re-entrenching stereotypes, and so on, nor do they target certain populations with unfairly aggressive messaging in a manner inconsistent with a just distribution of population engineering burdens. We will say more about this below when we develop an outline of a population engineering program.

⁶³Ruth W. Grant and Jeremy Sugarman, "Ethics in Human Subjects Research: Do Incentives Matter?" *Journal of Medicine and Philosophy* 29 (2004): 717-38, p. 720. See also Ruth W. Grant, *Strings Attached: Untangling the Ethics of Incentives* (Princeton: Princeton University Press, 2012), p. 43.

of coercion. It might even seem that offering a negative incentive amounts to a threat of coercion, since the target of the incentive is being asked to behave in one way or suffer a cost, with no prospect of receiving a genuine benefit. Making the intuitive distinction between positive and negative incentives rigorous so as to vindicate the view that negative incentives are necessarily (or even more likely to be) coercive has proven difficult. The major issue is that it is unclear what the appropriate baseline is for determining “costs” and “benefits.”⁶⁴ Here we follow Robert Veatch’s suggestion that the difference is psychological: positive incentives are those that would make us better off than we believe we are entitled to be, negative incentives are those that would make us worse off than we believe we are entitled to be.⁶⁵ But beliefs about what we are in fact entitled to receive are not necessarily reasonable, such that an incentivizing intervention’s being “positive” or “negative” does not track whether it is in fact coercive, nor whether it is morally justified in any broader sense.

In addition to the positive/negative distinction, there are several other ways in which incentivizing interventions can be categorized: the type of benefit offered (money, other goods), the timeframe in which it will be delivered (short term, long term), to whom it is offered (the person to be motivated, intermediaries), for whom it is a benefit (the person to be motivated, the broader community), and the type of behavior targeted (the behavior of policy interest, behaviors that indirectly influence that behavior), among others.⁶⁶ Incentivizing interventions modified along these dimensions have been tried for the purposes of reducing fertility rates and have seen varying degrees of success. Under previous iterations of China’s so-called “one-child policy,” local Communist Party officials were incentivized to discourage their constituents from producing too many children in a given year.⁶⁷ In India in the 1960s, clothing, electronics, and cash payments were provided to intermediaries and to would-be procreators to incentivize the latter’s sterilization or delayed childbearing.⁶⁸ In the 1970s, Singapore’s government successfully lowered fertility through a number of negative incentives: increased hospital delivery fees for each additional child, elimination of maternity leave after three or more children, and the

⁶⁴Kristin Voigt, “Incentives, Health Promotion and Equality,” *Health Economics, Policy and Law* 7 (2012): 263-83, pp. 266-69.

⁶⁵Veatch, “Governmental Population Incentives,” p. 102. Voigt suggests that even a modest account such as Veatch’s overstates the difference between positive and negative incentives (“Incentives, Health Promotion and Equality,” p. 267).

⁶⁶Veatch, “Governmental Population Incentives,” pp. 100-108; Voigt, “Incentives, Health Promotion and Equality,” pp. 264-66.

⁶⁷Thomas, “Population Control in Rural China,” p. 7.

⁶⁸Robert Repetto, “India: A Case Study of the Madras Vasectomy Program,” *Studies in Family Planning* 1 (1968): 8-16.

elimination of tax breaks beyond the third child, among others.⁶⁹ Each of these incentive programs saw some success, and although more research is needed, a meta-analysis of empirical research on eight contemporary programs that offered incentives to alter procreative behaviors suggests that these interventions are effective, even across differences in local cultural norms and resource availability.⁷⁰

Although we believe historical instances of incentives aimed at reducing fertility show the potential efficacy of such interventions, these incentive programs often had significant moral drawbacks, including unacceptably high risks of coercion. Until relatively recently, the combination of positive and negative incentives deployed as part of China's family planning policy spurred social pressure that resulted in coerced abortions, and in some cases infanticide.⁷¹ India's incentives took advantage of low literacy rates among its poorest classes, resulting in the sterilization of thousands without informed consent.⁷² Similarly, Singapore's negative incentives imposed significant financial burdens on poor mothers and their children, while the rich were relatively unaffected.⁷³ But just as the morally problematic token instances of preference-adjusting interventions did not undermine the moral justifiability of that type of intervention, problematic token instances of incentivizing interventions need not impugn all incentives. A quick survey of how the fertility-reducing incentivizing interventions in China, India, and Singapore could have mitigated the risk of coercion shows how such incentives could be crafted in the future.

First, the risk of fertility-reducing incentivizing interventions becoming coercive could have been ameliorated or avoided entirely with greater political transparency about the goals, methods, and outcomes of those policies. Insufficient data collection on the efficacy of fertility-reducing incentives and on the frequency of abuses by recruiters is part of what led to morally objectionable instances of coercion in India.⁷⁴ Second, offering

⁶⁹Swee-Hock Saw, "Singapore: Resumption of Rapid Fertility Decline in 1973," *Studies in Family Planning* 6 (1975): 166-69.

⁷⁰Sarah H. Heil, Diann E. Gaalema, and Evan S. Herrmann, "Incentives to Promote Family Planning," *Preventive Medicine* 55 (2012): S106-S112.

⁷¹Thomas, "Population Control in Rural China," p. 10; Therese Hesketh and Zhu Wei Xing, "The One Child Family Policy: The Good, the Bad, and the Ugly," *British Medical Journal* 314 (1997): 1685.

⁷²Repetto, "Madras Vasectomy Program," p. 13. For a contemporary comparison, see Ellen Barry and Suhasini Raj, "Web of Incentives in Fatal Indian Sterilizations," *The New York Times*, 12 November 2014, <http://www.nytimes.com/2014/11/13/world/asia/web-of-incentives-in-fatal-indian-sterilizations.html>.

⁷³Swee-Hock Saw, *Population Policies and Programmes in Singapore* (Singapore: Institute of Southeast Asian Studies, 2005), pp. 84-85, 90, 149, 155-56.

⁷⁴Repetto, "Madras Vasectomy Program," pp. 13-14. Much of the following discussion draws on Veatch's "Governmental Population Incentives."

incentives to government officials, health professionals, family members, or other actors, rather than directly to would-be procreators, increases the likelihood of people being coerced into engaging in “appropriate” reproductive behaviors. China incentivized local and regional officials to reduce their constituents’ fertility,⁷⁵ while India offered rewards to various intermediaries to encourage others to undergo sterilization.⁷⁶ Although there is some evidence that such indirect incentives are more effective,⁷⁷ their increased risk of coercion should motivate policymakers to prioritize incentives directly targeting would-be procreators.

Finally, incentivizing interventions to reduce fertility have historically failed to consider the special vulnerabilities of groups such as children, the poor, women, disabled people, or racial/ethnic minorities. In China, inadequate planning of incentive programs resulted in increased rates of gender-selective abortion and infanticide.⁷⁸ In India and Singapore, incentives were more likely to result in coercion of poor women, who were often members of despised minority groups, since their financial and social situation was more significantly influenced by offers that would seem modest to the wealthy and powerful.⁷⁹ One way to minimize the risk of harm to children is to direct incentives at “upstream” procreative behaviors, such as the use of birth control and other family planning practices. Admittedly, addressing the broader risk of coercion for other vulnerable groups is more complicated, as this would require policymakers to be responsive to factors such as local cultural norms and intergroup power dynamics when designing incentivizing interventions.

⁷⁵Thomas, “Population Control in Rural China,” p. 7; Hesketh and Zhu, “The One Child Family Policy.”

⁷⁶Repetto, “Madras Vasectomy Program,” p. 13. For discussion of similar problems in Peru, see Brita Schmidt, “Forced Sterilization in Peru,” *Committee on Women, Population, and the Environment*, 12 July 2006. <http://www.cwpe.org/node/49>.

⁷⁷Lenni W. Kangas, “Integrated Incentives for Fertility Control: Wider Use of Material Incentives Should Make Family Planning Programs More Effective,” *Science* 169 (1970): 127-83; Geoffrey McNicoll, “Community-Level Population Policy: An Exploration,” *Population and Development Review* 1 (1975): 1-21.

⁷⁸Thomas, “Population Control in Rural China,” p. 10; Hesketh and Zhu, “The One Child Family Policy.” The true extent of this problem is disputed, however; see Lawrence W. Green, “Promoting the One-Child Policy in China,” *Journal of Public Health Policy* 9 (1988): 273-83.

⁷⁹Barry and Raj, “Web of Incentives”; Saw, *Population Policies*, pp. 153-55. For other examples of this problem, see Schmidt, “Forced Sterilization”; Maloney, “Peruvian Women Haunted”; and Antelava, “Uzbekistan’s Policy.”

10. The Undue Inducement Objection to Incentivization

So far, we have argued that incentivizing interventions would be an effective means for reducing fertility, and that there are a number of ways of minimizing the risk of these policies becoming coercive. But even assuming that fertility-reducing incentives would be effective and would not be directly coercive, one might nonetheless worry about these incentives being so large as to constitute *undue inducement*. Although there are conflicting interpretations of “undue inducement,”⁸⁰ the basic idea is that a noncoercive incentive can still be morally problematic when the benefit it offers is large enough to short-circuit the recipient’s free and autonomous choice. Many people think that the state should not offer large (relative to an individual’s circumstances) financial rewards for becoming a living organ donor or for participating as a subject in medical research, precisely because these offers might manipulate someone into acting against her autonomous *ex ante* preferences (and perhaps even her best interest). One might argue that the size of the incentives needed to effectively reduce fertility would involve a similar sort of undue inducement.

We have three responses to the undue inducement objection. First, as with preference-adjusting interventions, it is not apparent that most people’s *ex ante* procreative preferences are autonomous to begin with. In pro-natalist societies such as the U.S., people are already offered incentives in the form of tax breaks or other benefits for producing larger families. These pro-natalist incentives influence people’s *ex ante* reproductive preferences in a way that potentially undermines their autonomous endorsement. Anti-natalist, fertility-reducing incentives are not obviously more objectionable, and might even serve to counteract the manipulative influences of pro-natalist incentives, much in the way that incentives for quitting smoking or getting tested for stigmatized diseases often do.

Second, large incentives most clearly seem to constitute undue inducement when they motivate people to act against their own best interests, not purely because they undermine autonomous choice.⁸¹ But most of the people targeted by fertility-reducing incentives will not be made worse off, and many will be better off overall.⁸² Some targets of incentives will have already been affected by preference-adjusting interventions, which will change their *ex ante* reproductive preferences. In addition, research sug-

⁸⁰In addition to Grant and Sugarman, “Ethics in Human Subjects Research,” esp. p. 728, see Ruth Macklin, “‘Due’ and ‘Undue’ Inducements: On Paying Money to Research Subjects,” *IRB: Ethics and Human Research* 3 (1981): 1-6; and Ezekiel J. Emanuel, “Undue Inducement: Nonsense on Stilts?” *American Journal of Bioethics* 5 (2005): 9-13.

⁸¹Emanuel, “Undue Inducement,” pp. 10-11.

⁸²For a summary of benefits of slowed population growth, see Patrick Gerland et al., “World Population Stabilization Unlikely This Century,” *Science* 346 (2014): 234-37.

gests that having fewer children does not generally make one worse off than having more children,⁸³ which suggests that fertility-reducing incentives will not invariably diminish people's welfare. And even if incentives do motivate people to act against their ex ante best interests, in many cases the incentives will serve to compensate for that welfare setback.

There will be some people, however, who would likely be left worse off by sizable fertility-reducing interventions—for example, wealthy people who are deeply committed to having a large family but are influenced by large negative incentives.⁸⁴ This brings us to our third response to the undue inducement objection: in short, autonomy is not the only moral value. Fertility-reducing incentives are an important policy option for avoiding the serious harms of dangerous climate change; the welfare and rights of current and future people are at stake, as well as the possibility of the distributively just world we ought to strive for. We believe that securing these other values justifies any moral remainder of the undue inducement objection to fertility-reducing incentivizing interventions that was not defused by the previous two responses.

In the previous four sections, we have described two types of interventions that aim at reducing human fertility, and have defended their moral justifiability against a number of plausible objections. In the next section, we will proceed to outline how these two policy types could fit together into a progressive, global fertility-reduction strategy in order to equitably distribute the burdens of these interventions and to maximize their ameliorative impact on global climate change.

11. Outlining a Global Population Engineering Program

We will now offer a skeletal outline of a global population engineering program that would be responsive to the real urgency of climate change and to the moral concerns raised in the previous sections. This outline does not amount to anything like a policy recommendation, which would take a massively collaborative effort between ethicists, policymakers, social scientists, governments, NGOs, and others. Rather, we are merely sketching the rough shape of a *morally permissible* fertility reduction effort, as a first step toward more robust policy development.

⁸³Recent studies indicate that having children generally has no impact or a negative impact on people's quality of life. See Thomas Hansen, "Parenthood and Happiness: A Review of Folk Theories versus Empirical Evidence," *Social Indicators Research* 108 (2012): 29-64; and Rachel Margolis and Mikko Myrskylä, "A Global Perspective on Happiness and Fertility," *Population and Development Review* 37 (2011): 29-56.

⁸⁴For more on why wealthy people are more likely to be subjected to large negative incentives, see section 11 below.

In developing nations, especially those that are expected to significantly increase their per capita GHG emissions over the next century, the first and central focus should be a rapid and comprehensive expansion of choice-enhancing interventions, such as women's education and improved access to reproductive healthcare. These interventions have proven efficacy and cost-effectiveness for radically reducing fertility with no moral downsides. Simultaneously, preference-adjusting interventions such as informational media and values-focused messaging are likely to be extremely cost-effective in developing contexts. Concerns about egregious misinformation and brainwashing are easy to avoid, and the concerns mentioned above about shaming, stigmatizing, or otherwise unfairly burdening the targets of preference-adjusting interventions could be avoided with careful planning. Importantly, achieving the full potential of preference-adjusting interventions requires the implementation of choice-enhancing interventions, since it doesn't help to affect the attitudes of individuals to have fewer children if they lack access to or knowledge of family planning resources.

Positive incentives should be the next priority in developing nations, and these should be put into place only as choice-enhancing and preference-adjusting interventions begin to decline in efficacy. Examples might include paying women on a progressive scale to fill prescriptions for birth control, go to the gynecologist, or take classes on family planning (beyond merely making all of these accessible and affordable). A smaller role will be played by negative incentives, which will typically target citizens in developing nations whose incomes and standard of living approach what is commonly seen in developed nations. As a nation transitions from developing to developed, however, negative incentives will play a more important role in reducing fertility, as we will now explain.

In developed nations, the prioritization and structure of fertility-reducing interventions will look slightly different. Specifically, positive and negative incentives will play a more significant role than choice-enhancing or preference-adjusting interventions, mainly because the latter will not be as effective in developed contexts. Although there are still gaps in access to and education about family planning services in places like the U.S., which it will be important to correct, the problem is proportionately less severe than in developing nations.⁸⁵ Likewise, the comparatively high saturation of media markets in developed nations means that preference-adjusting interventions will likely be more expensive and less effective than in developing nations.

The extant pro-natalist incentives, cultural norms, and psychological biases that keep fertility at 1.9 rather than 1.4 expected births per woman

⁸⁵UN DESA, *World Population Situation*, pp. 7-8.

in the U.S., for example, are likely to be more effectively counteracted by fertility-reducing incentives than by other policy interventions (unlike the move from, say, 5 to 3 births per woman, which will be characteristic in some developing contexts). More specifically, we believe that a progressive system of positive and negative incentives, in which the relatively poor are more likely to receive positive incentives and the relatively wealthy are more likely to receive negative incentives, will be the most important tool to employ in developed nations. Such a system might involve reducing child tax credits beginning at a middle income bracket, or even introducing a progressive, income-sensitive tax for every additional child one creates.⁸⁶ Such interventions would attempt to fairly distribute burdens on procreative behavior across income levels within a nation, and would be designed specifically to keep individual children from being seriously harmed (e.g., lower-income parents being deprived of income that otherwise would have gone to their children).

Our outline for a global population engineering program suggests that the greater a would-be procreator's wealth, the more appropriate it will be to target that person with interventions to the right on the coercion spectrum. This is justifiable not only pragmatically, but also morally: since wealth is a fairly reliable proxy for individuals' GHG emissions, and so for their carbon legacy, it is morally justifiable to exert greater pressure on wealthy people's procreative behaviors.⁸⁷ Greater contributions to the dangers of global warming justify stronger fertility-reducing interventions. This principle supports our view that more effort should be directed toward reducing fertility in developed nations than in developing nations, since developed nations will emit more GHGs in the near term.⁸⁸ Similar reasoning justifies exerting greater pressures on the absolutely wealthy across

⁸⁶Veatch, "Governmental Population Incentives," pp. 106-7; "An Ethical Analysis," pp. 458-61.

⁸⁷One might be concerned that short of imposing exorbitant negative incentives, wealthy procreators would simply bear the costs and have however many children they would have had were no incentives in place. Depending on how the incentives are designed, we think in many cases they could permissibly be made large enough to make even the super-wealthy think twice about having a third or a fourth child, even if they could not motivate them to refrain from having a second. Also, the revenues collected from these negative incentives could be used to fund other climate change mitigation efforts, which would be valuable even if the incentives did not alter the behaviors of wealthy procreators. Thanks to Bob Veatch and an anonymous reviewer for raising this concern.

⁸⁸Several commentators have raised the worry that reducing fertility in developed nations, where fertility is already relatively low, could have drastic destabilizing economic effects. This is a serious worry, as investment from developed nations is necessary to fund decarbonization of the global energy system. Although the conventional wisdom is that lower fertility (and the subsequent aging of a population) undermines economic growth, recent empirical research suggests otherwise. Ronald Lee et al. argue that lower fertility is in many cases compatible with economic growth, in part because of savings in the costs of

the globe and on the relatively wealthy in developed nations. The slogan “carrots for the poor, sticks for the rich” is a reasonably fair description of our approach to global population engineering. Of course this rough outline needs to be responsive to particularities about costs, institutional hurdles, and culture-specific facts regarding prospects for efficacy, all of which will impact return on investment. Working out these important details will be the job of policymakers, social scientists, and others.

12. Concluding Remarks

In this article, we have argued that the dire and imminent threat of climate change requires an aggressive policy response, and that it is reasonable to think that this response should include population engineering. Further, we have argued that aggressive implementation of well-designed choice-enhancing, preference-adjusting, and incentivizing interventions aimed at reducing global fertility would be morally justifiable and potentially effective parts of a global population engineering program. In closing, we would like to briefly address one final issue: practicality.

Part of the motivation for arguing in favor of population engineering is that the current consensus approach to mitigating the risk of dangerous climate change, which refuses to consider population as a variable to be manipulated, might turn out to be too little, too late. World governments are not yet, even in the wake of the 21st Conference of the Parties, on track to achieve the GHG emissions reductions necessary to avoid a 2°C increase in average surface temperatures by 2100, and every day we delay increases the required aggressiveness of our response. But given that humanity has dragged its feet for so long with policies that do not involve the intuitive unpleasantness of population engineering, why would anyone ever agree to the interventions we have defended?

We have three brief responses to this concern about practicality. First, it is important to make our proposal in order to understand the options, even if it is no more likely to garner wide support than the more unlikely elements of the consensus approach to climate change mitigation. A vivid depiction of population engineering as a necessary backup if the consensus approach fails might alter how quickly and seriously we pursue non-population-related mitigation policies. Second, the fertility-reducing interven-

providing for non-producing young people (“Is Low Fertility Really a Problem? Population Aging, Dependency, and Consumption,” *Science* 346 (2014): 229-34). Combining these savings with a global immigration scheme that allows younger people from developing nations to move to developed nations could also reduce any economic drag caused by reduced fertility. Of course, more needs to be said about this issue, and we offer more details in a currently unpublished manuscript.

tions we advocate have some advantages over other mitigation strategies: reducing fertility is likely very cost-effective and is well within our current technological capabilities.⁸⁹ Significant progress in reducing fertility could be made without first reaching a grand global consensus. Reducing fertility in developing nations is likely both an effect and a cause of improving the lives of the world's poor (especially women), and so helps to satisfy other duties of distributive and social justice.

Finally, the population engineering interventions we have defended offer a new way of distributing the burdens of climate change mitigation. In many cases, it will be *easier* for individuals to cut their GHG output by reducing their fertility than by reducing their personal consumption. Reducing one's fertility would often be in one's own best interest, either because one originally wanted fewer children and choice-enhancing interventions provide means to achieve this, or because one has been swayed by preference-adjusting interventions to want fewer children. Reducing one's personal GHG emissions by reducing one's economic consumption, however, virtually always involves some sort of personal sacrifice.⁹⁰ Fertility-reducing interventions shift some of the burdens of climate change mitigation to individuals while reducing (though not eliminating) the need to cut back on personal consumption. This way of distributing the burdens of climate change mitigation cuts across the typical conflicts between governments and corporations, or developed nations and developing nations. Granted, it would generate new conflicts, forging new alliances as well as new antipathies. But perhaps this sort of realignment is what we need to break political gridlock in the global fight against climate change.⁹¹

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⁸⁹It is even possible that revenues collected from negative fertility-reducing incentives imposed on the wealthy would cover the costs of the other fertility-reducing interventions.

⁹⁰We thank an anonymous reviewer for this helpful observation.

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