*Consequentialist climate ethics**

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Abstract

The article argues that the moral foundation of climate change relates to avoiding and preventing harm and that this harm originates from impersonal moral violations. Moral cognitive neuroscience indicates that consequentialism better approximates the moral processes and judgments that humans naturally utilise when faced with issues such as climate change that involve impersonal notions of harm. Therefore, a consequentialist approach to climate ethics ultimately proves more morally acceptable and politically feasible than current deontological constructs. In light of this evidence, the article delineates and specifies the fundamental traits of a consequentialist proposal for tackling climate change, both at the individual and collective levels. The collective-level framework, based on the distribution of a carbon budget, is explored in depth, with a view to its theoretical traits and empirical features. Finally, the article defends the consequentialist proposal against the difficulties raised by its divergence from common moral intuitions.

Keywords: Carbon budget, Climate ethics, Consequentialism, Deontology, Impersonal harm, Moral cognitive neuroscience

1. Introduction

Altered climate dynamics are causing an array of negative impacts on our planet's natural and socio-economic systems (IPCC 2007b). These impacts are directly or indirectly harmful to all of humankind and potentially catastrophic for many of the poorest people in the world.[1] In their scientifically ascertained anthropogenic determinant, such impacts are the consequence of actions people take now that harm other people living both now and in the future.[2] In particular, anthropogenic carbon

[1] Consistent with the scientific consensus, I assume that i) climate change, despite denialism, *exists* and ii) that there is '*very high confidence*' (IPCC 2007a, p. 3, emphasis in the original) that human actions have an impact on climate systems.

[2] This article adopts an anthropocentric perspective, but it does not intend to confute the intrinsic value of nature (Leopold 1949) or to uphold the moral superiority of humans to other animals. I, however, argue that in the climate crisis, nature is the means through which humans harm each other. In other words, I believe that, for this article, reflections on nature and non-humans are redundant because, to protect humanity from climate impacts, we must first protect our environment in its broadest sense. Furthermore, western ethical tradition, on which my account is based, has largely focused on human-human relations.

emissions (i.e., the harmful actions, basically related to the combustion of fossil fuels, long-term deforestation and agricultural practices) produced globally by a diverse group of people, by consuming the common resource atmospheric absorptive capacity, threaten the stability of climate systems, alter climatic dynamics and eventually harm current and future people around the globe.

Given the harmful nature of climate change, and consistent with the only fundamental requirement shared by all accounts of morality, i.e., avoidance and prevention of harm to others (Gert 2011), I argue that the moral foundation of climate change relates to avoiding and preventing harm,[3] as the objective of the United Nations Framework Convention on Climate Change (UNFCCC) implicitly acknowledges, and that it critically depends on actions that people take now that harm and will harm other people living now and in the future.[4]

In my opinion our scant familiarity with climate change determined by mental models and ontological assumptions (Chen 2011), cognitive biases and use of heuristics (Baron 2006) and the misunderstanding of physical traits of risk and harm (Sunstein 2006) have precluded a proper perception of the harm-related moral nature of climate change and have eventually led to an ethical approach to climate change that, though increasingly sophisticated, seems to miss its true moral challenge. In fact, this dominant perspective argues that climate change entails two moral commitments. First, it is essential to curb anthropogenic greenhouse gases (GHG) emissions and/or enhance their sinks to avoid the increase of GHG concentration in the atmosphere. Second, it is imperative to support and fund efforts aimed at preventing climate change impacts or adapting to them. These moral commitments are known as the *duty of mitigation* and the *duty of adaptation*, respectively (Caney 2010a), and they

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However, on this anthropocentric basis, it could, to some extent, make international affairs include consideration of non-humans, as in the case of the Convention on Biological Diversity (CBD).

[3] I uphold the traditional and widely agreed Lockean view, according to which harm relates to the endangerment of anyone's life, health, liberty or possessions. Such endangerment in this context of analysis originates from the negative, yet greatly regionally differentiated, impacts of climate change on freshwater resources, ecosystems, food, fibre and forest products, coastal systems and low-laying areas, and industry settlement and society (IPCC 2007b).

[4] In the same vein, Shue (2011) considers the requirement to *do no harm* as the fundamental trait of climate ethics, although he confronts the moral dimensions of climate change on the basis of the notion of responsibility. Also Vanderheiden (2011) maintains that any plausible theories of justice should uphold a strong imperative to prevent people from suffering *climate-related harm*.

are subject to intense debate in the burgeoning literature on the moral implications of climate change.[5]

However, in my view, both the duty of mitigation and the duty of adaptation are means to address comprehensively the harm resulting from climate change. In fact, the only way to avoid and prevent climate-related harm requires both protecting nature form society (mitigation, i.e., avoidance of harm) and society from nature (adaptation, i.e., prevention of harm) (Stehr and von Storch 2005). Consequently, I argue that the two related moral commitments are two sides of the same moral coin because they both ultimately address a single, fundamental moral issue: avoiding/preventing certain people from harming other people, which is the moral core of climate change and the fundamental source of moral dilemmas arising from it. Such harm, moreover, originates from impersonal moral violations (as I will make clear in section 2), and its inherent intertemporal/transgenerational character (Shue 2011, Page 2006) further emphasizes this impersonality.

In light of these considerations, this article presents a confirmation of a moral approach to the harm-related moral dilemmas raised by climate change based on insights from moral cognitive neuroscience, that basically suggest that consequentialist climate ethics is more morally acceptable because it is consistent with human morality in the context of climate change.[6] For this reason, consequentialism is both more widely acceptable and more politically feasible. In fact, as the literature on political science unambiguously indicates (e.g., Dahl 1998), the more policy-making is consistent with people's values and beliefs, the more it is likely to succeed in the long term in democratic societies. Crompton (2011) echoes this argument specifically with respect to the climate crisis.

In sum, this article will first synthesize the contributions of moral cognitive

[5] These two duties involve different areas of ethical inquiry: scientific uncertainty, responsibility for past emissions, the establishment of mitigation targets, adaptation and compensation for past and future harm, scientific and technical resources, geo-engineering, and threats to non-humans (Gardiner 2010, Jamieson 2010a). Based on the dichotomy of duties emphasized, a large and rapidly growing body of literature has flourished. It is not reviewed here due to space constraints.

[6] Consequentialism is a moral approach that holds that acts and/or intentions are morally relevant, i.e., right, wrong or indifferent, only by virtue of their consequences, that is, of the state of affairs that they bring about. Consequentialism is usually juxtaposed with deontology, which judges the morality of states of affairs on the basis of their conformity with a moral norm, usually in reference to rights and/or duties that should be observed by any moral agent.

neuroscience for developing harm-related consequentialist moral reasoning in climate ethics. Next, it intends to delineate and specify the fundamental traits of a consequentialist proposal for addressing climate change, both at the individual and collective levels. The collective level framework, based on the distribution of a *carbon budget*, is explored in greater depth with a view to its theoretical traits and empirical features. By way of conclusion, the article briefly defends the consequentialist approach against some of its main possible critiques.

2. Implications of moral cognitive neuroscience for climate ethics[7]

Before discussing the implications of moral cognitive neuroscience for developing an, alternative, consequentialist climate ethics, it is necessary to examine in more detail the moral traits of climate change outlined above.

As stated, the primary moral dilemmas that characterize climate change are related to harm. However, such harm does not have the features of an archetypal moral problem: i) intentionality on the part of harming subjects, ii) the possibility of identifying the harm and the harming and harmed subjects, and iii) proximity in time and space of the harm and the harming and harmed subjects. In fact, in the context of climate change, there is no clearly identifiable subject (agent) that acts intentionally to harm another clearly identifiable subject (victim), who is proximate in time and space. Rather, there are numerous agents who, through their quotidian actions (e.g., driving a car, working at a computer, eating meat), inadvertently, inevitably and/or ignorantly set in motion forces that will harm numerous victims distant in time and space.[8]

Because it is not possible to identify agents and victims as well as the causal link between them and the relevant moral dimensions, the harm that arises from climate change is a distant and abstract one. This kind of *impersonal harm* is consistent with the idea that '[w]e tend not to see climate change as a moral problem, it does not motivate us to act with the urgency characteristic of our responses to moral challenges' (Jamieson 2008, p. 546).

[7] This section synthesizes, and thus necessarily reduces the complexity and the extent of, an argument fully developed in Grasso (2011a). For details and references on the issues confronted in this section, see the above-mentioned article.

[8] Based on different premises, Oreskes (2011, p. 225, emphasis in the original) similarly underlies this point: '[climate] harms are not, by and large, *immediate*'.

This claim is indisputable: we are aware of the scant acceptance and instrumental use that moral issues have in the policy debate on climate change and, consequently, in the *realpolitik* of climate negotiations. Unfortunately, despite the limited impact that moral issues have had on the climate change debate, the relevant literature rigidly adheres to a perspective based on the duties of mitigation and adaptation and persists in framing the moral challenges of climate change rather ineffectively. In fact, it fails fully to grasp the harm-related moral nature of the climate crisis, let alone the type of the harm associated with it and continues largely to confront climate change as a resource-sharing moral issue involving deontological thinking.[9] More specifically, I argue that, embracing the internalist perspective of metaethical analysis (Rosati 2009) demanded by the global and intertemporal nature of climate change and by the multiplicity and dissimilarity of subjects involved that require a connection between moral judgement and motivation for overcoming political inertia, deontological approaches, by misunderstanding of the *justifying reasons* that make the climate crisis an urgent moral problem, crowd out the *motivating reasons* that would urge agents to address it.

To clarify, I do not argue that the current climate ethics is wrong in largely adopting a deontological perspective on mitigation and adaptation duties. Much indisputable theoretical and experimental evidence indicates that deontological moral reasoning is widely adopted and effective in dealing with resource-sharing moral dilemmas (i.e., it is closer to the moral nature of human beings; in fact, humans demonstrate a strong commitment to fairness in these cases).[10] Furthermore, I do not contend that it is wrong, *per se,* to frame climate ethics in relation to the duties of mitigation and adaptation, nor do I critique the sophisticated ethical treatments that adopt this perspective. Rather, I claim that this ethical focus risks rejection and may thus be

[9] Jamieson (2007, p. 160) extends the critique to current climate ethics: 'I believe that the one reason [why philosophers have largely remained silent about global environmental change, and in particular about climate change] is because it is hard to know what to say from the perspective of the reigning moral theories: Kantianism, contarctarianism, and common sense pluralism'. He rather demands that climate ethics should be based on a new value system that takes into account the urgency of climate change (Jamieson 2010), the characteristics of time and space distance of climate-related harm (Jamieson 2008, 1992), and, more generally, a respectful approach to nature (Jamieson 2010).

[10] The literature on behavioural economics and neuroeconomics (e.g., Camererer *et al.* 2005, Sanfey *et al.* 2003, Fehr and Schmidt 1999, Kahneman *et al.* 1986) has long established this point.

politically problematic (i.e., it risks to have poor *motivating reasons*) because it fails to understand and address the inner moral nature of climate change close to human morality, defined by the impersonal harm produced by its effects (i.e., because of the misunderstanding of the *justifying reasons*).

The argument is apparently at an impasse: climate change is a macroscopic moral issue, but climate ethics cannot effectively treat it as such. In fact, the current literature generally insists on considering the ethical dimensions of climate change from a moral standpoint (deontology) that is inconsistent with its inner moral nature, removed from the relevant moral processes and judgments and thus hardly feasible. We need therefore, as Jamieson argues on different grounds and with different lines of reasoning (2010b, 2005, 1992), a radical paradigm shift in climate ethics.

Moral cognitive neuroscience may provide important assistance to foster this required paradigm shift. This emerging field of research is based on the integration of psychology, neuroscience, evolutionary biology and anthropology and 'aims to elucidate the cognitive and neural mechanisms that underlie moral behaviour' (Moll *et al.* 2005, p. 799). In other words, it seeks to find empirically based explanations for moral judgment processes by studying the interactions between the three levels of analysis associated with moral cognition: the psychological level, which investigates the nature of relevant psychological states, their developmental origins and their cultural and evolutionary history; the cognitive level, which focuses on the pertinent information-processing mechanisms; and the neural level, which concerns the brain mechanisms and regions involved in moral judgements.

In particular, Greene and colleagues (Greene *et al.* 2008, 2004, 2001; Greene 2008 for a discursive overview; Cushman *et al.* 2010 for an effective synthesis) provide a promising moral cognitive neuroscience foundation for the current analysis due to the emphasis their research places on harm-related moral dilemmas. Their explorations of the neural bases of moral judgement have made it possible to develop a dual-process theory of morality, which confirms that both affective/emotional and cognitive/controlled responses play fundamental, and sometimes mutually competitive, roles. Greene and colleagues focus on moral dilemmas related to 'physically harmful behavior' (Cushman *et al.* 2010, p. 2). They define a moral dilemma as personal if it causes direct, serious bodily harm to a particular person or set of people; if, on the contrary, it involves no serious physical harm, harm to indefinite victims (as in the case of climate change) or demands diverting some pre-

existing threat onto different victims rather than personally producing the harm, then the dilemma is impersonal (Greene *et al*. 2004). Based on this categorisation of harm, they advance descriptive, normative and metaethical implications for deontological and consequentialist moral reasoning.[11]

Greene *et al.* (2004, 2001) hypothesize, based on brain imaging evidence, that the divergent responses to harm-related moral dilemmas depend on the emotional content of the harming action. When the harm is caused in an impersonal way (such as occurs with climate change), it is less significant, whereas, when the harm is *up close and personal*, it triggers alarm-bell-like emotions that activate the affective/emotional brain areas (the posterior cingulated cortex, the medial prefrontal cortex and the amygdala) and override more controlled responses. Greene *et al.* further argue that these alarm-bell emotions are rooted in our genes. As evolutionary psychology suggests, the emotional aversion to harming other humans evolved as a strategy that allowed people to build stable social structures that gave them an advantage over other species (Greene 2008, Cohen 2005, Singer 2005). In contrast, impersonal scenarios fail to prompt such alarm-bell emotions and therefore allow for cognitive/controlled moral reasoning.

The dual-process theory ultimately reveals two different processes of moral judgment: a (predominantly) emotional one, prompted by direct personal harm, that aims at the right, and a (predominantly) cognitive one, triggered largely by impersonal harm, that supports the increase of the overall good. Of the two processes, the one that is more intensely activated determines the final moral judgment (Cushman and Young 2009). A sensible interpretation of these findings, evinced by observation of brain activity, is that the first process involves deontological reasoning and the second consequentialist reasoning (Greene 2008). Greene (forthcoming) vividly illustrates these operations of the moral brain through the *camera analogy*: like a camera, our moral brain has both (easy) *automatic settings* that produce efficient intuitive emotional responses – that is, deontological reasoning – for straightforward, familiar

[11] In what follows, I assume the fundamental, and less controversial, result of Greene's *et al.* fMRI studies, namely, the connection between the nature of harm and the typology of moral thinking. Such a finding closely addresses the harm-related nature of climate ethics, making it possible to shape a more acceptable and feasible approach (consequentialist, in fact) to the relevant moral dilemmas. On the contrary, any consideration of Greene's *et al.* metaethical anti-deontological arguments lacks usefulness for my line of reasoning and is far beyond the scope of the article.

moral problems, and (difficult) *manual settings* that make it possible to carry out flexible, deliberate moral reasoning – that is, consequentialist reasoning – for complex and unfamiliar moral problems, such as climate change. It is worth noting that by treating deontology and consequentialism as '*psychological natural kinds*', that is, 'philosophical manifestations of two dissociable psychological patterns, two different ways of moral thinking' (Greene 2008, p. 37, emphasis in the original) and by focusing on their functional role as seen in their empirical evidence, Greene's and colleagues argument runs counter to the philosophical tradition that assumes that deontology, being a rule-based morality founded in the respect of a norm, operates on the basis of rational moral judgment, whereas consequentialism is associated with the Humean sentimentalist tradition (Cushman *et al.* 2010).

Equipped with the insights provided by moral cognitive neuroscience, it may eventually be possible to develop a novel and more effective approach to climate ethics. To this end, we must abandon deontology, whether it is based on a resource-sharing perspective or on an ill-defined notion of harm, in favour of a moral approach that better approximates human morality and acknowledges the impersonal nature of the harm that creates climate-related moral dilemmas. Although this approach would ultimately dispute the deontological ethical provisions of the UNFCCC, we must 'do what will produce the best consequences' (Singer 2005, p. 346). The dual-process theory suggests, in fact, that consequentialist approaches aiming at improving overall welfare in a just way offer a more effective moral approach to climate change. Therefore, moral cognitive neuroscience's ultimate contribution to climate ethics lies in its dismissal of ineffective moral deontological thinking in favour of consequentialism, due to the consistency of such an approach with the relevant processes of human morality in the context of climate change and to its resulting greater political feasibility.

3. Consequentialist climate ethics: general considerations and virtuous individual behaviours

There are different forms of consequentialism, depending on the combination of its three constituents: i) the properties that specify the rightness of consequences, ii) a deontic principle that specifies how and to what extent such properties should be achieved for an action to be right, wrong or indifferent, and iii) the domain of the deontic principle (Sinnott-Armstrong 2008). I argue that both the dual-process theory and the complexity and uncertainty of the issues at stake call for the adoption of a

non-maximising version of consequentialism.[12] This is a less demanding and more practically feasible approach that is similar to that of satisficing consequentialism (Slote 1984), the deontic principle of which only demands creating enough utility, or of progressive consequentialism (Jamieson and Elliot 2009) that requires subjects only to act to the extent that they can.

It is worth noting that, in addition to the support given by moral cognitive neuroscience, other reasons, in my opinion, call for a consequentialist climate ethics. First and foremost, consequentialist climate ethics, as shown later, envisions taking more efficient/effective actions against climate change than the initiatives generally proposed by deontological approaches, which often entail excessive and unbalanced costs (Grasso 2011b). Furthermore, in a broader perspective, I maintain that the application of a consequentialist approach in this context of analysis has sound and *solely* moral rationales. In fact, consequentialism, despite the usual charges of leading agents to 'horrendous deeds' (Pettit 1993, p. 234), of threatening individual liberty (Sen 1976) and of having several counterintuitive implications (Mulgan 2001, Portmore 2011), is committed to the idea that morality is concerned with generating better or the best outcomes. Therefore, climate change, due to the scientifically proven (IPCC 2007b) factual assumption of bringing about harmful outcomes for many, diverse subjects of justice, whose situation therefore can, and has to, be improved, should be a fundamental moral issue for consequentialism.

That being said, a crucial point must be discussed before proceeding with the development of consequentialist climate ethics. Given the anthropocentric perspective of my attempt, which is highlighted in note 2, who/what are the subjects of justice – the potential members of a scheme of distributive justice – in the context of climate change? In this regard, I endorse neither Sinnott-Armstrong's (2005) denial of personal moral obligation in climate change because of the impossibility of defending any moral arguments, nor Johnson's (2003) view of climate change as solely a

[12] The dual process theory rejects the abstractedness of optimal (i.e., maximising) moral thinking. Furthermore, due to the complexity of the climate crisis, we are ignorant of the consequences of actions; a circumstance that, in my opinion, makes maximising consequentialism potentially clueless (Lenman 2000) in regard to climate change.

collective-action problem.[13] Consistent with the liberal literature on global justice, I do hold that individuals are subjects of climate justice.[14]

In practice, however, states are undeniably actors under the international climate regime, that is, entities to and through which the UNFCCC allocates burdens and benefits. It would therefore be paradoxical to consider them incapable of moral action or, more explicitly, not to regard them as subjects of justice in the context of this analysis, despite the controversies that such an assumption entails (Miller 2004). Consistently, I maintain that also collectivities are moral agents. More specifically, I refer to *conglomerate collectivities*, which unlike *aggregate collectivities*, qualify as subjects of justice because they are organizations of individuals whose 'identity is not exhausted by the conjunction of the identities of the persons in the organization' (French 1984, p. 13).

Therefore, I ultimately argue that both individuals and conglomerate collectivities are subjects of climate justice. Having thus argued, a consequentialist approach to climate ethics is articulated into the two levels embodied by subjects of justice: the individual and the collective.[15] The second, due to its greater theoretical and empirical complexity, will be more extensively analysed in the ensuing section.

At the individual level, the point seems uncontroversial: every human on earth, irrespective of her socio-economic condition, must move towards a less carbon-dependent lifestyle through novel and virtuous behaviours for reducing energy waste, increasing energy efficiency and the use of renewable resources, promoting carbon-independent forms of mobility and alternative agricultural practices, and so on.

On theoretical grounds, I argue that this difficult demand to adopt a structural low-carbon lifestyle (Gardiner 2010, Garvey 2008), or, more generally, an ethic of frugality (Wiggins 2011), which is even more challenging for poor people, can be inscribed in Jamieson and Elliot's (2009) non-maximising progressive consequentialist account of justice. In particular, the progressive consequentialist individual, to fruitfully address

[13] Johnson (2011) has subsequently come to different conclusions and has acknowledged, with some distinctions, individual moral obligations.

[14] Some of the literature on climate ethics expressly defends this option: e.g., Nolt 2011, Hourdequin 2010, Caney 2005.

[15] Jamieson (2010b) similarly argues that there is an individual and a political (i.e., collective) level for dealing with climate change though, since he develops his arguments around the notion of responsibility, he is sceptical about the soundness and feasibility of the latter.

climate change, should endorse non-contingency; that is, she should minimize her contributions to the crisis independently of the behaviours of other individuals and the complex calculations necessary to weigh others' behaviours, an impossible task in the case of global problems such as climate change (Jamieson 2007), as already underlined. To this end, the progressive consequentialist individual, following Jamieson's convincing line of reasoning, should become a *virtue theorist*, i.e., she should develop *green virtues* that she tries 'to exemplify in [her]self and elicit in others, given the reality of the global environmental crisis' (Jamieson 2007, p. 181). Such virtues will ultimately give rise to the virtuous, yet demanding, behaviours mentioned above that are necessary to address climate change. Interestingly, such virtuous behaviours can be inscribed in, and are akin to, Haidt and Joseph's (2004) *purity/sanctity* group of virtues, one of the five psychological foundational groups of morality that, according to the authors, characterize social practices across cultures, and that are also common among all primates (de Waal 1996).

4. Consequentialist climate ethics: a collective proposal

I argued in the previous section that, in addition to the scientific rationale pointed out below, also moral reasoning, acknowledging collective subjects of justice, demands that virtuous individual behaviours be supplemented by mandatory collective action, since in democratic societies individuals delegate to governments a portion of their powers to deal with problems, such as global climate change, that cannot be addressed only by single persons. Such collective action should not however replace individual behaviours, because they are not 'mutually exclusive alternatives' (Jamieson 2007, p. 170). I do not refer to the mere promotion of virtuous behaviours, as, for instance, libertarian paternalism (Thaler and Sunstein 2003) requires, but, with regard to consequentialist ethics, to binding policy initiatives specifically aimed at reducing climate-related harm in an efficient/effective and just way. Therefore, a more detailed investigation of the collective level of consequentialist action is in order. At this level, as anticipated, subjects of justice are conglomerate collectivities, in particular states being the key political units of international climate policy.[16]

[16] The perspective of justice adopted in this study is problem specific, and it is often known as a *local justice* approach. It does not account for the unjust, pre-existing distribution of other goods and for welfare disparities. Instead, it only addresses ethical issues that arise in relation to the distribution of emission rights without acknowledgment of the repercussions for other aspects of society (Gosseries

In what follows, I will try to frame and vindicate a non-maximising consequentialist framework targeted to collective subjects of justice. Methodologically, such framework is isolationist, deterministic, normative, technocratic, policy-relevant but not policy-based (it does not include governance issues), and substantively it applies to the climate-related moral dilemmas of avoiding/preventing harm through mitigation of emissions and adaptation to climate impacts.

The scientific rationale for this collective consequentialist framework is provided by recent developments in climate science positing that, to prevent dangerous anthropogenic interference with the climate system, emissions should be capped at a given threshold. Based on Meinshausen's *et al*. (2009) work,[17] for instance, it is possible to claim that to limit global warming in the year 2100 to 2° C above the pre-industrial level, a threshold whose crossing would result in disastrous and irreversible climate impacts, the amount of emissions from today (2012) to 2050 (the so-called *carbon budget*[18]) is 584.5[19] Gt CO_2. In contrast, CO_2 cumulative emissions in 2050

2007). Caney (2010b, p. 23) argues instead that, for a number of reasons, 'we need to study global climate change ... in conjunction with global economic problems', thus inscribing his argument in an approach of *general justice*. This latter standpoint would in principle be more appropriate in the context of a far-reaching issue such as climate change: yet it seems that in analytical terms it is more convenient to keep these levels of analysis apart, as done here, where, in fact, only the first one is considered.

[17] Meinshausen *et al*. model, for the 1000 Gt class of scenarios, 19 marginal probability density functions (PDFs) of climate sensitivity, whose probability of exceeding 2 °C ranges from 10 to 42%; in their study, 25% probability is the average result for the class of scenarios considered (available from: www.primap.org at THE PRIMAP 2 °C Check Tool [Accessed 31 December 2011]). The 584.5 Gt CO_2 figure is obtained by subtracting from the reference carbon budget (1000 Gt CO_2) the 2000-06 emissions (234 Gt) and the 2007-2011 emissions, calculated assuming Meinshausen's *et al*. constant rate of emission of 36.3 Gt CO_2 yr^{-1} (181.5 Gt CO_2). For a slightly different figure, see the Carbon Tracker Initiative (available from www.carbontracker.org/carbonbubble [Accessed 31 December 2011]), whose estimated carbon budget (565 Gt CO_2) covers however one additional year (2011-2050).

[18] It should be noted that the carbon budget approach includes intergenerational ethical considerations that demand that the current generation bequeath to future generations their just share of CO_2 emissions. The notion of a carbon budget has an intrinsic intergenerational span because it is shared among current and future generations, such that the emissions allowed are 'zero-sum across all emitters across foreseeable time' (Shue 2011, p. 303).

[19] This figure was obtained through calculations on data drawn from the Climate Analysis Indicators Tool (CAIT) Version 8.0 (Washington, DC: World Resources Institute, 2011. Internet: http://cait.wri.org/cait.php, accessed 31 December 2011), and is based on the IPCC SRES-A1 (A1B) Scenario-AIM. In this representative scenario, 2011 cumulative emissions are 36.2 Gt CO_2, while 2050

under a *business-as-usual* scenario would amount to 2,260 Gt CO_2. Therefore, it is clear that individual voluntary efforts that should, for instance, allow western citizens to cut their emission by 80-90% in the next few years, tough fundamental, would not be sufficient to save the 1,675.5 Gt CO_2 – the global abatement burden – necessary to avoid harmful and irreversible climate impacts, whose prevention needs additional drastic measures on the part of collective subjects of justice. It is worth underlining again that I do not intend to downplay the role and importance of individuals' efforts to make their lifestyles less carbon-intensive, nor do I uncritically emphasize the necessity of a technocentric carbon-efficient society. I am only arguing that individuals' behaviours alone, virtuous and necessary as they may be, are insufficient to prevent harmful climate change.

Consequentialism, at a collective level and consistent with the orthodox entry point for mitigating climate change (i.e., based on the usual means for reducing carbon emissions, from cutbacks to sequestration)[20] and with current adaptation options, demands efficient/effective solutions increasing overall welfare and capable of justly distributing such welfare gain among involved subjects.

Given the nature of the climate crisis and the target imposed by the carbon budget, the ultimate challenge is to assure fair access to a scarce common property resource[21] to collective subjects who are *a priori* equally entitled to it. To this end, I propose a dual consequentialist framework that aims to generate sufficient good, i.e., to efficiently and effectively reduce climate harm in a just way, as predicted by the non-maximising version of consequentialism adopted, through the two primary strategies of mitigating and adapting to climate change that characterize most of the climate ethics literature. However, this framework is not substantiated by, or aimed to, these two strategies. Rather, it merely uses both strategies to efficiently/effectively and justly address climate harm in a comprehensive manner.

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ones are 58.7 Gt CO_2, with an annual increase of 1.2% and a total growth over the period 2011-2050 of 61.9%.

[20] I nonetheless claim that consequentialism is also defendable in unorthodox (i.e., not based on traditional emissions abatement/sequestration methods) collective approaches to mitigation, despite Gardiner's (2011) argument about the impossibility of a consequentialist approach to geo-engineering. This point is beyond the scope of this article.

[21] That is, the atmospheric capacity available for absorption of CO_2, expressed and quantified through the carbon budget and distributed by means of emission rights.

Before introducing the consequentialist framework two qualifications are in order. First, efficiency, in general, depends on the costs and benefits that a course of action brings about. Benefits of climate change policies are however much more uncertain than costs (Leach 2009, Johnston 2009). Furthermore, the necessity of achieving the emission target imposed by the carbon budget overshadows the consideration of benefits. Therefore, I argue that the most useful reference for increasing overall welfare in the context of climate change mitigation is cost minimization/reduction for the emissions goal given by the carbon budget, that is, (cost) effectiveness. Such perspective takes the quantitative environmental goal as given and aims to achieve it at the lowest possible cost. Second, according to economic theory, market-based instruments of environmental policy are generally considered the most efficient and effective for dealing with climate change (Stavins 2003). In particular, when the marginal costs of pollution abatement are known, both an emission tax (a price instrument) and a marketable permits (rights) scheme (or cap-and-trade, a quantity/property instrument) are equivalent and attain exactly the same result (Baumol and Oates 1988, Weitzman 1974). Though economics by and large upholds an international harmonized (carbon) tax for curbing GHG emissions (e.g., Nordhaus 2007), I endorse Wiener's (2009) view on, and justification of, the advantages and greater political feasibility of a cap-and-trade system over a tax, for its better prospects to achieve efficient/effective and just solutions for tackling global climate change in line with the demand of consequentialism.[22]

[22] Cap-and-trade raises, however, serious ethical concerns (e.g., Page 2011a, b, Caney 2010a, Goodin 1994). The most debated and feared of these concerns relate to the commodification of the atmosphere (Page 2011a) resulting from neoliberal ideology (Athanasiou and Baer 2002). In this scenario, developed countries could 'buy their way out of their commitments' (Ott and Sachs 2000, p. 17) without substantially reducing their emissions, corroding their intrinsic motivations (Dobson 2003, p. 2-3) and environmental morale (Page 2011a). On psychological grounds, natural resources are thought to have an absolute value protected against trade-offs with material values (Tetlock et al. 2000). These protected (Baron and Spranca 1997) values are strictly related to deontological duties, which forbid certain actions, regardless of their consequences (Tanner et al. 2008, Baron and Spranca 1997). The emotional activation produced by the transgression of a protected value would prevent people from a consequentialist inclination to accept profitable trade-offs. Ultimately, in the climate change context, it would inhibit decisions that benefit the environment and general welfare. Because my consequentialist proposal includes the role of individuals in combating climate change through virtuous behaviours, it should neither face the charges outlined above, risk the moral stigma associated with antisocial behaviours that Sendel (2005) links to emission trading, nor prompt an environmental crowding-out effect (Page 2011a).

The architecture of the consequentialist framework proposed is quite straightforward. After a binding carbon budget is established by an international body (based, for instance, on scientific works such as that of Meinshausen *et al.*), part of it, with exclusive mitigation objectives, should be freely distributed to states. The remaining portion should be auctioned off to all potential buyers (including collective subjects of justice such as states, firms, international organizations, and individuals) and the resulting revenues placed in a global fund for adaptation activities in needy countries and for compensation for those already harmed by climate effects.[23]

Consequentialist moral thinking, in my view, demands that the mitigation-centred portion of the carbon budget should be distributed so as to increase aggregate social welfare, taking at the same time account of the common-ownership of the finite atmospheric resource, that, different from private property resources, requires fair consideration of co-owners, as Locke (1690/1963) acknowledges. In other terms, a consequentialist distribution of the carbon budget for mitigation purposes entails two distinct but strongly intertwined issues: i) a *who should abate emissions* (or *where to abate*) question that demands effectiveness; and ii) a *who should pay emission abatements* question that, taking account of the effectiveness considerations prompted by i), requires ethics (Sinden 2010).

As far as the effectiveness dimension is concerned economic theory shows quite uncontroversially, as made clear above, that it is possible to cut the largest amount of global emissions at the lowest cost to society by properly implementing a system of marketable emission rights. To this end, such emission rights scheme, due to the variance of marginal abatement costs across countries, should envision a distribution of permits that equalizes countries' marginal abatement costs.[24] Emissions with a lower marginal cost of abatement are typical of the developing world, which still faces a flat curve of marginal costs of abatement (Frankel 2007, Sheeran 2006). On the

[23] I am purposely vague regarding the amounts of the two portions of the carbon budget. *Prima facie*, I would argue that the first part should be calculated residually, i.e., after some estimation of the second portion. The second portion should be determined by adaptation needs (which, of course, should not be covered completely, or their figure would be much larger that the revenues deriving from the auctioning of the entire carbon budget), due to the extreme urgency of undertaking major adaptations (Grasso 2010).

[24] As made clear, the distribution of emission rights implies a contextual and inversely proportional distribution of costs for abating emissions, given that the carbon budget (584.5 Gt CO_2) is smaller than *business-as-usual* emissions (2,260 Gt CO_2).

contrary, the industrialised countries are now on the steepest segment of the curve of marginal costs of abatement, and their marginal return on controlling emission cutbacks has dramatically decreased, while their costs have substantially increased (IPCC 2007c). Thus, in regard to *who should abate emissions* (or *where to abate*), according to the effectiveness proviso of marginal abatement costs equalization, cheaper and less costly emissions cutbacks are primarily to be carried out in the global South, where the marginal cost of abatement is lower (in principle, the lower the cost, the higher proportionally the amount of emission rights distributed).

Yet, the second point reported above – *who should pay* – needs to take account of the distributional implications of the marketable permits system, since the search for effectiveness, by attributing larger cutbacks to the South, ignores ethics. To put it differently, co-ownership of the atmosphere requires inclusion of ethical considerations in the architecture of the cap-and-trade system, because the appropriateness of such system, that is, the definition of the effective and just share of abatements burden to be shouldered by states, depends on how permits are initially freely distributed (or on how revenues from auction are allocated, in case permits would not be freely distributed).

Importantly, consequentialism, in my opinion, suggests that what ultimately counts in terms of mitigation-finalized burden sharing for a cap-and-trade system is end-state justice. I do not believe, in fact, that an effective and just cap-and-trade system can be practically achieved through subsequent market exchanges, *irrespective* of the initial distribution of emission rights. Rather, I argue that they should *initially* be distributed in an effective and just way. This outcome-based focus (Rose et al. 1998) demanded by consequentialism differs from the typical deontological approaches that centre only on the initial distribution of emission rights, unrealistically assuming that their subsequent trading takes place on competitive (Walrasian) markets that would necessarily achieve just outcomes. In light of these considerations, it seems possible to argue that allocation-based rules, largely grounded in deontology, disregard the matter of ultimate importance: the effectiveness and justness of the final situation achieved by the distribution of emission rights.

Having said so, I do accept the claim that in the context of mitigation effectiveness is the smallest common denominator for achieving a final just distribution of a common resource. Specifically, the equalization of countries' marginal abatement costs, by diminishing global abatements cost and increasing the global amount of abatements,

provides, in fact, a global effectiveness gain that, if justly distributed, can make all countries better off, so as to satisfy the internal principle of justice of mutual advantages, which states that an option should have positive net benefits for all (Gauthier 1986). To generate advantages for all subjects involved, the global effectiveness gain should be distributed through side payments, a mechanism that, in fact, ultimately enables a distinction between who should abate emissions (where to abate, question i)) and who should pay for such abatement (question ii) (Sheeran 2006). In particular, if the cap-and-trade scheme allows subsequent trading of emission rights, side payments can take the form of different initial distribution of permits.[25]

Negotiations of emission rights do not take place in perfectly competitive markets, nor does there exist any international body in possession of lump-sum redistributive instruments. Therefore, I argue, as anticipated, that subsequent market negotiations of emission rights cannot achieve effective and just allocations in case of inappropriate initial distributions. All in all, an effective and just cap-and-trade scheme should therefore be based on a free initial distribution of emission rights that can assure to those countries penalized by the larger abatements demanded by the search for effectiveness side payments in the form of greater amounts of permits that can subsequently be sold. In particular, the amount of rights freely allotted to *primary abaters* (i.e., those countries with lower marginal abatement costs, typically the South, that in virtue of this should carry out most of abatements for effectiveness reasons) should be more than the country-specific portion of the carbon budget that would be distributed according to the sole effectiveness rule of marginal abatement cost equalization. At the same time, the amount of permits given to *secondary abaters* (i.e., those countries with higher marginal abatement cost, typically the North, with lower abatement burden) should be less than that envisaged by their country-specific effectiveness quotas.[26] This ultimately implies that (Northern) countries not penalized by the lower initial emission cutbacks demanded by effectiveness compensate through side payments in the form of permits purchase penalized (Southern) countries

[25] If, on the contrary, non-tradable permits are distributed, side payments consist of lump sum redistribution between countries.

[26] For a critique of 'carbon colonization' in this pattern of initial distribution of emission rights, see Page (2011b, p.56).

characterized by greater effectiveness abatements.[27] Such a cap-and-trade architecture would be effective, because it would have the majority of emission cutbacks done by (Southern) countries with lower marginal abatement costs. At the same time it would be just because through a larger distribution of negotiable permits than that demanded my mere effectiveness reasons to (Southern) countries with lower marginal abatement cost and a stricter one to those (Northern) with higher marginal abatement costs it would urge the latters to purchase emission rights from the firsts, i.e., it would prompt side payments from the North to the South. Ultimately, besides being effective, such a cap-and-trade architecture would respond to the justice principle of mutual advantages, for it would be beneficial to all subjects involved.

This approach to the distribution of the mitigation part of the carbon budget, furthermore, should be dynamic. As Helm (2008, p. 450-1) emphasizes, the framework envisaged, as long as countries accept the general logic behind it, can structure negotiation processes, and consequently the distribution of emission rights 'could be adjusted in regular intervals to allow for new information', say on marginal abatement costs. Significantly, on policy grounds, the framework envisaged would assure the necessary full involvement of developing countries in mitigation efforts that the post-Kyoto debate urges. Finally, this account is similar in its logic to the provisions of the North-South cooperation mechanism introduced by the Kyoto Protocol, the Clean Development Mechanism (CDM), which makes it possible for richer Northern countries to undertake part of their mitigation duties through abatement projects, whose cost they fully support, in developing countries.

To address the second portion of the carbon budget, a premise is first necessary. I maintain that adaptation is a merit good (Musgrave 1959) that, given the non-consideration of the positive externalities that it generates and the incapacity of individuals of accounting for its long-term benefits, tends to be both under-supplied by, and under-demanded in, market systems. In other words, the complexity of adaptation (Grasso 2010) largely prevents individuals from having the correct and/or relevant information, so that their preferences should be paternalistically substituted by those of society. In light of these considerations and the urgency of adaptation, I envision

[27] Ideally, the same logical approach also applies, *mutatis mutandis*, at the national level: less-expensive emissions should be pursued and the related collective subjects of justice allotted a larger amount of emission rights than the effectiveness level within the national ambit.

that a second portion of the carbon budget, complementary to the first and targeted to adaptation, be auctioned. In particular, consequentialist moral reasoning demands, in my view, the establishment of a global fund similar to that defended by Barnes *et al*. (2008) and Tickell (2008). An important proviso would be that the dividend raised by selling emission rights be directed to subjects (i.e., people, institutions, research centres) for adapting to climate change in the broadest sense, including the enabling of adaptations, compensation for non-adapted effects, technology transfer and research support, in an inverse proportion to their welfare level (the welfare benchmark can also be complemented by other non-welfaristic indicators). The consequentialist spirit of this fund is therefore two-fold. First, it lies in the fact that subjects who buy emission rights – and thus contextually finance adaptations – are those whose marginal abatement costs, even after the free distribution of the first portion of the carbon budget illustrated above, remain higher than average, making the *buy* option still more convenient for them than the *make* one. This circumstance ultimately results in a greater overall efficiency that allows the subjects to adapt to climate impacts in the most cost-effective way, and therefore increases the general welfare consistent with consequentialist reasoning. Second, transferring larger quotas of the raised revenues to poorer subjects optimises the marginal utility of the resources, compounding the increase of the overall efficiency produced by the least-cost adaptations determined by the auctioning of emission rights. Furthermore, on different grounds the dynamics of this fund are characterized by a conception of justice that displays a general concern for the least well-off subjects, whose improvement becomes the most ethically important objective.

5. Conclusions

I have argued that the dual-track consequentialist proposal for collective action illustrated in the previous sections can successfully seek the primary goal of consequentialist climate ethics, that is, efficient/effective and just avoidance and prevention of harm. Nonetheless, one possibly unfavourable point is evident: the first part of the collective consequentialist proposal against climate change runs counter to common moral intuitions. By arguing that what should be performed is what produces the best consequences, the envisaged framework focuses on the convenient emission cutbacks of the South, irrespective of the intuitive (deontological) considerations about the duty of mitigation that would indicate opposite solutions.

The inevitable objection to such a framework, and more generally to consequentialist climate ethics, is that it disregards the ostensible truth of facts: some subjects have contributed the most to the climate crisis and are suffering from it the least (the North); other subjects have contributed the least and are suffering the most (the South). Shue (1999, p. 535), for instance, is clear in condemning such an approach: '[i]f I said to you, "I broke it, but I want you to clean it up", then I would be your master and you would be my servant'. It is in fact the poorer subjects of the South who are expected to suffer the most in terms of emission cutbacks and who are disposed to carbon colonization insofar as they are paid to address the mess made by the richer Northerners as servants.

Therefore, this vexing counter-intuitiveness is the primary disadvantage of a consequentialist approach to the ethics of climate change, despite its consistency with human morality: how can such a supposedly cynical proposal be persuasive in the current climate debate and in the frantic context of climate negotiations to pro-Southern activists, to spirited environmentalists, to advocates of egalitarianism, of past responsibilities, of human rights? In fact, arguments based on welfare have a weaker motivating force than those based on rights and duties (Posner 2008), and they are unlikely to shake the common moral intuitions that firmly ground the standard (deontological) perspective on the moral dimensions of climate change.

The pro-consequentialism strategy, I argue, mainly relies on the role of scientists. I refer primarily to social scientists, who should not only acknowledge and disseminate scientific evidence supporting the efficiency/effectiveness and justness of a consequentialist approach against climate change, but they should also try to modify the perception of the moral challenge that it poses, according to the indications of moral cognitive neuroscience set out above. The final goal should be to eradicate the perception of climate change as a deontological moral issue in favour of welfare-improving consequentialist moral reasoning. To this end, the obvious entry points for modifying the current, unreliable moral intuitions that social scientists should better explore and communicate are those resistances, highlighted in the Introduction, that distort the moral understanding and treatment of climate change: established mental models, ontological assumptions, cognitive biases, use of heuristics, misunderstanding of risk and harm, and loss aversion.

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