Sustainability Science and the Anthropocene: Re-negotiating the Role for Science in Society

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Abstract

The concept of the Anthropocene conveys a radical novelty: humans have become a 'geological actor' and are able to influence and affect the biosphere to an extent unprecedented in history. This new state of affairs poses intertwined challenges to ecological, technological, political and normative systems. It also raises hard questions about knowledge and science. The emerging field of tainability Science seeks to respond to such challenges. In this paper we focus on the interface linking sciences and society, and explore attempts within Sustainability Science to conciliate two possibly divergent goals. On the one hand, the sheer urgency of problems related to the Anthropocene (e.g. climate change) calls for science to be more responsive to societal needs and provide quick-and-ready solutions to 'real-world' problems. On the other hand, a quality benchmark for science is still needed and wanted. How to avoid compromising one of the sides is an open question. In the literature on Sustainability Science, tendencies can be found to give science role to envision optimal, universally valid solutions to these challenges, as well as to negotiate these with society. If not cautiously done, this may lead Sustainability Science towards something akin to 'social engineering'. Such a development faces risks of the following three kinds: (i) to 'freeze' a solution, i.e. losing critical/ reflective perspectives, (ii) to be less open to instances from society, (iii) to neglect the immanent plurality of wills in collective decisions making. We assess some of the assumptions and implications of such

approaches, isolating their components with regards to the formulation of scientific questions, the procedures and methods employed, and the processes of transmission (and negotiation) of the results to society. We conclude by arguing that these challenges call for cautiousness when envisioning new forms for the intersections between science and society.

1 Introduction

The term Anthropocene is metaphorically an 'inverted prism': it recombines into a single beam the numerous (apparently) divergent messages that signal the unprecedented impacts that humans exercise on the biosphere and gives them a common meaning. The modification of climate on a global scale, the influence on macro-cycles of the fundamental elements of ecosystems (apart from carbon, also water, nitrogen, etc), the radical changes on landscapes and a vertical loss of land and marine biodiversity (in terms of species but also of biomes) have been highlighted by many scientific studies in the last decades ((Hoekstra *et al.*, 2005; Pauly *et al.*, 2005; Oki and Kanae, 2006; IPCC, 2007; Stern, 2007; UNEP, 2007; Bank, 2010). The metaphor of the Anthropocene (Crutzen, 2002) adds a surplus to these signs by combining them, and carries a message of epochal novelty: humanity has become a 'geological actor'. With the expansion of the technologies and practiced emerged with industrialization, human activities do not simply have local or temporary impacts on ecosystems and ecological conditions, but have pushed the "system Earth" to a different state, a different geological era - which might be less hospitable and favorable for human life.

This new state of affairs poses intertwined challenges to ecological, technological, political and normative systems. Not surprisingly, this has deep implications also on knowledge production. Which science(s) can understand the Anthropocene and provide analytical tools for dealing with the challenges that this novel condition poses? The modern body and taxonomy of scientific disciplines may be inadequate, and a radical reshaping of the sciences and bodies of knowledge that deal with the Anthropocene may be needed (Ziman, 1996; Gibbons, 1999; Pielke, 2002; Latour, 2004; Swyngedouw, 2010).

A theoretical reading of this question is that the Anthropocene does not allow to be blind in front of the conflicts between Weltanschauungen and epistemologies that emphasize contingency (as in critical social sciences) and others that accept and embody some form

of universality. With the words of Dipesh Chakrabarty, "the anthropogenic explanations of climate change spell the collapse of the age-old humanist distinction between natural history and human history" (2009, 201). Global warming does not allow to keep a polite and comfortable distance between natural sciences and critical social inquiry. With a (over)simplification, the former understands climate change as a threat to humanity as 'a species', and thus calls for solutions and agendas able to secure our 'common future' (see e.g. Parry *et al.*, 2009), while the latter emphasizes the contingency of the knowledge on climate change, and, given the differential positions and interests of different subjects even in front of global environmental changes, do not accept seeing humanity as a species. The question that indeed the Anthropocene (as climate change) forces us to deal with is: "How do we hold the two together as we think the history of the world since the Enlightenment? How do we relate to a universal history of life—to universal thought, that is—while retaining what is of obvious value in our postcolonial suspicion of the universal? The crisis of climate change calls for thinking simultaneously on both registers, to mix together the immiscible chronologies of capital and species history" (Chakrabarty, 2009, 220). In other words, the Anthropocene compels "the science(s)" that aspire to understand it to recompose divergent instances and traditions.

A more practical declination of the issue relates to the 'usefulness' and timeliness of the contribution provided by science(s). The Anthropocene conveys a sense of instability and contingency, as any phase of rapid transition, and the paths of change followed by the biosphere largely depend on human actions. The combination of these two elements (rapid, unstable changes, and 'responsibility') emanates a sense of urgency, which increases the demands and expectations posed on science. Now that humans can relatively quickly alter the very conditions of existence of the whole Earth, science(s) should be able to promptly provide analytical tools able to inform decisions. Moreover, since what is at stake might be the very survival of biomes and of humanity, several argue that science should become more open (democratic) to "societal needs" and be as inclusive as possible to different positions and voices. Following such a logic, the whole scientific enterprise – the individuation of the objects to be researched, the definition of procedures and methods, the negotiation, transmission and application of the findings - should respond more directly to the instances of an as broad as possible social base (e.g. Gibbons, 1999; Max-Neef, 2005; Farrell, 2008).

Such claims pose serious questions and problems. One the one hand about the role of science in relation to society, and, on the other hand, about the position of science

in the society. The problem come as a two-edged sword, concerning both science and society in the relation them between. First we have questions such as: what is the quality benchmark for a science increasingly driven by social and political goals? How can such a science maintain what is often considered as one of the qualifying features that differentiate science from 'opinion' (episteme vs doxa), i.e. the (at least partial or ideal) detachment of scientific enquiry from normative and political agendas? Secondly, questions need to be raised about the function and use of scientific knowledge in political and societal contexts. What can be expected of scientists? May politicians or people of power utilise and alter scientific knowledge freely without diminishing the epistemic virtue? These are among the questions tackled in this text.

This paper is structured as follows; section two briefly overviews the emergence of the field of Sustainability Science. Among other things, it is noted that the research in this field most of the times is structured around "challenges" rather than the traditional form of, supposedly, unprejudiced enquiries. The special circumstances surrounding the coming to be of this field—for instance, the pressing urgency of climate change-related problems—point to a need for caution. Sustainability science should pay attention to some of the shortfalls that lure in such circumstances, and which other sciences have not always evaded. In section three we drawn attention to the threat of unwarranted and unjustified *panaceas*. In the following two sections examples are offered and we attempt to deepen the discussion somewhat; firstly with a discussion of the troubling issue of universalism, and secondly with issues concerning robustness of science. In these discussions Sustainability Science and its grandiose ambitions are given an important contrast from the formal scientific history.

2 Sustainability Science: a candidate for understanding the Anthropocene

The reflections above are an appetizer that hint to the exciting challenges that any science candidating for understanding the Anthropocene has to confront. The emerging field of Sustainability Science (henceforth SuS) is surely one of those. First of all, the ambition to bring together the understanding of human actions and of geo/biophysical processes, which is a necessary condition for speaking about the Anthropocene (Rockström *et al.*, 2009, 475), is one of SuS's main pillars. The attempt to reinterpret and overcome the traditional

Nature-Society dichotomy that has so strongly marked ontological views but also scientific traditions in the past is one of the key-motives of SuS (Kates *et al.*, 2001; Ostrom, 2009; Jerneck *et al.*, 2010). Moreover, when looking at the themes SuS explores, one sees that the so called "sustainability challenges" (see e.g. Jerneck *et al.*, 2010) are a sort of humanization of the mainly biophysical messages that constitute the threads of the Anthropocene. Bill Clark provides an overview of the basket of such macro-themes inscribed in SuS's DNA: "improving access to water supplies of adequate quality and quantity, advancing cleaner energy and manufacturing systems, mitigating the human health impact of pollution and environmentally mediated disease, enhancing agricultural production and food security, encouraging more benign trajectories of rapid urbanization, and more generally making more effective use of environmental and natural resources to promote poverty alleviation" (Clark, 2007, 1737).

This set of goals and research macro-areas - which have proved being 'inedible' by mono-disciplinary approaches - delineate SuS's field of action more than disciplinary boundaries (Kates *et al.*, 2001; Clark and Dickson, 2003; Jerneck *et al.*, 2010). Such socio-ecological challenges are the 'human face' of the themes of the Anthropocene, a translation into a more societal perspective of the biophysical narration with which natural sciences have spoken of the Anthropocene. Although many of these issues are in effect old plagues (e.g. poverty or food insecurity), what the Anthropocene metaphor shows is that these old challenges are increasingly interconnected through relations and dynamics that have a planetary scope (Jerneck *et al.*, 2010). This novel web of global interactions, which force to reframe old stories, inscribes the sustainability challenges into the vocabulary of the Anthropocene, and legitimises SuS ambition to become one of the sciences for the Anthropocene.

2.1 (Re)inventing the wheel?

Sustainability Science therefore promises to be a vibrant field for innovative approaches and research, dealing with the complex and compelling issues of the Anthropocene – issues that traditional disciplines have proved unable to handle. However, the epochal implications of the studied phenomena, the aura of novelty that surrounds SuS and the sense of urgency embodied in its mindset may expose it to the risk of committing acts of hybris. SuS's novelty and mission do not per se guarantee for the quality of its ontological and epistemological assumptions and constructs; neither do they vaccinate SuS from the tensions that

other forms of scientific inquiry have suffered from in the past. The emerging field necessitates a good amount of humbleness, safeguarding reflexivity and an openness to consider and learn from the vicissitudes through which other fields and disciplines have gone when dealing with complexities and tensions similar to those that wait for SuS. Furthermore, the community that revolves around SuS is a creative, heterodox but also impromptu galaxy of researchers from disparate disciplines. This particular composition inevitably leads to a partial loosening of disciplinary codes, rules, practices, boundaries. Although also a stimulating incentive and probably a necessary condition for dealing with the Anthropocene, this larger freedom can get dangerously close to the tendency to improvise, increasing the risk for leaps forward explained more by theoretical rawness than by revolutionary insights.

A first move of reflexivity is to remember that SuS is a sociologically circumscribed field, emerged from an identifiable social and academic milieu, with strong relations to traditional academic families and disciplines. SuS's methods, ontological and epistemological assumptions are 'partial' choices, not the necessary implications dictated by the alleged novelty – see for instance the strong focus and great expectations on modeling present in the literature (see e.g. Kajikawa (2008, 231), Martens (2006)). Moreover, the conceptualization of the interaction between 'social' and 'natural' processes (as well as the very definition of 'human' and 'social') have been explored by a series of disciplines. Several contributions to the SuS debate seem to fail being open to (or even aware of) other contributions, presenting conceptualization of the so called Society-Nature dialectic that have a theoretical refinement not even close to that reached by other traditions. 'Seminal' examples of such crude conceptualizations can be found in the literature presenting the Earth System metaphor (see e.g. Schellnhuber, 1999; Schellnhuber *et al.*, 2004; Ehlers and Krafft, 2006). Although not fully coincident with the Earth system metaphor, SuS is profoundly connected to that heuristic and discourse, which could be defined as quasi-hegemonic within SuS. The metaphor of the "Earth system" is indeed a situated and historical construction rather than a given datum of reality (see e.g. Lövbrand *et al.*, 2009), which does not guarantee a direct access to the empirical elements it refers to; but SuS often echoes the (raw) conceptualizations present in the Earth system metaphor, conceptualizations that might be satisfactory for the agendas and research objects of certain natural sciences, but do not fit the inquiry methods and goals of social sciences. Even simply the choice to uncritically construct the two sphere of Nature and Society, which influent SuS contributions borrow from the Earth system metaphor (see for instance Schellnhuber *et al.*,

2004; Clark, 2007), is index of questionable theoretical refinement. Moreover, when thinking about the dimension of SuS's novelty connected to scales and scope, SuS can hardly be seen as the only/first science/field looking at the Global and that frames its questions as universal, as matters that matter for the whole humanity. Many sciences have and have had such ambitions and scopes. A banal observation that also calls for caution is that pretending being a global science is not enough for achieving a 'universalist' position that embodies the views and values of humanity as a whole. Several are the historical cases of allegedly universal sciences that in fact embodied and were the voice of very specific interests – see for instance the 'imperial' historical roots of Geography as a discipline and the dialectic between the European colonial project and that knowledge, or the critical history of development theories (Venn, 2006; Said, 2003).

Lastly, SuS risks connoting itself as a science of everything/nothing. The literature stresses that an element of novelty is the breadth of themes/challenges SuS explores. The sustainability challenges are in effect overarching goals (or socio-political challenges that motivate research etc) so broadly defined that they are not always 'direct objects' for scientific inquiry, if not narrowed down. The lack of specificity on one hand mirrors the ambitious attempt to take seriously the interconnectedness and scope of the analyzed themes. On the other hand, it threatens to dull the point of the issues since it sometimes offers little in the way of guidance towards research questions appropriate in scope. This aspect, apart from suggesting caution, implies also that the uniqueness and novelty of SuS cannot be uncritically grounded on the breadth of its themes. Indeed many other sciences and fields have large, urgent and challenging problems as their 'starting point'. If we take the example of urban development, other disciplines share the normative goal of "encouraging more benign trajectories of rapid urbanization" (whatever it means), although they frame it more as a normative motive rather than an operational research question. Traditional disciplines tend often to brake up such macro-themes into narrower sub-themes and questions. In conclusion, the balance between breadth and specificity is a ticklish question even for SuS, which so far has not found a fully satisfying solution - although the efforts by SuS to recombine and reframe traditional research-blocks in novel ways, highlighting unexpected connections, is undoubtedly of great value.

3 Enlightened solutions or counterproductive panaceas?

Where do we see materializations of these rather abstract concerns? One can find such issues in the relation to 'society' that SuS prefigures to itself. These questions are essentially bound to deep epistemological and ontological matters, but we will start from relatively blunt and practical observations. The lack of reflexivity and overemphasis on itself (as present and novel) emerge in certain tendencies within the debate that echo ambitions to provide scientific solutions to global problems, solutions over which general consensus can be achieved. The role of science becomes therefore also that of informing and enlightening the people. Let us have a look at this fragment: "Through this approach, science can contribute to goal-setting by supplying information for public debate with the aim of formulating rational consensus and supporting deliberative democracy (Åström 2001). Thus SuS can help select prior targets by providing scientific data obtained in an explicit and open manner" (Kajikawa, 2008, 231). Science should, according to this logic, facilitate the emergence of a rational consensus among conflicting instances in society, probably through the enlightened message the academy can produce. Such an idea is of course legitimate, but hides assumptions that remain in the shadow (for instance, the very possibility of achieving a rational consensus in society[1] and the related (non-justified) alleged coincidence of a democratic socio-political system with deliberative democracy). Apart from these assumptions, neither properly declared nor justified, another problematic aspect in the strife for some form of general, impartial answers is that SuS deals with normative questions (Martens, 2006; Kajikawa, 2008). A thorny question thus arises: what normative statements can be also impartial? What conditions have to be fulfilled for reaching such an equilibrium between impartiality and normativity?

Let us continue by looking at another fragment extracted from an article on SuS:

> How do we achieve agreement across society? If we have a comprehensive knowledge of the different components of society such decisions are possible. When conclusions are presented to stakeholders, however, it is usually difficult to persuade all of them of the validity of these conclusions, because their values and standards are different. To achieve consensus in society we need a common and objective platform on which the effects of different policies and options can

[1] An issue that has troubled political philosophers for a long time. See for instance John Rawls' extensive discussions about this, e.g. Rawls (1993)

> be examined and evaluated. This will facilitate the development of conclusions that accommodate different stakeholders. One candidate for such a platform is an integrated assessment model coupled to a climate model. (Sumi, 2007, 74)

The issues at stake seem very intriguing and complex. Different social classes and groups have distinct values, interests and "standards", which lead them to different ethical, moral and political evaluations not only of the 'good', but also of the 'rational'. Finding a "common and objective" platform does not at all seem as a minor task: a characteristic of political life is conflictuality, which is kind of an empirical constant, regardless if it is interpreted as a outcome to avoid (see deliberative democracy) or the very essence of the political (see more radical political theories). Anyhow, even a non-informed person can probably guess that such themes have occupied the social sciences and philosophy for a long time. Presenting, in a sentence, "integrated assessment model coupled to a climate model" as one of the possible ways for finding sucha common platform that has not been found throughout the last sentence seems to be a bit hasty.

These rather extreme cases can be interpreted as signs of a more general risk that SuS is exposed to, a risk discussed by the Nobel Laureate Elinor Ostrom and other colleagues (Ostrom *et al.*, 2007). Ostrom *et al.* warn for the risk of retracing a path that has been followed many times in the past in the context of environmental policy, i.e. shortcutting complex issues via oversimplified analytical models that then lead to over-simplistic and allegedly universal solutions. In their article, Ostrom and colleagues give an ample set of examples of how such panaceas have emerged and failed in past environmental discussion, and reflect upon the reason behind such 'mistakes.' Ostrom et al. call for:

> ...caution against the tendency, when confronted with pervasive uncertainty, to believe that scholars can generate simple models of linked social– ecological systems and deduce general solutions to the overuse of resources. Practitioners and scholars who fall into panacea traps falsely assume that all problems of resource governance can be represented by a small set of simple models, because they falsely perceive that the preferences and perceptions of most resource users are the same. (Ostrom *et al.*, 2007, 15176)

The message is simple: complex problems, as the sustainability challenges are, are not all the same, have localized peculiar traits, cannot be understood with a relatively small number of analytical models. Moreover, evaluation criteria and preferences, values and

practices strongly vary across space and social strata. To search for an 'objective platform' of course involves overruling individual and cultural preferences, but this 'denial' may be reasonable (given the reasons which can be found for the objective theory). Nevertheless, even in cases where such a 'denial' might be reasonable or even desirable, such differences and heterogeneity cannot be overlooked or ignored during the process of 'synthesis' towards some form of generality. The message is also that SuS should be cautious when planning to elaborate rational, impartial, interest-detached solutions optimal for society or even humanity as a whole. What is at stake is more complex than finding tools for listening to civil society and then for communicating the result to the public, convincing people of the rationality and universality of such paths. And this seems almost naive when considering that a feature of SuS that we all are proud of is its openly declared normative and political content.

Another problematic aspect that emerges here is the 'transmission of ideas from science to society'. Even if we assumed the possibility for SuS to generate 'perfect' understandings and solutions, this would not imply that society would 'apply' these recipes. The complexity that characterizes the relations linking power, interests, sciences, ideologies, and discourses exhorts SuS to elaborate more on the mechanisms that characterize the selection, emergence and retention (these terms are borrowed from Fairclough *et al.*, 2002) of theories, paradigms, and discourses within socio-political contexts, and their operationalization into policies. Moreover, can we really say that the sustainability challenges mainly derive from the de-coupling of science and policy? Are really the boundaries/varriers in knowledge-action systems that frustrate the efforts for meets the needs of human development (Cash *et al.*, 2002)? Is this the lesson we can take from what happened at COP15?

The diverse questions raised so far highlight several interconnected nodal points and tensions that remain unresolved within SuS. Ontological, epistemological and practical issues that are tipping points for SuS, at the same time opportunities, challenges and risks. We argue that reflexivity and openness are crucial ingredients if SuS is to succeed exploiting the innovative and creative potential inherent is such strains, and avoiding the perils hidden in the issues. In the following, we select two among these questions (universality and robustness of science, looking closer at the interface between science and society) and explore them in more depth with insights from analytical philosophy.

4 Universalism in theory and practice

In this section we shall pick up on a question left unanswered thus far, and try to dissect it from the perspective of analytic philosophy: Can there be such a thing as a universal normative science? The evolution of SuS, as a response to the conditions posed by the Anthropocene have provoked a science more oriented towards concrete action. It is talked about "sustainability challenges" that calls for responsiveness, and it is given weight to the pressing urgency with which the scientific agenda is set towards. The first issue raised thus is: what does presiding action guidance means for scientific quality? Can universalism, for instance[2], still be the guiding star for an overtly normative practice such as SuS?[3]

To further add to the complexity of the issue, we have an internal tension within SuS, between the initial ambitions and the actual shape of the solutions to climate change-problems. Ambitiously, in manifesto-like statements, it is spoken of a scientific revolution, and related to that, new modes of knowledge production underscored by desires to tear down the traditional "wall" diverting science and society. However, in the actual proposals, instead, we find what suspiciously looks like traditional science, that is, solutions purported as universal. This could be responded to in either of the following ways. One could press SuS on account of inconsistency, perhaps force the field towards some kind of consensus (around either being the revolutionary practice or as traditional scientific practice). But one could also – and this is what is suggested in this section – use the ambiguity to carve out room for a compromise between two demands that could pull apart otherwise.

Universalism as a theoretical norm for science has a long tradition. Most often it has been understood in the following way: to aim at descriptions as all-encompassing as possible in character. Not that scientists always has succeeded in it, but being universal as possible has been a goal to strive towards. An element of most scientific enterprises is indeed the attempt to find norms, procedures and codes that make it possible to sustain truth claims that go beyond contingent statements. Such a strife is evident even in traditions that have

[2]There could be parallel discussions about other scientific mores, such as objectivism or disinterestedness.

[3]One should notice that the discussion of this question has two sides to it. First, the discussion could revolve around scientific questions of quality, and let them be what sets the priority. Secondly, one could pose the question in the following way: is there a (high/too high) price to secure scientific quality when it comes to normative questions concerning the life of people? In this section, the discussion is primarily interested in the latter one.

been critical towards universalist claims. For instance, gender studies have been keen to showing the patriarchal (therefore 'particularist') contents of several scientific disciplines (e.g. biology), but did not give up with the aspiration to produce theoretical contribution for which some for of general validity can be claimed (Ramazanoglu and Holland, 2002). In blunt words, such a strife for some form of universality seems to be, also intuitively, a crucial element without which it is hard to justify the (social) usefulness of scientific inquiry: if all science can come up with are particular, contingent statements, what added value does it represent compared to other forms of knowledge?

One could, however, wonder whether this theoretical virtue can turn out to be a practical vice? The suspicion, to be teased out here, looking at a development that closes the gap between science and society, is that turning a scientific practice into a more directly normative enterprise may change the conditions of universalism as an imperative. It could even be that this theoretical virtue on the practical side is not only undesirable, or maybe also even directly harmful. It might be argued that SuS is doing society a disservice in its application of scientific norms to a wider non-academic audience, because the conditions for problem solving varies.

What is it to be critical about universalism applied in a practical setting? We could sketch the answer with the contrast of the traditional use of universalism – i.e. as a scientific more. We shall see that, given the consequences of the traditional use, which are quite harmless and confined, if universalism is objected to as used in a practical setting, the sense of the word must be quite different. Consider what Robert Merton says about universalism in science: "Universalism finds immediate expression in the canon that truth claims, whatever their source, are to be subjected to *pre-established impersonal criteria*: consonant with observation and with previously confirmed knowledge" (Merton, 1949, p. 553). This seems as self-evident as anything; who could possibly find anything objectionable with the use of impersonal criteria for testing of evidence? To be opposing universalism, it seems, would be to advocate personal attitudes, political thoughts (of, say, patriotic character) and subjective tastes not as biases but perfectly acceptable or even commendable criteria for the scientific practice. Unsurprisingly, universalism has been thought to be a scientific more, quite reasonable. The sense which it is thought that science is universal here is virtually the etymological one: 'of or belonging to all' (from the Latin 'universalis'). It is speculated about scientific knowledge as a common human good, freed from less important political and social conditions of everyday life. Grand of course, but also quite empty.

But what does it mean to apply universalism to normative, or ethical, questions? The ethical sense, is something like: 'that which are true for all *similarly situated* individuals'. A sense not only different from the thought of universalism as a scientific more, but also to be differentiated from the logical sense as: 'when a proposition is true in all different context without contradiction'. Together we have three different senses of universalism, commonly saying something about truth conditions, but differentiable when it comes to reasoning about the role of contexts. We need some way of sorting out which sense of 'universal' that is meant in the prescriptions from SuS, to be able to asses their merits. In other words, we would want to know whether SuS suggests something like 'a-contextualism', that is, context-independent truth conditions for statements, or if it is to be understood more reasonably along the lines of ethical universalism. Given the critique of 'a-contextualism' from social theory, we do not want to be left with the disturbing fact that SuS promotes a-contextualism, a socially flawed position.

What we want to suggest, given only this truncated discussion, is a positive thesis for SuS. A normative, yet scientific enterprise need not be intimidated by universalism, although it is a concept to be used with caution. Universalism in its traditional sense (as deployed by theorists of science) is plausible still, and that is not obviously threatened by being in states rapid transitions. When it comes to actual policy suggestions and action guidance, there is a possible danger of oversimplification, but even here universalism can be practiced. It should not be aimed at formulating proposals purported to be true no matter context – i.e. panaceas – but it can still be reasonable to let truth of statements be independent of similarly situated individuals.[4] Those social theorists afraid of, what we have called, 'a-contextualism', could rest assured; ethical universalism does not imply context-independence.[5]

Without engaging in the debate concerning ethical universalism too much—it is just too far-reaching—there are a few things worth noting about the relevance of context for ethical judgements. There has, in ethical theory, over the last two-three decades been a debate about contexts, where the contenders has been called atomism and communitarian-

[4]It is of course still needed to explain what 'similarly situated' really means. Perhaps one is also challenged to do this in a non-normative language.

[5]E.g. it could be a universalisable fact that satisfying the need for water over that of shelter (that is, true of all people in need of water and in need of shelter), even though (in fact, because of) the truth of the principle is relative to the people having the relevant needs (a relevant contextual feature could be that the actual whether conditions puts the one need over the other).

ism. These are two divergent views about the political and moral importance of context, amounting to different understandings of the relation between the individual and society. Atomism is the view that distribution of goods and rights is independent of context, springing from the characteristics of the individual. Communitarianism, on the contrary, suggests that we should understand such distribution—and thus justification for actions—in relation to various context.(cf., p. 189, Taylor, 1985)

The lesson we could learn from the debate between atomism and communitarianism comes from both sides. We should correct the communitarian-minded thinkers in that contexts matters in moral decisions, but reject their extensive relativism. Surely communitarians were right in emphasizing the human as a social animal, our dependence of friends and family, and the place of communal values, etc.. But they were wrong if they from this wanted to reject ethical universalism, because that is a non-sequitur. We should make proposals, from SuS for instance, sensitive to contexts; but we should resist making them completely relative contexts. Relativism is a thesis not only very hard to defend, but unserviceable in policy making and politics. We better not follow communitarian thinkers (such as Richard Rorty (see, 1985)) all the way, but stop short of relativism. Perhaps the greatest problem with relativism, which we want SuS to resist, is that it is internally inconsistent; while relativism oftentimes presents an additional thesis of tolerance of others, such a principle cannot be justified on their ground. Simon Caney nicely points this out in an article addressing the present problem of synthesising atomism and communitarianism: "one cannot maintain both the relativist and the tolerance theses, because whereas the former states that all principles are relative to given communities, the latter states that there is a non-relative principle of tolerance."(Caney, 1992, p. 288)

SuS should thus not be afraid of universalism as a dictum, there is no necessary biases connected to universalism. It should, however, be noticed that, while ethical universalism is compatible with assigning moral and political relevance to contexts, logical universalism is not. Whether it really was logical universalism that communitarianist objected to when the debate took place between them and atomists cannot be said. We should, however, be aware of the other extreme that emerged on some occasions in these efforts: the undesirable position of relativism. SuS thus should try to aim for universalism when possible, as a theoretical more, and in its ethical sense – but be aware of two extreme alternatives there: logical universalism and relativism.

5 Scientific Robustness

As we have mentioned there is close connection between SuS, the notion of the Anthropocene and deep epistemological revisions (transdisciplinarity, Mode-2 or postnormal science etc.). Under this section we consider some other issues with concerning what is sometimes referred to as *scientific robustness*. We differ between two kinds of scientific robustness and explain how they have been connected to each other and then proceed to discuss the somewhat contradictory points of potential risks and to what extent this development is actually new.

5.1 Two conceptions of robustness and their relation to each other.

Prima facie we may differ between two, we take it, rather common conceptions of robustness. The first one concerns the robustness of scientific procedure and methodology that is meant to secure the quality of knowledge produced.[6] Though this is related to truth somehow it is not obviously and directly so; illustrated vividly by the so-called demarcation problem within philosophy. Let us call this *procedural robustness*. Questions pertaining to how and to the possibility and actuality of such robustness have been central to philosophers for millennia. The second conception also shows an impressive pedigree in the history of science and philosophy but has notably been reinvigorated as of late; and especially then in connection to the Anthropocene. That robustness relates science to society (Gibbons *et al.*, 1994). This *social robustness* is thought of differently in different context but we have found two versions (or aspects of it) to be quite common; it is sometimes worded in terms of *reliability* (or perhaps range) and is then quite similar to procedural robustness, or; in terms of relevance. Gibbons (2000) emphasizes the former when claiming that scientists needs to produce knowledge that is reliable also outside the laboratories (161). The accusation concerns the poor generalizability of scientific results; even if they were useful they seem to have little validity outside of the narrow confinements of science itself.[7] The

[6]Included here would also be any other means by which science is thought to secure knowledge claims including the peer-review practice and such things as conferences and seminars etc.

[7]Curiously there is some tension in this line argument between more context-dependent knowledge and more universal knowledge. Given the above statement it would seem Gibbons is concerned with the lack of universality but what he is arguing for is actually a more 'context-sensitive' science, thus not necessarily a denial of universalism. This confusion, we think, is symptomatic and relates to how one understands 'universality' as such, as discussed in the previous section.

relevance issue, though similar in part, relates more to the type of knowledge claims rather than the quality of them. The idea is that if one lets science go it specializes itself into the void. A part of this problem concerns language issues but another the opportunistic character of research; the predjudice goes something like this: "science produces knowledge only where it comes easy." One puts one's efforts into the specific problems dictated internally and does not bother with the composite and difficult reality outside the windows of one's study. This concern (or similar variations) have been voiced it seems since antiquity (Schmidt, 2008) and was a major concern for e.g. the logical empiricists of 30's and 40's.[8]

These two meanings are not logically dependent but have been connected (Max-Neef, 2005). The argument connecting them appeals to the special character of problems of the so-called "real world." More specifically these problems are thought to be more complex, intricate, intertwined and even wicked (Rittel and Webber, 1973). Current epistemology was developed for other and ends and fall short of producing solutions. Due to the nature of (some) these problems (climate change etc.) that is something we cannot afford. The development of alternative epistemologies that is usually suggested go by way of revision of tenets concerning procedural robustness. Hence it is argued in order for science to socially robust we have to loosen its procedural robustness. The worry seems to be that the procedural robustness of science is too strict and needs to loosen up. For instance Max-Neef (2005) suggest deploying intuitionistic style logic.[9] Others have perhaps not gone so far but the tendency is clear; some more inclusive conception of scientific knowledge and procedure is needed.

5.2 Two Concerns

There are obvious risks with this, most obvious perhaps that loosening up scientific procedural rigidity directly threatens epistemic security; the risk is it does not help so much as it could potentially lure us into action though we lack crucial knowledge. On the other hand perhaps this is exactly what is called for; urgency is a salient feature of these problem-

[8]See for instance the furious debate between Otto Neurath and Horace Kallen that took place in the mid 40's, (Kallen, 1946a,b; Neurath, 1946a,b).

[9]One may also note here that regarding this the status of intuitionistic logic is not clear. That particular case it seems could be interpreted differently. Proofs in inuitionistic logic are generally harder to produce since certain inferences aren't allow; for instance one cannot infer the existence of something simply from contradiction.

complexes. Perhaps the poor epistemic situation can be balanced by means of subsequent strategies like adaptive management. This has often been suggested.[10] Ironically it seems that the more inclusive our knowledge-criteria are formulated the more we need to rigidify our conception of a solution. Strategies like adaptive management narrows the spectrum of possible solutions to a problem quite significantly. Admittedly such strategies have other merits to them and adopting such approaches could be justified independently. One could however question why we need to retool our epistemology for such purposes. Lowering the bar for scientific knowledge as such seem an unnecessary hassle when it would suffice only to lower the bar for when it is time to spring into action. Definitions of knowledge is not the issue. In the spirit of Neurath it would perhaps be much more useful to work on how knowledge is presented rather than produced. To inspire action with proper caution it is vital to know what we know; how far does the knowledge we possess take us and where does it end? By paying proper attention to the range and scope of knowledge claims it seems the context-sensitive science Gibbons is calling for is realized without a new epistemology.

There are other hazards with such suggestions. Knowledge production in Mode-2 (Nowotny, 2000; Nowotny *et al.*, 2003; Gibbons *et al.*, 1994; Gibbons, 2000) and transdisciplinary research (Max-Neef, 2005)—common epistemological alternatives in this debate—are often defended on grounds that this practical aspect or real world relevance draws additional justification on democratic grounds. Social robustness ensures that science comes to those who need it in a form they can understand and use. These ideas build only in part matters of crossing or doing away with scientific boundaries, the other leg is some form of practical engagement or relevance. An admirable venture of course though some scientist surely would object and say that the whatever use some discovery will have is impossible to predict; we simply do not have epistemic access to the information we need to make that sort of judgement. Enough attention and resources is already directed towards society (in the form of industry) and the products wanted there. Important discoveries are overlooked and research takes longer or is even impossible when focus is on such short time-frames. But regardless of this, the important question here regards this democratization of science. The worry is that this is only scientific claims to power (re)dressed. It is not so much a matter democratizing science as it is a question of scientifying society. There are certainly traces of this to be read of the frustration of scientists with the lumbering giant of deliberative democratic processes. Below the surface lurks ancient philosophical prob-

[10] See for instance Mitchell (2009).

lems regarding the distinction between factual statements and those that concern value. On that terminology science is removing a range of topics from the hands policy-makers. There might well be justification for that but it is none-the-less a dangerous and quite 'traditional'-sounding development.

5.3 What's ever new?

The closing sentence of the last section referred to something often alluded to in these contexts; 'traditional science' or knowledge production in mode-1. These epistemologies come with a claim of novelty; a new situation requires a different and new science. But how new are they and what is this traditional conception? With these concerns we are not the first, Pestre (2003) for instance claims that phenomena relevantly similar to mode-2 has been around for centuries. Regardless, what we want to do under this heading is to use a rather basic taxonomy of scientific entities by means of which we may make a (very crude we're afraid) analysis of the extent to which science and society are already intertwined.

So suppose we differ between the following: science can thus be thought of as consisting of, among other things, *problems*, *methods* or *procedures* and *results*. Perhaps these can be regarded as idealized phases or something in that general direction. We do not suppose however that these classes partition the domain of everything in science exhaustively. Quite to the contrary much is left to wind and there will be considerable overlap. These are simply important aspects of scientific progress.

It should be fairly clear that when it comes to problem-formulation privileges society already has far reaching influence in how science works. There are many examples of this; funding is usually from state or private interest and even if scientists formulate their own problems the have to get they are dependent on the benevolence of powers external to science itself. A lot of science is applied science where instrumental aspects are highly important.[11]

Concerning procedural or methodological issues science is also, if not all in many fields at least, under considerable influence from society. Experimental or would-be experimental sciences (social sciences counted) operate under the same moral and ethical principles as society at large and are generally only bent if the gains prove especially valuable. An

[11]There is of course scientific prestige projects that are in the interests of states but has little or at least not very obvious societal benefits beyond that prestige, like CERN for instance.

obvious example is medicine where ethical councils are ever present; but there are of course more, psychology, any science where data is collected by means of for instance interviews etc. The point is only that in this domain there is already deep connections between science and society and societal influence is salient.

When it comes to the result phase we seem to have a slightly different situation, at least *prima facie*. Making the scientific product an object of negotiation is usually not considered to make the quality of the results any *better*. There are however examples of this, such as the IPCC where policy makers have influence over the results as they are negotiated. None-the-less there is always to option of disregarding scientific information and influence results in that way, surely a common practice.

Thus it seems that societal relevance and influence is already there to a large extent and the difference between for instance mode-1 and mode-2 is likely to be one of degree rather than kind. Many of the arguments concerning revised epistemologies may well turn out to be sound and the development sought perhaps even necessary. We might not however be so far from the mark to begin with.

6 Conclusion

We started by highlighting some reason for which SuS has the potentiality to figure among the sciences able to understand the Anthropocene, and to deal with the multiple, intertwined and intriguing challenges that the novel condition presents.

Focusing on the interface between science and science and society, our contributions has highlighted several ticklish issues that indicate that SuS can fulfil the promises it represents only with a great deal of reflexivity. We stressed the critical importance for the novel field of SuS to be particularly open to the contributions of other traditions and approaches, avoiding the risk to commit sins of hybris because of the aura of novelty and the sense of urgency that surround SuS. Hinging mostly upon reflections from analytical philosophy, we have attempted to deepen and problematize the discussion on two related topics: universality and the robustness of knowledge. we explored these aspects in connection to the different phases of scientific production, i.e. the definition of research questions and directions, the coding and performing of scientific procedures, methods and mores, and the negotiation/transmission of results with/to society. We sketched the complexities inherent in these issues and spelled out the different meanings and implications that they assume in

relation to the different phases of knowledge production. Such reflections do not dismantle or downsize the scope of SuS's ambitions to interpret the Anthropocene and to represent a vibrant novelty in the academic landscape. In fact, our reflections (also by showing the old roots of several among the novel ontological and epistemological issues SuS has to confront) calls for caution when dealing with ticklish issues as universality and robustness/openness of science. Rather then in simple blueprints of questionable theoretical refinement, we argue that the ways forward for the envisioning of the science(s) of the Anthropocene should look for fragile equilibria and trade-offs between the often conflicting requirements that the Anthropocene poses on SuS.

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