A human-right approach to scientific progress. The deontic framework

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Abstract

The Chapter starts with an analysis of the 'right to enjoy the benefits of scientific progress and its applications' (REBSP). Its long history goes back to the UN Declaration of Human Rights in 1948 and the International Covenant on Economic, Social and Cultural Rights (ICESCR) in 1966. Its importance and patchy implementation was reiterated by the UNESCO Venice Statement in 2009. The Chapter offers a diagnosis for the patchy implementation to date, back to a number of assumptions about scientific knowledge and its progressive nature that are common to what Massimi calls the 'manifest image' of progress and the 'philosophical image'. The Chapter offers a different image of scientific knowledge and its growth, building on Massimi's work on perspectival realism. It urges replacing individuals with situated epistemic communities, the siloed picture with interlacing scientific perspectives and a view of progress *sub specie aeternitatis* or "from here now" with one of progress "from within". The Chapter lays out the contours of a possible 'deontic framework' as a way of reinterpreting the core content of REBSP in light of perspectival realism. By doing so, the REBSP can be read as a 'cosmopolitan right' no longer trapped between the strictures of individual rights vs. the rights of the communities to share in it. This epistemic shift brings with it much needed 'cosmopolitan obligations' when it comes to sharing in scientific knowledge and its advancements. It has ultimately the potential to change the legal landscape where the prescriptive force of REBSP currently remains delegated to the good will of individual nations ratifying ICESCR.

1. Introduction. A different way of thinking about scientific progress

An experts' meeting in Venice organized by UNESCO in collaboration with the European Inter-University Centre for Human Rights and Democratisation (EIUC) took place in July 2009. The goal of the meeting was to examine the core content and legal national and international obligations concerning the "right to enjoy the benefits of scientific progress and its applications", or, in brief, REBSP. Such right has been enshrined in a long list of legal documents: from Article 13 of the American Declaration of the Rights and Duties of Man in 1948 to Article 27(1) of the UN Declaration of Human Rights (UNDHR) also in 1948; from Article 15(b) of the 1966 International Covenant on Economic, Social and Cultural Rights (ICESCR), to the 2009 Venice Statement that resulted from the aforementioned meeting.

There are important changes in the language of these different legal documents. From "intellectual progress, especially scientific discoveries" in the American Declaration of the Rights and Duties of Man to "scientific advancement and its benefits" in UNDHR, to the "right to enjoy the benefits of scientific progress and its applications" in ICESCR. It is to this last version—known as REBSP and making explicit reference to scientific progress—that I turn my attention to in this Chapter. The Venice meeting lamented the patchy implementation of the Article 15(b) almost half century after ICESCR and highlighted the need to clarify the core content of REBSP

and associated notions of "science and knowledge as 'global public goods'" (Venice Statement 2009, p. 7). In its final form, point 7, the Venice statement asserts the necessity to

> *clarify the nature of scientific knowledge*, progress or advancement and who decides on goals, policies, allocation of resources and possible conflicts between freedom of research and the protection of other human rights and human dignity. In addition, whereas the individual right to enjoy the benefits of scientific progress and its applications must be respected, the rights of communities to share in these benefits must be recognized as equally important (p. 14, emphasis added).

In this Chapter, I focus on "science and knowledge as 'global public goods'" and I take some preliminary steps towards a different way of asking philosophical questions about scientific progress. For there cannot be a meaningful discussion about scientific progress and its nature—or, needless to say, about a human right such as REBSP—until one elucidates the nature of scientific knowledge. Or better, the idea that one can have a philosophical discussion about scientific progress by insulating the very notion and associated ones (such as scientific knowledge) from the wider debate about its role in society engenders inward-looking discussions that risk missing the main point about why we care (and should care) about scientific progress.

My take here is that we should care about scientific progress mostly because without a better understanding of it, the very human right to enjoy the benefits of scientific progress remains an abstract concept, with a patchy implementation at the level of individual nation states and a nebulous core content. REBSP risks resembling more wishful thinking than actual legal ground for action whenever such human right is violated or neglected.

In this Chapter I argue that legal obstacles to the implementation of REBSP, and in particular the difficulty mentioned by the Venice Statement in reconciling "the individual right to enjoy the benefits of scientific progress and its applications" with the "rights of communities to share in these benefits" originates from a pervasive, well-entrenched and ultimately impoverished picture of scientific knowledge.

I make a plea for replacing such an impoverished picture with a different one that in my view can deliver on "science and knowledge as 'global public goods'". I highlight how this new picture of scientific knowledge is best equipped to deliver on the normative content of REBSP and has the potential to shed new light on some of the traditional controversies concerning the "rights of communities to share in these benefits".

Such rights should not be an afterthought in a legal framework that understands science and knowledge mainly in terms of individualistic discoveries and privately-funded innovations. They should be embedded, and naturally follow from, the very fabric of scientific knowledge production as a social and collective human endeavour. Appreciating what makes scientific knowledge a progressive kind of enquiry implies understanding how *many situated epistemic communities contribute to reliable knowledge production over time*. Or so I shall argue, building here on my work on perspectival realism (Massimi, 2022b).

Where to start then? Let me start by comparing two images of scientific progress broadly construed—what I call the 'manifest image' and the 'philosophical image'—how they are related to one another and what I take to be missing in both. Scientific progress is one of those notions that has entered public discourse and regularly features in media releases as well as in science policy and political speeches. What is the manifest image of scientific progress?

In daily parlance, scientific progress is often associated with scientific discovery; devising a new scientific theory; designing a new piece of technology; creating a new drug, or innovation. Scientific fields are regarded as making progress (or not) depending on whether new particles are discovered, new cures for diseases are found, more complete theories are introduced. Lack of progress (real or perceived) is accompanied by absence of a full understanding of some mechanisms, or shortage of new discoveries or innovations. Milestones are set in research agendas and research funding distributed depending on their respective potential for making progress.

The idea that scientific progress is essential to the welfare of a nation and that research funding should be distributed in accordance to such potential for progress has a long tradition in science policy, back to *Science, the Endless Frontier* in 1945 by President Roosevelt's scientific advisor, Vannevar Bush (Bush, 1945). The Summary of the Report opened with a section entitled "Scientific Progress is Essential". But nowhere in the report Bush explained what scientific progress was; or, why the pursuit of scientific progress—in and of itself—results in better economy, better welfare and better national security.

As Philip Kitcher (Kitcher, 2001) in Chapter 11 has argued, *Science, the Endless Frontier* was operating with an elitist view of progress whereby an elite of scientists are entrusted with the task of pursuing fundamental research along the Baconian model of the *New Atlantis* with its envisaged House of Salomon. Vannevar Bush's model has served American society well with its governance vision of the State (rather than individual philanthropists) funding universities and scientific research more in general. But the Bush model has also revealed the glaring shortcomings of what might be called the 'manifest image' of scientific progress.

Scientific progress—in and of itself—does not necessarily translate into societal progress. The entanglement of scientific and military purposes behind the Manhattan project and similar ones in the following Cold War years was a powerful reminder of it. Democratic societies, with better quality of life and better welfare for their citizens, require and demand scientific knowledge that serves their needs. But *whose* needs? The needs of whoever produces knowledge and owns patent rights to specific innovations? Or those of the general public, who despite its "right to enjoy the benefits of scientific progress" (REBSP) is often at the receiving end of commercialised innovations? What makes scientific knowledge progressive? And how can scientific knowledge be expected to serve democratic societies and to advance them?

Here enters the 'philosophical image'. For long time, scientific progress has been identified with getting closer to the truth—the so-called verisimilitude account, see (Niiniluoto, 1984), (Niiniluoto, 2014). The intuitively simple idea is that progress tracks truth. When compared to an earlier theory, a scientific theory is said to make progress if it preserves true claims and discards false ones (think of relativity theory vis-à-vis Newtonian mechanics).

This theory-centric approach to scientific progress seems however to leave out many other examples where progress seems to do more with technological advances and innovations than with putting forward a new theory. Thomas Kuhn's puzzle-solving account was meant to remedy for this pitfall. Scientific discovery has to do with the ability to solve puzzles and problems, where sometimes those problems originate from scarce data, or questionable assumptions—see for example (Kuhn, 1957) for a discussion related to the passage from Ptolemaic to Copernican astronomy.

Defenders of the verisimilitude account have been unmoved by Kuhn. They have worried that focussing on problems detracts attention away from what really matters—namely, truth. After all, how many scientific advances were made that solved problems but were based on false principles / false assumptions? Think, for example, of Carnot's ideal cycle, key to steam engines, and yet based on the false assumption that heat was an immaterial substance called caloric.

The more recent noetic account—see (Dellsén, 2018)—has gone some way towards addressing these concerns besetting both the verisimilitude and the puzzle-solving account. By focussing on understanding and relaxing the demand on truth as the epistemic norm, progress can be understood in terms of "improved ability to use an unjustified (but correct) theory to explain or predict phenomena" (Dellsén 2018, p. 7).

Without entering into the details of any of these specific accounts (and leaving here out others for reasons of space), one strikingly common feature is the attention paid to individual theories or individual problems to be solved, or the ability of an individual theory or research

programme to improve on their predecessor. The 'philosophical image' of scientific progress bears the hallmark of individualism. Progress is by and large an individualistic achievement: i.e. it is the achievement of either some individual person who puts forward a new theory or produces a scientific innovation; or of some (small or large) individual group of persons sharing for example a scientific paradigm able to solve more puzzles. This much is shared by the 'manifest image' of scientific progress. Vannevar Bush's idea of investing in basic (i.e. fundamental) research done by individual scientists with the hope of a positive cascade-down effect on society as a whole was born out of the same individualistic approach that has fueled the 'philosophical image'.

But what both the 'manifest image' and the 'philosophical image' have left untouched are the aforementioned fundamental questions: What makes scientific knowledge progressive? And how can scientific knowledge be expected to serve the needs of democratic societies and advance them? *Whose* needs? Those of the IP rights / patents owners? Or those of the general public at the receiving end of them? In posing these questions, I want to signal my broad alignment with the view that takes progress as linked somehow to scientific knowledge (rather than truth, or puzzle-solving or understanding). At the same time, I part way from the traditional epistemic account of progress, see e.g. (Bird, 2007), because I am not interested in defining progress as the accumulation of knowledge, but in progress as a distinctive feature of scientific knowledge that needs be explained (rather than taken for granted as a methodological fiat).

I see the individualistic approach to scientific progress as tacitly underpinning the REBSP and indeed the whole tradition behind the human-right approach to scientific advancements and progress. Already in the UNDHR, Article 27(1) celebrated the individual right to "share in scientific advancement and its benefits" and coupled it with Article 27(2) which established the "right to the protection of the moral and material interests resulting from any scientific, literary and artistic production of which he is the author". Equally, the ICESCR of 1966 intertwined Article 15(b) concerning REBSP with Article 15(c) which reiterated the right of everyone to "benefit from the protection of the moral and material interests resulting from any scientific, literary or artistic production of which he is the author".

To be clear here: I am not saying that the problem with REBSP has to do with the patent system, current IP rights provision, TRIPS (Trade-Related Aspects of Intellectual Property Rights), or more broadly with the private/public funding divide in which inevitably scientific progress and innovations take place. Or better, in the measure in which the problem with REBSP may indeed have to do with some of these aspects, there are experts in law, economics, social studies of science and distributive justice who are better placed than me to address and tackle these specific aspects—

see for example (Sunder, 2007), (Biagioli et al., 2011), (Biagioli, 2019), (Miller & Taylor, 2018), (Patten, forthcoming).

All I am saying is that philosophers of science have a role to play in this debate. For what is fundamentally at stake in the Venice statement lamenting the patchy implementation of REBSP to date is the lack of clarity about the core content of REBSP and in particular about the "*nature of scientific knowledge*, progress or advancement and … possible conflicts between freedom of research and the protection of other human rights and human dignity" (Venice Statement 2009, p. 14). Clarifying the *nature of scientific knowledge*—on which discussions about individualistic achievements vs collective rights to share in benefits depend—is one of the primary tasks for philosophers of science. I turn to it in the next Section, where I give a diagnosis of three main problems I see at play in a well-entrenched view on scientific knowledge; and explain how these problems in turn feed into both the manifest and the philosophical image of scientific progress to date.

2. **Three problems about scientific knowledge production and its progressive nature**

The idea that progress is an individualistic achievement (of either one scientist who brilliantly devises a new theory; or, a team of scientists that skillfully come up with the right technological innovation or discovery) camouflages a more complex and nuanced social dynamics always at play in science. The further idea that scientific progress for the public good is just the natural consequence of pursuing one's own research interests naively passes the camouflage off for a universal norm in science policy: 'Let us foster scientific progress and societal progress will follow naturally'.

As already mentioned, the history of science has often put the lie to the latter idea. Too often scientific programmes that were regarded as progressive at their time advanced hideous social agendas (e.g. think of eugenics as just one example). It is wishful thinking to believe that the relation between scientific progress and societal progress is a linear cascade-down one. Nor, a fortiori, should scientific progress be conceptualized as a mostly individualistic pursuit and achievement (of either an individual scientist or group of scientists at a particular time).

No one—no individual or particular scientific group or community—can ratify their own claims of knowledge as constituting scientific progress, on pain of particular groups passing off as progressive deleterious or harmful advancements. Rather than being worried about theories with false or speculative assumptions being passed off as progressive in the name of puzzle-solving, I think we should worry more about the risk of passing off as progressive pieces of scientific research that may feed into harmful and discriminatory research agendas. For this very simple

reason alone, I think it is a mistake to take scientific progress as an individualistic achievement, pace the manifest and philosophical image.

Three main problems affect the received view of scientific knowledge on which philosophical discourse on progress (and its individualistic underpinning) has been built. They revolve around the following questions:

1. *Who produces scientific knowledge?*
2. *How does scientific knowledge grow?*
3. *What makes scientific knowledge progressive?*

Let us take a quick look at each of them, starting from 1.

2.1 Who produces scientific knowledge? The injustice of epistemic trademarking

Scientific knowledge production is typically associated with someone's name: e.g. Newton's laws, Lavoisier's oxygen, Maxwell's equations, Carnot's cycle and Boltzmann's constant, just to mention a few examples from the history of physics. Attaching names to a scientific result (be it equations, laws, constants, models, particles, chemical elements, etc.) is a way of rightly recognizing authorship and tracing back the original idea to its legitimate owner.

This is of course a common and uncontroversial practice, and key to copyright laws and patent rights (where applicable). Indeed, it is a recognised universal right as per ICESCR Article 15(c) to protect "the moral and material interests resulting from any scientific, literary or artistic production of which he is the author". Labelling scientific discoveries and innovations in this way is not only a recognised universal right but it is also epistemically innocuous.

However, a problem arises when an (epistemically innocuous) label or mark becomes what in Massimi (2022b, Chapter 11 on which I draw here) I have called an "epistemic trademark": namely, when there is an *epistemic overstretch* from a particular scientific output or achievement of someone, who is legitimately recognized as its intellectual owner, to wider swaths of knowledge claims that for various historically contingent reasons become associated with that specific label or mark.

For example, under the mark "Newtonian mechanics" one would typically include not just Newton's laws codified in the *Principia* but more broadly a certain understanding of the mechanical motion of bodies as distinct from Aristotelian physics. Such understanding of mechanical motion began to emerge and can be traced back via Galileo in 17th-century Pisa and Oresme in 14th-century

Paris to medieval scholars like Abu Al-Barakāt in Baghdad, among others (without mentioning the contribution of authors like Émilie Du Châtelet to the field, for example). While these historical lineages are not lost to the historians of science, they can easily get lost outside historical circles as soon as the term "Newtonian mechanics" is coined and gains traction in common parlance among scientists and the wider public. A mark has become an "epistemic trademark", in my idiolect, overstretching and encompassing much wider swathes of knowledge claims—contributed through complex historical lineages and social dynamics—by various authors at various times and places.

I have elsewhere argued that epistemic trademarking is a way of avoiding 'consumer confusion' and 'dilution by blurring'—a way of ringfencing the uniqueness and originality of a particular body of knowledge claims over others. In this example, "Newtonian mechanics" is a way of demarcating and ringfencing a body of knowledge from another one dominant in previous centuries, namely "Aristotelian physics". But the cost of this manoeuvre is that it tends to obfuscate complex and nuanced historical lineages and trademark them *as if* they were the *exclusive* achievement of a single individual:

> A label or mark in scientific discourse (e.g. "Maxwell's equations") becomes an *epistemic trademark* (e.g. "Maxwellian electromagnetic theory") when it ends up *concealing* the complex historical lineages and *blurring* the epistemic contributions of various communities. To be clear, in these examples there is no culpability on the part of individual epistemic agents (be it Maxwell, or similar) in the process of transforming a mark into an epistemic trademark… *epistemic trademarking* is first and foremost a structural phenomenon of how scientific narratives (or a particular kind thereof) get off the ground and tacitly enter public discourse as a result of specific epistemic norms that codify scientific knowledge production in particular societies (Massimi 2022b, p. 356-7).

Some of these epistemic norms favour, for example, textual knowledge over oral knowledge, theoretical knowledge over artisanal knowledge, knowledge produced by a particular social group over others. Epistemic trademarking is a way of saying "Newtonian mechanics" is really one and the same as Newton's laws as much as "Maxwellian electromagnetic theory" is really one and the same as Maxwell's equations, and this is what one often finds in scientific narratives. The epistemic trademark shows its efficacy by branding large bodies of knowledge as epistemic goods that can be easily recognized and commodified for the use of a particular consumer audience. An example is in Richard Feynman's assessment of Maxwellian electromagnetic theory as reducible to Maxwell's equations:

> It was not yet customary in Maxwell's time to think in terms of abstract fields. Maxwell discussed his ideas in terms of a model in which the vacuum was like an elastic solid. He also tried to explain the meaning of his new equation in terms of the mechanical model. There was much reluctance to accept his theory, first because of the model, and second because there was at first no experimental justification. Today, we understand better that what counts are the equations themselves and not the model used to get them. We may only question whether the equations are true or false. This is answered by doing experiments, and untold numbers of experiments have confirmed Maxwell's equations. If we take away the scaffolding he used to build it, we find that Maxwell's beautiful edifice stands on its own. He brought together all of the laws of electricity and magnetism and made one complete and beautiful theory. (Feynman's lectures, 18-1 The Maxwell equations, online from: https://www.feynmanlectures.caltech.edu/II_18.html)

The problem is that taking away "the scaffolding," as Feynman put it, amounts to more than simply getting rid of an inadequate (and ultimately false) ether model in this particular case. It implies severing the very contribution of a number of epistemic communities—not just the ether modelers at the time, like FitzGerald and MacCullagh, but also experimentalists like Faraday and Ampère, without mentioning the role of artisanal communities like kelp-makers and glass-blowers involved in producing lead-free glass tubes such as cathode rays—whose contributions to the understanding of the laws of electricity and magnetism proved pivotal.

2.2 How does scientific knowledge grow? The injustice of epistemic severing.

Elsewhere (Massimi 2022b, Ch 11, p. 349-50) I have argued that epistemic trademarking presupposes another epistemic injustice, namely epistemic severing:

> *Epistemic severing* affects *narratives* about scientific knowledge production that tend to surgically excise the contributions of particular epistemic communities. This might happen both across communities that might share the same 'scientific perspective' —see (Massimi, 2022b), (Giere, 2006)—*and* across communities belonging to culturally diverse scientific perspectives. Severing is an act of informational injustice in how scientific knowledge production *gets narrated* in scientific textbooks and canons.

Epistemic severing differs from what might be called epistemic "blinkering". Inevitably, in any scientific narrative decisions are made about what to include and what to leave out, what piece of info to foreground and what to background depending on their relevance to the narrative and important ethical considerations too. If writing a popular science piece on Maxwell's electromagnetic theory, it might not be necessary to enlarge the scope of the narrative and give a fine-grain historical picture of the context that made it possible to flourish. However, in recounting the historical narrative in a history of science textbook it is important not to omit the fine-grain contextual details; or worse, to give the historiographical impression that this particular achievement is simply the product of a lone genius.

I see epistemic severing as "the act of cutting off specific historically and culturally situated communities to historically remove or blur their contributions to what I call 'historical lineages' in the scientific knowledge production" (Massimi 2022b, p. 350). I understand the notion of historical lineages as the "open-ended, ever-growing, and irreducibly entwined body of scientific knowledge claims grounded in well-defined scientific practices and in their experimental, modelling, and technological resources" (ibid., 341). Historical lineages and the situated knowledge they embed are a way of counteracting a pervasive picture of how scientific knowledge grows that can be found in philosophy of science: namely the idea that scientific knowledge grows by replacing one old theory with a better one; one degenerating scientific programme with a progressive one (to use Lakatos's terminology); or, with Thomas Kuhn, one old scientific paradigm beset by anomalies with a new one with higher puzzle-solving.

This ubiquitous picture reinforces the impression that scientific knowledge grows in silos and that progress is a matter of surgically excise faulty claims and replace them with better ones (however one wants to read 'better' in this context—i.e. getting closer to the truth, more puzzle-solving or else). That scientific knowledge grows in silos has been one of the most widespread and too often unquestioned assumptions in this debate. But as an image of how scientific knowledge historically grows it remains highly questionable, as I explain in the next Section.

2.3 What makes scientific knowledge progressive? Progress 'sub specie aeternitatis' and 'from here now'

Zooming into the internal dynamics of how these processes of historical replacement and substitution operate, the question as to whether progress has indeed been made seems characterized by some kind of "atemporal chauvinism", for lack of a better word. In asking whether the replacement of T_1 with T_2 amounts to scientific progress, one is not just assuming that T_1 and T_2 are sufficiently well insulated theories produced by different individuals (e.g. Ptolemy vs Copernicus, Aristotle vs Galileo, Newton vs Einstein, and so on). One is also typically

assuming that the replacement in question amounts to scientific progress *sub specie aeternitatis*. Elsewhere (Massimi, 2016) I have described this as "the view of success from nowhere (or, the view of success from God's eye)" whereby "We might never be in the position of achieving such complete true knowledge of nature, but it acts as a regulative idea of scientific inquiry to assess success and failure at any given historical time" (p. 760).

A more modest variant of it is what I have called "success from here now", whereby progress is not assessed vis-à-vis some regulative ideal *sub specie aeternitatis* but from the standpoint of 'here now' as a privileged epistemic standpoint. On this other view, although neither Copernican astronomy nor Galilean physics were perfectly accurate descriptions of the relevant phenomena, they constituted nonetheless progress when assessed from here and now. One is here reminded of the need to weed out the false claims of past theories from the true posits that remained intact as knowledge grew. Varieties of semi-realism and selective realism have flourished against this backdrop—see e.g. (Chakaravartty, 1998), (Lyons, 2006).

The problem with both these takes is that they tacitly assume that epistemic agents do occupy such privileged standpoints, either *sub specie aeternitatis* or from 'here and now'. And while the former is hard to reclaim for any historically and culturally situated community of epistemic agents, the latter risks smuggling in contextual and perspectival standards 'here and now' *as if* they were *sub specie aeternitatis*.

3. The deontic framework: where perspectival realism meets cosmopolitan rights

In reply to these three problems, I suggest a number of moves that I have already hinted at in the previous Sections. In response to *Who produces scientific knowledge?*—and with an eye to avoiding epistemic trademarking—I suggest taking situated communities as the starting point of these conversations. Scientific knowledge production is never the product of the lone genius or isolated individual (no matter how brilliant) or (small or large) group of people. It starts instead from historically and culturally situated scientific practices of many epistemic communities at any one time.

As an answer to 2. *How does scientific knowledge grow?*— against the injustice of epistemic severing—in my book *Perspectival Realism*, I have defended a different picture of science which starts from a plurality of historically and culturally situated scientific perspectives and analyses the growth of scientific knowledge in terms of how these perspectives have *methodologically intersected* with one another and *historically interlaced* in historical lineages.

By *interlacing* with one another in highly complex and non-linear historical lineages, scientific perspectives allow us to track the evolution of knowledge concerning some phenomena by looking

at how some of the tools, artefacts and experimental techniques changed use and function as a result of this interlacing. In my book I give the example of the early Chinese wet and dry compasses which originally situated in geomantic practices became eventually navigation tools and allowed knowledge of phenomena concerning the Earth magnetic field. Going back to the history of electromagnetic theory, one could similarly make the point that the exhausted glass tubes, used among others for Crookes's speculative radiometer science—see (Gay, 1996)—became in the following decades the key scientific tool (cathode rays) for the study of electrical phenomena.

Paying attention to how a plurality of situated perspectives have historically interlaced has a twofold function. First, against the picture of insulated siloes, it celebrates the social and deeply collective nature of scientific knowledge. Second, it reinstates epistemic communities that too often have been severed in scientific narratives, especially under-represented communities that "on various grounds (e.g. class, ethnicity, gender) are not the dominant, ruling, scientific-canon-writing ones" (Massimi 2022b, p. 351).

Epistemic severing and epistemic trademarking are the very same reasons why today it continues to be hard to acknowledge the contribution of underrepresented communities to the production of scientific advancements and their benefits. The patchy implementation of REBSP lamented by the Venice Statement and the tension between the individual rights to enjoy the benefits of scientific progress and "the rights of communities to share in these benefits" is, in my view, nothing but the natural consequence of a ubiquitous image of scientific knowledge production (and narratives thereof) blighted by epistemic severing and epistemic trademarking.

Coming to 3. *What makes scientific knowledge progressive?,* in Massimi (2016, pp. 764-5) I made some tentative steps to answer the question by appealing to a notion of "success from within" as "the ability of a theory to perform adequately with respect to standards that are appropriate to the scientific perspective of the time, when assessed from the point of view of other scientific perspectives". The key idea is that a scientific claim meets the criterion of "success from within" iff the propositional content of the claim is true (i.e. it corresponds to the way things are) and it satisfies the standards of performance adequacy in the original scientific perspective when assessed from the viewpoint of other (subsequent) scientific perspectives. This perspectival take is meant to counteract both the presumption of a God's eye view on scientific progress ("success from nowhere") as well as the presumption of "success from here now" whereby we by our current lights would stand better than our predecessors in assessing what counts as scientific progress.

In Massimi (2022b), I have further clarified how scientific knowledge production is ultimately the ability to *reliably* identify modally robust phenomena, i.e. stable (qua lawlike) events in nature that can be identified and re-identified by a number of situated epistemic communities

from different datasets via many perspectival data-to-phenomena inferences (see Massimi 2022b, Ch 6). Ultimately, the propositional content of a knowledge claim is true if it corresponds to modally robust phenomena in my phenomena-first ontology. And progress is assessed perspectivally by considering how claims of knowledge continue to be retained (or withdrawn) when assessed from the point of view of other scientific perspectives.

I made also the point that different communities may have the epistemic upper hand in the identification of particular phenomena: for example, local beekeepers know best how to identify the phenomenon of pollination peak for a particular plant in their region—see (Massimi, 2022a). And I have urged to see natural kinds as open-ended groupings of historically identified phenomena so as to give communities their due without the risk of identifying one particular phenomenon as more foundational than any other in a truly Neurahian spirit (Massimi 2022b, Ch 8).

At this point one might ask: Is not there a suspicion of passing off as scientific knowledge some claims that although may be reliably produced were not justified by the particular historically situated scientific perspectives in question? In other words, is not there a risk of passing off as scientific knowledge some claims about ether, caloric, or maybe even Crookes' radiometer speculations in the name of interlacing scientific perspectives?

I think this way of posing the question forces a false dichotomy on us: either go multicultural, embrace the social and perspectival nature of scientific knowledge *at the cost of* jeopardizing, say, Popper's demarcation criterion; *or*, uphold the latter and continue to assume that scientific progress is a matter of replacing one by one false theories with better new ones, pace situated epistemic communities and their interlaced scientific perspectives.

Here enters the human-right approach—or deontic framework as I'd like to call it—to scientific progress, at a really important cross-junction between perspectival realism and existing landmark legislative documents that have long established REBSP. This is the cross-junction where a new philosophical image of scientific knowledge has the potential to shed light on the core content of REBSP and some of the thorny questions about its patchy implementation to date. Conversely, the human-right approach to progress encapsulated by REBSP can in turn help re-align epistemic narratives about scientific progress beyond the well-trodden path of individualistic achievements and siloed systems of knowledge that get replaced over time with better ones.

Most importantly, this cross-junction between a new image of scientific knowledge and core content of REBSP can help address the aforementioned epistemic injustices—epistemic severing and epistemic trademarking—and put center stage the multicultural roots of scientific knowledge and the reasons why communities *have the right* to enjoy and share in scientific progress and its

applications. What is to be said then about this fertile cross-junction between the epistemology of science and human rights legislation? In what follows, for reasons of space, I will only make two main remarks:

(I) I suggest that if one understands the core content of REBSP along the lines of an image of scientific knowledge as that proposed by my perspectival realism, REBSP is best understood as a *ius cosmopoliticum* or 'cosmopolitan right', namely a right that pertains to everyone as a world citizen.

(II) Understood as a 'cosmopolitan right', REBSP is no longer trapped into the tension between the individual right to enjoy in scientific progress and the "rights of the communities" to share in progress and its benefits as the Venice Statement still lamented in 2009.

Let me briefly sketch the contours of (I) and (II), starting with (I). I started this Chapter by mentioning a lacuna flagged by the Venice Statement and concerning the need to "*clarify the nature of scientific knowledge*, progress or advancement" with an eye to addressing why more than half century after the landmark UNDHR and ICESCR, the REBSP remains at the mercy of nation states. The rise of 'vaccine nationalism' that the COVID-19 pandemic has glaringly brought to light—and the remaining gap in vaccine supplies for the Global South—is just one manifestation of how the implementation of REBSP continues to face roadblocks. Bioprospecting and biopiracy, namely the unauthorized use of knowledge about flora, fauna (and more broadly the harvesting of genetic resources) from indigenous people and local communities (IPLC) for commercial purposes, is yet another painful manifestation. Can a different take on the core content of REBSP help address these structural inequities in access to and benefit sharing when it comes to scientific progress?

A deontic framework is an important step in this direction. By 'deontic' I mean a philosophical framework that takes scientific progress explicitly as a *matter of right and duty* at the same time. For there can only be duties (or obligations) when there are rights. A recent literature in international human rights law has increasingly focused on REBSP under the name of 'Right to Science' (RtS)—see (Porsdam & Porsdam Mann, 2021), (Donders & Tararas, 2021), (Porsdam Mann et al., 2018). This literature has gone back to other legislative tools such as e.g. (Committee on Economic, Social and Cultural Rights, 2020) and has elucidated both the international obligations related to scientific progress and its applications, as well as the challenges in translating such international human rights law into domestic law. For example, there are still countries like the USA that have signed but not ratified to this day (April 2022) the ICESCR—see for a

discussion (Porsdam Mann et al., 2021). And even among the 170 countries that have signed and ratified the ICESCR, the threefold State obligations to "*respect* the right, to *protect* it, and, finally, to *fulfil* it" (ibid. p. 232) may not necessarily be implemented.

The problem originates from the difficulty of translating an international human right law into domestic law of various State Parties. The onus of the legal implementation is left effectively to individual nations where often socio-economic poverty, private interests, political lobbies stand on the way to the implementation of REBSP and the wider RtS. Even in the more recent (Committee on Economic, Social and Cultural Rights, 2020), the emphasis lies entirely on State parties to

> direct their own resources and coordinate actions of others to ensure that scientific progress happens and that its applications and benefits are distributed and are available, especially to vulnerable and marginalized groups. This requires, inter alia, instruments for the diffusion of science (libraries, museums, Internet networks, etc.), a strong research infrastructure with adequate resources, and adequate financing of scientific education (ibid. Article 16)

Moreover, States are reminded of the "duty of international cooperation" which is

> essential because of the existence of deep international disparities among countries in science and technology. If it is necessary, owing to financial or technological constraints, developing States should resort to international assistance and cooperation, with a view to complying with their obligations under the Covenant. Developed States should contribute to the development of science and technology in developing countries, adopting measures to achieve this purpose, such as allocating development aid and funding towards building and improving scientific education, research and training in developing countries, promoting collaboration between scientific communities of developed and developing countries to meet the needs of all countries and facilitating their progress while respecting national regulations. (ibid. Article 79).

Framed thus and so, however, there is a risk that the duty to implement REBSP reduces at best to the goodwill of individual States to ratify the ICESCR and, more precisely, to the goodwill of "developed States" to contribute—through "development aid and funding"—"to the development of science and technology in developing countries". The onus of the legal enforcement lies squarely within individual States which "should establish effective mechanisms

and institutions, where they do not already exist, to prevent violations of the right…As this right can be threatened or violated not only by actions of the State but also through omission, remedies must be effective in both cases" (ibid., Article 89).

In my view, the only way of remedying these shortcomings in the implementation of REBSP to date is to relocate its governance from domestic law (in those States which have signed and ratified ICESCR), or even international human rights law, to cosmopolitan law. I contend that if one endorses an image of scientific knowledge as that proposed by my perspectival realism, REBSP is best understood as a *ius cosmopoliticum* or 'cosmopolitan right' rather than international human right law. What is the difference, one may ask?

The idea of cosmopolitan rights has a long-standing tradition in political and legal theories, and in recent times has been brought back to the general attention thanks to the work of Pauline Kleingeld and Seyla Benhabib (Benhabib, 2006), among many others. The idea of *ius cosmopoliticum* can be found in Kant's *Toward Perpetual Peace* and *Metaphysics of Morals*— see (Kant, 1795), (Kant, 1797). In *Toward Perpetual Peace,* Kant saw each person as amenable to three different kinds of rights: (1) rights that pertain to "*citizens of a state* governing the individuals of a people (*ius civitatis*)"; (2) international rights "governing the relations of states among one another (*ius gentium*)"; (3) "*cosmopolitan right,* to the extent that individuals and states, who are related externally by the mutual exertion of influence on each other, are to be regarded as citizens in a universal state of humankind (*ius cosmopoliticum*)" AAVIII: 349 (Kant, 1795) (English translation, p. 73).

Most of the discussions surrounding cosmopolitan rights in Kant's original context focused on the right to hospitality for foreigners based on the idea of a "*peaceful*…universal community of all people on earth who can come into active relations with one another" not as a "philanthropic (ethical)" idea but rather as "a principle of *right*" AAVI:352, (Kant, 1797) English translation p. 146. The far-reaching legal implications of this notion for holding accountable injustices and crimes that go beyond both national and international law are well-known and have been discussed in a long-standing tradition back to Hannah Arendt, Karl Jaspers, Jürgen Habermas, Jeremy Waldron, among others.

But so far the debate on cosmopolitan rights has surprisingly not been applied to science and scientific progress. If the diagnosis I have offered in this Chapter is on the right track, one can begin to see why the debate on cosmopolitan rights has left REBSP untouched. For one would need to first embrace a different philosophical image of science and scientific knowledge as genuinely 'global public goods' compared to the image that has been prevalent in both the manifest and the philosophical image to date. Perspectival realism provides such an alternative philosophical image where scientific knowledge, its progress and benefits can legitimately be regarded as 'global

public goods' to the extent that they are the product of myriad historically and culturally situated epistemic communities whose scientific perspectives have historically interlaced.

That scientific progress and its applications should be regarded as 'public goods' openly accessible to all might seem uncontroversial. But that they should be regarded as a 'global public good' is less so. Consider typical examples of public goods: for example, public parks, motorways, military defense systems—the sort of goods that nation states provide to their citizens via taxation systems. Each public good might benefit some portion of the population more than others. City dwellers might benefit more from public park than country dwellers; and car-drivers might benefit from good motorways more than non-car-drivers. Considerations of this nature typically drive debates about what a fair system of national taxation might look like in terms of benefits-costs to the citizen of a State—see e.g. (Miller & Taylor, 2018) for a discussion.

Now one may think of scientific progress and its applications along the same lines of public parks and motorways as 'public goods': e.g. vaccines, medicines, fMRI scans, but also particle accelerators, telescopes, digital innovations and myriad other examples resulting from scientific research paid through taxpayers' money via research councils funded projects and initiatives. Taken as 'public goods' within the confines of national boundaries, it would seem that nation States have duties towards their own citizen to make sure they enjoy the benefits of scientific progress and its application.

However, understood thus and so, it is not very clear why nation States should have equally binding duties towards foreign nationals to make sure they too enjoy the benefits of scientific progress and its application. For example, at the time of a pandemic, when access to vaccines becomes a priority, should individual nation States give priority to their own citizen before shipping any extra supply to foreign countries? And should this duty towards one's own citizen trump any other consideration, including stark disparities in vaccine supplies and vaccination rates across countries and especially in the Global South?

My point is the following: what makes scientific progress and its applications different from say public parks, or motorways, or similar is that former are 'global public goods' whose *right to enjoy* extends well beyond national boundaries and nation States' jurisdictions (including international relations among them). These are rights that ought to be enjoyed by *everyone everywhere* all else being equal (i.e. assuming equal access to them and equal ability to enjoy their benefits in the absence of, say, structural socio-economic stark inequalities).

But treating scientific progress and its applications as a 'global public good' means relocating its normative core content from the realm of domestic law (where national systems of taxations determine funds allocated to different public goods and the extent to which individual states might

or might not be willing to "contribute to the development of science and technology in developing countries") to the realm of cosmopolitan law. Hence, my suggestion that REBSP ought to be treated as a cosmopolitan right, namely a right that pertains to everyone not in virtue of either being citizen of a nation State or in virtue of international law, but in virtue of a *ius cosmopoliticum*.

This is not a moot shift. Nor is it one that can be justified on the back of traditional images of science and scientific progress 'from nowhere' so to speak. "Success from nowhere" as well as the presumption of "success from here now" would hardly square with the idea of scientific advancements as 'global public goods' and hence of REBSP as a cosmopolitan right. For they are both the disguised philosophical expression of what is historically a Global-North take on scientific progress and its applications. They tend to treat implicitly scientific advancements as 'public goods' like public parks and motorways, but not necessarily as 'global public goods'.

I think it is indicative that the operating definition of science that still lies at the core of the REBSP and the more recent (Committee on Economic, Social and Cultural Rights, 2020) "General Comment" tacitly and unwittingly buys into a view of "success from nowhere":

> the word "science" signifies the enterprise whereby *humankind, acting individually or in small or large groups,* makes an organized attempt, by means of the objective study of observed phenomena and its validation through sharing of findings and data and through peer review, to discover and master the chain of causalities, relations or interactions; brings together in a coordinated form subsystems of knowledge by means of systematic reflection and conceptualization; and thereby furnishes itself with the opportunity of using, to its own advantage, understanding of the processes and phenomena occurring in nature and society (ibid., Article 4. Emphases added)

There is mention of "objective study of observed phenomena", of "sharing of findings and data and through peer review", of "subsystems of knowledge" and "systematic reflection and conceptualization" as if all this epistemic feat were the product of a culturally deracinated and historically decontextualised "humankind, acting individually or in small or large groups" rather than the outcome of myriad historically and culturally situated epistemic communities, whose scientific perspectives have historically interlaced.

Unsurprisingly, as a consequence of this take, partaking in REBSP becomes then mostly a matter of duties of nation States to "disseminate" scientific progress—from the centre of production to the periphery—for the enjoyment of everyone, as stressed by the aforementioned Articles 16 and 79 of (Committee on Economic, Social and Cultural Rights, 2020).

But if one understands the normative core content of REBSP by taking as a starting point a different image of scientific knowledge as the one proposed by my perspectival realism, partaking in REBSP ceases to be a matter of "disseminating" knowledge from developed countries to developing countries where local duties give way to international duties. Partaking in REBSP—I maintain—is a cosmopolitan right, a right that *everyone everywhere* can reclaim as their own in virtue of belonging to a seamless multicultural web of interlaced scientific perspectives through which only scientific knowledge becomes possible.

Re-aligning REBSP with cosmopolitan rights is therefore only possible by embracing a richer and more substantive philosophical image of scientific knowledge: one that places epistemic communities and their situated knowledge center stage; that does not treat knowledge production as a siloed exercise of surgically excising theories or parts thereof; and that does not assess progress *sub specie aeternitatis* but as something that every community at any time can reclaim as its own contribution.

Coming to point (II), re-interpreted as a cosmopolitan right on the back of perspectival realism, REBSP becomes a powerful tool to fight the injustices of epistemic severing and epistemic trademarking. Because where there are rights, there are obligations. And REBSP qua *ius cosmopoliticum* brings along with it the cosmopolitan obligation to ensure that scientific progress and its benefits are indeed accessible to a world citizenship rather than to a few privileged developed countries. To be counteracted, vaccine nationalism and biopiracy—see on the latter e.g. (Mgbeoji, 2006)—require more than "access and benefit sharing" (ABS) mechanisms with developing countries. They require changing some deeply seated presuppositions behind "community sharing" which should not be understood as an act of philanthropy or "dissemination" from the centre to the periphery, from developed countries to developing ones; but instead as a cosmopolitan obligation towards fellow citizens, no matter in which nation states or international law order they happen to be living in.

This shift requires the creation of institutions and governance systems that can secure the implementation of such cosmopolitan obligations analogous to The Hague International Court of Justice, which over decades has secured the implementation of cosmopolitan obligations in fighting crimes against humanity. If REBPS continues to be delegated to nation States for its implementation, the intended promise of being a 'universal human right' risks remaining wishful thinking. In our after-COVID world, the time is ripe for making sure that vaccine nationalism does not repeat itself and REBSP is not paid lip-service. Philosophers of science have a voice to contribute to these important ongoing debates. A deontic framework for scientific progress, which

starts from a perspectival and multicultural image of scientific knowledge and reinterprets REBSP as a cosmopolitan right, is a good starting point for continuing these conversations.

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