Epistemic severing and epistemic trademarking. Two garden varieties of epistemic injustice in science

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In this paper, I identify two inter-related varieties of epistemic injustice ubiquitous in science. *Epistemic severing* is the act of cutting off some epistemic communities from the narrative of scientific knowledge production. *Epistemic trademarking* is the ensuing process of trademarking relevant portions of scientific knowledge as the exclusive product of one epistemic community over others. I elucidate the nature of these two notions with examples from the history of physics and contemporary biopiracy.

Keywords: epistemic injustice, informational justice, biopiracy, local knowledge, Nagoya protocol, Access and Benefit Sharing (ABS)

1. Two garden varieties of epistemic injustices in science

The multifaceted landscape of epistemic injustice in science has attracted growing attention among philosophers of science. In this paper, I lay out the contours of two garden varieties of epistemic injustice in science: what I call *epistemic severing* and *epistemic trademarking*. These both originate from a common and much-treasured feature of scientific knowledge: its being an "epistemic good" that can travel, be shared, expanded upon, and traded for.

In societies where the socio-economic levers of power are unequally distributed, or across situated scientific perspectives whose historical "interlacing" has been exploitative in nature (see Massimi 2022), this otherwise treasured feature of scientific knowledge opens the door to the risk of specific epistemic injustices. Their origin can be identified in broader and well-studied mechanisms of epistemic exclusion affecting marginalized groups in what Kristie Dotson (2014) has called "epistemic oppression" and Emmalon Davis (2018) has characterized as "epistemic appropriation."

Davis, for example, sees epistemic appropriation as a twofold epistemic injustice involving what she calls *epistemic detachment*, whereby the "epistemic resources developed within the margins gain intercommunal uptake, those resources are overtly detached from the marginalized knowers responsible for their production," and *epistemic misdirection*, "when epistemic resources developed within, but detached from, the margins are utilized in dominant discourses in ways that disproportionately benefit the powerful" (Davis 2018, p. 705)—concepts that she illustrates with examples from gender and race.

One fundamental feature typical of epistemic injustices more generally is the failure "to identify a speaker as a knower" and the inability of the audience to "discern the possession of credibility" by the speaker (Dotson 2011, p. 242). In some contexts, however, marginalized groups are harmed not so much by the perceived lack of credibility of their speakers, but, if anything, by the "credibility excess" of the dominant group' (Davis 2016).

There are two related garden varieties of epistemic injustices that affect a particular kind of knowledge—scientific knowledge—and that so far have received much less attention in philosophy of science. They have, however, often been discussed in postcolonial science studies, although no philosophical analysis of them has been offered to date. My aim here is to articulate the underlying epistemic mechanism behind these two varieties of epistemic injustices in science.

Their domain is not so much testimonial justice or hermeneutical justice (see Fricker 1999, 2007), but instead what is referred to as "informational justice": namely the broad framework that focuses on "equitable inclusion of people, groups, and communities as they themselves are sources of information, and they actively contribute to, seek, process, and analyse information" (Atkins and Mahmud 2021, p. 1). Much of the current work in this field concerns information and communication technology (ICT), with a focus on notions such as "information poverty" and "information inequities" in the way in which particular data are collected, analyzed, and used by various social groups (see, e.g., Eubanks 2011).

However, there is an additional and no less important aspect of informational justice that concerns not so much *access to* data and information already available, but instead the very *production of scientific knowledge qua information*—in the forms of data, inferred phenomena, modeling practices to elicit them, experimental tools, and so forth—and how that information gets passed on, shared, and traded from one epistemic community to another in the seamless process of knowledge production. By virtue of being an "epistemic good" whose production unfolds across communities and over time, scientific knowledge lends itself to two distinctive garden varieties of epistemic injustice.

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 2022; 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. It should not be confused with the omission or epistemic "blinkering," as one might call it, that inevitably accompanies any scientific narrative, where the narrator can of course always choose to foreground some pieces of information and background others depending

on their relevance to the narrative and on basis of important ethical considerations too (e.g., Nazi science being removed from scientific narratives).

Epistemic severing is 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. This can be done on various socio-economic-ethnical grounds, as when it is epistemically and socially inconvenient for the ruling class to admit the contribution to scientific achievements resulting from manual labor of the working class. At the receiving end of epistemic severing are often what get referred to as *minority communities*, where "minority" is here understood as synonymous with "under-represented," communities that on various grounds (e.g. class, ethnicity, gender) are not the dominant, ruling, scientific-canon-writing ones.

Epistemic severing can happen in various ways. It can either happen as a wilful act on behalf of the narrator to exclude the contribution to scientific knowledge production of under-represented communities. But it can equally happen in a non-wilful —yet still culpable—way as a result of socio-economic structures and epistemic norms that place an emphasis on particular modalities of scientific knowledge production over others (e.g. textual rather than oral, codified in educational curricula rather than artisanal, universal rather than local knowledge). In the latter case, the narrator who fails to acknowledge such contributions, while often unaware of them, would still commit an epistemic injustice—one resulting from structural inequities in the way in which scientific knowledge production is described and rewarded within particular societies.

Epistemic severing therefore is not simply failing to "recognize" the contribution of specific epistemic communities. It slashes through the very fabric of scientific knowledge production; it tears apart the historical interlacing of situated scientific perspectives that is ultimately responsible for the growth and evolution of scientific knowledge over time. By severing the historical lineages at the junctures where minority communities feature, epistemic severing damages and jeopardizes the very possibility of understanding the processes through which scientific knowledge becomes possible over time. Failing to do justice to the historical fact that scientific knowledge is indeed the outcome of a seamless multicultural web makes it hard to acknowledge ways in which today it continues to benefit from interlaced perspectives of minority communities.

The second variety of epistemic injustice—closely connected with epistemic severing—is *epistemic trademarking*. Epistemic severing is a precondition for epistemic trademarking. Having severed the very historical lineages of knowledge production, the next step typically involves the appropriation and branding of entire bodies of knowledge claims with associated practices as a "trademark" of one particular epistemic community. Epistemic trademarking manifests itself in

the fencing, labeling, and ultimately often merchandising of portions of scientific knowledge that are the products of myriad interlaced scientific perspectives.

Epistemic trademarking builds on epistemic severing to further exploit merchandising rights arising from scientific knowledge to the exclusive socio-economic benefit of one epistemic community at the expense of others. Traditionally, in economic theory and law, trademark protection has served two main functions: "the prevention of consumer confusion" and the protection against "dilution by blurring" (Sunder 2018, pp. 217 and 219). The first is an argument that a market where consumers are not confused about the source and quality of trademarked products is more competitive, with more choice, higher-quality goods, and lower prices. The second refers to preventing the dilution of the originality and uniqueness of the trademarked products through unauthorized reproductions and unmonitored uses.

By analogy, I see epistemic trademarking operating along these two dimensions. Applying an "epistemic trademark" to a piece of scientific knowledge or technological innovation is indeed a way of preventing consumer confusion. But it is equally a way of laying claim to merchandising rights. And it is a powerful way of ringfencing the uniqueness and originality of a piece of knowledge or innovation as if it were the exclusive product of either one agent alone, or one particular epistemic community over any other that might have contributed to the process of scientific knowledge production, and that—once severed from the historical lineage—loses any rights to it. In either case, epistemic trademarking is often the expression of merchandising concerns about scientific knowledge qua "epistemic good" that can be commodified and traded to a target consumer audience.

By its very nature, epistemic trademarking harms forms of scientific knowledge that do not easily lend themselves to commodification and merchandising: for example, when the knowledge is collective rather than individual; oral instead of written; passed on from one generation to the next rather than codified in scientific canons and epistemic norms. In what follows, I focus on epistemic trademarking and the harm it makes in different epistemic contexts in science.

2. First example of epistemic trademarking: across historically situated epistemic communities

What counts as a mark in science? Consider how even in common parlance scientific outputs and achievements are marked with someone's name: Newton's laws, Lavoisier's oxygen, Maxwell's equations, and Boltzmann's constant are just 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). Like with epistemic severing/ epistemic blinkering, here too one should not confuse epistemic trademarking with the (epistemically innocuous) epistemic "labelling", so to speak, which is ubiquitous in science and does not necessarily presuppose that *severing* has occurred. In other words, it is possible to epistemically "label" without severing. But I do not take it to be possible for epistemic trademarking to occur without severing.

Then the question arises: when does a label or mark become an "epistemic trademark"? The transition from an (epistemically innocent) label or mark to an "epistemic trademark" occurs when there is an *epistemic overstretch* of the former to include not just a particular scientific output or achievement of someone, who is legitimately recognized as its intellectual owner, but also swaths of knowledge claims that for various historically contingent reasons become associated with that specific label or mark.

Consider the following examples: the passage from Newton's laws to "Newtonian mechanics"; or from Maxwell's equations to "Maxwellian electromagnetic theory"; or from Lavoisier's oxygen to "Lavoisier's system of chemistry." The former are marks. The latter are epistemic trademarks that designate entire bodies of scientific knowledge claims under the aegis of Newton or Maxwell or Lavoisier. Within those bodies of knowledge claims lie particular contributions and scientific achievements that predate Newton or Maxwell or Lavosier, respectively.

For example, under 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 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. 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.

Likewise, under "Maxwellian electromagnetic theory" one would typically count not just Maxwell's equations for the electromagnetic field but an entire corpus of knowledge about electromagnetic phenomena that begins with Ørsted's experiments in 1820s Denmark and continues with Faraday's experiments in 1830s England, without counting the whole tradition of electrical researches with exhausted glass tubes that developed in the mid- to late 19th century and was made possible by the manufacture of lead-free glass, produced by professionally trained glass-blowers, using alkali sources obtained from ashes of burnt seaweed (kelp) and, later, synthetic soda.

The specific contribution of each epistemic community—including glass-blowers and kelp-makers (see Massimi 2022 and in press)—is lost in the name "Maxwellian electromagnetic theory." The emphasis is placed on the theory rather than on the tools, technological and experimental resources, or better the wider scientific perspective (qua historically and culturally situated scientific practice) in which the theory was embedded and became possible.

One might be tempted to brush this observation under a rug as epistemically moot. A label is after all just an expedient shorthand to refer to something. The historians know these historical lineages, it could be argued, and they can choose to zoom in and out of them depending on the focus of their narrative. Scientists and the public, however, do not need to be constantly reminded of them in daily discussions and common parlance.

Yet, I argue, what lies in the label is important. A label or mark in scientific discourse (e.g. "Newton's laws") becomes an *epistemic trademark* (e.g. "Newtonian mechanics") 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 Newton, or Maxwell, or Lavoisier) in the process of transforming a mark into an epistemic trademark, for there is no reasonable assumption of a wilful act of severing in the agent's intentions. Instead, *epistemic trademarking* is here 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.

It is the perceived need to protect epistemic goods (like the body of knowledge behind "Newtonian mechanics" or "Maxwellian electromagnetic theory" or "Lavoisierian chemistry") under a trademark so as to avoid "consumer confusion" with rival products, so to speak. In this case, the rival products included Aristotelian physics, which was still lingering in the medieval impetus theories of Oresme and Abu Al-Barakāt; the "electromagnetic worldview" associated with ether theories; and Joseph Priestley's "dephlogisticated air" and associated chemistry, respectively.

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 bodies of knowledge as epistemic goods that can be easily recognized and commodified for the use of a particular consumer audience. An indicative 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)

"Consumer confusion" was removed, and acceptance secured, by trademarking the electromagnetic theory—a hodgepodge of ether models and electrical fluid views at the time of Maxwell—under the epistemic trademark associated with Maxwell's equations. 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 experimentalists like Faraday and Ampère, among others—whose contributions to our understanding of the laws of electricity and magnetism were pivotal.

Historical examples of epistemic trademarking abound. However, it would be hasty to conclude that this is just a historical phenomenon, or maybe one concerning narratives about physics in particular, whose past historiographical tendency to portray science as the product of a "lone genius" has done much damage in cutting out entire communities from scientific narratives. Epistemic trademarking is very much an ongoing epistemic injustice in science affecting in equal measure the biomedical sciences, as the next example shows.

3. Second example of epistemic trademarking: across culturally situated epistemic communities

In the biomedical sciences, the commodification of scientific knowledge for merchandising purposes relies more than ever on the practice of "epistemic severing" and "epistemic trademarking." At the receiving end, there are ethnic minorities and indigenous communities

whose local knowledge—often orally transmitted from one generation to the next—is particularly vulnerable to these types of epistemic injustice. Indeed, epistemic trademarking is the very epistemic mechanism that structurally underpins the phenomenon known as "biopiracy." In this case, the epistemic trademark finds its tangible incarnation in commercial trademarks that often overstretch swaths of knowledge claims contributed by a number of different communities.

One of the much-quoted examples concerns the use of local knowledge about the rosy periwinkle plant in Madagascar. The plant known in botany as *Catharantus roseus*—and with local names such as *tonga trongatsy*—has long been known in ethnobotany for its medicinal properties. Tea made with its leaves in the Philippines was believed to help with diabetes, among other conditions. The story goes that Canadian-trained surgeon C.D. Johnston in Jamaica became interested in collecting the leaves, drying them, and sending them to Robert Laing Noble, who was the Associate Director of the Collip Medical Research Laboratory at the University of Western Ontario (see Duffin 2000, on which I draw here). His brother Clark Noble played an important role in the discovery of insulin.

While the hypothesized anti-diabetic properties of the plant had already been refuted in the late 1920s, Robert Noble and his team was able to identify other unexpected medical properties. His collaborator Charles Beer was able to isolate vinca alkaloids with powerful anti-cancer effects. The discovery of vinblastine was announced in 1958 by Noble and Beer and the first clinical trial for the anti-cancer drug started in 1959 run by the pharmaceutical company Eli Lilly & Co. The company earned over $100 million from the production of vincristine and vinblastine, two compounds used in anti-cancer drugs.

Rosy periwinkle continues to be harvested, dried, and collected today in southern regions of Madagascar where the highest-quality vinca alkaloids can be found. Local rural Malagasy communities continue to provide labor for large international corporations. Recent studies (e.g. Neimark 2012) have remarked how despite international protocols such as access and benefit sharing (ABS) and the Convention on Biological Diversity, very few socio-economic benefits trickle down to the local Malagasy community. By and large, the community continues to rely on traditional methods for harvesting, drying, and transporting (often for long distances and on foot) the dried plants to central facilities where subsidiaries for multinational companies collect them for international transport. Often such tasks fall on older women in the Malagasy community, who can pick periwinkle in the wild and carry "up to 5 to 10kg per trip. … Some buyers estimate that close to half of all root bundles are brought to market by older women" (ibid., p. 436).

Malagasy periwinkle producers continue to be at the receiving end of the commodification of scientific knowledge that I call "epistemic trademarking." This case, among others (including

neem trees in India used for toiletries and insecticides or the African katempfe plant for a calorie-free sweetener—see Ostergard et al. 2001), has raised questions about how local knowledge of biodiversity, for example, can be subject to intellectual property laws.

Some have remarked how the current WTO system of Trade-Related aspects of Intellectual Property Rights (TRIPS) ends up protecting the interest of multinational corporations at the expense of communities who, despite providing the local knowledge, often "are among the least likely to benefit from the resulting drugs, much less even hear about them or reap any monetary benefits at all" (Jiang 2008, pp. 30–31).

Legal scholars have been considering alternative options such as benefit-sharing agreements that Western companies must sign when using the National Cancer Institute's Natural Product Collection, whose biodiverse materials mostly come from the Global South (Jiang 2008, p. 32). In other cases, like the deal between Merk & Co. and Costa Rica's National Institute of Biodiversity (INBio), compensation takes the form of shares in royalties ("undisclosed" and "thought to be between 1% and 3%") for the development of new drugs using indigenous plant and animal extracts while retaining patent rights for the corporation (Stone 1992, p. 1624).

Tools for legally protecting indigenous knowledge—such as the UN Convention on Biological Diversity (CBD) adopted at the Earth Summit in Rio de Janeiro in 1992 and the Nagoya Protocol in 2010—have so far aimed to facilitate "access and benefit sharing (ABS) mechanisms" and biopiracy is now recognized as a "serious violation of indigenous peoples" rights' (see UN 2014, p. 2).

Yet the normative-legal force of the CBD and Nagoya Protocol remains at the mercy of individual nation-states, whose sole sovereignty on the public land, its biodiverse materials, and local knowledge means that local people's rights are ultimately still dependent upon nation-states' decisions.

On November 21, 2019, the UN General Assembly in its "Implementation of the Convention on Biological Diversity and Its Contribution to Sustainable Development" (UN 2019) reiterated the 2050 Vision for Biodiversity in engaging indigenous people and local communities (art. 8 (d)); lamented "the limited progress made by its parties in the implementation of the Nagoya Protocol" (art. 25); and stressed "the importance of the engagement of the private sector and relevant stakeholders, as well as indigenous people and local communities, women and youth," in the implementation of the Convention (art. 40).

Behind the battle for recognizing intellectual property rights to varieties of local knowledge, there are huge economic interests. But this debate is also eye-opening for philosophical discussions about the nature of scientific knowledge: *who produces* scientific knowledge, and *who gets to benefit*

from it. Epistemic severing cuts off the interlacing of scientific perspectives upon which scientific knowledge historically grows and evolves. Epistemic trademarking applies the trademark to well-defined portions or fragments of this vast and open-ended interlacing in order to advance merchandising rights.

4. Conclusion. What remedies for epistemic trademarking?

Epistemic trademarking as an epistemic injustice associated with scientific knowledge production calls for more than ABS as a legal tool for sharing benefits with the source countries and communities, whose local knowledge about the methods and practices for harvesting biodiverse materials proves commercially lucrative. Epistemic trademarking can only be remedied by *re-instating intellectual ownership* of the relevant knowledge to local communities. In other words, it is important to distinguish between the harm that epistemic trademarking does from that caused by the commercial practice of appropriating and merchandising local botanical knowledge, for example.

Even in the best case scenarios where fair ABS mechanisms are in place, credit to the origin of the biodiverse material is given, and dividends are paid back to local communities, there would still be epistemic injustice. There would still be "epistemic severing" if the story that gets narrated is the story of progress in biomedical innovations where local knowledge is marginalized and downgraded to a mere repository of traditional wisdom, in the words of the legal scholar Madhavi Sunder

> presenting poor people's knowledge as the raw material of innovation—ancient, static, and *natural*—rather than as intellectual property—modern, dynamic, *scientific, and cultural invention.* Under this view, traditional knowledge holders may receive remuneration for conserving biodiversity and contributing the raw materials of innovation, but they are not recognized as intellectual property holders in their own right. (Sunder 2007, pp. 100–101, emphases in original)

Moreover, there would still be "epistemic trademarking" in the seamless process of knowledge production—from the original identification of the relevant phenomena (e.g. particular suspected medicinal effects of some plants) to the subsequent refinement of the associated knowledge claims via a variety of practices and methods until the new drug is produced. In a society whose epistemic norms codify scientific knowledge as written knowledge produced via experimental methods, the

oral knowledge of local communities without the financial-technological resources to satisfy these epistemic norms is bound to be severed and left at the periphery rather than being celebrated in the co-production of knowledge. Worse, it becomes easy to exploit.

To conclude, understanding the epistemic structural mechanism behind biopiracy implies grasping the deeper source of widespread epistemic injustices in science. Biopiracy is only one manifestation, glaring as is with its merchandising implications, of a wider and more subtle variety of epistemic injustice affecting scientific knowledge production and narratives thereof. Redistribution remedies by themselves (in the form of ABS or similar) are not sufficient. For the problem is not so much or only about "giving back" scientific knowledge, or not restricting access to it. The bigger substantive problem is how to "reclaim" as one's own portions of knowledge that have been appropriated, re-used, and eventually "trademarked" by others. Philosophers of science have a responsibility to analyze the mechanisms behind such epistemic injustices.

The dynamic, fluid, open-ended, inferential nature of scientific knowledge as I have described it in my monograph (Massimi 2022)—a spectacular product of myriad interlacing perspectives—does not lend itself to the logic of severing and trademarking. It undercuts precisely the dichotomy that Sunder highlights as a barrier to the legal protection of local communities' knowledge. A phenomena-first ontology like the one I advocate undercuts any argument designed to ghettoize local knowledge and downgrade it to wisdom about "raw materials."

There is more. The perspectival pluralism that I see as compatible with realism makes trademarking an epistemic injustice before it even qualifies as a socio-economic injustice in the dress of biopiracy. For epistemic trademarking undercuts the situatedness of scientific knowledge; it breaks down historical lineages. Perspectival realism offers a philosophical framework (surely not the only possible one) for understanding scientific knowledge production that is stridently at odds with epistemic narratives friendly to epistemic severing and trademarking.

Acknowledgments

This material is reproduced in suitably edited and abridged form from Michela Massimi (2022) *Perspectival Realism* (Oxford University Press), Chapter 11. I am very grateful to Julia Bursten, Ana-Maria Crețu, Adrian Currie, Catherine Kendig, Sabina Leonelli, and John Turney for various comments on an early draft of my book chapter. S. Andrew Schroeder kindly provided very helpful comments on a draft of this paper. Filipa Lopez Melo and Aidan McGlynn offered useful references. This article is part of a project that has received funding from the European Research Council (ERC) under the European Union's Horizon 2020 research and innovation programme

(grant agreement European Consolidator Grant H2020-ERC-2014-CoG 647272 *Perspectival Realism. Science, Knowledge, and Truth from a Human Vantage Point*).

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