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**ABSTRACT**

The contestation between mainstream science and counter-science is a longstanding phenomenon. The current issue of Science as Culture addresses the need for scientists to consciously engage in a broad-spectrum science that simultaneously focuses its lens on the social and natural dimensions of the universe. The question of how this objective can be achieved by Science and Technology Studies (STS) scholars is, therefore, the main thrust of this special issue.

## Introduction

The contestation between mainstream science and counter-science is a long-standing phenomenon. Indeed, the valorisation of science in the nineteenth century stems from scientists' conceptualisation of nature as 'passive' and understanding its functioning through certain 'eternal laws' expressed in unilineal, 'simple equations' engendered by the notion that ' … all truth is already inscribed in the structures of the universe' (Wallerstein, 2007, p. 132). The rise of a new movement among mainstream scientists led to the emergence of counter-scientists. It is noteworthy to acknowledge the attrition warfare among mainstream scientists and a group of counter-scientists, both of whom were originally orthodox scientists.

To counter the hegemony of science, the emergence of complexity studies and cultural studies presents a different perspective on the nature of reality. The field of complexity studies asserts that nature is composed of multiple realities and is not as simplistic as natural scientists conceive it to be. Cultural studies also emphasises the relativism of social reality as being against mainstream scientists' doctrine of 'universalism' and 'determinism.' Closely associated with the notion that science is relative to culture or interests, Eriksen (2001) explains cultural

relativism on the grounds ' … that societies or cultures are qualitatively different and have their own unique inner logic, and […] it is therefore scientifically absurd to rank them on a scale' (p. 7). Without a doubt, Eriksen's thesis buttresses the need for a broader perspective than that of mainstream science on the multifaceted challenges confronting humanity.

That said, Immanuel Wallerstein's proposition on the hybridisation of knowledges is relevant to the four papers published in this special issue. In what he refers to as the 'social scientisation of all knowledge,' Wallerstein (2007) suggests the need ' … to place the study of social reality within an integrated view of the study of all material reality' (p. 134). The current issue of Science as Culture, therefore, addresses Wallerstein's concern about the need for scientists to consciously engage in a broad-spectrum science that simultaneously focuses its lens on the social and natural dimensions of the universe. The question of how this objective can be achieved by Science and Technology Studies (STS) scholars is, therefore, the main thrust of this special issue.

Logan Williams and Sharlissa Moore's editorial comments on *Conceptualising Justice and Counter-Expertise* are positioned within the social study of knowledge production meant for enhancing human well-being and progress. Drawing from Heeks et al. (2013), they de-emphasise the orthodoxy and underscore the need to radically move away from Grand Narrative, which conceives of science as linear and straightforward. Instead, they emphasise the importance of metanarratives that are cognisant of the holistic and diverse viewpoints of the voiceless in the knowledge production process (see, for instance, Wallerstein, 2007). The need to democratise the socio-technical process (through the full engagement of both mainstream scientists and counter-scientists, including lay experts in marginalised communities) comes to bear in the editorial.

The Guest Editors identify certified expertise and counter-expertise as two major opposing forms of expertise that strive to shape knowledge production. While credentialed expertise derives from mainstream experts who have acquired Western educational training, counter-expertise is broadly conceived of as 'knowledge deployed by any actor, whether a credentialed expert or member of a social movement organisation, [which is meant] to intervene in a power structure to address a goal of a marginalised group' (Williams and Moore, 2019).

In their typology of counter-expertise, Williams and Moore identify three categories as 'Allied Certified Expertise' (ACE), 'Transgressive Expertise' (TE) and 'Activated Lay Expertise' (ALE). While the Guest Editors clearly affirm the credentialed status of the first two categories, the relationship of the third category, ALE, to educational credentials is unclear. I further define ALE here: I propose that there are as many counter-experts in the core countries of the world-system as exist at the periphery; I furthermore argue it is erroneous to conceptualise counter-experts as those who largely received Western training either inside or outside their local home context; Instead, I suggest that a significant number of these counter-experts are individuals who received little or no

formal training but have, over the years, acquired experiential knowledge of certain phenomena within their given socio-ecological space.

While Morrell (2017) refers to this category of counter-experts as 'experiential experts,' Collins and Evans (2002) refer to them as 'experienced-based experts' (p. 251). As described by Williams and Moore (2019), these experiential or lay experts are those who point to the failings of credentialed knowledge and instead validate and express [their] ' … non-credentialed knowledge as useful and valuable in a political debate.' The Cumbrian sheep farmers' experience with scientists' lack of understanding of local issues, as well as their insincerity and arrogance in relation to the erroneous scientific advice that they offered the farmers after Chernobyl's radioactive fallout (Wynne, 1992), provides a useful example. The experts' denial of the 'specialist hill farming expertise' of the sheep farmers, which inherently forms the core of their social identity, further reinforces the cognitive injustice meted out to the farmers' knowledge systems.

The local Cumbrians' recognition of scientists' lack of credibility serves as a major tipping point because it erodes these government scientists' authority and power. More importantly, Wynne (1992) observes that '[t]his [farmers'] expertise was not codified anywhere [and that] it was passed down orally and by apprenticeship from one generation to the next, as a craft tradition, reinforced in the culture of the area' (p. 295). His observation supports the earlier claim that many lay experts gain their knowledge through experience. Nonetheless, Collins and Evans (2002) juxtapose experience and expertise and opine that '[e]xperience, however, cannot be the defining criterion of expertise' if an individual acquires an experience that anyone can obviously acquire without any specialised training, be it formal or informal. Therefore, conceptualising lay expertise as experiential expertise may not necessarily be straightforward or wise.

While Collins and Evans (2002) admit that certain types of expertise might derive from the acquisition of some special 'esoteric skill,' exclusively confined to a particular group and legitimised by its consumers (e.g. astrological and theological expertise), all 'contributory expertise' (e.g. the Cumbrian sheep farmers' expertise) that is complementary to mainstream expertise and that might be useful for making technical decisions could be recognised as such among 'scientists' core-groups' (see also, Turner, 2001). But then, there is need for the experts to be consciously aware of the fluidity or dynamic nature over time of the status of certain peripheral sciences, which hitherto are not in the mainstream.

The Guest Editors advocate for distributive justice and argue that Western trained experts need to open up space for a more democratised knowledge production process. It is essential to recognise lay experts and enable their participation to evenly distribute the social benefits of scientific research to knowledge users, particularly those in marginalised communities. The outcomes of science, whether just or unjust, are dependent on whose story is told, where and how it is told, and by whom it is told. The Guest Editors conclude that in the future, STS

scholars will need to play the dual role of engaging in all-inclusive ethical scholarship, which is devoid of prejudices, and fighting the injustices in the knowledge production process. That way, societal good will be achieved.

## Between Economic Gains and Human Wellbeing

In their case study, Florencia Arancibia and Renata Motta provide a vivid narrative of how an Argentine local community employed a four-level strategy to overcome a structural, environmental health problem arising from the activities of chemical companies and big farms. To address this unjust environmental-health-related problem, community members enlisted three kinds of experts. Wielding local environmental knowledge, the community carried out an epidemiological mapping of areas where pesticide-induced illnesses occurred. Community members also engaged mainstream scientists and social movements (such as NGOs) in enabling all partners to learn about the effects of pesticides on human health. This, in turn, motivated the mainstream scientists to produce new knowledge on pesticide contamination in the community. Having enrolled the support of the health authorities, the community then sought the expertise of legal experts in the government bureaucracy to enact relevant laws and enforce them to prevent the spraying of pesticide in the area.

It is instructive to note that this storyline may not have revealed anything new about the traditional political ecology of natural resource management, which is skewed in favour of the powerful elite at the expense of the poor majority who largely bear the brunt of environmental degradation (see Blaikie, 1985; Blaikie and Brookfield 1987). It, however, provides a roadmap and basis for overcoming the challenges of environmental injustice brought about by the 'organised hypocrisy' (see Brunsson, 1989) of multinational chemical companies and government bureaucracy, which covertly engage in unethical business expansion and profit-making instead of enhancing environmental management and human wellbeing. To address the undemocratic procedures of mainstream science, therefore, there is need to activate 'undone science,' which is produced by counter-experts and offers alternative knowledge that has a counteractive and neutralising effect on the excesses of mainstream science. Ultimately, both 'counter-science' (in the forms of refined and more democratic expert scientific knowledge) and local knowledge (produced by lay experts), which seek to blur the boundary between diverse knowledges (whether Western or indigenous), are desirable for achieving informed decision-making in advancing societal progress.

While the 'lay' expert and mainstream expert are constructed on the basis of the training they received (or otherwise) in a Western-tailored college, it is indeed patronising to view uncertified or non-credentialed knowledge producers as 'laypeople' (as inadvertently conceived throughout in Arancibia and Motta's paper), for they are by no means inferior to their Western trained expert colleagues. Like their Western counterparts, these citizen scientists (see Kimura,

2019) and/or local knowledge producers, do naturally engage in observation, experimentation and validation of phenomena in the process of generating new knowledge (see Kolawole, 2001, 2012, 2013). Differentiation only comes to bear in the limitations local knowledge producers face, as they are generally non-literate and ill-equipped to do what they need to do in a more 'refined' manner that is acceptable in the eyes of the 'experts.'

Robert Chambers reported Paul Richards' anecdote about how local farmers could be ahead of mainstream scientists in plant breeding techniques. The case of a certain Western-trained scientist who had just made a 'breakthrough' in yam breeding will suffice. The scientist who managed to breed yam through seeds (contravening the normal vegetative process) had believed his achievement was the first of its kind. He afterwards had 'a chance encounter' with an innovative, local farmer who indicated to him (the scientist) that he himself had in the past achieved that feat and

> … had also discovered, as had the scientist, that although the first generation of tubers were small, second and subsequent generations were of normal size. Legend concludes this anecdote with the scientist thanking God that farmers did not compete in writing scientific papers. (Chambers, 1983, p. 92)

Doing 'counter-science' would not occur without stiff opposition from the government and powerful elite. Throughout the social movements' attempts to address and overcome the environmental injustice meted out to them by large-scale, chemical agricultural farms, the process of doing counter-science continues to prove daunting. Nonetheless, the community's dogged desire to engage sympathetic government officials and legal experts (who underwent 'expertification' to enable them to have a better understanding of the issues) provided leeway for achieving a measure of environmental justice in the area. In other words, it provided a sizeable number of bureaucrats and legal luminaries, who through their in-depth knowledge of certain contextual problems, could join forces with counter-scientists to address the institutional failings in achieving common, societal goals.

While the authors highlight the roles of allies (such as social movements, like-minded scientists and legal experts) in doing and legitimising 'undone science,' innovative strategies for undoing the legitimacy of the bureaucracy and its *business as usual* approach is key to overcoming all structural or systemic barriers and counter-productive mechanisms that perpetuate environmental pollution and injustice.

## 'Politics of Knowledge' – Power Relations Between Professional and Experiential Experts

Erica Morrell's exposition is primarily based on the rivalry between 'professional experts' and 'experiential experts' in the agri-food system of Detroit, USA. The

analysis shows how certain strategies were devised by experiential experts (through organised social movements) to establish legitimacy and by that means bring about 'transforming exchanges' between them and the professional experts. Morrell articulates that local Detroiters (like people of colour in the southern US) have largely devised a cooperative local agricultural system that also encompasses distribution and marketing of farm produce. This account buttresses those of other scholars on how social movements around local agriculture can reveal an enduring organic knowledge of how to grow healthy indigenous food (see Bowens, 2015; Kolawole, 2017).

Realising that multinational retail stores could aggravate their food problem, the experiential experts used their organised network to displace professional experts from their leadership positions (expulsion); delve into policy-making roles (expansion); guard against exploitation in their leadership roles (protection); and allow professional experts to work with them while the former still operate within their traditional, scientific space (accommodation).

The experiential experts' strategy to accommodate professional experts within the context of their boundary-work enabled them to acquire legitimacy that they had long desired. And the experiential experts' ability to effectively utilise boundary-work in establishing their own legitimacy came to fruition because they recognised and partnered with government agencies or departments, which were sympathetic to their cause.

To make expulsion and expansion occur, and to gain legitimacy in the eyes of society, experiential experts had to tactically label their rivals (that is, professional experts) as anti-people, anti-environment, and unfriendly in their socio-economic and ecological pursuits. Morrell's four boundary-work processes (i.e. expulsion, expansion, protection and accommodation) gradually converged in a strategy to subsume both lay experts' and professionals' knowledge systems.

To be sure, accommodation, which in itself is not a new empirical phenomenon, has hitherto been overlooked by researchers as an appropriate buzzword in participatory methodologies. Indeed, the term comes to bear when qualitative research approaches, such as participatory learning and action (PLA) or participatory action research (PAR), are used to enhance human capacity and facilitate the role of both Western scientists and local knowledge holders in solving certain place-based problems (see Scoones and Thompson, 1994; Chambers, 1994). It is noteworthy that this form of boundary-work, in which the role of the lay expert was legitimised even by the professional experts, clearly came to bear in the case study of the Argentine pesticide contamination (see above) and Japanese radiation measurement research (see below).

*Accommodation* provides a platform for both lay and professional experts to learn and unlearn from each other in a 'transforming exchanges' scenario through the cross-fertilisation of ideas as witnessed in Detroit. Achieving this lofty objective would have meant that the elite scientists or professional

experts had either advertently or inadvertently acquired what Collins and Evans (2002) refer to as 'interactional expertise.' Yet, in many cases, such accommodation also poses a challenge because of the long-standing enmity harboured between professional and lay experts and the skewed power relations and attrition warfare between the two types of experts. This hostile relationship remains a stumbling block for amalgamating knowledges that otherwise may have been more relevant for advancing meaningful development (see, for instance, Kolawole, 2013). Therefore, I argue that it is necessary for future STS research to identify the fundamental reasons why boundary maintenance is strongly entrenched within and among knowledge producers.

## 'Taking Their Destiny in Their Own Hands' – Lay Women use Counter-science to (in)Validate Science

Aya Kimura's paper on citizen science analyses the activities of Japanese Citizen Radiation Measuring Organisations (CRMOs) and similar NGOs that challenge the orthodoxy of the science of environmental protection and food safety. Triggered by the 2011 Fukushima Daiichi Nuclear Power Plant accident, certain self-motivated Japanese women deployed their energy to verify (or falsify) the claim of government authorities and experts that the contamination arising from the radiation release was insignificant to affect food consumption and human safety. Providing analyses on the activities of counter-experts in achieving environmental justice, Kimura's narrative also aligns well with other authors' work (that is, Arancibia and Motta, 2019 and Egert and Allen, 2017).

Paradoxically, the paper argues that women outsider experts, who sought environmental justice through counter-science, and who, owing to their advocacy activities, were labelled as 'weak' and without knowledge of science, used a scientific platform to overcome the stereotypical barriers erected by the so-called experts. The women tactically used the rules of the game to achieve legitimacy, rights, and status. While many CRMOs shied away from activism, boundary-work was one of the major activities in which the CRMOs engaged, and which enabled them to pursue 'sanitised science' that ensured the neutrality and credibility of the information they provided to their clientele. Women used the scientisation platform to legitimise their identity, validate their concerns about food contamination, re-affirm their ability to engage in scientific discourses and dispel certain stereotypical notions about women (e.g. as being weak in techno-science and hyper-irrational about food contamination).

More often than not, women in the study created a boundary between pursuing legitimate, beneficial science and activism. They frequently viewed the duty of a mother as primary, to the extent that adding activism and politics to that role would jeopardise the essence of motherhood itself. Unlike Arancibia and Motta's research, which underscores the role of activism in addressing environmental injustice, Kimura's analyses highlight the need to separate science from

activism and politics. While Kimura's proposition is well noted, this may be difficult to achieve because sociologists and STS scholars often argue that it is an uphill task to achieve in practice because science and politics are co-constructed. Given that the needs and aspirations of different groups of people [in power struggles] shape the outcome of science and technology, it is, therefore, difficult to divorce science and technology from activism and politics (see Pinch and Bijker, 1987; Hård, 1993; Kleinman, 1998).

Nonetheless, Aya Kimura's paper points readers' attention to the need for empirical investigations on how citizen science impacts environmental injustice at the intersection of science and activism. Throughout, the constant re-emergence of popular participation and social movement issues in the process of advancing counter-science suggests that activism (as witnessed in rural Argentina) is highly likely to play an important role in achieving both cognitive and environmental justices in the end. Throughout the Japanese and Detroit case studies, the concept of boundary-work resonates as an avenue for seeking and valorising lay experts' legitimacy in science and technology (see also, Santos, 2007).

## Whose Priority Counts?

To Philip Egert and Barbara Allen, *knowledge justice* is knowledge produced and equitably shared among all 'knowers'– both local and Western. The main thrust of the authors' exposition is finding ways to address the competing interests in the demand for and application of scientific knowledge. In the case of the avian flu (H5N1) virus, they argue that the 'dual use' hypothesis of scientific discoveries, in which security issues override knowledge disseminations, excludes some pertinent, but voiceless stakeholders in the knowledge production chain. The opinions of the Western knowledge producers and elite policy-makers far outweigh those of counter-experts in the Global South.

Beyond the debates raging on the H5N1 issues, Egert and Allen argue that knowledge justice is relevant in all other social justice issues that seem to be out of place in 'conventional policy models of the Westphalian nation-state … ' centring on cross-border issues such as global pandemics and environmental pollution. Here, knowledge justice connotes the contestation of power in knowledge production that overcomes the moorings of international borders as opposed to the traditional contestation of justice that addresses social injustice arising from skewed power relations.

Egert and Allen's paper emphasises Western science's suppression of outsiders' ways of knowing and their realities (for more on this, see Kolawole, 2013, 2015). Furthermore, their paper argues that *recognition justice* is needed to address the failings of *distributive justice* in order to allow for multiple viewpoints. In contrast to the traditional, linear approach of the few institutionalised elites' way of doing science (see also, Wallerstein, 2007; Kolawole, 2012), they

argue that *recognition justice* is needed to allow for multiple viewpoints in producing knowledge. Employing diverse justice theories (e.g. distributive, procedural, cognitive), the authors argue that as long as knowledge could be used to produce social injustice, it could also be wielded to advance social justice.

The article provides a chronology of the emergence of H5N1 in Asia and the response of the World Health Organization (WHO), the United States, and other national agencies to H5N1, and how knowledge injustice resulted in socio-economic disaster for the hapless, backyard poultry farmers in the Global South. The knowledge injustice of H5N1 created a gulf between the North and South, which was further exacerbated within affected countries in the Global South because their national governments also fuelled the injustice meted out to smallholder poultry farms by favouring big farms. This reflects the typical political economy of knowledge production in developing countries, the outcomes of which tend to favour the powerful elite and rent seekers whose socio-economic interests override those of the voiceless, poor majority (see, for instance, Blaikie, 1985).

Suffice it to say, the regimented approach used by the regulatory bodies to unjustifiably stifle good science because of security concerns was met with backlash from counter-scientists and even certain mainstream scientists. In the end, the small farmers' accounts have now been proven right: the spread of avian flu virus had no strong association with the interaction of migratory birds and backyard poultry but rather with human activities. This was counter to the narrative of the experts. The small farmers' hypotheses were validated as 'H5N1 virus has found its way' into larger US corporate farms.

Interestingly, Egert and Allen's and Arancibia and Motta's propositions converge. Both papers surmise that rather than overlook and/or suppress lay experts' opinions on matters that concern them, the promotion of knowledge justice that equitably recognises all parties' expertise is desirable for achieving social justice.

## Conclusion

All four papers in this special issue point in one direction. They all emphasise the important role that civil society and ordinary individuals could play in advancing science for the betterment of humanity. They argue that counter-expertise has the potential to address the social and environmental injustices that mainstream science advertently or inadvertently promotes in the course of advancing knowledge.

Both mainstream science and counter-science may have largely been conceived of as two opposing cultures. Nonetheless, the notion may be incorrect, and Wallerstein (2007) rejected this idea, labelling it a 'gigantic mystification.' Western science may not necessarily need to compromise its epistemological traditions in advancing knowledge. Nonetheless, it can create a conducive

space for accommodating other ways of knowing in conceptualising problems by those who matter in the knowledge production chain. The implication is to expand 'who matters,' and this may require that we, as Wallerstein (2007) rightly advised, 'reconstruct our institutions in such a way that we maximise our chances of furthering collective knowledge' (p. 134). Both science elite and lay experts need to learn (and unlearn) from each other so that science as a culture can enhance human progress.

## Disclosure Statement

No potential conflict of interest was reported by the author.

## Notes on contributor

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