The Hybrid Legal-Scientific Dynamic of Transnational Scientific Institutions

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Abstract

The objective of the present article is to develop a better understanding of the institutional dynamic of transnational regulatory scientific institutions (RSIs). RSIs play a significant role in the transnational regulatory process by mediating between the scientific community and policy-making bodies. I argue that RSIs have a hybrid structure involving both political-legal and epistemic authority. The hybrid structure of RSIs—their capacity to exert both normative and epistemic authority—constitutes an innovative response to the demand of modern society for scientific certainty and to the scarcity of normative power in the international domain. This hybrid nature has a triple structure involving three complementary pairs: law~science, law~non-law and science~pseudoscience. I examine the way in which RSIs cope with the challenge of maintaining their epistemic and legal authority against the tensions generated by their hybrid structure. The discussion of hybrid authority is related to the problem of scientific uncertainty. I examine this theoretical argument drawing on an in-depth analysis of three RSIs that reflect the institutional diversity of the RSI network: the Intergovernmental Panel on Climate Change, the International Commission on Non-Ionizing Radiation Protection and the European Committee of Homeopaths. I conclude with a discussion of some of the policy issues associated with the institutional design of RSIs. The policy discussion refers, first, to the risk posed by RSIs’ hybrid structure to their internal stability and, second, to some potential adverse social impacts that need to be considered alongside RSIs’ projected benefits.

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1 Introduction

One of the key features of the field of transnational law is its highly pluralist structure. The norm-making process at the transnational arena is driven by multiple institutions with diverse structures.¹ Scholars have used various metaphors to describe the complex dynamic generated by this multiplicity – from the notion of hybridity to the image of the mythological Lernaean Hydra.² This article focuses on one type of transnational regulatory body: the transnational regulatory scientific institution (RSI). RSIs play a significant role in the transnational regulatory process by mediating between the scientific community and policy-making bodies, through the provision of policy-relevant scientific input. The institutional structure of RSIs is highly diverse, exhibiting varied levels of independence, output structure and integration with policy-making bodies. The RSIs community includes diverse institutions such as the Intergovernmental Panel on Climate Change (IPCC), the International Commission on Non-Ionizing Radiation Protection (ICNIRP), the Global Earthquake Model (GEM), and the European Committee of Homeopaths (ECH). I argue that the authority of RSIs has a hybrid political–legal–epistemic nature, which has two key features. First, it reflects the way in which RSIs operate simultaneously across the scientific and legal domains, producing output with both normative and epistemic implications. Second, it reflects the gap between the discursive output of RSIs and the structure of paradigmatic legal or scientific propositions.

The hybrid structure of RSIs constitutes an innovative institutional response to the demand of modern society for scientific certainty and to the scarcity of normative resources in the international domain. RSIs operate in areas in which social-political calls for regulatory intervention generate a demand for immediate and assured epistemic response (for example, climate change and nanotechnology).³ However, the hybrid structure of RSIs – the institutional juxtaposition of science, law and politics – is also a source of institutional tensions that threaten their legitimacy and authority.

My argument about the hybrid nature of RSIs draws on two strands of literature. The first one is the empirical work that has documented the development of non-conventional forms of norms and knowledge creation. In the legal context, the literature on ‘soft law’ has depicted the increasing influence of nuanced forms of legal normativity on transnational social processes.⁴ Similar processes are taking place in

⁴ See, e.g., d’Aspremont, ‘Politics of Deformalization in International Law’, 3 Goettingen Journal of International Law (2011) 503. While part of this literature is predominantly conceptual, it also includes some empirical studies. See, e.g., Perez, ‘Private Environmental Governance as Ensemble Regulation: A Critical Exploration of Sustainability Indexes and the New Ensemble Politics’, 12(2) Theoretical Inquiries in Law (2011) 543; Davis, Kingsbury and Merry, supra note 1.
the domain of science, where the traditional locations of scientific work, universities and peer-reviewed journals have been challenged by new models of making science, which are taking place in diverse sites such as ‘research centers, government agencies, think-tanks, high-tech spin-off companies and consultancies.’

The foregoing empirical work challenges the traditional distinctions between law and non-law and between science and pseudoscience. These empirical observations have received further support from a second strand of literature that has pointed out, in a more abstract fashion, new ways of thinking about the linguistic and sociological structure of opposites. Two particularly important strands of thought in this context are the theory of complementary pairs and fuzzy-set theory. The theory of complementary pairs (TCP), developed by Scott Kelso and David Engstrom, provides an overarching critique of the either/or framework that has dominated the demarcation discourse in both law and science. TCP argues that understanding the social dynamic underlying the use of semantic opposites requires us to replace the (static) binary frames through which opposites are usually conceptualized (either/or, dualism, or monism) with a dynamic framework that seeks to reconcile these three basic frames by treating them as ‘equally valid dynamical modes, tendencies, or dispositions of the complementary pair.’ TCP seeks to explore the dynamic nature of complementary pairs and, more specifically, to uncover the contested space between opposites as it manifests itself in the dynamics of social and biological systems. What is interesting in the dynamics of complementary pairs is that in many systems contrary tendencies coexist simultaneously, exhibiting what Kelso and Engstrom term as metastability.

Using TCP to explore the dynamic of RSIs requires, as a preliminary step, to identify the key complementary pairs associated with them. Fuzzy-set theory provides a strict modeling language for studying vague phenomena. It offers a nuanced conceptual framework for reinterpreting the binary distinctions used in the demarcation discourse of law and science. In particular, this framework can be used to analyse the semantic products of RSIs.

The empirical work on soft law and post-normal science, and the abstract conceptualizations of TCP and fuzzy-set theory, highlight the need to extend the vocabulary
used to analyse the phenomenon of RSIs. I argue that it is a mistake to describe the operation of RSIs using a conceptual framework that sharply distinguishes between the realms of knowledge, politics and law. Such a distinction is implicitly assumed by scholars such as Peter Haas, who describes the work of transnational scientific institutions using the metaphor of ‘speaking truth to power.’

This binary framework cannot capture, I argue, the hybrid dynamic of RSIs and the dilemmas it generates. Although the science and technology (STS) literature has developed more nuanced conceptualizations for analysing the work of scientific institutions – in particular, the ideas of ‘boundary objects’, ‘boundary work’ and ‘co-production’ – these conceptualizations do not capture the unique hybrid dynamic of RSIs. Particularly problematic is the disconnection between these conceptualizations and the literature on vagueness and its social manifestations (for example, TCP and fuzzy-set theory).

The present article seeks to develop a better understanding of the hybrid dynamic of RSIs, both by going beyond the conceptual structures that have dominated the STS literature and by linking the analysis of RSIs to the literature on transnational law. In particular, I examine the challenge this hybrid structure poses to the authority, legitimacy and resilience of RSIs and the various institutional strategies RSIs have developed in response to this challenge. The article proceeds in the following way. The next (second) part develops the argument about the hybrid authority of RSIs. The third part analyses more closely the institutional dilemmas and dynamics generated by this hybrid structure, focusing on three case studies: the IPCC, ICNIRP and ECH. The first section explores the tension between truth and hierarchy; the second section links the discussion of hybrid authority with the problem of scientific uncertainty. Finally, the fourth part concludes with a discussion of the policy implications of the foregoing analysis.

### 2 The Triple-Hybrid Structure of RSIs

The hybrid model of RSIs constitutes an ingenious institutional innovation. By merging epistemic and legal-political authority in a way that allows them to simultaneously influence the scientific and legal-political worlds, RSIs respond to two key regulatory challenges:

- The need to make collective decisions with respect to risks. This need generates a demand for mediating institutions that can provide authoritative, policy-relevant and prompt scientific advice. It is particularly acute when policy choices must be

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made against a background of scientific uncertainty. RSIs relieve transnational rule-making bodies from the epistemologically difficult task of identifying the scientific position on controversial regulatory questions.

ii. The scarcity of normative resources at the international level. The fragmentary structure of global society creates a deficit of legal-political decision-making powers. RSIs fill this lacuna by creating a new type of norm-making authority. The normative contribution of RSIs has two unique advantages. First, they provide a response to the difficult task of translating complex scientific findings into legal prescriptions. Second, owing to the quasi nature of their legal authority, they allow policy makers at the national and international levels some leeway when they translate the statements of the RSIs into binding legal prescriptions.

RSIs respond to these regulatory demands by developing a dual legal-scientific authority structure, which involves three complementary pairs: science~law; science~pseudoscience (or non-science) and law~non-law. This hybrid structure has two key sociological effects. First, it turns the discursive products of RSIs into fuzzy statements (as they are considered against the criteria of perfect legality or scientificity, which is discussed in more detail later in this article). Second, the invocation of these three complementary pairs in a single organizational space triggers a process of contestation, in which the structure of the contradictory space delineated by each of these three distinctions is being questioned. This process requires RSIs to deal with (conflicting) external expectations, forcing them to continuously rethink (and possibly realign) their institutional structure. The following discussion outlines these two effects in more detail.

RSIs may have different institutional structures, with varied levels of independence, integration with policy-making bodies and output structure. Most multilateral environmental treaties have some form of scientific body associated with them – the IPCC is a prominent example. Technical-scientific organizations such as the International Electrotechnical Commission, the ICNIRP, and the GEM, which produce technical standards and guidelines, constitute another type of RSI. Another organizational

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13 One should distinguish between regulatory scientific institutions (RSIs) and transnational scientific bodies such as the International Astronomical Union and the International Union of Pure and Applied Chemistry, which are more detached from the regulatory domain.


type is that of professional associations, which commonly also act as representatives of a field of expertise. Examples from the field of alternative medicine are the ECH and the European Central Council of Homeopaths (ECCH), which represent national associations of homeopaths.16

A starting point for thinking about the hybrid structure of RSIs is the tension between their hierarchical structure and the conventions of scientific inquiry – in particular, the way in which scientific truth is commonly understood to evolve. RSIs resolve the tension between the regulatory demand for assured knowledge and the fallibility of scientific understanding by developing a hierarchical process of ‘generating truths’ that resolves the ‘fallibility’ problem through the mechanism of institutional ordering.17 There is, in this context, a surprising similarity between the operational mode of RSIs and that of legal institutions. As opposed to the non-hierarchical nature of scientific inquiry, legal truth, defined as valid law, is constituted by the proclamations of authorized institutions. Legal utterances, as noted by Pierre Bourdieu, have a performative nature: ‘The judgment of a court, which decides conflicts or negotiations concerning persons or things by publicly proclaiming the truth about them, belongs in the final analysis to the class of acts of naming or of instituting. The judgment represents the quintessential form of authorized, public, official speech, which is spoken in the name of and to everyone.’18

To understand the tension at the core of RSIs, I need to say more about the conventions of scientific inquiry. Scientific truth is supposed to emerge through the free and uncoordinated process of scientific inquiry and deliberation, not as a result of a hierarchical decision-making process.19 These two features, lack of hierarchy and network structure, capture what William Kornfeld and Carl Hewitt have called the parallelism and pluralism of science.20 Parallelism reflects the fact that different scientific groups can work on the same topic in an attempt to improve

16 European Committee of Homeopaths, http://www.homeopathyeurope.org/ (last visited 1 May 2015) and European Central Council of Homeopaths, http://www.homeopathy-ecch.org/ (last visited 1 May 2015) respectively. See also the International Council for Homeopathy (ICH), http://www.homeopathic-ich.org/ (last visited 1 May 2015). The link that I make above between the Intergovernmental Panel on Climate Change (IPCC) and the ECH is non-trivial and requires further elaboration (as was pointed out by the anonymous referee). I will return to this question below.


each other’s performance.\textsuperscript{21} Pluralism reflects the fact that there is no central arbiter of truth in science.\textsuperscript{22} At any given time, scientific publications may reflect heterogeneous and even conflicting information and opinions. The parallelism and pluralism of science reflect its spirit of free criticism. As Karl Popper notes, a scientist ‘may offer his theory with the full conviction that it is unassailable. But this will not impress his fellow-scientists and competitors; rather it challenges them: they know that the scientific attitude means criticizing everything, and they are little deterred even by authorities’.\textsuperscript{23} Science’s non-hierarchical nature is a key feature of its systemic logic.\textsuperscript{24}

The hierarchical structure of RSIs is clearly at odds with the foregoing portrait of scientific inquiry. Epistemic authority idyllically emerges spontaneously through the network dynamic of scientific contestation. Legal authority is grounded, in contrast (again, idyllically), in formal constitutional structures.\textsuperscript{25} Traditionally, these two realms of authority have been conceived as completely separate. Legal authority cannot transform epistemic claims into truths, although it can endow statements with normative power. By contrast, epistemic authority cannot produce binding prescriptions but can advise us about the true state of affairs in a particular field.\textsuperscript{26} The two realms also differ sharply in their \textit{modus operandi}. Since scientists are concerned with truth, when they are uncertain they can avoid the risk of being wrong by deferring judgment.\textsuperscript{27} But in politics and law, decisions must be made now. RSIs are thus torn between the ‘timelessness’ of science and the immediacy of law and politics.\textsuperscript{28}

\textsuperscript{21} Kornfeld and Hewitt, \textit{supra} note 19, at 25.

\textsuperscript{22} Experiments or observations, with their potential for testing or refuting scientific theories, are still conceived as the impartial arbiters of scientific controversies. See Karl Popper, \textit{The Open Society and Its Enemies}, vol. 2: \textit{Hegel, Marx, and the Aftermath} (1971), at 218. While Popper’s philosophy was subject to wide-ranging critique by philosophers of science, this idea has remained dominant. See, e.g., the emerging concept of evidence-based medicine. Ross C. Brownson \textit{et al.}, ‘Evidence-Based Public Health: A Fundamental Concept for Public Health Practice’, 30 \textit{Annual Review of Public Health} (2009) 175.

\textsuperscript{23} Popper, \textit{supra} note 22, at 218. See also Mercier and Heintz, ‘Scientists’ Argumentative Reasoning’, 33 \textit{Topoi} (2014) 513, at 515–516 (arguing against the view of scientific work as ‘lonely reflection’).

\textsuperscript{24} This feature of ‘scientific praxis’ remains intact even as philosophers have discarded Popper falsifiability criterion and developed alternative views of science. See Pennock, ‘Can’t Philosophers Tell the Difference between Science and Religion?: Demarcation Revisited’, 178 \textit{Synthese} (2011) 177, at 200; Niklas Luhmann, \textit{Ecological Communication}, translated by John Bednarz (1989), at 76–77.

\textsuperscript{25} There is a gap between the ideal notion of epistemic authority, as depicted earlier, and some of the scientific practices that can be observed in reality (e.g., some scholars receive their authority from their institutional affiliations and not from their scientific achievements; journal editors hold significant power). But the point of this argument is that the ideal of epistemic authority functions as a regulatory mechanism. We feel uncomfortable when we are confronted with such cases because they deviate from the ideal. See further Hansson, ‘Cutting the Gordian Knot of Demarcation’, 23 \textit{International Studies in the Philosophy of Science} (2009) 237, at 240; Perez, ‘Open Government, Technological Innovation and the Politics of Democratic Disillusionment: (E-)Democracy from Socrates to Obama’, 9 \textit{I/S: A Journal of Law and Policy for the Information Society} (2013) 61.


\textsuperscript{28} Faigman, \textit{supra} note 27.
RSIs challenge the conventional boundaries between science~law, charting a new institutional and semantic space between these opposites. However, this very act of re-mapping also creates a challenge to the conventional distinction between science~pseudoscience. To understand this point, it is necessary to look at the way in which philosophers of science have approached the ‘demarcation’ problem.\footnote{A thorough discussion of this literature would lead us too far afield. See further Pennock, supra note 24.} A useful starting point to this debate is the definition of pseudoscience proposed by Sven Ove Hansson. For Hansson, a statement is pseudoscientific if, and only if, it satisfies the following three criteria:

i. It pertains to an issue within the domains of science (in a broad sense).
ii. It is not epistemically warranted.
iii. It is part of a doctrine whose major proponents try to create the impression that it is epistemically warranted.\footnote{Hansson, supra note 25, at 240.}

The advantage of Hansson’s approach lies, first, in the fact that it can accommodate varied approaches to the question of what is the hallmark of scientific work through the idea of epistemic warrant. Thus, for example, epistemic warrant can be seen as a function of repeatability, conformity with the procedures of methodological naturalism or the capacity of the research programme to produce unexpected predictions.\footnote{See, respectively, Pennock, ‘Naturalism. Evidence and Creationism: The Case of Phillip Johnson’, 11 Biology and Philosophy (1996) 543, at 549; Agassi and Laor, ‘How Ignoring Repeatability Leads to Magic’, 30 Philosophy of the Social Sciences (2000) 528, 572; Lakatos, ‘Introduction: Science and Pseudoscience’, in John Worrall and Gregory Currie (eds), The Methodology of Scientific Research Programmes (1978) 1.} Second, the notion of epistemic warrant is fuzzy, and its invocation in this context opens the door to nuanced interpretations of ‘scientificity’.\footnote{For similar view, see Brigandt, ‘Intelligent Design and the Nature of Science: Philosophical and Pedagogical Points’, in K. Kampourakis (ed.), The Philosophy of Biology (2013) 20.}

The hierarchical structure of RSIs can undermine the epistemic trustworthiness of their epistemic output. Whereas the epistemic power of scientific propositions depends on their (content-dependent) persuasiveness and their capacity to withstand the (free and pluralistic) scrutiny of the scientific community, legal norms have a ‘because I said so’ quality.\footnote{William A. Edmundson, ‘Because I Said So’, Georgia State University College of Law, Legal Studies Research Paper, 27 October 2012, available at http://ssrn.com/abstract=2165428 (last visited 1 May 2015); Joseph Raz, Between Authority and Norms: On the Theory of Law and Practical Reason (2009), at 7.} Mixing these two forms of justifications can therefore diminish the epistemic trustworthiness of RSIs output – its level of scientificity – because it reduces the extent to which this output meets the conditions of ‘proper’ scientific work. The propositions produced by RSIs are therefore located somewhere between the poles of perfect science and pseudoscience.

The way in which certain RSIs mix together questionable scientific discourse with normative power provides another example of the way in which the institutional juxtaposition of hierarchy and truth calls into question the traditional distinction between science and pseudoscience. RSIs such as the International Psychoanalytical
Association,\textsuperscript{34} the International Society for Astrological Research,\textsuperscript{35} the ECH, the ECCH and the International Council for Homeopathy (ICH) constitute a useful example. The limited epistemic credibility of these bodies stems not from the way in which they mix together hierarchy and truth but, rather, from the deep flaws in their underlying research programmes.\textsuperscript{36} These programmes are characterized by the fact that the community of practitioners associated with them makes little attempt to develop the theory towards solutions of problems, shows no concern for attempts to evaluate the theory in relation to other theories and is selective in considering confirmations and disconfirmations.\textsuperscript{37} What enables organizations representing degenerative research programmes such as the ECH, the ECCH and the ICH to operate alongside scientifically prestigious bodies such the IPCC is the fact that science and law use different criteria of legitimacy and validity. The questionable epistemic status of homeopathy or psychiatry does not prevent practitioners in these fields from establishing legal entities that can acquire regulatory powers.\textsuperscript{38} The intertwinenment of scientific and legal authority can therefore provide institutional support to epistemic claims that do not meet the criteria of sound science.

To complete the description of the triple-hybrid structure of RSIs, I must also explore its legal facet, which has two aspects that correspond to the complementary pairs: science~law and law~non-law. First, in contrast to conventional wisdom, according to which RSIs provide policy-relevant, but not prescriptive, advice, the output of RSIs does in fact carry some normative force (science~law). This normative impact is reflected in the way in which the statements produced by RSIs shape international or national legal instruments or are directly incorporated into them. There is a gap, however, between the de facto normative authority of RSIs and conventional jurisprudential conceptions of legal authority. This gap reflects the second aspect of the hybrid structure of RSIs: law~non-law. Although RSIs satisfy certain prerequisites for legal authority (they have a formal legal structure with detailed decision-making procedures),\textsuperscript{39} their authority to make law does not satisfy common constitutional

\textsuperscript{34} International Psychoanalytical Association (IPA), http://www.ipa.org.uk/ (last visited 1 May 2015). The IPA has policy-normative aspirations. One of its outreach groups, the United Nations Committee, is entrusted with the task ‘to consider, advise, and promote contributions that the profession of psychoanalysis might make in such areas of international concern’, especially in the context of the Economic and Social Council and its subsidiary bodies. See http://www.ipa.org.uk/en/Committees/Outreach/OutreachGroups.aspx (last visited 1 May 2015).


\textsuperscript{36} A common feature of these programmes is a lack of capacity to produce ‘dramatic, unexpected, stunning predictions’ and the fact that they tend to lag behind the facts. Lakatos, supra note 31.


\textsuperscript{39} See note 17 in this article for the constitutional frameworks of the IPCC, the ICNIRP, the SBSTTA, and the ECH. For a detailed analysis of the formal legal structure of the IPCC and the ICNIRP, see Adi Ayal et al., ‘Science, Politics and Transnational Regulation: Regulatory Scientific Institutions and the Dilemmas of Hybrid Authority’, 2 \textit{Transnational Environmental Law} (2013) 45.
conceptions of groundedness and procedure (at both the national and international spheres). In this sense, the authority of RSIs transcends the conventional account of legal authority. This is not a unique phenomenon. As is noted by the literature on global administrative law (GAL), the sources of authority of international organizations are becoming increasingly blurred. This gap between the (de facto) legal authority of RSIs and constitutional conventions mirrors the gap between their epistemic authority and the conventions of scientific inquiry.

The legal hybridity of RSIs thus reflects not only the fact that their output carries both normative and epistemic meaning but also the fact that the normative force of this output does not reach the level of normativity associated with conventional national or transnational law-making bodies. This feature reflects a more general thesis about the fuzzy nature of legal normativity. Legal normativity under this view forms a continuum bounded by the ideal types of 'non-law' at the one end and 'crisp (or absolute) law' at the other. The notion of graded normativity can also be conceptualized by drawing on our extensional knowledge of exemplars of perfect/imperfect legal institutions. The Supreme Court of Israel and the World Trade Organization Appellate Body are both exemplars of perfect legal institutions. The judges in a moot court trial provide a contrary example. RSIs are situated somewhere between these opposites.

To make this discussion more concrete, I want to explore a few examples that demonstrate the range of normative effects associated with the work of RSIs. The ICNIRP publishes exposure guidelines, which are formally adopted by the World Health Organization (WHO) and regularly serve as a basis for national regulation in many countries. These standards govern, among others, the mobile phone industry (maximal permitted exposure both from hand-held devices and from cell phone towers) as


43 While the judge in a moot court trial has some normative influence within this artificial process (e.g., she can declare one team to be the winner) it has no influence beyond this process. In contrast, RSIs have a general but nuanced – normative power (thanks to the anonymous referee for his/her comments on this point).


well as power-frequency magnetic fields emitted by power lines, transformers, appliances and so on.\textsuperscript{46} The International Organization of Standardization’s (ISO) Technical Committee (TC) 229 on Nanotechnologies develops standards in the field of nanotechnologies focusing on understanding and controlling matter and processes at the nano scale and potential technological applications that exploit the unique properties of nano-scale materials.\textsuperscript{47} The work of ISO TC 229 has already led to the publication of standards governing various aspects of nanotechnologies.\textsuperscript{48} Another example is the involvement of the ECH and the ECCH in the development of guidelines for homeopathic proofs, education (core curriculum requirements) and accreditation.\textsuperscript{49}

The normative influence of the IPCC is less direct. IPCC reports have substantial influence on climate change research, on public discourse about climate change and on the policy formation process within the United Nations Framework Convention on Climate Change (UNFCCC).\textsuperscript{50} Although, unlike the ICNIRP or the ISO TC 229, the IPCC does not produce technical standards, it would be wrong to treat its output as lacking normative force. For example, the US Environmental Protection Agency has relied on the findings of the IPCC in its proposed Endangerment and Cause or Contribute Findings for Greenhouse Gases under section 202(a) of the Clean Air Act.\textsuperscript{51}

The following figure provides a graphic depiction of the triple-hybrid structure of RSIs. The arrows represent the constant contestation of boundaries that characterizes an RSI’s internal dynamic. The next section elaborates this dynamic and the challenges it creates.

\begin{itemize}
\item See http://www.icnirp.de/PubMost.htm (last visited 1 May 2015).
\item See ECH, Homeopathic Drug Provings Guidelines, version 1.1 (June 2011); European Central Council of Homeopaths (ECH) and International Council for Homeopathy (ICCH), International Guidelines for Homeopathic Education (May 2011); ECCH, European Guidelines for Accreditation of Courses of Education in Homeopathy (June 2002).
\end{itemize}
The Institutional Dynamic of RSIs

A Between Truth and Hierarchy

The hybrid structure of RSIs is reflected by the juxtaposition of three complementary pairs – science~law, law~non-law and science~pseudoscience – in a single institutional space. This juxtaposition induces a dynamic of incessant contestation and self-reflection within RSIs, which are torn between the competing conventions of science and law. These intrinsic tensions threaten the authority of RSIs with respect to all of the audiences with whom they interact: the scientific community, the policy-makers community and the lay public. This threat forces RSIs to continuously rethink and possibly realign their internal structure. It should be noted that the full sociological implications of this dynamic are not necessarily transparent at the level of the RSI itself. Rather, they become visible only when the organization is observed from a second-order level, in which the social-linguistic implications of these first-order social processes can be exposed. Institutional crises (for example, the ‘climate-gate’ scandal in the IPCC context) sometimes force organizations to engage in such second-order observation.

The way in which RSIs are commonly described in science and technology literature, which tends to focus on the concepts of ‘boundary objects’ and ‘co-production’, captures only part of the unique dynamic of RSIs, primarily because these concepts are not sufficiently refined. The idea of ‘co-production’, which was proposed by Sheila Jasanoff, refers to the ‘mutually constitutive nature of science and social order’.

In the framework of co-production, Jasanoff notes ‘virtue in science cannot be constituted any differently from virtue in society; the two are inseparable, cut from the same cultural cloth, and seamed with the same ethical and political understandings’.

However, the idea of co-production is somewhat vague with respect to the constitutive


53 Jasanoff, supra note 12, at 237.
elements of science, law and politics and, consequently, cannot fully capture the potential frictions that could be generated by the process of co-production. The idea of co-production also does not seem to capture the unique semantic structure of the discursive outputs of RSIs.

The ideas of boundary work and boundary objects are similarly vague. The image of a boundary object is of something like an immigration officer or a doorman that functions as a bridge across a boundary. Thus, David Guston defines boundary objects as entities that ‘sit between two different social worlds, such as science and non-science’, and Daan Boezeman and his colleagues argue that boundary organizations ‘operate in a boundary zone between social worlds’ and ‘function as an intermediate between science and politics, facilitating the two-way flow of information’. Yet this image is misleading because it misses the way in which RSIs juxtapose – in their organizational realm – the discourses of science, law and politics. Picturing RSIs as a kind of ‘doorman’ misses the unique dynamic generated by this institutional juxtaposition and the challenges it creates for the operation and stability of RSIs.

The key blind spot of the ‘co-production’ and ‘boundary object’ metaphors is, therefore, that they are not sufficiently sensitive to the institutional tensions created by a RSI’s hybrid structure. In this section, I explore how this institutional tension has manifested itself in the context of three different RSIs (the IPCC, the ICNIRP and the ECH) and examine the way in which these RSIs have attempted to balance the competing demands of science and law in order to sustain their authority in both domains. This institutional dynamic can be interpreted as a form of institutional ‘metastability’.

The IPCC provides an excellent case study of these tensions because its structure has been the subject of broad public debate. This debate reached its peak in 2010 with the ‘Climategate’ crisis that challenged the IPCC’s epistemic and political authority. The scandal has led to a wide-ranging process of reflection about the decision-making structure of the IPCC. The most important review was conducted by the InterAcademy Council (IAC). The IAC’s report highlighted four issues concerning the IPCC’s work procedures that demonstrate the tension between the normative and scientific facets of its work: the sources of the information used by the IPCC and the composition of its working groups, the peer review process of the IPCC’s reports, the

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54 See, e.g., Lemos and Morehouse, supra note 52, at 59.
55 Guston, supra note 12, at 400.
59 InterAcademy Council (IAC), Climate Change Assessments: Review of the Processes and Procedures of the IPCC, 2010. For the other reviews, see Kevin E. Trenberth, Communicating Climate Science and Thoughts on Climategate, Joint Presidential Session on Communicating Climate Change, AMS 23–27 January 2011, Seattle, Washington, 2011.
conflict of interest, and the conceptualization and communication of uncertainty. I focus on the first three issues in this section and defer the discussion of uncertainty to the next section.

The issues surrounding the sources and the review process illustrate the tension generated by the juxtaposition of the scientific focus on intellectual merit and objectivity and the legal-political emphasis on voice, participation and transparency. In the context of sources, this tension is reflected in the debate about the kind of publications the IPCC should refer to in its reports. There is a strong academic convention that only peer-reviewed materials count. However, in a hybrid body such as the IPCC, the question of what sources should be incorporated into its database cannot be determined exclusively on epistemic grounds. From a political-legal perspective, restricting the class of ‘legitimate’ publications to peer-reviewed materials is problematic because it disregards the need to give voice to civic society players that operate outside conventional academic circles. Expanding the circle of knowledge sources is important for sustaining the IPCC’s political-legal legitimacy.

The IPCC has adopted a middle position on this question. The current working principles of the IPCC include a specific provision on this issue, which recognizes that sources that have not undergone peer review can provide crucial information for IPCC reports, but this provision requires chapter teams to ‘review the quality and validity of each source before incorporating information into an IPCC Report’. The policy grants substantial discretion to the IPCC teams in making the determination of ‘quality and validity’. A good example of this more liberal approach is the controversial IPCC decision to cite in its recent Special Report on Renewable Energy Sources and Climate Change Mitigation (SRREN) the Greenpeace report, *Energy Revolution 2010: A Sustainable World Energy Outlook*. Although the extension of the IPCC’s knowledge space can also be justified on epistemic grounds, as publication in peer-reviewed journals is only a rough proxy for sound knowledge, the epistemic argument remains qualitatively distinct from the political one.

Similar tensions emerge also in the context of the IPCC’s review process. The scientific peer-review system is based on a sharp separation between the producers of epistemic work and its judges (for example, editors of scientific journals). Traditionally, this system

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61 Procedures for the Preparation, Review, Acceptance, Adoption, Approval and Publication of IPCC Reports (Procedures of IPCC Reports), Annex 2 on the Procedures for Using Non-Published/Non-Peer Reviewed Sources in IPCC Reports, Adopted at the Fifteenth Session (San José, 15–18 April 1999), amended at the Twentieth Session (Paris, 19–21 February 2003), Twenty-first Session (Vienna, 3 and 6–7 November 2003), and Twenty-Ninth Session (Geneva, 31 August – 4 September 2008).


The Hybrid Legal-Scientific Dynamic of Transnational Scientific Institutions

...has tended to be highly secretive and non-transparent. By contrast, in politics and law, decision-making processes are expected to be transparent and open to participation. Indeed, the IPCC is facing increasing demands to extend the transparency of its operations. As documented by the GAL literature, the principles of transparency and voice have been applied to a wide range of transnational institutions, and GAL scholars argue further that these principles have acquired a meta-regulatory status. The IPCC has been struggling to find the proper balance point between these conflicting paradigms. On the one hand, it has sought to strengthen its review procedures, making them more consistent with scientific practices. For example, the IPCC has clarified the important role of the review editors, who are responsible for coordinating the review process and assisting the lead authors. By separating the role of lead authors from that of review editors, the IPCC has sought to improve the agreement between its internal procedures and the peer-review conventions of the scientific community. On the other hand, in response to demands for greater transparency, the IPCC has also sought to find ways to open up the review process. Although the IPCC has been hesitant to make the peer-review process available to wide-ranging public participation, it has increased substantially the opportunities for experts to review its work products. It has done so by allowing experts interested in participating in an IPCC review to register as expert reviewers and gain access to draft chapters. While formally, this process has limited the review process to experts only, it has nonetheless broadened extensively the boundaries of the participating community. This ‘broadening’ effect was reflected, first, in the large number of experts who participated in the process and, second, in the fact that some of the experts have leaked draft reports to the media (although this was not allowed under the terms of the review).
Opening the review process to wide participation can improve the quality and legitimacy of the IPCC by expanding the community of evaluators and increasing the range of viewpoints, but it also creates new epistemic and political challenges because of the difficulty of dealing efficiently and fairly with a large number of comments.72

Another source of tension involves the composition of teams responsible for preparing the reports. Once the authority to produce truth is conferred upon a particular institution, the question of who participates in internal processes within that institution becomes a political issue. The IAC report suggests ‘the IPCC should establish a formal set of criteria and processes for selecting Coordinating Lead Authors and Lead Authors’, and it notes that ‘the absence of a transparent author-selection process or well-defined criteria for author selection can raise questions of bias and undermine the confidence of scientists and others in the credibility of the assessment’.73 In response to the IAC report, the IPCC adopted new procedures for the selection of lead authors and team members and for handling conflicts of interest. These procedures reflect an attempt to balance the epistemic and political aspects of the work of the IPCC. According to the Procedures for the Preparation, Review, Acceptance, Adoption, Approval and Publication of IPCC Reports, the composition of the group of coordinating lead authors and lead authors shall aim to reflect the range of scientific views, geographical representation, mixture of experts with and without previous experience in the IPCC and gender balance.74 The tension between these criteria and the purely scientific criteria of epistemic balance is clear.

The IPCC’s policy on conflict of interests (COI) reflects a similar mixture of political and epistemic commitments by distinguishing between COI and bias. Bias represents the legitimate need to ‘include individuals with different perspectives and affiliations’, and it can be managed by an ‘author team composition that reflects a balance of expertise and perspectives’. COI is a state of affairs in which ‘an individual could secure a direct and material gain through outcomes in an IPCC product’, and, contrary to bias, it should prevent a candidate from being nominated to the IPCC’s teams. The COI policy of the IPCC clarifies that ‘holding a view that one believes to be correct, but that one does not stand to gain from personally is not a conflict of interest’.75 Whereas COI is conceived as a threat to the objectivity of the IPCC, bias, as defined within the framework of COI policy, is conceived as a mechanism that can contribute to the deliberative strength of the IPCC.76

The ICNIRP has developed a different strategy to address the tension between epistemic authority and political legitimacy. Its position on the issues explored in the IAC’s report can be found in its constitutional documents and in a statement from 2002 (on the general approach to protection against non-ionizing radiation).77

72 For the IAC’s view on these issues, see IAC, supra note 59, at 18–19.
73 Ibid., at 15.
76 Edenhofer, supra note 63.
77 ICNIRP Charter and Statutes, supra note 17.
these documents, the ICNIRP makes some concessions to the political-legal issues of representation and transparency, but these concessions seem unconvincing by comparison with the discussion that took place in the IPCC.

A good example is the ICNIRP’s policy on public consultation. The ICNIRP established an open review process in 2009. According to this policy, draft guidelines are made public for a 90-day period, allowing comments from all interested parties.78 Yet the commitment of the ICNIRP to public review is rather limited – the ICNIRP does not publish the comments it receives, and it does not explain which comments are accepted or why some are deemed to be irrelevant.79 Overall, the ICNIRP has invested relatively little effort in the political facet of its authority, relying primarily on its epistemic reputation.80

The case of the homeopathic RSIs, such as the ECH and the ECCH, provides another illustration of the unique sociological dynamic induced by the coupling of epistemic and legal authority. In justifying their regulatory output, the ECH and the ECCH refer not only to epistemic foundations but also to ethical concepts such as well-being and self-determination. For example, in a document entitled Homeopathic Care in a Medical Context, the ECH emphasizes the right of European citizens for self-determination, noting that:

Today’s European citizens feel themselves responsible for their own lives, for their own health. They want to make their own choice of therapy, whether it belongs to conventional medicine or homeopathy. This right of self-determination is, in fact, a basic right of European citizens. Most users of homeopathy do not want to give up conventional medicine, but just want to choose the medical approach that seems to produce the best result in certain situations or that fits into their own lifestyle.81

In another joint document of the ECH and several other alternative care organizations, the ECH emphasizes the advantages of the holistic model of health used by homeopathic and other complementary and alternative medicine (CAM) practitioners, with reference to the ethical ideas of therapeutic partnership and patient empowerment:

The holistic model of health and disease shifts a greater responsibility not only for health maintenance, but also for treatment of disease, from the provider to the patient. Holistic CAM practitioners encourage people to use and to recognise their own self-healing abilities and to develop more active approaches to life and health. They involve the patient as an active partner in his/her care.82

79 Furthermore, this commitment has not been incorporated into the ICNIRP statutes and appears only on its website.
80 This is reflected also in the ICNIRP’s annual report of 2012, which notes the need to improve the ICNIRP website, but distinguishes between communication with the public (one-sided, educational in nature) and communication with the scientific community, which would include consultation activities. See ICNIRP, Activities Report (2012), at 4. For a similar critique of the ICNIRP, see Pascual, supra note 45, at 36–37.
The juxtaposition of ethical and epistemic arguments is clearly anomalous from the perspective of scientific praxis, but the turn to ethical considerations makes perfect sense from a political perspective. The different ways in which the political-epistemic discord manifests itself in the three RSIs discussed earlier are a function of the concrete social situation of each of these organizations. The difference between the levels of political commitment of the IPCC and the ICNIRP can be explained by the high visibility of the IPCC. This visibility, together with public scandals such as climate-gate, has produced a legitimacy crisis at the IPCC, forcing it to realign its internal processes with the expectations of its multiple audiences in order to sustain its epistemic authority. The decision of the ECH to create a linkage between its epistemic claims about the capacity of homeopathic drugs to provide a remedy to certain types of illness and ethical claims about citizens’ right for self-determination and optimal health represents a different strategy. The ECH and other related organizations such as the ECCH and the ICH present themselves not only as epistemic experts but also as ethical experts. The two forms of authority support each other – indeed, they form part of the holistic homeopathic approach to medical care and well-being.

B Hybridity and the Problem of Scientific Uncertainty

The issue of scientific uncertainty provides another area in which the tension between the political-legal and epistemic facets of RSIs is manifested. The scientist can avoid the risk of being wrong by deferring judgment. In politics and law, however, decisions must be made now. Any decision adopted by the RSI (taking deference as a sort of decision as well) would thus be in conflict with either scientific or political expectations. The IPCC, the ICNIRP and the ECH each adopted distinct strategies for coping with scientific uncertainty. In the case of the IPCC, the uncertainty arises from the non-linearities involved in the dynamic of the climate system and the need to make long-term predictions. In the ICNIRP context, scientific controversy surrounds the question of the health risks associated with mobile phones and extremely low-frequency magnetic fields – the non-thermal effects of non-ionizing radiation – for which there is still no clear bio-physical model. In the case of homeopathy, there is deep uncertainty regarding the causal efficacy of homeopathic drugs because they are prepared using highly diluted substances.

84 Ibid., at 8.
The IPCC has accepted that because of the need for immediate action on climate change it cannot defer judgment on climatic questions until more data is collected and better models are developed. Its solution was to develop a nuanced ranking of epistemic confidence based on two qualitative indicators: the strength of the evidence and the level of agreement. This approach was codified in a guidance note on uncertainty, which was published in 2010. The following figure depicts the IPCC’s view of the relationship between evidence, agreement and confidence. Confidence increases toward the upper right corner, as suggested by the increased shading.

The following figure depicts the IPCC’s view of the relationship between evidence, agreement and confidence. Confidence increases toward the upper right corner, as suggested by the increased shading.

![Figure 2: IPCC’s Confidence Scale](https://academic.oup.com/ejil/article-abstract/26/2/391/423031)

The IPCC’s strategy reflects a value-laden decision, driven by a precautionary approach, to also give some credence to weak evidence if it indicates potentially catastrophic outcomes. Indeed, the guidance note encourages author teams to provide information about the tails of distributions of key variables, stating that ‘low-probability outcomes can have significant impacts, particularly when characterized by large magnitude, long persistence, broad prevalence, and/or irreversibility’. This practice poses a risk to the epistemic authority of the IPCC by exposing it to the criticism that its epistemic claims are driven by ideology and not based on science. To understand this risk, consider the following hypothetical situation: how would the epistemic authority of the International Astronomical Union be affected by a decision to publish a prediction produced by a group of astrologists and to assign it a low confidence mark?

The ICNIRP developed a different and more conservative approach to the question of uncertainty. In an article published in 2002, explaining the approach that the ICNIRP uses in providing advice on protection against non-ionizing radiation (NIR) exposure, it emphasized that the ICNIRP’s exposure guidelines were based on the

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90 Guidance Note for Lead Authors, supra note 89, at 3.


identification of ‘adverse effects on human health related to NIR exposures that are judged to be well established’.93 To become ‘established’, an exposure hazard must be supported by data, and the ICNIRP adopted a conservative ranking of data that could be used to support such conclusions.94 In contrast to the IPCC, which is willing to engage also in discussion about low-probability outcomes, reflecting (implicitly) a precautionary approach, the ICNIRP has tried to disassociate itself from precautionary risk management measures, noting ‘the need to ensure that the practical manner in which such approaches are applied should not undermine or be to the detriment of science-based exposure guidelines’.95 By avoiding making policy recommendations (for example, exposure guidelines) on issues where scientific consensus is lacking, the ICNIRP has sought to preserve its identity as a ‘pure’ scientific body,96 distinguishing itself from other transnational organizations involved in risk governance.97

The conservative approach of the ICNIRP exposes it to a different type of criticism, accusing it of providing legitimacy to non-precautionary policies toward the (admittedly highly controversial) risks of non-ionizing radiation. In a move that could be interpreted as an indirect criticism of the ICNIRP approach, the International Agency for Research on Cancer has recently classified radio frequency electromagnetic fields as possibly carcinogenic to humans (Group 2B), based on an increased risk for glioma, a malignant type of brain cancer associated with wireless phone use.98 The conservative approach of the ICNIRP was also criticized in the academic literature, some authors arguing that the current evidence supports a more precautionary approach.99

One way in which the differences between the IPCC and the ICNIRP can be articulated is through a distinction between Type I and Type II errors. A Type I error (false positive) refers to an act of falsely describing something as hazardous, whereas a Type II error (false negative) refers to the act of failing to detect a true hazard.100 The

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93 Ibid., at 544 (emphasis added). The ICNIRP reiterates its position in the article, concluding the section, noting that ‘[t]he ICNIRP approach to providing advice on limiting exposure to NIR necessarily requires well-based scientific data related to established health effects’. Ibid., at 546.

94 E.g., they not only emphasize the importance of peer-reviewed materials (ibid., at 544) but emphasize the fact that certain types of data, such as epidemiological studies, cannot support ‘established’ assertions on causality (at 543).

95 Ibid., at 547.


97 Regarding the question of the carcinogenic potential of extremely low frequency magnetic fields, the ICNIRP emphasized the lack of proof of a causal relationship and referred to the World Health Organization for ‘risk management advice, including considerations on precautionary measures’. ICNIRP, ‘Guidelines for Limiting Exposure to Time-Varying Electric and Magnetic Fields (1 Hz to 100 kHz)’, 99(6) Health Physics (2010) 818. Note, however, that the binary distinction between well-established/non-well-established sciences is in itself a meta-regulatory decision.


relatively liberal approach to hazard characterization of the IPCC reflects an increased sensitivity to Type II errors (false negative), which is motivated by a belief that in some environmental health contexts that involve severe hazards, the possibility of false negatives should be considered to be much worse than the possibility of false positives. The position of the ICNIRP reflects the conventional scientific sensitivity to Type I errors (false positive), which reflects science’s conservative approach to epistemic judgments. Both choices carry their own social risks.

In contrast to the IPCC and the ICNIRP, whose strategies remain bounded by the conventional scientific conceptions of causality and method, the ECH has responded to the uncertainty challenge by developing a new epistemology, which challenges these conventions and allows homeopaths to make causal determinations that are inconsistent with common scientific ‘wisdom’. This strategy replaces the conventional medical terminology of ‘clinical trials’ and ‘dose-response efficacy’, and its strong empiricist underpinnings, with the competing ideas of ‘proving’ and the ‘law of similars’. The law of similars is the fundamental causal model underlying homeopathic practice. According to this law, ‘a substance capable of provoking symptoms in a healthy organism acts as a curative agent in a diseased organism in which the same symptoms are manifested’. The concept of ‘proving’ provides an empirical strategy for demonstrating the medical power of a homeopathic drug in accordance with the law of similars:

A Homeopathic Drug Proving (HDP) is a systematic observation and recording of symptoms which occur after the defined administration of a potentized drug or a druglike effective substance, not yet or not sufficiently homeopathically proved, to healthy persons (Volunteers). It is done under the responsibility of a principal investigator, if need be with the assistance of further observers.

The idea of the law of similars and the method of proving are at odds with basic scientific approaches to causality. Causality in science is usually understood in either probabilistic or mechanistic terms. Probabilistic models are based on two key ideas: (i) positive causes raise the probability of their effect(s) – that is, \( P(E/C) > P(E) \) – and (ii) negative (or preventatives) causes lower the probability of their effect(s) – that is, \( P(E/C) < P(E) \).
P(E/C) < P(E). Mechanistic models of causality maintain that C is a cause of E if there is a mechanism of the appropriate sort that links C to E.\textsuperscript{106} The law of similars and the method of proving are not based on mechanical or probabilistic approaches but, rather, on analogical reasoning. Homeopathy does not provide a ‘scientific’ explanation for the use of analogical reasoning.\textsuperscript{107} Practitioners of homeopathy portray the dispute between conventional medicine and homeopathy as a war between opposing paradigms, in which the dominant paradigm overlooks the capacity of alternative paradigms to provide competing explanations that are not less legitimate.\textsuperscript{108}

The risk inherent in this strategy is that the ECH and other homeopathic RSIs (for example, the ECCH and the ICH) may isolate themselves from the broad scientific community in a way that can make it difficult for them to cooperate with public health organizations such as the WHO or the British National Health Service. Nevertheless, it seems that this strategy has been successful with regard to the public perception of homeopathy. Studies have shown the increasing popularity of homeopathic medicine,\textsuperscript{109} turning the ECH and related RSIs into important players in the global regulation of health, despite the opposition to homeopathic medicine in the conventional health community.

4 Conclusions: Institutional and Social Risks of the Hybrid Structure of RSIs

The hybrid structure of RSIs – their capacity to exert both normative and epistemic authority – constitutes an ingenious institutional response to the social need for certainty and to the scarcity of normative resources at the international level. However, the hybrid structure of RSIs is also a source of institutional and societal risks. At the organizational level, the hybrid nature of RSIs requires them to cope with the competing models of authority of science, politics and law. This contestation process, which involves the juxtaposition of the three complementary pairs: science~law, law~non-law and science~pseudoscience, forces RSIs to continuously question their internal structure. While this reflexive dynamic is critical for the survival of RSIs, it also has a destabilizing potential because any structural change would almost inevitably offend one of the opposing logics underpinning their operation. This destabilization potential reflects the fact that the tension between legal, political and epistemic conceptions of


\textsuperscript{107} Such an explanation seems particularly apt because of the indeterminate nature of analogical reasoning. As Cass Sunstein notes, ‘[t]he method of analogy is based on the question: Is case A relevantly similar to case B, or not? … To answer such questions, one needs a theory of relevant similarities and differences. By itself, analogical reasoning supplies no such theory. It is therefore dependent on an apparatus that it is unable to produce.’ Sunstein, ‘On Analogical Reasoning’, 106 \textit{Harvard Law Review} (1993) 741, at 773–774.

\textsuperscript{108} Wassenhoven, \textit{supra} note 103, at 15.

legitimate authority is, in principle, irreconcilable. The hierarchical structure of RSIs allows them to reach ad hoc pragmatic compromises between the competing logics associated with these domains, reflecting a state of fragile equilibrium. The fragility of this equilibrium reflects the tension between these ad hoc compromises and the remaining (unbridgeable) gaps between these competing logics.\footnote{For the concept of ‘fragile equilibrium’, see Varadarajan V. Chari, Ali Shourideh and Ariel Zetlin-Jones, \textit{Adverse Selection, Reputation and Sudden Collapses In Secondary Loan Markets}, National Bureau of Economic Research (2010), at 38. The recent \textit{Wall Street Journal} editorial, which criticizes the IPCC (in the context of the fifth Assessment Report) for having an ‘agenda that’s less about climate change than income inequality and redistribution’, is a good demonstration of this fragility. ‘Second Climate Thoughts’, \textit{Wall Street Journal} (7 April 2014), at A18.}

The hybrid structure of RSIs does not only pose a risk to the internal stability of RSIs, but it could also have adverse social impacts that need to be considered alongside RSIs’ projected benefits. These potential adverse effects are connected to the capacity of RSIs to use their dual authority as a cross-justificatory device. This capacity is a product of the divergent criteria of legitimacy and validity that are used in science and law. Two types of problems should be distinguished in this context. First, RSIs can use their legal authority to gain influence in the scientific/epistemic domain. This could be problematic either when it is used to support epistemic claims whose scientific basis is questionable or when it is used to marginalize competing points of view. The case of RSIs such as the International Psychoanalytical Association or the ECH is an example of the first problem.\footnote{The popularity of homeopathy, which can be attributed, at least partially, to the work of homeopathic RSIs, constitutes a social problem, e.g., when people turn to homeopathy rather than to conventional medicine for treatment for infectious diseases, increasing the risk of epidemic. See \url{http://sciencebased-pharmacy.wordpress.com/2009/08/21/world-health-organization-warns-against-homeopathy/}; \url{http://www.nhs.uk/Conditions/Homeopathy/Pages/Introduction.aspx} (last visited 1 May 2015).} The emergence of epistemic monopolies is an example of the latter problem. There are voices in the literature that criticize the IPCC, for example, for abusing its epistemic power (which can be associated at least partially with its legal status under the UNFCCC), advocating the use of regulatory instruments similar to those used in the antitrust field.\footnote{Tol, ‘Regulating Knowledge Monopolies: The Case of the IPCC’, 108(4) \textit{Climatic Change} (2011) 827.} A second type of problem concerns the capacity of RSIs to use their epistemic authority to validate their normative output in a way that could short-circuit democratic expectations. This type of strategic behaviour characterizes (arguably) the behaviour of the ICNIRP.\footnote{Pascual, supra note 45.}

Thinking about the optimal design of RSIs should thus take into account both the internal challenges that RSIs face when they attempt to preserve their authority and the external social risks created by their hybrid structure. My approach in considering these dual challenges is primarily instrumental. RSIs have emerged in response to two regulatory dilemmas (scientific uncertainty and normative scarcity), and the question is whether we can think of regulatory mechanisms that can improve their capacity to respond to these two dilemmas.\footnote{For this instrumental approach, see Posner, ‘Regulation (Agencies) versus Litigation (Courts): An Analytical Framework’, in Daniel P. Kessler (ed.), \textit{Regulation vs. Litigation: Perspectives from Economics and Law} (2010) 11.} One possible response is to look for a mechanism...
that can respond to the social demand for scientific certainty, without relying on the problematic intervention of experts and comitology. Algorithmic models for eliciting scientific consensus could provide such an alternative. These models replace expert judgment with meta-epistemic inquiry that draws on meta-knowledge indicators to evaluate the level of scientific contestation. This method utilizes knowledge about knowledge (citation data, ranking data about institutions and journals) to develop insights about the state of knowledge itself – for example, identifying areas of consensus.

However, the idea that RSIs can be replaced by algorithmic mechanisms is highly problematic. The first problem is that even if we assume that scientific consensus can be algorithmically identified, it is not clear that consensus should be equated with truth. History suggests that science proceeds by challenging conventional views and through paradigm shifts. It is not clear therefore that regulation that mechanistically sticks to scientific consensus would be always welfare enhancing. The flexibility of human judgment seems to offer potential advantages in this context. Further, it is also unclear how such algorithms could operate in situations in which there is no obvious consensus (as is the case in some of the issues discussed in the IPCC reports). Obviously, once the problem facing such an algorithm is more complex than identifying a consensus (for example, to produce nuanced rankings of scientific confidence), its output would become much more controversial and subject to dispute. Further, given the various uncertainties associated with using such an algorithm, it seems highly unlikely that the international community would agree to use it instead of a RSI.

Therefore, it seems that RSIs, with their unique hybrid structure, play an indispensable role in contemporary society. The question is whether there are any institutional innovations that could be used to reduce the frictions underlying their operation, without undermining their social-functional utility. The main institutional response to this challenge consists, I believe, in creating a more competitive epistemic environment – both internally (within the institutions) and externally, at the macro-social level. The creation of more competitive epistemic environments responds simultaneously to the dual challenges associated with the operation of RSIs. A competitive environment alleviates the tension between hierarchy and truth, which threatens the stability and legitimacy of RSIs, by creating a space for critical conversation, at the same time establishing a political-legal environment that is more compatible with democratic ideals simply by being less centralized.

117 For a critique of the use of algorithmic models in environmental regulation, see Wagner, Fisher and Pascual, supra note 51.
118 Davis, Kingsbury and Merry similarly emphasize the important role of processes of contestation. See Davis, Kingsbury and Merry, supra note 1, at 88–89.
Creating an internal competitive epistemic environment could be facilitated by various mechanisms. These include, for example, extending the opportunities for participation in the decision-making process and making sure that the process does not exclude certain points of view. The IPCC, for example, has made substantial efforts to improve its procedures in this direction following the IAC’s report. Nonetheless, there is one aspect of the IPCC’s procedures that characterizes other RSIs as well and that still lags behind in this respect: the focus on consensus. The IPCC’s reports do not give voice to minority views. To the extent that there exist diverged views on some issues, the IPCC deals with them through the aggregated measure of scientific confidence: the level of confidence synthesizes the author teams judgments about the validity of findings as determined through evaluation of the available evidence and the degree of scientific agreement.119 However, to the extent that there are significant scientific disputes, such an aggregated measurement may shield decision makers from important information.120 However, the rule against disclosing minority views is inconsistent with the practices of both science and law. Scientific progress depends on ‘continual challenges to the current state of always-imperfect knowledge’.121 The presence of credible minority views actually enhances the epistemic authority of science by demonstrating that the deliberative framework of the RSI has been sensitive to competing points of view. RSIs can draw in that context on the well-established legal tradition of ‘dissent’. In most common law jurisdictions, when courts issue a split decision they present the dissenting opinions alongside the majority position.122

At the macro level, the challenge is to establish a competitive epistemic environment that would ensure that the products of RSIs can be compared and assessed against the products of competing institutions. Such a competitive environment could be facilitated either by requiring central international institutions to recognize the output of more than one RSI or by breaking existing RSIs into several sub-organizations. In the case of the ICNIRP, for example, organizations such as the Institute of Electrical and Electronics Engineers could provide an alternative voice that could be recognized by international organizations such as the WHO.124 Proposals to split the IPCC into three


120 Such disputes exist, for example, with respect to the potential influence of rapid dynamic processes in the Greenland and West Antarctic ice sheets on the projected rise in sea level. See Oppenheimer et al., *supra* note 20, at 1505.

121 Sarewitz, *supra* note 20.


independent groups seem to reflect a similar concern for the creation of a competitive epistemic environment.\textsuperscript{125}

While creating a more competitive epistemic environment could alleviate the tension between truth and hierarchy and prevent the abuse of epistemic authority, there are obvious disadvantages to competition. These include the duplication of fixed costs, potential power struggles and the loss of epistemic authority when consumers of knowledge cannot determine whom to trust. Furthermore, because the number of competing RSIs is likely to be relatively small, the possibility of cartel-like collusion is not negligible. Indeed, the relationship between the homeopathic RSIs discussed earlier indicates such a colluding tendency. Finally, encouraging competition also means that we have to accept the potential emergence of anomalous RSIs such as the ECH. Neither of these solutions provides a perfect response to the risks associated with the operation of RSIs. It seems that RSIs, with their unique hybrid structure, perform an indispensable function in contemporary society. However, as noted earlier, there is a price to pay for mixing together law, politics and science. True to its hybrid nature, hybridity is both a virtue and a vice.

\textsuperscript{125} Mike Hulme argued that the IPCC should be dissolved after the Fifth Assessment Report (AR5) in 2014, and its work should be divided into three types of assessment undertaken by three new groups. The first would be a Global Science Panel; the second would be made up of Regional Evaluation Panels and the third would be a Policy Analysis Panel. Hulme, ‘IPCC: Cherish It, Tweak It or Scrap It’, 463 \textit{Nature} (2010) 730. Hulme served as a lead author in AR3.