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Makane Moïse Mbengue
University of Geneva, Faculty of Law

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International Courts and Tribunals as Fact-Finders: The Case of Scientific Fact-Finding in International Adjudication

MAKANE MOÏSE MBENGUE*

I. INTRODUCTION: FINDING . . . THE "UNCERTAIN FACT"

Fact-finding is both intrinsic and extrinsic to any international adjudication process.[1] It is intrinsic to the adjudicatory process since the very *leitmotiv* of the international judicial function is to make findings of law in light of the particular facts of a dispute. Without facts, law as "clarified"[2] or "developed"[3] by international courts and tribunals would be a mere abstraction. Law, and more especially international law, is not "so rigid or so inflexible as not to leave room for reasoned judgments in confronting the endless and ever-changing ebb and flow of real facts in

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* Lecturer, University of Geneva, Faculty of Law (Department of Public International Law and International Organization) and Graduate Institute of International and Development Studies (Geneva). The author would like to express his gratitude to Professor José Alvarez, Professor Laurence Boisson de Chazournes, and His Excellency Judge Bruno Simma for their insightful comments and remarks. The author would also like to express his deep gratitude to Katherine Del Mar, Ph.D. Candidate at the Graduate Institute (Geneva) and Visiting Scholar at the Lauterpacht Centre for International Law for her insightful comments and her invaluable help in editing the present contribution.

1. *See* Christine Chinkin, *U.N. Human Rights Council Fact-Finding Missions: Lessons from Gaza*, *in* LOOKING TO THE FUTURE: ESSAYS ON INTERNATIONAL LAW IN HONOR OF W. MICHAEL REISMAN 477 (Mahnoush H. Arsanjani, Jacob Katz Cogan, Robert D. Sloane & Siegfried Wiessner eds., 2011) ("Fact-finding has often been perceived and engaged in as complementary to dispute resolution processes.").

2. On the idea of international courts and tribunals acting as "law-clarifiers" and not as "law-makers," see, for example, Appellate Body Report, *United States – Measures Affecting the Imports of Wool Shirts and Blouses From India*, 19, WT/DS33/AB/R (Apr. 25, 1997). *See also* South West Africa Cases (Eth. v. S. Afr.; Liber. v. S. Afr.), Judgment, 1962 I.C.J. 465, 540 (Dec. 21) (joint dissenting opinion of Sir Percy Spender and Sir Gerald Fitzmaurice) ("It is not for a Judge today, in the light of the greater knowledge granted him by the passage of time, to do more than apply the law as it is, in the light of the facts as they stood when the situation he is dealing with arose.").

3. *See* HERSCH LAUTERPACHT, THE DEVELOPMENT OF INTERNATIONAL LAW BY THE INTERNATIONAL COURT xiii (1958).

real cases in the real world."[4] Fact-finding is furthermore extrinsic to any adjudicatory process for the administration of international justice and is primarily contingent upon an appreciation, determination, and qualification of the facts that surround a legal dispute. Without a proper systematization of facts, international courts and tribunals would operate in a vacuum and their decisions would address facts that are either moot or disconnected from a legal dispute, to say the least. Dealing efficiently with "the complexities involved in the serious and rigorous sifting of evidence"[5] requires sound fact-finding. Indeed, if the "law lies within the judicial knowledge of"[6] the "International Judge"[7] (*jura novit curia*), facts lie at the periphery of judicial control and demand to be rationalized through the adjudicatory process.[8]

The "elucidation of facts"[9]—which is referred to today as "fact-finding"—thus appears as a "Gentle Civilizer"[10] of international courts and tribunals. Fact-finding has become so intertwined with the international judicial function that the judicial notice of facts is incontestably part of the "common law of international adjudication."[11]

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4. Appellate Body Report, *Japan – Taxes on Alcoholic Beverages*, 31, WT/DS10/AB/R, WT/DS11/AB/R, WT/DS8/AB/R (Oct. 4, 1996).

5. ELIHU LAUTERPACHT, ASPECTS OF THE ADMINISTRATION OF INTERNATIONAL JUSTICE 18 (1991).

6. Fisheries Jurisdiction (Ger. v. Ice.), Judgment, 1973 I.C.J. 49, ¶ 18 (Feb. 2) (jurisdiction of the court) [hereinafter Germany Fisheries Jurisdiction of the Court].

7. DENNIS TERRIS, CESARE P. ROMANO, LEIGH SWIGART & SONIA SOTOMAYOR, THE INTERNATIONAL JUDGE: AN INTRODUCTION TO THE MEN AND WOMEN WHO DECIDE THE WORLD'S CASES xi–xii (2007).

8. *See* C. E. FOSTER, SCIENCE AND THE PRECAUTIONARY PRINCIPLE IN INTERNATIONAL COURTS AND TRIBUNALS: EXPERT EVIDENCE, BURDENS OF PROOF AND FINALITY 5 (2011). The author explains that

> [t]he notion that it is a court or tribunal's task to apply the law to the facts forms part of what has been characterized in the West as the "rationalist" tradition . . . . In the rationalist conception, fact and law are approached as distinct and separate. Rules governing evidence and procedure serve to help bring about "rectitude of decision" through the "correct application of valid law to true facts" . . . . The expectation of being able to determine the facts is the guiding principle.

Id. See also MICHELLE T. GRANDO, EVIDENCE, PROOF, AND FACT-FINDING IN WTO DISPUTE SETTLEMENT 5 (2009) ("the process of fact-finding is the process through which a panel formulates its conclusions with respect to the facts of a case, that is, it is the process through which the facts of a case are established. In this regard, it is important to note that panels consider and establish facts against the background of a legal provision . . .").

9. Convention on the Pacific Settlement of International Disputes art. 9, July 29, 1899, 32 Stat. 1779.

10. *See generally* MARTTI KOSKENNIEMI, THE GENTLE CIVILIZER OF NATIONS: THE RISE AND FALL OF INTERNATIONAL LAW 1870–1960 (2004).

11. CHESTER BROWN, A COMMON LAW OF INTERNATIONAL ADJUDICATION 90–118 (2007) (laying the groundwork for the common law of international adjudication).

Nevertheless, the "process of fact-finding"[12] is not linear. It is rather a circular process where international courts and tribunals always find themselves contemplating new types of facts. The nature of those facts varies substantively, and with it the nature of the process of fact-finding. One of the categories of facts that is of utmost importance in international adjudication and which shakes the foundations of fact-finding processes is the category of scientific facts. Scientific facts cover the broad array of facts pertaining to "the structure and behavior of the physical and natural world."[13] The present contribution focuses on the specific question of what may be called "scientific fact-finding" before international courts and tribunals.

At the outset, one may query if there is such a thing as "scientific fact-finding" by international courts and tribunals. International adjudicators are not scientists,[14] and scientists, regardless of their potential contribution to the international dispute-settlement processes, are clearly not organs "of law"[15] capable of, nor requested, to settle a dispute "by the application of principles and rules of international law."[16] As international courts and tribunals are mainly "composed of legal experts or arbitral practitioners,"[17] there is arguably *a priori* "inherent limitations on the exercise of [their] judicial function"[18] when they are requested to ascertain scientific facts or data. As rightly pointed out by Arbitrator Goldsmid, "[g]eneral principles [of law] . . . are

12. GRANDO, *supra* note 8, at 5.

13. CONCISE OXFORD ENGLISH DICTIONARY 1287 (11th ed. 2008).

14. *See, e.g.*, Legality of Threat or Use of Nuclear Weapons, Advisory Opinion, 1996 I.C.J. 226, ¶ 15 (July 8) [hereinafter Nuclear Weapons Advisory Opinion].

> The Court does not consider that, in giving an advisory opinion in the present case, it would necessarily have to write "scenarios", to study various types of nuclear weapons and to evaluate highly complex and controversial technological, strategic and scientific information. *The Court will simply address the issues arising in all their aspects by applying the legal rules relevant to the situation.*

Id. (emphasis added).

15. Nuclear Tests (Austl. v. Fr.), Judgment, 1974 I.C.J. 259, ¶ 23 (Dec. 20) [hereinafter Australia Nuclear Tests Case].

16. Border and Transborder Armed Actions (Nicar. v. Hond.), Judgment, 1988 I.C.J. 89, ¶ 52 (Dec. 20).

17. Abyei Arbitration (Sudan/Sudan People's Liberation Movement/Army), ¶ 482 (Perm. Ct. Arb. 2009), http://www.pca-cpa.org/showpage.asp?pag_id=1306 [hereinafter Abyei Arbitration Final Award].

18. N. Cameroons (Cameroon v. U.K.), Judgment, 1963 I.C.J. 29 (Dec. 2) (preliminary objections) [hereinafter N. Cameroons Case].

always important, but they cannot produce facts."[19] This is particularly true when it comes to scientific facts.

Scientific facts do not obey nor are they governed by general considerations of law. They are first and foremost substantially dependent on "scientific evidence,"[20] that is, "information furnishing a level of proof based on the *established and accepted methods of science.*"[21] They are governed by "scientific principles," namely "accepted fundamental laws and facts of nature *known through the methods of science.*"[22] In a nutshell, scientific fact-finding is rooted in methods of science and not (at least not *prima facie*) in methods of law.[23] In general, international courts and tribunals are embedded with methods of law. Such embedment implies that "methods of science" or "scientific fact-finding" have necessarily to be balanced against and rationalized with "legal purposes."[24] In other words, the function of the "international adjudicator"[25] is to make use of scientific methods and thus to "find" scientific facts "only so far as required for the application of international law."[26]

The process of scientific fact-finding before international courts and tribunals is (or perhaps should be) characterized by that dialectic between "methods of science" and "methods of law."[27] However, methods of science and methods of law do not always serve as blueprints for each other. Scientific fact-finding can be conducted *within* and *without* law since methods of science and methods of law are not interchangeable or mutually supportive in every case. The tribunal in the *Abyei Arbitration* emphasized this very point when it stated that

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19. Helmand River Case (Afg. v. Persia), Award of Goldsmid, Arb. (1872), *in* INTERNATIONAL ENVIRONMENTAL LAW REPORTS, Volume 1, Early Decisions 8 (Cairo A. R. Robb ed. 1999).

20. *See*, *e.g.*, BLACK'S LAW DICTIONARY 639 (9th ed. 2009) (defining "scientific evidence" as "fact or opinion evidence that purports to draw on specialized knowledge of a science or to rely on scientific principles for its evidentiary value").

21. *See* WHO, International Health Regulations art. 1.1 (2d ed. 2005) (emphasis added), http://whqlibdoc.who.int/publications/2008/9789241580410_eng.pdf.

22. *Id.* (emphasis added).

23. *See* CONCISE OXFORD ENGLISH DICTIONARY, *supra* note 13, at 1287 (defining "science" as "the intellectual and practical activity encompassing the systematic study of the structure and behavior of the physical and natural world through observation and experiment").

24. Continental Shelf (Tunis./Libyan Arab Jamahiriya), Judgment, 1982 I.C.J. 18, ¶ 61 (Feb. 24).

25. Laurence Boisson de Chazournes & Sarah Heathcote, *The Role of the New International Adjudicator*, 95 AM. SOC. INT'L L. PROC. 129, 129 (2001).

26. *Continental Shelf*, 1982 I.C.J. ¶ 61.

27. *See generally* J. D'Aspremont, "The International Judge and Science," ILA Brazil Conference, Joao Pessoa, Brazil, October 2010 (on file with the author) (discussing how the international legal system interacts with the scientific world in processing scientific evidence).

"the original decision-making body (the ABC Experts) and the reviewing body (this Tribunal) are each programmed to assess the facts using quite different methodologies (i.e. the methodology of science vis-à-vis the methodology of law)."[28]

And yet, despite the existence of "inherent limitations,"[29] international adjudicators cannot "decline to take cognizance of one aspect of a dispute merely because that dispute"[30] has scientific aspects and issues. To do otherwise would almost be tantamount to a *non-liquet* in the worst scenario, or at least "a factual *non-liquet*."[31] Nowadays, it "is one of the attributes of [the] judicial function"[32] to deal with highly "complex scientific or technical disputes."[33] And, that is an "understandable fact of life"[34] since "[t]here is no question that modern international relations, and hence modern diplomacy and modern international litigation, is daily becoming increasingly concerned with scientific and technological facts."[35]

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28. Abyei Arbitration Final Award, *supra* note 17, ¶ 406.

29. *See, e.g.*, Lauterpacht, *supra* note 5, at 18 ("Of course, cases can arise that make great intellectual demands upon the judges in the sense, for example, that they may require the assimilation of a mass of detailed evidence . . . ").

30. United States Diplomatic and Consular Staff in Tehran (U.S. v. Iran), Judgment, 1980 I.C.J. 3, ¶ 36 (May 24).

31. Abyei Arbitration Final Award, *supra* note 17, ¶ 479.

32. Nuclear Tests (N.Z. v. Fr.), Judgment, 1974 I.C.J. 457, ¶ 30 (Dec. 20); Nuclear Tests (N.Z. v. Fr.), Request for an Examination of the Situation in Accordance with Paragraph 63 of the Court's Judgment of 20 December 1974 in the Nuclear Tests (N.Z. v. Fr.) Case, 1995 I.C.J. 288, ¶ 56 (Sept. 22); Fisheries Jurisdiction (Spain v. Can.), Judgment, 1998 I.C.J. 432, ¶ 30 (Dec. 4) (jurisdiction of the court).

33. On this expression, see Pulp Mills on River Uruguay (Arg. v. Uru.), 2010 I.C.J. 14, 112, ¶ 8 (Apr. 20) (joint dissenting opinion of judges Al-Khasawneh and Simma) [hereinafter Pulp Mills Case Joint Dissent].

34. Rosalyn Higgins, *International Courts and Tribunals—The Challenges Ahead: Conference Opening Speech*, 7 LAW & PRAC. INT'L CT. & TRIBUNALS 262, 262 (2008).

35. SHABTAI ROSENNE, *Fact-Finding Before the International Court of Justice*, *in* ESSAYS ON INTERNATIONAL LAW AND PRACTICE 235, 237 (2007). *See also* Cesare Romano who goes as far as considering that

> [t]he debate about the proper role of science and scientists in courtrooms is nearly three centuries old. It began during the 18th century, when the scientific revolution of the age of Enlightenment swept away metaphysics and relegated the scientist-philosopher to the cabinet of curiosities. Since then, courts have struggled to develop criteria to evaluate the credibility of experts and the facts they present with varying results.

Cesare Romano, *The Role of Experts in International Adjudication*, *in* LE DROIT INTERNATIONAL FACE AUX DÉFIS ENVIRONNEMENTAUX 181, 181 (Société française pour le droit international ed., 2009).

Perhaps this has always been the case.[36] Indeed, in international adjudication, facts are facts. The vast majority of the statutes and rules governing international courts and tribunals do not distinguish between categories of facts.[37] International courts and tribunals are supposed to make an "objective assessment of the *facts*"[38] or give "careful consideration to all the evidence placed before [them] by the Parties, to determine which facts must be considered relevant, to assess their probative value, and to draw conclusions from them as appropriate."[39] Thus, it seems that there is no dissimilarity between "simple" facts and "complex" facts. All fact-finding processes are by definition intricate and complex processes, regardless of the nature of the facts to be ascertained in a particular case. Non-scientific facts can also beget "fact-intensive cases"[40] and prove to be difficult for international adjudicators to ascertain.[41]

Scientific facts, particularly those relating to environmental and/or health risks, pose unique problems in international adjudication due to their specific nature; they are *uncertain facts*. If a differentiation between "simple" and "complex" facts is purely abstract, a dichotomy between facts characterized by "certainty" and facts singularized by "uncertainty" reflects the process of scientific fact-finding in

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36. *See, e.g.*, Helmand River Cases (Afg./Persia), Award of Arbitrator McMahon, *in* INTERNATIONAL ENVIRONMENTAL REPORTS, VOLUME 1, EARLY DECISIONS 12–13 (1999). In "Clause V" of his Award, the Arbitrator states:

> To enable both sides to satisfy themselves that this award is being complied with, and at the same time to avoid the necessity of fresh references to the British Government and the expense of special Missions, a British officer of irrigation experience shall be permanently attached to the British Consulate in Seistan. He will be empowered to give an opinion, when required by either party, on any case of doubt or dispute over water questions that may arise. He will, when necessary, *take steps to bring the real facts* of any case to the notice of the Government concerned. He will be able to call the attention of either party to any important indications of threatening danger to their water-supply arising from natural causes or their irrigation works.

Id. (emphasis added).

37. *See, e.g.*, Statute of the International Court of Justice arts. 36, 61, June 26, 1945, 59 Stat. i 1937–1946.

38. *See* Understanding on Rules and Procedures Governing the Settlement of Disputes, art. 11, Apr. 15, 1994, 1869 U.N.T.S. 408 (emphasis added).

39. Pulp Mills on River Uruguay (Arg. v. Uru.), 2010 I.C.J. 14, ¶ 168 (Apr. 20) [hereinafter Pulp Mills Case Judgment].

40. Pulp Mills Case Joint Dissent, *supra* note 33, ¶ 8.

41. *See, e.g.*, Armed Activities on the Territory of the Congo (Dem. Rep. Congo v. Uganda), 2005 I.C.J. 168, ¶ 61 (Dec. 19) [hereinafter Armed Activities Case]; *see also* Stephen M. Schwebel, *Three Cases of Fact-Finding by the International Court of Justice*, *in* FACT-FINDING BEFORE INTERNATIONAL TRIBUNALS 1, 1–17 (Richard B. Lillich ed., 1992) (defining the fact-finding process).

international adjudication more acutely.[42] Such a dichotomy also takes into account the peculiarity of scientific facts. Indeed, scientific facts are often a source of scientific uncertainty or the result of scientific uncertainty. Scientific fact-finding is irresolutely orientated towards the unknown—i.e., the "not known yet:" the uncertain.[43]

Consequently, scientific fact-finding may be understood as a method to uncover the "non-fact" (the uncertain fact), whereas traditional fact-finding processes before international courts and tribunals are orientated toward the "freezing"[44] of "facts." Scientific fact-finding enunciates "probabilities" while traditional fact-finding methods validate "veracities." Herein lies the underlying reason for the difficulties encountered by international courts and tribunals in dealing with and fully appreciating scientific facts. When dealing with scientific fact-finding, international courts and tribunals have the feeling that they are embarking on a journey with no end. Of particular note is a distinction drawn by the tribunal in the *Abyei Arbitration* between the task of "merely ascertain[ing] the facts" and the task of "scientifically research[ing], select[ing] and weigh[ing] such facts" with respect to the "complex constellation of historical, anthropological and geographic facts (many of which remain obscure to this day)" that confronted the tribunal in that case.[45]

The present contribution aims at depicting the limits that scientific fact-finding *per se* may face within the system of international courts and tribunals.[46] First, it demonstrates that scientific fact-finding is often dependent on a Cornelian "judicial" choice between ascertaining or not ascertaining scientific facts (Part I). The contribution then highlights the

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42. *See, e.g.*, Seabed Disputes Chamber of the Int'l Tribunal for the Law of the Sea, Responsibilities and Obligations of States Sponsoring Persons and Entities with Respect to Activities in the Area, Case No. 17, Advisory Opinion of Feb. 1, 2011, ¶ 131, http://www.itlos.org/fileadmin/itlos/documents/cases/case_no_17/adv_op_010211.pdf [hereinafter Seabed Disputes Chamber Advisory Opinion] (emphasizing the Tribunal's need to take into account "scientific evidence concerning the scope and potential negative impact of the activity in question [which] is *insufficient* . . . where there are plausible indications of potential risks") (emphasis added).

43. *Cf.* Foster, *supra* note 8, at 5–6 ("In disputes involving scientific uncertainty and potential future harm, international courts and tribunals are called upon to make judicial decisions in circumstances where potentially decisive facts about future events clearly cannot be obtained at the time of adjudication . . . . Here the concept of 'certainty' is to be taken literally: an absence of certainty has to be accepted from the start.").

44. Frontier Dispute (Burk. Faso/Mali), Judgment, 1986 I.C.J. 554, ¶ 30 (Dec. 22).

45. Abyei Arbitration Final Award, *supra* note 17, ¶ 477.

46. *See* YUVAL SHANY, THE COMPETING JURISDICTION OF INTERNATIONAL COURTS AND TRIBUNALS 104–15 (2004) (explaining the existence of a "system of international courts and tribunals").

hurdles confronting international courts and tribunals when they act either as "triers" (Part II) or as "weighers" (Part III) of scientific facts.

II. TO ASCERTAIN OR NOT TO ASCERTAIN? THE EXODUS OF SCIENTIFIC FACTS IN INTERNATIONAL ADJUDICATION

International adjudication is a cradle of Cartesian thinking. The second maxim of Descartes seems to underscore international case law dealing with "factual underpinnings"[47]—"My second maxim was to be as firm and resolute in my actions as I was able, and not to *adhere less steadfastly to the most doubtful opinions, when once adopted, than if they had been highly certain*[.]"[48] "[A]dher[ing] less steadfastly to the most doubtful opinions," international courts and tribunals appear ready to "establish which relevant facts [they] regard as having been convincingly established by the evidence,"[49] to find "from any quarter"[50] a fact not "suggesting the slightest doubt,"[51] to identify "evidence that can safely be relied on in a court of law,"[52] to look for "clear and compelling evidence,"[53] to "attain the . . . degree of certainty . . . that the facts . . . are supported by convincing evidence,"[54] to acknowledge the absence of "doubt,"[55] to "satisfy [themselves] that [they are] in possession of all the available facts,"[56] and to determine "established facts."[57]

Not only is it the case that international courts and tribunals pay no heed to "the most doubtful"[58] factual elements. Loyal to the Cartesian mantra, they also subscribe to the corollary rule of the second maxim according to which

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47. Polis Fondi Immobliare di Banche Popolare S.G.R.p.A. v. Int'l Fund for Agric. Dev., Case No. 2010-8, ¶ 65 (Perm. Ct. Arb. 2010), http://www.pca-cpa.org/showfile.asp?fil_id=1510 [hereinafter Polis Fondi Arbitration].

48. RENE DESCARTES, DISCOURSE ON THE METHOD OF RIGHTLY CONDUCTING THE REASON, AND SEEKING TRUTH IN THE SCIENCES 25 (John Veitch trans., Cosimo Books 1st ed. 2008) (1924) (emphasis added).

49. Armed Activies Cases, *supra* note 41, ¶ 72.

50. Germany Fisheries Jurisdiction of the Court, *supra* note 6, ¶ 24.

51. *Id.*

52. Armed Activities Case, *supra* note 41, ¶ 130.

53. Saluka Investments B.V. (Neth. v. Czech Rep.), Partial Award, ¶ 273 (Perm. Ct. Arb. 2006), http://www.pca-cpa.org/showfile.asp?fil_id=105.

54. Military and Paramilitary Activities in and Against Nicaragua (Nicar. v. U.S.), Judgment, 1986 I.C.J. 14, ¶ 29 (June 27) [hereinafter Nicaragua Case].

55. Romak S.A. (Switz. v. Uzb.), Case No. AA280, Certified Award, ¶ 236 (Perm. Ct. Arb. 2009), http://www.pca-cpa.org/showfile.asp?fil_id=1348.

56. Australia Nuclear Tests Case, *supra* note 15, ¶ 31.

57. Polis Fondi Arbitration, *supra* note 47, ¶ 156.

58. DESCARTES, *supra* note 48, at 25.

> it is very certain that, when it is not in our power to determine what is true, we ought to act according to what is most probable; and even although we should not remark a greater probability in one opinion than in another, *we ought notwithstanding to choose one or the other, and afterwards consider it, in so far as it relates to practice, as no longer dubious, but manifestly true and certain, since the reason by which our choice has been determined is itself possessed of these qualities*.[59]

As a consequence, international adjudicators are inclined to "make factual findings,"[60] to "evaluate the relevance and probative force of each piece"[61] of evidence, to isolate "insufficient evidence"[62] or unconvincing evidence[63] that has been adduced to prove facts, to ignore factual evidence that is not characterized by "precise observation"[64] or which is "uncertain,"[65] to categorize undisputed facts,[66] to refrain from taking into account facts "based on the paucity of evidence,"[67] to disdain "fragmentary and inconclusive"[68] factual information, and to refuse "to weigh intangible and elusive points of proof."[69]

The above-described practice of international courts and tribunals rests upon the assumption that before an international adjudicator "can give a worthwhile legal opinion, he or she *must know the facts*."[70] *Da mihi factum, dabo tibi jus* (give me the facts and I shall give you the law).[71] In other words, international courts and tribunals will apply the relevant rules of international law to "those facts which they have found *to have existed*."[72] How then should courts and tribunals react in

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59. *Id.* (emphasis added).

60. Appellate Body Report, *EC Measures Concerning Meat and Meat Products*, ¶ 133, WT/DS26/AB/R, WT/DS48/AB/R (Jan. 16, 1998) [hereinafter Meat Products Appellate Body Report].

61. Appellate Body Report, *Korea – Definitive Safeguard Measure on Imports of Certain Dairy Products*, ¶ 137, WT/DS98/AB/R (Dec. 14, 1999).

62. Delimitation of Maritime Boundary (Guy. v. Surin.), ¶ 424 (Perm. Ct. Arb. 2007), http://www.pca-cpa.org/showfile.asp?fil_id=664.

63. Delimitation of the Exclusive Economic Zone and Continental Shelf (Barb. v. Trin. & Tobago), 27 R.I.A.A. 147, 186 ¶ 131 (Perm. Ct. Arb. 1910) [hereinafter Continental Shelf Case].

64. Delimitation of the Border (Eri./Eth.), 25 R.I.A.A. 83, 114 ¶ 3.21 (Perm. Ct. Arb. 2002).

65. *Id.* at 115, ¶ 3.25.

66. Polis Fondi Arbitration, *supra* note 47, ¶ 182

67. Abyei Arbitration Final Award, *supra* note 17, ¶ 479.

68. Continental Shelf Case, *supra* note 63, ¶ 266.

69. Maritime Delimitation (Eri./Yemen), 22 R.I.A.A. 335, 352 ¶ 71 (Perm. Ct. Arb. 1999).

70. ROSENNE, *supra* note 35, at 235.

71. Daryl A. Mundis & Fergal Gaynor, *Current Developments at the Ad Hoc Criminal Tribunals*, 2 J. INT'L CRIM. JUST. 879, 897 n.135 (2004).

72. Pulp Mills Case Judgment, *supra* note 39, ¶ 168.

situations in which the facts in question are so uncertain that they have not been "found to exist?"[73]

Scientific facts, in contrast to non-scientific facts, are precisely typified by their volatility, their circularity, their paucity, their impalpability[74] as well as their "conjectures and refutations."[75] They are marked by disagreements "not only on the interpretation of the facts, but even on the existence or nature of at least some of them."[76] In short, international adjudicators may be confronted by difficulties in establishing the very "existence" of scientific facts. Does this mean that international courts and tribunals should decline to deal with scientific aspects of international disputes? Clearly not. As already explained, statutes and rules governing international courts and tribunals do not purport to segregate or exclude scientific facts from the process of fact-finding. Moreover, the practice of international courts and tribunals demonstrates that a "culture of scientific fact-finding" is entrenched in international adjudication.

What is required of the international adjudicator is that she or he strive to better integrate the rationale of scientific facts, i.e., the rationale of uncertainty in the process of legal fact-finding. The "scientific status" of a scientific fact is its "falsifiability, or refutability, or testability."[77] As Gaston Bachelard theorized: "*toute connaissance se construit contre ce que l'on sait déjà*"(we know *against* previous knowledge).[78] The truth can have two faces when it comes to scientific facts.[79]

The legal conception of "fact" does not admit a "dearth of direct evidence"[80] as a factual element to be taken into account by international adjudicatory bodies. By contrast, the scientific perception of the "fact" may confer "an *ex nunc*, constitutive effect"[81] to scientific uncertainty. This is due to the fact that being in the *absence of factual*

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73. MAKANE MBENGUE, ESSAI SUR UNE THÉORIE DU RISQUE EN DROIT INTERNATIONAL PUBLIC: L'ANTICIPATION DU RISQUE ENVIRONNEMENTAL ET SANITAIRE 98–100 (2009).

74. On the nature and content of scientific facts, see *id.* at 97–116.

75. KARL POPPER, CONJECTURES AND REFUTATIONS 33 (1963).

76. Nicaragua Case, *supra* note 54, ¶ 57.

77. POPPER, *supra* note 75, at 37.

78. *See generally* GASTON BACHELARD, LA FORMATION DE L'ÉSPRIT SCIENTIFIQUE: CONTRIBUTION À UNE PSYCHANALYSE DE LA CONNAISSANCE OBJECTIVE (1938).

79. *Contra* Abyei Arbitration (Sudan/Sudan People's Liberation Movement/Army), ¶ 182 (Perm. Ct. Arb. 2009) (dissenting opinion of Judge Al-Khasawneh), http://www.pca-cpa.org/showfile.asp?fil_id=1242 [hereinafter Dissenting Opinion of Judge Al-Khasawneh] ("[I]t is said that the truth cannot have two faces.").

80. Continental Shelf Case, *supra* note 63, ¶ 247.

81. Abyei Arbitration Final Award, *supra* note 17, ¶ 485.

evidence is not synonymous with *evidence of absent facts* when it comes to scientific fact-finding. For instance, in the field of climate change, it took almost seventeen years for the Intergovernmental Panel on Climate Change to determine the "very likelihood" of the impact of human activity on global warming (anthropogenic warming).[82] During those seventeen years, the absence of factual evidence on the real source of global warming never implied that there was no evidence at all on the reality of global warming (i.e., the "fact" of global warming). Therefore, encouraging "factual *non-liquet*" in situations in which there is an "absence of sufficient evidence"[83] would constitute a failure "to perform the act of justice requested of"[84] international courts and tribunals, thereby hindering the good administration of justice and preventing international "litigation to come to an end."[85]

As long as international courts and tribunals continue to disregard the peculiarities of scientific fact-finding, "judicial lamentation" (Sir Hersch Lauterpacht may perhaps have said "judicial caution" or "judicial hesitation")[86] will continue to surround scientific fact-finding. International adjudicators are indeed not at ease with "mass[es] of scientific and technological information,"[87] or "vast amount[s] of factual and scientific material containing data and analysis,"[88] or "complex scientific"[89] evidence, or "highly complex and controversial technological, strategic and scientific information"[90] or again "vast mass[es] of factual material."[91]

Behind the apparent quantitative problems lie concerns of a qualitative character with respect to the uncertain nature of scientific

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82. *See* INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, IPCC FOURTH ASSESSMENT REPORT: CLIMATE CHANGE 2007, 2.4 ATTRIBUTION OF CLIMATE CHANGE, *available at* http://www.ipcc.ch/publications_and_data/ar4/syr/en/mains2-4.html.

83. *See* Abyei Arbitration Final Award, *supra* note 17, ¶ 485 (as seemingly suggested by Professor Hafner, sitting as one of the arbitrators in the Abyei Arbitration).

84. Germany Fisheries Jurisdiction Judgment, *supra* note 6, at 209.

85. Application of Convention on Prevention and Punishment of Crime of Genocide (Bosn. and Herz. v. Serb. and Montenegro), Judgment, 2007 I.C.J. 43, ¶ 116 (Feb. 26) [hereinafter Genocide Convention Case]; *see, e.g.*, ROSENNE, *supra* note 35, at 242 (underlining that the "provision of Article 59 of the Statute is likely to pose special difficulties for the Court when confronted" with scientific fact-finding).

86. LAUTERPACHT, *supra* note 3, at 75 (judicial causation), 116 (judicial hesitation).

87. Gabcikovo-Nagymaros Project (Hung./Slovk.), Judgment, 1997 I.C.J. 7, 232, ¶ 2 (Sept. 25) (dissenting opinion of Judge *ad hoc* Skubiszewski).

88. Pulp Mills Case Judgment, *supra* note 39, ¶ 229.

89. Pulp Mills Case Joint Dissent, *supra* note 33, ¶ 11.

90. Nuclear Weapons Advisory Opinion, *supra* note 14, ¶ 15.

91. Legality of the Threat or Use of Nuclear Weapons, Advisory Opinion, 1996 I.C.J. 429, 451 (July 8) (dissenting opinion of Judge Weeramantry) [hereinafter Legality of the Threat or Use of Nuclear Weapons, Dissenting Opinion of Judge Weeramantry].

facts. The treatment of scientific uncertainty by the International Court of Justice (ICJ) in the *Gabcikovo-Nagymaros* case is illustrative of the factual anxiety that international courts and tribunals may develop when involved in scientific fact-finding.[92] Scientific uncertainty was abundant in the evidence presented in this case, and the ICJ considered that the best approach was to avoid entering into a scientific fact-finding process *tout court*.[93] In the words of the Court:

> Both Parties have placed on record *an impressive amount of scientific material* aimed at reinforcing their respective arguments. The Court has given most careful attention to this material, in which the Parties have developed their opposing views as to the ecological consequences of the Project. It concludes, however, that . . . it is not necessary in order to respond to the questions put to it in the Special Agreement for it to determine which of those points of view is *scientifically better founded*.[94]

Yet, assuming that the judicial function does not require the international adjudicator "to give a scientific assessment . . . but to evaluate the claims of parties before it and whether such claims are sufficiently well-founded,"[95] international courts and tribunals are without doubt mandated to ascertain scientific facts in disputes raising scientific aspects[96] and to draw "the legal consequences that would follow from these facts."[97] International courts and tribunals are characterized by a *dédoublement fonctionnel* (functional duality) when dealing with any process of fact-finding.[98] If international courts were to put aside their task as fact-finders because of the complexity and uncertainty of the scientific issues in question, they would be prevented from "establish[ing] particular facts that are unclear, unknown, or disputed."[99] And, as a consequence, they would be unable to participate in any sort of judgment as to the legal consequences that flow from the scientific facts that they decline to ascertain. This would in turn serve to "increase doubts in the international legal community" as to whether

92. Gabcikovo-Nagymaros Project (Hung./Slovak.), Judgment, 1997 I.C.J. 7 (Sept. 25).

93. *See id.* ¶ 54.

94. *Id.* (emphasis added).

95. Pulp Mills Case Joint Dissent, *supra* note 33, ¶ 4.

96. *See*, *e.g.*, Dissenting Opinion of Judge Al-Khasawneh, *supra* note 79, ¶ 232 ("There has to be some factual evidence to evaluate.").

97. Abyei Arbitration Final Award, *supra* note 17, ¶ 476.

98. *See generally* Antonio Cassese, *Remarks on Scelle's Theory of "Role Splitting" (dédoublement fonctionnel) in International Law*, 1 EUR. J. INT'L L. 210 (1990) (describing the theory of "role splitting" with regards to adjudication, and the role of adjudicators, who act "on behalf of the whole community").

99. Abyei Arbitration Final Award, *supra* note 17, ¶ 476.

international courts and tribunals are "well-placed to tackle complex scientific questions."[100]

In a visionary article, Wilfred Jenks concluded that

> [t]he impact of advanced science and technology is the most incisive of the decisive forces which are reshaping contemporary society on a scale and at a rate unprecedented in human experience. *It has a threefold bearing on the law of nations. It has a profound, if subtle, influence on the fundamentals of legal thought; it poses a wide range of specific problems for the law; and it raises acutely the general question of the relationship of law, science and technology in the life of the world community.*[101]

International courts and tribunals are integrated components of the world community and as such they are also deeply concerned about reflecting upon the relationship between law and science.

How then is it possible to build a bridge between traditional adjudicatory fact-finding processes and scientific fact-finding? The solution could well be found in reconciling the legal concept of "fact" with the (pure) scientific concept of "fact." Common sense and judicial notice may be helpful for fact-finders, but facts are not always susceptible of being domesticated through the lens of legal syllogisms or the "spirit of legal realism."[102] They do not necessarily "[lead] logically to a single conclusion."[103]

In order to ensure this harmonization between different disciplinary understandings of "fact," international courts and tribunals should free themselves of any ready-made yardsticks against which scientific facts are to be scrutinized. Fact-finding in international adjudication should thus be brought into "juxtaposition" with the "raw realities"[104] of scientific facts. Traditional fact-finding processes need to better reflect scientific rules and principles governing scientific evidence. Scientific rules and principles, such as those formulated by Karl Popper, are more than "nice calculations"[105] of scientific theory:

> (1) It is easy to obtain confirmations, or verifications, for nearly every theory—if we look for confirmations.

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100. *See, e.g.*, Pulp Mills Case Joint Dissent, *supra* note 33, ¶ 3.

101. C. Wilfred Jenks, *The New Science and the Law of Nations*, 17 INT'L & COMP. L.Q. 327, 327 (1968) (emphasis added).

102. Gabcikovo-Nagymaros Project (Hung./Slovk.), Judgment, 1997 I.C.J. 7, 120, ¶ 60 (Sept. 25) (separate opinion of Judge Bedjauoi) [hereinafter Gabcikovo-Nagymaros Judgment, Separate Opinion of Judge Bedjauoi].

103. Corfu Channel (U.K. v. Alb.), Judgment, 1949 I.C.J. 18, 18 (Apr. 9).

104. Dissenting Opinion of Judge Weeramantry, *supra* note 91, ¶ 6.

105. Maritime Delimitation, *supra* note 69, ¶ 71.

> (2) Confirmations should count only if they are the result of *risky predictions*; that is to say, if, unenlightened by the theory in question, we should have expected an event which was incompatible with the theory—an event which would have refuted the theory.
> (3) Every "good" scientific theory is a prohibition: it forbids certain things to happen. The more a theory forbids, the better it is.
> (4) A theory which is not refutable by any conceivable event is non-scientific. Irrefutability is not a virtue of a theory (as people often think) but a vice.
> . . .
> (7) Some genuinely testable theories, when found to be false, are still upheld by their admirers—for example by introducing *ad hoc* some auxiliary assumption, or by reinterpreting the theory *ad hoc* in such a way that it escapes refutation. Such a procedure is always possible, but it rescues the theory from refutation only at the price of destroying, or at least lowering, its scientific status.[106]

Greater integration of scientific uncertainty when ascertaining facts, particularly facts relating to environmental and health issues, is necessary and ineluctable. International courts and tribunals, like other actors in the international legal order, are bound by the "duty to prevent, or at least mitigate" harm to the environment, a duty which has "become a principle of general international law."[107] Such a duty is met if scientific fact-finding is conducted for "anticipatory" purposes, where facts are ascertained in light of their dual nature—certain and uncertain—and in adherence to the philosophy of risk. Fact-finding by international courts and tribunals should also be subject to "new norms and standards"[108] appertaining to scientific fact-finding.[109] This would

106. POPPER, *supra* note 75, at 36–37.

107. Iron Rhine Railway (Belg./Neth.), 27 R.I.A.A. 35, 66–67, ¶ 59 (Perm. Ct. Arb. 2005).

108. Gabcikovo-Nagymaros Judgment, Separate Opinion of Judge Bedjauoi, *supra* note 102, ¶ 140.

109. *See* Judge Weeramantry dissenting opinion in Nuclear Tests (N.Z. v. Fr.), Request for an Examination of the Situation in Accordance with Paragraph 63 of the Court's Judgment of 20 December 1974 in the Nuclear Tests (N.Z. v. Fr.) Case, 1995 I.C.J. 288, 339–40 (Sept. 22) [hereinafter Request for Examination in Nuclear Tests, Dissenting Opinion of Judge Weeramantry] where he expands on the issue:

> It is a truism that scientific knowledge increases exponentially. The knowledge of 1995 is not the knowledge of 1974. Nor was the knowledge of 1974 the knowledge of the 1950s. There is perhaps as much of a differential between the knowledge relating to such matters between the 1970s and the 1950s as there is between the knowledge of the 1990s and the 1970s.
>
> The Court is seised of the present Request at this point of time and must bring to bear upon it the scientific knowledge now available. A court, faced with a science-oriented problem of present and future damage in 1995, cannot resolve it by ignoring the

allow *faire entrer le doute dans le droit* (integration of uncertainty in law).[110] Only then would the exodus of scientific facts be "without return." Indeed, international adjudication would constitute a new promised land for scientific fact-finding.

III. THE PROMISED LAND? INTERNATIONAL ADJUDICATORS AS "TRIERS" OF SCIENTIFIC FACTS

Are international courts and tribunals the "preferred arbiters of fact"[111] or, to use the words of the World Trade Organization (WTO) Appellate Body, the adequate "triers"[112] of scientific facts? As triers of facts, international courts and tribunals have "[t]he duty to make an objective assessment of the facts[,] . . . [i.e.,] an obligation to consider the evidence presented . . . and to make factual findings on the basis of that evidence."[113] In other words, for a court or tribunal to be a trier of facts implies a duty to examine (all) scientific evidence submitted to it in a given case and to ascertain the facts.

One can easily imagine the uneasiness of international adjudicators when being asked to deal with ascertaining "scientific evidentiary material"[114] relating to bad odors, persistent organic pollutants, genetically modified organisms, effluent discharges, absorbable organic halogens, phosphorus, algal bloom, phenolic substances, nonylphenols, dioxins and furans, air pollution, risk of eutrophication, hormones, fisheries data, manganese-base fuel additives, and so on. States, at

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> knowledge acquired between 1974 and 1995, and by applying to the problem in hand the knowledge of 1974. That would be an exercise in unreality.

Id.

Professor Philippe Sands took the same position in the *MOX Plant* case with respect of the implications of new scientific knowledge on the law:

> The United Kingdom says that the discharges are minimal and no harm is caused. That may have been right in 1982 when the Law of the Sea Convention was adopted, but our understanding of the impacts of radiation on the environment and on human health have changed and new technologies have emerged to reduce or eliminate entirely releases into the marine environment. The law evolves to take into account these changes. What may have been internationally lawful in 1982 may not be lawful in 1993. What may have been lawful in 1993 may not be lawful in 2001.

MOX Plant (Ir. v. U.K.), Case No. 10, Verbatim Record, 29 http://www.itlos.org/fileadmin/itlos/documents/cases/case_no_10/vre1911.06.pdf.

110. Laurence Boisson de Chazournes, *Faire entrer le doute dans le droit*, 3 BIOTECH FORUM 10–11 (2001).

111. Abyei Arbitration Final Award, *supra* note 17, ¶ 415.

112. Meat Products Appellate Body Report, *supra* note 60, ¶ 132. *See also* Appellate Body Report, *Korea – Taxes on Alcoholic Beverages*, ¶ 161, WT/DS75/AB/R, WT/DS84/AB/R (Jan. 18, 1999) [hereinafter Korea Alcoholic Beverages Report].

113. Meat Products Appellate Body Report, *supra* note 60, ¶ 133.

114. *Id.* ¶ 110.

times, are even more reluctant to consider that international courts and tribunals can analyze scientific facts. The arguments of Japan in the *Southern Bluefin Tuna* case with respect to its admissibility are illustrative of such reluctance—even a certain animosity—towards scientific fact-finding within international adjudication. Japan went as far as asserting that "questions of scientific judgment . . . are not justiciable" and concluding that "all turn on matters of scientific, not legal, judgment."[115] Such a hermetic approach to the relationship between science and law is far from the "contemporary concerns of the community of nations."[116] The ICJ itself has acknowledged the "normative" value of science when it declared: "[O]wing to new scientific insights . . . new norms and standards have been developed."[117]

International adjudication "would be devoid of meaning if disputes concerning questions of scientific fact and opinion were not justiciable."[118] International courts and tribunals are legitimately expected to act as triers of scientific facts,[119] and they cannot decline to undertake such a task by asserting that "disputes are scientific rather than legal."[120] Otherwise, they could appear as acting *infra petita*. Practice before international adjudicatory bodies reveals that these fora could serve as institutional fertilizers for scientific facts. This is mainly due to the fact that "international tribunals are generally free to admit and evaluate evidence *of every kind*."[121] Thus, there is no fear *a priori* of

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115. Southern Bluefin Tuna (N.Z. v. Japan, Austl. v. Japan), 23 R.I.A.A. 1, ¶ 40(a) (Perm. Ct. Arb. 2000) [hereinafter Southern Bluefin Tuna Arbitration].

116. Appellate Body Report, *United States – Import Prohibition of Certain Shrimp and Shrimp Products*, ¶ 129 WT/DS58/AB/R (Oct. 12, 1998) [hereinafter Shrimps Products Report].

117. Gabcikovo-Nagyamaros Judgment, *supra* note 92, ¶ 140.

118. Southern Bluefin Tuna Arbitration, *supra* note 115, ¶ 41(c).

119. European Communities – Measures concerning Meat and Meat Products (Hormones), Report of the Appellate Body, 19 January 1998, WT/DS26/AB/R, WT/DS48/AB/R, ¶ 133. *See also* Meat Products Appellate Body Report, *supra* note 60, ¶ 132.

120. Southern Bluefin Tuna Arbitration, *supra* note 115, ¶ 35.

121. Appellate Body Report, *European Communities – Anti-Dumping Duties on Imports of Cotton-Type Bed Linen from India*, ¶ 6.34, WT/DS141/R (Oct. 30, 2000) [hereinafter European Communities Appellate Body Report]; *see also* MOJTABA KAZAZI, BURDEN OF PROOF AND RELATED ISSUES: A STUDY OF EVIDENCE BEFORE INTERNATIONAL TRIBUNALS 180, 184 (1996) (emphasis added).

> The inherent flexibility of the international procedure, and its tendency to be free from technical rules of evidence applied in municipal law, provide the "evidence" with a wider scope in international proceedings . . . . Generally speaking, international tribunals have not committed themselves to the restrictive rules of evidence of municipal law. They have found it justified to receive every kind and form of evidence, and have attached to them the probative value they deserve under the circumstances of a given case.

dealing with scientific information contained, for instance, in "satellite photographs,"[122] "environmental impact assessment[s],"[123] "contemporary satellite evidence,"[124] or "hazardous waste evaluations and assessments."[125]

At the same time, practice also evinces a tendency for international courts and tribunals to reduce scientific facts to simple "euphemisms,"[126] and to "embark upon the vain task of equalizing the facts of nature,"[127] or to "refashion . . . nature."[128] These ambivalent dynamics have implications on the treatment of scientific facts by international adjudicators.

Indeed, in their capacity as triers of facts in general, and of scientific facts more particularly, international courts and tribunals are caught between the dilemma of ascertaining facts through "legal characterization"[129] or through a "science-oriented"[130] methodology. The tribunal in the *Abyei Arbitration* even tentatively formulated a sporadic distinction between "pure fact-finding," in reference to fact-finding dealing only with scientific and technical facts, and "full adjudication."[131] Yet, scientific fact-finding should not in principle lead to any fragmented methodology in the ascertainment of facts, if as underlined "a scientific question can be answered only through rigorous scientific research" and "there should not be one standard for scientists and another for the courtroom."[132] Such a desire to "combin[e] the

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Id.

122. Certain Activities Carried Out by Nicaragua in Border Area, Request for Indication of Provisional Measures (Costa Rica v. Nicar.), ¶ 46 (Mar. 8, 2011) (order).

123. *See, e.g.*, World Bank Inspection Panel, *Request for Inspection: Argentina/Paraguay: Yacyretá Hydroelectric Project Panel Review and Assessment* ¶ 2.8 (Sept. 16, 1997), http://siteresources.worldbank.org/EXTINSPECTIONPANEL/Resources/PanelReviewandAssessment.pdf; Técnicas Medioambientales Tecmed, S.A. v. Mex., ICSID Case No. ARB(AF)/00/2, Award, ¶ 150 (May 29, 2003), 19 ICSID Rev. 158 (2004).

124. Abyei Arbitration Final Award, *supra* note 17, ¶ 368.

125. Metalclad Corp. v. Mexico, ICSID Case No. ARB(AF)/97/1, Award, ¶ 86 (Aug. 30, 2000), 5 ICSID Rep. 209 (2002).

126. Legality of the Threat or Use of Nuclear Weapons, Dissenting Opinion of Judge Weeramantry, *supra* note 91, at 451.

127. Continental Shelf (Tunis./Libyan Arab Jamahiriya), Judgment, 1982 I.C.J. 18, ¶ 13 (Feb. 24) (dissenting opinion of Judge Gros).

128. Continental Shelf (Tunis./Libyan Arab Jamahiriya), Judgment, 1982 I.C.J. 18, 299 ¶ 17 (Feb. 24) (dissenting opinion of Judge *ad hoc* Evensen); *see also* Continental Shelf (Tunis./Libyan Arab Jamahiriya), Judgment, 1982 I.C.J. 18, 257 ¶ 91 (Feb. 24) (dissenting opinion of Judge Oda).

129. Meat Products Appellate Body Report, *supra* note 60, ¶ 117.

130. Request for Examination in Nuclear Tests, Dissenting Opinion of Judge Weeramantry, *supra* note 109, 340.

131. Abyei Arbitration Final Award, *supra* note 17, ¶ 462.

132. ROSENNE, *supra* note 35, at 245.

rigour of the scientific community with the requirements of the courtroom" remains to be fully realized.[133]

What is evident is the relief that international courts and tribunals show when there is "a preference for a scientific methodology"[134] and that the task of "customary . . . fact-finders,"[135] as well as applying the said scientific methodology, is accordingly entrusted to non-adjudicatory bodies. In the eyes of the concerned courts and tribunals, those "scientific fact-finders" are more appraised to "disclose the fruits of their research *in some manner appropriate to their respective fields of scientific research*."[136] What is the legal effect of such a relief on the power (requirement, in certain cases) of international courts and tribunals to act as triers of scientific facts? Does scientific fact-finding by non-adjudicatory bodies ("based on scientific analysis and research"[137]) only acquire a status of "extra-judicial evidence?"[138] Or should international adjudicators subject scientific facts to a "Darwinian" process of "legal selection?"

The arbitral tribunal in the *Abyei Arbitration*, for example, opted for a passive treatment of scientific fact-finding taking into account the interpretation of its mandate as excluding "an analysis of the substantive correctness" of scientific facts.[139] The tribunal put it clearly that it would not "engage at the outset in an omnibus re-opening of the . . . [scientific] appreciation of evidence[.]"[140] Noteworthy are, however, the consequences that the tribunal deduced from its passive approach. While international courts and tribunals are generally reluctant *vis-à-vis* the value of scientific evidence, the *Abyei Arbitration* considered scientific fact-finding based on "scarce factual evidence,"[141] facts ascertained "regardless of the strength or weakness of the evidence . . . uncovered,"[142] or "marked, in varying degrees, by some imprecision"[143] and by "subjective assessment"[144] to be highly probative. The reluctance

133. *Id.*
134. Abyei Arbitration Final Award, *supra* note 17, ¶ 521.
135. *Id.* ¶ 478.
136. *Id.* ¶ 521 (emphasis added).
137. *Id.*
138. Azinian, Davitian & Baca v. Mexico, ICSID Case No. ARB(AF)/97/2, Award, ¶ 55 (Nov. 1, 1999), 5 ICSID Rep. 269 (2002) *available at* http://naftaclaims.com/Disputes/Mexico/Azinian/ AzinianFinalAward.pdf.
139. Abyei Arbitration Final Award, *supra* note 17, ¶ 410.
140. *Id.* ¶ 411.
141. *Id.* ¶ 455.
142. *Id.* ¶ 482.
143. *Id.* ¶ 534.
144. *Id.*

of the tribunal in entering into a process of scientific-finding reached its peak with the tribunal stating evasively and without further reasoning that it "does not believe that any new evidence that has come to light is outcome-determinative."[145]

The approach of the arbitral tribunal in the *Methanex* case starkly contrasts with the *Abyei Arbitration*. There, the tribunal opted for an active approach in its treatment of scientific facts (i.e., it decided "to summarise the principal findings of fact which [it] has made in regard to the scientific issues relating to MTBE" (methyl tertiary-butyl ether)).[146] It is true that one of the parties to the case expressly requested the arbitral tribunal to deal with the question of "whether the scientific conclusions which were presented to the Governor were so faulty that the tribunal may reasonably infer that the science merely provided a convenient excuse for the hidden regulation of methanol producers."[147] The tribunal acted as a true trier of the scientific facts by ascertaining the facts and evidence before it. In its "scientific fact-finding" part, the award reads as follows:

> (1) The California ban on the oxygenate MTBE began as a policy decision of the California Senate which, as expressed in the California Bill, was contingent on the scientific findings of the UC [University of California at Davis] Report and which was to be implemented by California in the light of its public hearings, testimony and peer review;
> (2) This policy was motivated by the honest belief, held in good faith and on reasonable scientific grounds, that MTBE contaminated groundwater and was difficult and expensive to clean up;
> (3) There is no credible evidence that, by commissioning or producing the UC Report, the California Senate or the University of California researchers intended to favour the United States ethanol industry or particular companies within it (including ADM); and
> (4) There is no credible evidence of any intention on the part of the California Senate or the University of California researchers, by commissioning or producing the UC Report, to injure methanol producers, whether US or foreign companies (including Methanex).[148]

145. Abyei Arbitration Final Award, *supra* note 17, ¶ 538.

146. Methanex Corp. v. United States, Final Award of the Tribunal on Jurisdiction and Merits, ¶ 102 (NAFTA Ch. 11 Arb. Trib.), http://naftaclaims.com/Disputes/USA/Methanex/Methanex_Final_Award.pdf [hereinafter Methanex Final Award].

147. *Id.* at 8, ¶ 19.

148. *Id.* ¶ 102.

Other international courts and tribunals adopt an intermediary approach consisting of giving prevalence to "sound scientific findings,"[149] not to say "scientific certainty" ("evidential certainty")[150] in the ascertainment of scientific facts without properly (or systematically) presenting an "outline"[151] of the identified facts. The said international courts and tribunals are governed by what may be called the *Trail Smelter* "pattern."[152] This is an approach taken by the ICJ, which accords significant weight to "bulky scientific evidence."[153] One can then understand more easily the disarray in which the ICJ finds itself when it is not provided with conclusive scientific evidence or "matters of popular knowledge."[154] The number of formulations that the Court employed in the *Pulp Mills case* expresses the scientific vacuum in which the Court felt it was left. As Judge *ad hoc* Vinuesa, dissenting in the case, points out:

> In various key passages, the Court reaches conclusions on alleged substantial violations while acknowledging the lack of scientific certainty underpinning those findings: "Argentina has not convincingly demonstrated that Uruguay"; "the Court is not in a position to conclude that Uruguay"; it has "not been established to the satisfaction of the Court"; "there is insufficient evidence"; "there is no clear evidence to link"; "a clear relationship has not been established"; "the record does not show any clear evidence."[155]

It is clear, however, that regardless of the approach adopted, international courts and tribunals are guided by the same primary *leitmotiv*: the constant need to "know" what constitutes the "scientific factual matrix" of international disputes. Where they might differ is

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149. Pulp Mills on River Uruguay (Arg. v. Uru.), 2010 I.C.J. 14, 266–67, ¶ 40 (Apr. 20) (dissenting opinion of Judge *ad hoc* Vinuesa) [hereinafter Dissenting Opinion of Judge *ad hoc* Vinuesa].

150. *Id.*

151. Legality of the Threat or Use of Nuclear Weapons, Dissenting Opinion of Judge Weeramantry, *supra* note 91, ¶ 451.

152. Trail Smelter Case (U.S./Can.), 3 R.I.A.A. 1905, 1970 (Perm. Ct. Arb. 1941).

> The Tribunal, therefore, finds . . . that, under the principles of international law, as well as of the law of the United States, no State has the right to use or permit the use of its territory in such a manner as to cause injury by fumes in or to the territory of another or the properties or persons therein, when the case is *of serious consequence and the injury is established by clear and convincing evidence*.

Id. at 1965 (emphasis added).

153. Methanex Final Award, *supra* note 146, ¶ 13.

154. Request for Examination in Nuclear Tests, Dissenting Opinion of Judge Weeramantry, *supra* note 109, ¶ 340.

155. Dissenting Opinion of Judge *ad hoc* Vinuesa, *supra* note 149, at 284, ¶ 70 (citations omitted).

with respect to the precautionary treatment of scientific facts. This may lead to "anachronistic results."[156] For example, although scientific certainty is fundamental in the multilateral trading system,[157] the WTO Appellate Body has acknowledged that "'theoretical uncertainty' . . . is inherent in the scientific method and . . . stems from the intrinsic limits of experiments, methodologies, or instruments deployed by scientists to explain a given phenomenon."[158] The complexity and uncertainty of scientific fact-finding needs to be addressed adequately and promptly by international courts and tribunals. A long march awaits until then.

IV. *THE LONG MARCH?* INTERNATIONAL ADJUDICATORS AS "WEIGHERS" OF SCIENTIFIC FACTS

It is generally "within the discretion" of international courts and tribunals "to decide which evidence [they] choose to utilize in making [factual] findings."[159] "*Not to choose is, in fact, to choose not to choose.*"[160] As "weighers" of scientific facts, it is expected that international courts and tribunals proceed to determine "the credibility and weight properly to be ascribed to (that is, the appreciation of) a given piece of evidence."[161] What differentiates the function of the international adjudicator as "trier" and its function as "weigher" is a psychological element: the element of *choice*. International courts and tribunals are purely identifying the scientific evidence, the known (certainty) and the unknown (uncertainty) with respect to a scientific fact, when they act as triers of scientific facts. As such, they are engaged in a process of ascertaining *stricto sensu*. When acting as weighers of scientific facts, international courts and tribunals select among scientific facts. That is to say, they are categorizing what ought to be relevant scientific facts and what ought not to be. It is no longer a process of ascertaining *stricto sensu,* but a process of *evaluation*.

Weighing factual evidence "is part and parcel of the fact finding process."[162] International courts and tribunals are thus presumed to be

156. OSPAR Convention (Ir. v. U.K.), 12 R.I.A.A. 103, ¶ 103 (Perm. Ct. Arb. 2003).

157. *See, e.g.*, Meat Products Appellate Body Report, *supra* note 60, ¶ 186 ("The Panel might arguably have used the terms 'scientifically identified risk' and 'identifiable risk' simply to refer to an ascertainable risk: if a risk is not ascertainable, how does a Member ever know or demonstrate that it exists?").

158. Appellate Body Report, *Japan – Measures Affecting the Importation of Apples*, ¶ 241, WT/DS245/AB/R (Nov. 26, 2003) [hereinafter Japan Appellate Body Report].

159. Meat Products Appellate Body Report, *supra* note 60, ¶ 135.

160. JEAN-PAUL SARTRE, BEING AND NOTHINGNESS 481 (2d ed. 2003) (emphasis added).

161. Meat Products Appellate Body Report, *supra* note 60, ¶ 132.

162. *Id.*

able to "second-guess"[163] scientific findings and are not required in principle to accord to factual evidence submitted by parties to a dispute "the same meaning and weight as do the parties."[164] Such an understanding of the international adjudicator in the wonderland of scientific "fact-weighing" seems to contrast with the "scientific spleen" that characterizes the role of the international adjudicator as an "original-trier-of-facts."[165] But this is just the tip of the iceberg.

Indeed, strong doubts and criticisms have been raised about the capacity of international courts and tribunals to adequately "evaluate the relevance and probative force of each piece"[166] of scientific evidence. In particular, such doubts were raised with respect to the judgment of the ICJ in the *Pulp Mills case* by Judge *ad hoc* Vinuesa who firmly questioned "the Court's ability to make appropriate determinations of fact . . . based on sound scientific findings"[167] and who charged the Court with "transforming a previous binding obligation to produce evidence into a mere goodwill gesture to co-operate by providing evidence to the Court."[168] Judge *ad hoc* Vinuesa went so far as to assert that "*despite the lack of specialized expert knowledge,* the Court sets itself the task of choosing what scientific evidence is best, discarding other evidence, and evaluating and weighing raw data and drawing conclusions."[169]

Similarly in the same case, Judges Al-Khasawneh and Simma strongly objected to the "deficient method of scientific fact-finding"[170] used by the ICJ in weighing scientific evidence, and they lamented that the "Court has clung to the habits it has traditionally followed for the assessment and evaluation of evidence."[171] However, it is noteworthy

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163. Korea Alcoholic Beverages Report, *supra* note 112, ¶ 161; *see also* Appellate Body Report, *India – Quantitative Restrictions on Imports of Agricultural, Textile and Industrial Products*, ¶ 143, WT/DS90/AB/R (Aug. 23, 1999).

164. Appellate Body Report, *Australia – Measures Affecting Importation of Salmon*, ¶ 267, WT/DS18/AB/R (Oct. 20, 1998); *see also* European Communities Appellate Body Report, *supra* note 121, ¶ 177; Island of Palmas (Neth./U.S.), 2 R.I.A.A. 841, 841 (Perm. Ct. Arb. 1928) (although not referring to scientific fact-finding, explaining that "an arbitral tribunal must have entire freedom to estimate the value of assertions made by the Parties . . . . The value and the weight of any assertion can only be estimated in the light of all the evidence and all the assertions made on either side, and of facts which are notorious for the tribunal.").

165. GRANDO, *supra* note 8, at 242.

166. Appellate Body Report, *United States – Definitive Safeguard Measures on Imports of Wheat Gluten from the European Communities*, ¶ 150, WT/DS166/AB/R (Dec. 22, 2000).

167. Dissenting Opinion of Judge *ad hoc* Vinuesa, *supra* note 149, at 266–67, ¶ 40.

168. *Id.* ¶ 44.

169. *Id.* ¶ 71 (emphasis added).

170. Pulp Mills Case Joint Dissent, *supra* note 33, ¶ 2.

171. *Id.* ¶ 3.

that both Judges Al-Khasawneh and Simma concluded in relation to the role of the ICJ and other international courts and tribunals as "weighers" of scientific facts that

> [t]he Court on its own is not in a position adequately to assess and weigh complex scientific evidence of the type presented by the Parties . . . a court of justice cannot assess, without the assistance of experts, claims as to whether two or three-dimensional modelling is the best or even appropriate practice in evaluating the hydrodynamics of a river, or what role an Acoustic Doppler Current Profiler can play in such an evaluation. Nor is the Court, indeed any court save a specialized one, well-placed, without expert assistance, to consider the effects of the breakdown of nonylphenolethoxylates, the binding of sediments to phosphorus, the possible chain of causation which can lead to an algal bloom, or the implications of various substances for the health of various organisms which exist in the River Uruguay. *This is surely uncontroversial: the task of a court of justice is not to give a scientific assessment of what has happened, but to evaluate the claims of parties before it and whether such claims are sufficiently well-founded so as to constitute evidence of a breach of a legal obligation*.[172]

It is undisputable—not to say evident—that international courts and tribunals would benefit by resorting more systematically to the "assistance of experts" when confronted with issues of scientific fact-finding. However, it is not within the scope of the present contribution to describe the rules for use of experts before various international courts and tribunals, nor to analyze whether specific procedures such as, for instance, the Permanent Court of Arbitration's Optional Rules for Arbitration of Disputes relating to Natural Resources and the Environment, are more suitable to cope with scientific fact-finding than the traditional approach taken in international dispute settlement.[173] These aspects have been dealt with elsewhere in legal scholarship.[174] At

172. *Id.* ¶ 4 (emphasis added).

173. *See* Permanent Court of Arbitration, Optional Rules for Arbitration of Disputes Relating to Natural Resources and/or the Environment (adopted on June 19, 2001), *available at* http://www.pca-cpa.org/showfile.asp?fil_id=42.

174. *See*, *e.g.*, Pulp Mills Case Joint Dissent, *supra* note 33, ¶¶ 4–13; *see also generally*, Katherine Del Mar, *The International Court of Justice and Standards of Proof*, *in* THE ICJ AND THE EVOLUTION OF INTERNATIONAL LAW: THE ENDURING IMPACT OF THE *CORFU CHANNEL* JUDGMENT 98 (2012) (analyzing the ICJ's use of various standards of proof); FOSTER, *supra* note 8, at 136–82; *see generally* GRANDO, supra note 8 (discussing the approach taken by the WTO in international dispute settlement); *see generally* CESARE P.R. ROMANO, *The Role of Experts in International Adjudication*, *supra* note 35 (discussing the approach taken by the WTO in international dispute settlement); BROWN, *supra* note 11, at 112–17; *see generally* ROSENNE, *supra* note 35 (discussing the rules for use by experts and the Rules of Evidence with reference to

the end of the day the vast majority of international courts and tribunals are "guardian[s]"[175] of their statutes and/or rules of procedure and they have the "sole competence"[176] to determine "mandatory requirements"[177] or "matters under [their] Statute."[178] Thus, international adjudicators are at liberty to make use in principle of expert advice and assistance when they deem it reasonable and necessary. They have done so in the past, they are doing so presently and they will surely do so in the future.

What needs to be addressed leveling this contribution is the idea according to which the "task of a court of justice is not to give *a scientific assessment* of what has happened."[179] If "scientific assessment" means "a *scientific* process aimed at establishing the *scientific* basis"[180] of facts, then there is no doubt that international courts and tribunals are not "scientific facts or risks assessors." If "scientific assessment" implies "matters . . . susceptible of quantitative analysis by the empirical or experimental laboratory methods commonly associated with the physical sciences,"[181] or ascertainment of facts "in a science laboratory operating under strictly controlled conditions,"[182] one can still agree with the claim that the "exercise and the integrity of the . . . adjudicative function"[183] does not entail "scientific assessment." As a consequence, it is difficult to support criticisms relating to the absence, within an international court, of "discussion about the scientific integrity of the scientific methodologies applied," and of "discussion about the scientific integrity of the results," or relating to "silence on the important issue of credibility of the scientific submissions."[184] The international judicial function does not call out international courts and tribunals as going so far as "determin[ing] whether the data is scientifically viable or credible."[185]

Nevertheless, if "scientific assessment" is understood in its other ordinary meaning (i.e., as "a process characterized by systematic,

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specific articles in the Rules of Court); and M. LOUIS SAVADOGO, *Le recours des juridictions internationales à des experts*, 50 ANNUAIRE FRANÇAIS DE DROIT INTERNATIONAL 231 (2004) (discussing the use of experts in international courts).

175. N. Cameroons Case, *supra* note 18, at 29.

176. Genocide Convention Case, *supra* note 85, ¶ 139.

177. *Id.*

178. *Id.*

179. Pulp Mills Case Joint Dissent, *supra* note 33, ¶ 4 (emphasis added).

180. Meat Products Appellate Body Report, *supra* note 60, ¶ 187 (emphasis added).

181. *Id.*

182. *Id.*

183. Appellate Body Report, *United States – Continued Suspension of Obligations in the EC-Hormones Dispute*, Annex IV ¶ 8 WT/ DS320/AB/R (Oct. 16, 2008).

184. Dissenting Opinion of Judge *ad hoc* Vinuesa, *supra* note 149, at 285, ¶ 72.

185. *Id.*

disciplined and objective enquiry and analysis, that is, *a mode of studying and sorting out facts and opinions*"),[186] nothing prevents *a priori* an international court or tribunal as a "weigher" of facts—even less the ICJ—to "give a scientific assessment of what has happened."[187] Any court of law can conduct this task of "scientific assessment"—even more efficiently with the assistance of experts,[188] technical international organizations,[189] *experts fantômes*,[190] or "any relevant source"[191]—as long as it is not engaging in "quantitative analysis by the empirical or experimental laboratory methods commonly associated with the physical sciences,"[192] which would be materially and functionally impossible for a court of law. As clearly pointed out by a WTO panel:

> We cannot conduct our own risk assessment. Nor do we attempt to do so. . . . Our mandate is different. We are not asked to make a scientific risk comparison nor to state with scientific certainty that one product is riskier than the other. *We can only weigh the evidence put before us and, on the basis of the rules of burden of proof we adopted, including the use of factual presumptions, decide whether sufficient evidence is before us*—evidence which has not been rebutted—in order to state that it can be presumed that one product is riskier than the other.[193]

For international courts and tribunals to successfully carry out the task of "scientific assessment," "the necessity or propriety of examination and *evaluation*" of scientific facts "would have to be addressed on a case-by-case basis,"[194] free from any monolithic perception of fact-finding processes in international adjudication. Thus, ideas according to which "the parties are masters of the evidence" and

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186. Meat Products Appellate Body Report, *supra* note 60, ¶ 187 (emphasis added).

187. Pulp Mills Case Joint Dissent, *supra* note 33, ¶ 4.

188. *Id.* ¶¶ 3–4.

189. Panel Report, *Australia – Salmon*, WT/DS18/R, ¶ 8.71, (June 12, 1998) [hereinafter Australia Panel Report].

190. Pulp Mills Case Joint Dissent, *supra* note 33, ¶ 14.

191. *See* Understanding on Rules and Procedures Governing the Settlement of Disputes, art. 13, Apr. 15, 1994, 1869 U.N.T.S. 401.

192. Meat Products Appellate Body Report, *supra* note 60, ¶ 187.

193. Australia Panel Report, *supra* note 189, ¶ 8.126 (emphasis added); *see also id.* ¶ 8.41 (where the court further stressed that "in examining this case we did not attempt (nor are we, in our view, allowed) to conduct our own risk assessment or to impose any scientific opinion on Australia. We only examined and evaluated the evidence—including the information we received from the experts advising the Panel—and arguments put before us in light of the relevant WTO provisions and, following the rules on burden of proof set out above, based our findings on this evidence and these arguments.").

194. Meat Products Appellate Body Report, *supra* note 60, ¶ 206 (emphasis added).

international adjudicators have a "passive role" do not reflect the challenges posed by scientific fact-finding.[195]

The weighing of scientific facts—or, the scientific assessment of what has happened—indisputably requires international courts and tribunals to determine whether a scientific fact "is sufficiently supported or reasonably warranted" by scientific evidence.[196] For courts and tribunals to move more spontaneously in such a direction, they would have to adopt an active role and to "[interweave] legal process with knowledge and expertise",[197] but most of all they would have to acknowledge the evolutionary character of their inherent fact-finding powers in light of scientific complexity and uncertainty.

The *Affaire du lac Lanoux* shows that, among international courts and tribunals, weighing scientific facts "of which [they] ha[ve] been apprized"[198] was already an accepted practice in early interstate arbitrations dealing with partially or wholly scientific questions.[199] However, it was the arbitral tribunal constituted in the *Methanex* case which most recently confirmed that the ability of international judicial organs to act as weighers of facts is not a myth nor illusory.[200] In a long passage—which deserves to be quoted in its entirety—the arbitral tribunal set the tone and shortened the "long march" to scientific "fact-weighing" in international adjudication:

> Having considered all the expert evidence adduced in these proceedings by both Disputing Parties, the Tribunal accepts the UC Report as reflecting a serious, objective and scientific approach to a complex problem in California. Whilst it is possible for other scientists and researchers to disagree in good faith with certain of its methodologies, analyses and conclusions, the fact of such

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195. Western Sahara, Advisory Opinion, 1975 I.C.J. 127, 138 (Oct. 16) (separate opinion of Judge de Castro).

196. Meat Products Appellate Body Report, *supra* note 60, ¶ 186.

197. *See* Pulp Mills Case Joint Dissent, *supra* note 33, ¶ 3.

198. Diversion of Water from the Meuse (Neth./Belg.), Judgment, 1937 P.C.I.J. (ser. A/B) No. 70, at 79 (June 28) (separate opinion of Judge Hudson).

199. Affaire du lac Lanoux (Fr./Spain), 12 R.I.A.A. 281, 367 (Trib. Arb. 1957). According to the Arbitral Tribunal:

> [I]t has never been alleged that the works envisaged present any other character or would entail other risks than other works of the same kind which today are found all over the world. It has not been clearly affirmed that the proposed works would entail an abnormal risk in neighbourly relations or in the utilization of the waters. . . . [T]he technical guarantees for the restitution of the waters are as satisfactory as possible.

Id.; *see generally* CESARE P.R. ROMANO, THE PEACEFUL SETTLEMENT OF INTERNATIONAL ENVIRONMENTAL DISPUTES: A PRAGMATIC APPROACH (2000) 219–32 (analyzing the facts, judgment an aftermath of the *Affaire du lac Lanoux*).

200. *See generally* Methanex Final Award, *supra* note 146 (considering the facts of the case).

> disagreement, even if correct, does not warrant this Tribunal in treating the UC Report as part of a political sham by California. In particular, the UC Report was subjected at the time to public hearings, testimony and peer-review; and its emergence as a serious scientific work from such an open and informed debate is the best evidence that it was not the product of a political sham engineered by California, leading subsequently to the two measures impugned by Methanex in these arbitration proceedings. Moreover, in all material respects, the Tribunal is not persuaded that the UC Report was scientifically incorrect: the Tribunal was much impressed by the scientific expert witnesses presented by the USA and tested under cross-examination by Methanex; and the Tribunal accepts without reservation these experts' conclusions.[201]

If international arbitral tribunals can act as weighers of scientific facts, there are no objective reasons for preventing other international courts and tribunals—in particular the ICJ and, to a lesser extent, the International Tribunal for the Law of the Sea—from playing the same role and, in so doing, they may acknowledge the deficiency of their own "traditional methods of evaluating evidence."[202] One must commend the greater "scientific prudence,"[203] "vigilance"[204] and "caution"[205] of international courts and tribunals that cope with scientific fact-finding. The international adjudicator is facing a "time of [scientific] perplexity"[206] and "postmodern [factual] anxieties."[207] International courts and tribunals will have to address those anxieties by adopting a clear and predictable position *vis-à-vis* scientific facts. To put an end to the "long march" of scientific fact-finding, will international adjudicators have to choose between the roads of conservatism ("*one who does not go far enough*"), radicalism ("*one who goes too far*"), and reaction ("*one who won't go at all*")?[208] The answer requires—yet

201. *Id.* ¶ 101.

202. Pulp Mills Case Joint Dissent, *supra* note 33, ¶ 3.

203. Japan Appellate Body Report, *supra* note 158, ¶ 241.

204. Gabcikovo-Nagymaros Judgment, *supra* note 92, ¶ 140.

205. Southern Bluefin Tuna (N.Z. v. Japan, Austl. v. Japan), Case Nos. 2–3, Order of Aug. 27, 1999, ¶ 77, http://www.itlos.org/fileadmin/itlos/documents/cases/case_no_3_4/Order.27.08.99.E.pdf.

206. *See* INTERNATIONAL LAW AT A TIME OF PERPLEXITY: ESSAYS IN HONOUR OF SHABTAI ROSENNE x (Y. Dinstein ed., 1989); Thomas M. Franck, *Epistemology at a Time of Perplexity*, 13 EUR. J. INT'L L. 1025, 1025 (2002).

207. Martti Koskenniemi & Päivi Leino, *Fragmentation of International Law?: Postmodern Anxieties*, 15 LEIDEN J. INT'L L. 553, 553 (2005).

208. Inspired from a quote of President Woodrow Wilson: "By 'radical,' I understand one who goes too far; by 'conservative,' one who does not go far enough; by 'reactionary,' one who won't go at all." Woodrow Wilson, New York, New York (Jan. 29, 1911).

again—the weighing of facts. This time, however, the facts are not scientific; rather, they are judicial.