

How to Cite:

Esmaeili, M. A., & Seifi, S. J. (2022). From legal proof to scientific proof. *International Journal of Health Sciences*, 6(S1), 7909–7923. <https://doi.org/10.53730/ijhs.v6nS1.6681>

From legal proof to scientific proof

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Abstract---Legal proof and scientific proof have similarities and differences. Legal proof is a customary affair, while the nature of scientific proof separates it from general custom, and it is a burdensome and methodological affair. Philosophical issues of scientific proof, including induction and transcendence inherent in any description, can penetrate legal cases and turn into seemingly reasonable grounds for suspicions and abuses. Disregarding the nature of proving scientific laws and the difference between a legal claim and a scientific hypothesis can lead to failure in scientific proof. Disregarding the distinction between natural laws and specific observable events in international cases such as beef hormones and EC- biotech was one of the factors of failure in scientific proof and prolongation of proceedings. In order to have a better approach to scientific evidence, it is necessary not to confuse these concepts in court.

Keywords---Evidence, Scientific proof, Natural laws, Scientific theories, Induction.

Introduction

Legal knowledge and empirical science have different subjects, goals, and methods. Despite these differences, the interaction of these two areas of human consciousness is inevitable in various cases, including scientific claims. Both the law and empirical science deal with proof. Legal proof and scientific proof have similarities and differences. Lawyers' ignorance, especially judges, about the nature of scientific evidence may be problematic in scientific litigation. This study examines the gap between legal proof and scientific proof and seeks to answer these questions: What are the similarities and differences between legal proof and scientific proof?

Furthermore, what effect may the gap between legal proof and scientific proof have on scientific litigation in courts? It is hypothesized that the philosophical problems of scientific proof can penetrate legal claims and complicate the process of scientific proof. Lawyers' neglect of the nature of scientific evidence is a factor that leads to expecting more than the competence of the litigation process.

The similarities and differences between legal proof and scientific proof

In empirical science, scientific evidence is anything capable of confirming or falsifying a hypothesis.¹ Conclusions, accepting or rejecting hypotheses, or evaluating their relative validity are based on scientific evidence². In law, based on one definition, legal proof is the presentation of evidence in order to find out a matter of fact.³ According to Article 194 of the Iranian Law of Civil Procedure, "Evidence is something that litigants invoke to prove or defend a lawsuit." These legal definitions are quite simple and understandable to the public since the evidence presentation is a customary phenomenon. Seemingly, these definitions of evidence are similar to those offered by empirical science. However, terms like "hypothesis," "falsification," and "confirmation" are used in scientific definitions more than legal definitions.

According to the US Supreme Court, the function of a standard of proof is to guide the fact-finder concerning the degree of confidence that the American society thinks he should have in the correctness of factual conclusions for a particular type of adjudication.⁴ The US Supreme Court believes that public confidence is the criterion, which is a customary perspective. The customary perspective as opposed to the philosophical one. This does not mean that when the custom is accepted as the criterion, the process of proof becomes free from any philosophical challenges. Philosophical problems should be taken seriously, especially when it comes to scientific evidence. In law, it is a claim that should be proved, while in empirical science, what has to be proved is called a hypothesis. These two concepts are not the same and have fundamental differences.

Verification or confirmation

A claim does not need to have the characteristics of generality and necessity. The claim can be quite partial and case-specific. However, a hypothesis points to a necessary cause-and-effect relationship between two phenomena and is a kind of logical conjecture to test natural laws and scientific theories. Therefore, what has to be proved in law is often partial and case-specific, but in scientific matters, theories and natural laws are discussed, bringing about complexities, including the problem of induction. In deductive logic, results can be obtained from the premisses. The more valid the premisses, the more valid the results. The premisses and result are logically related, and if the premise is correct, the result cannot be incorrect. Nevertheless, the situation is fundamentally different for

1. Taper, M. and Lele S., *The nature of scientific evidence, Statistical, Philosophical, and Empirical*

2. Longino, H., "Evidence and Hypothesis: An Analysis of Evidential Relations." *Philosophy of Science*, vol. 46, no. 1, The University of Chicago Press, Philosophy of Science Association, 1979, P. 35

3 Jafari Langroodi, Mohammad Jafar, *Expanded in terminology of law*, 1st vol., 1st Edition, Tehran, Ganjedianesh publication.

4. Loevinger, L., "Standards of proof in science and law". *Jurimetrics*, 32(3), 1992, P. 333.

induction. In induction, general results are obtained from the specific details. These results can never be totally certain even if the premisses are completely correct and the induction process is well completed. All that can be said is that the conclusion of induction has a certain degree of probability.⁵

The legal, customary evidence also suffers from some philosophical flaws. Just as a witness may err in his observation, so in scientific matters, it is possible for scientists to err in their observations of a partial proposition. Carnap, The German philosopher, believes that even partial propositions obtained through observations can never be completely definite since observers may err in their observations. This uncertainty about general propositions, namely scientific laws and scientific theories, is much more intensified since, in addition to possible errors in observations and partial experiments, the problem of inductive uncertainty is also added. As the number of observations and experiments and their accuracy increases, that specific natural law could be claimed to have a relatively solid basis. Nevertheless, even the best laws of physics are based on limited observations, and it is always possible to find a counterinstance in the future and question a scientific law. By concluding that it is impossible to claim that scientific laws have been conclusively proven, Carnap contends that talking about verification is wrong so we should only talk about confirmation.⁶

To correct some beliefs about science, Carnap is not merely satisfied to redefine the concept of verification and to propose an uncertain definition of it, rather, he uses another word: confirmation. This is because, in the popular sense, the words “verification” and “certainty” are very closely related, and the mere use of the word “verification” can be misleading. According to a seventeenth-century conception of science, science is a system built upon facts. Science is formed based on what can be seen, heard, and touched. Personal beliefs, tastes, and speculative imaginings have no place in science; science is objective and its propositions have been proven objectively. Chalmers considers this image a superficial image of science and deems it indefensible.⁷ Some people, who are non-specialists, still believe in this misconception of science. Judges and lawyers may also suffer from this misconception explicitly or implicitly.

Falsifiability

A legal claim may be wrongly thought to be falsifiable like an empirical hypothesis. As mentioned previously, a claim in law could be partial and case-specific. This significantly reduces the testability, and consequently, the falsifiability trait of many legal claims. That is why the “oath” exists in law. An oath is no different from a claim from a purely empirical or philosophical perspective. In the knowledge of law, however, a swear is deemed a kind of proof (which is, something other than a claim).

5. Carnap, R., *An introduction to the philosophy of Science*, New York: Basic Books Inc., 1995, P. 20.

6. *Ibid.*, PP. 20-21

7. Chalmers, Alan Francis, *What is this thing called science?: An assessment of nature and status of science and its methods*, Translated by Saeid Zibakalam, 2nd Edition, 1982, Samt publication.

Given that the problem of induction in empirical science remains unsolved, Karl Popper introduces the concept of “**falsification**” instead of verification. Thus, the decline process from verification to confirmation, when it comes to Popper's view, reaches an opposite concept called “falsification.” Popper believes that the principle of induction is neither justified by logical rules nor by sensory experience. According to his view, widely accepted by the scientific community, any hypothesis could be falsified but could not be verified.⁸

To achieve falsifiability, a set of hypotheses, questions, and tests must be devised. Science begins with speculation. These conjectures must be systematically and accurately adjusted to determine the criteria for testing them experimentally. As long as a theory maintains its compliance with reality under severe experiments and is not replaced by another theory in the process of advancing science, one can claim that this theory has manifested its capability. In Popper's view, a theory is not preferred by the empirical justification of its propositions; rather, selected theories will be those that show their competency for survival in competition with other theories in a difficult process (like natural selection). Such a theory has not only successfully passed the most difficult experiments but has the potential to be testable in the most possible accurate and delicate way.⁹ To achieve this, a theorist must formulate his hypothesis in the most accurate way possible, without any slightest ambiguity. The less the ambiguity, the more testable the theory. It should be noted that complete falsification is impossible for the same reason that complete verification is infeasible.

Repeatability

Popper distinguishes between potential falsifiability and actual falsification. He argues that potential falsifiability is merely a criterion for the empirical description of a system of propositions. Regarding the actual falsification of propositions, he sets out rules that determine the circumstances in which a particular system of propositions is considered invalid. According to Popper, a theory is invalid only when the basic statement¹⁰ that contradicts it is accepted. This condition is necessary but insufficient since the accepted propositions must be repeatable. According to him, unrepeatable, single, and exceptional events have no importance in experimental science. Popper's emphasis on the repeatability of the falsifying proposition means that the proposition itself must be presented in the form of a competing hypothesis, and it should be repeatedly confirmed.¹¹

However, there is no need for what is proven, to be repeatable in a lawsuit. Some authors consider this to be fundamentally true for all fields of the humanity knowledge and believe that “no socio-political event happens more than once, and no socio-political experience can be repeated in the laboratory. [Emphasis added]

8. Loevinger, Op. cit., P. 327.

9. Popper, K., *The logic of scientific discovery*, London: Taylor & Francis e-Library, 2005, PP. 10, 91.

10. Basic statements are propositions which state that something observable has been happened in a certain time and place. All basic statements are partial, but not all partial propositions could be considered basic statements. The reason to call a statement as “basic” is that it is the basis for testing and falsifying scientific theories. For this reason, any partial proposition, in order to be a basic statement, must be testable and falsifiable.

11. Ibid., P. 66.

“¹² This difference between the experimental sciences and the humanity knowledge can be attributed to the determinism of nature and man's free will. Man's autonomy not only makes it impossible to repeat social and political events, but this is the same free will that provides man an opportunity for experimenting and repeating in experimental science. According to another author, what is proved in empirical science is inevitably predictive, while in contrast, the propositions proved in law are postdictive.¹³ Predictability is closely related to determinism, that's because man's free will, the subject of legal knowledge, does not necessarily have to be predictable.

Conviction and Judicial hunch

Evidence “in the general sense means to provide the means that satisfy the judge's conscience.”¹⁴ Of course, convincing the judge's conscience is not always central, but in cases such as confession and swear, the judge sometimes is required by law to regard a matter as real, regardless of his inner beliefs.¹⁵ In general, the system of legal evidence is against the system of moral evidence. In the system of moral evidence, the evidence that the plaintiff can cite is not enumerated in the law. No evidence has limited probative power, and the judge can freely accept or reject the evidence presented by the parties based on his conscience's reactions without any legal restrictions. In the system of legal evidence, the law imposes ways of satisfying conscience on the judge; in other words, the judge is obliged to accept only the evidence enumerated in the law, and the law determines the probative power of the evidence. In the system of legal evidence, the freedom of the judge to determine absolute truth is limited to the constraints prescribed by law, and he may be forced to convict a party while his conscience does not confirm this conviction¹⁶.

International law does not essentially address many issues related to the proofs of claim in the sources written by the International Court of Justice, and the Court has applied them in practice by appealing to the general principles and rules, such as the freedom of the court to assess the evidence.¹⁷ The legislative vacuum regarding issues related to evidence, especially the standard of proof, brings the Court's approach closer to the system of moral evidence. This creates an opportunity for using a higher level of intuitive decision-making or judicial hunch. Some authors opine that,

“Intuitive decision-making is the process of subconsciousness in which the decision-maker, in the light of inferred experiences, relying on his inner insight, does what he thinks is right, and he has no clear logic about the correctness of his decision ...This kind of decision making does not follow a specific method or rule. In short, some people can perceive facts outside the usual framework. They

12. Tabatabaei, Javad, A contemplation on Iran, 2nd Vol: The theory of rule of law in Iran, 2nd part: the foundations of the theory of constitutionalism, 3rd Edition, Tehran, MinaviKherad Publication.

13. Loevinger, Op. cit., P. 328.

14. Shams, Abdollah, Civil procedure, An advanced course, 3rd Vol, 29th Edition, Tehran, Derak publication.

15. Ibid, p.82.

16. Ibid, p. 84, 85

17. Sadat Meidani, Seyed Hossien, *Law of evidence in the case law of the international court of justice*, Doctoral thesis, University of Tehran.

are an instance of this famous proverb: What the young man sees in the mirror, the old man sees in raw clay.”¹⁸

This decision-making method is scientifically unjustifiable, but it is noteworthy that even empirical science is not immune to this flaw. Popper states that mental experiences and inner feelings of conviction, no matter their intensities, never justify propositions but can only be the subject of psychological research and distinction must be made between this category of affairs on the one hand and the objective, logical relations between the various systems of scientific propositions on the other.¹⁹ So even if any doubt seems silly for a person with a deep sense of certainty, this is not a slightest justification for empirical science to accept a proposition. Popper considers any belief other than this to be contrary to scientific objectivity.²⁰

There are also rules in the domestic laws that regulate the judge's knowledge and judicial insight to act according to a certain standard. According to Article 211 of the Islamic Criminal Code of Iran, “The judge's knowledge is the certainty obtained from the illustrative evidence presented for him. When the invocation of a verdict is the judge's knowledge, he is obliged to explicitly state the illustrative indications and context of his knowledge in the verdict.” According to the commentary of this article, “items such as expert's opinion, on-site inspection, local investigations, informed statements, officers' reports, and other evidence that is typically informative could be used as evidence for a judge's knowledge. In any case, mere inferential knowledge, which does not typically make the judge certain, cannot be the criterion for sentencing.”²¹ However, the judge's knowledge is more superior than other proofs. According to Article 212, “If the judge's knowledge conflicts with other legal evidence, if his knowledge remains illustrative, those other evidences are not valid for him, and the judge issues a verdict by mentioning the invocations of his knowledge and rejecting other evidences. If no knowledge is acquired for the judge, the legal evidence is valid, and a verdict will be issued based on them.”²² Such provisions in international law are necessary to provide a more objective basis for the judge's knowledge.

Fries's Trilemma and the Trans-Empirical Nature of Propositions

To properly understand the scientific proof, a misconception must first be discarded; for example, the belief that the propositions of science ultimately end in self-evident propositions and, therefore, have strong roots in those propositions. This belief is not true about science in the present era. Whether a new theory in the philosophy of science may solve this problem in the future is a distinct subject. According to the current philosophy of science, full adherence to logical proof is impossible because logical proof always leads to infinite regress, and resorting to self-evident propositions is impossible for avoiding this infinite regress. This is because the self-evident propositions are either empty of any

18. Bozorgmehr, Amir Abbas, Naseri Dolatabadi, Mahdi, *The status and validity of judicial hunch, Faslname tahghighat hoghooghi (legal research journal), Number 90.*

19. Popper, Op. cit., P. 22.

20. Ibid., P. 24.

21. *Iran criminal code, approved by 2013, Article 211*

22. Ibid, Article 212.

content (like the law of non-contradiction) or limited to a specific time and place (like direct sensory experiences). In other words, they are partial, not leading to general results, and they may be disputed at any other time or place.²³

First, the Fries's Trilemma should be discussed to explain this problem further. Fries was a German philosopher who came up with a three-way solution to the problem of the basis of observation:

1. Dogmatism
2. Infinite regress
3. Psychologism

Dogmatism refers to the acceptance of scientific propositions without reasons. According to Fries, avoiding dogmatism needs justifying scientific propositions. If logical reasoning is chosen to justify propositions, scientists will be faced with the view that “**propositions**” can only be justified by “**propositions**.” The justification of propositions will only lead to a sequence with other propositions since any **proposition** that is justifying must also be justifiable, and this process will be endless. Fries and most epistemologists who sought to justify the empirical basis of science chose a third way, psychologism, to escape dogmatism and infinite regress. Based on psychologism, propositions can be justified not only by other propositions but also by purely **observed phenomena** or **immediate objective experiences**. Humans have a direct immediate knowledge about their sensory experience. This direct cognition is the basis of **indirect** cognition of humans, which is expressed in the form of **propositions** and includes words and sentences of the language. In short, propositions express sensory experiences.

Popper does not accept the above view. He believes that the problems with induction and acceptance of universal propositions also invalidate the above theory since all scientific propositions go beyond immediate experience and all descriptions exceed observable boundaries. Linguistic propositions are not confined within the realm of observations **inherently**, which Popper calls the **transcendence inherent in any description**. Each description contains names, symbols, or universal ideas. Each proposition has the characteristics of a theory or hypothesis. The simplest proposition, such as “Here is a glass of water,” can not be proved merely by observational experience since the immediate experience occurs only once and is unique and partial.

In contrast, the words in the above proposition, such as “glass” and “water,” are **universals** that have the characteristic of law-like behavior.²⁴ By law-like behavior, Popper refers to general definitions and descriptions given to glass and water; for example, the description of the transparency in water implies that “The light always passes through this liquid.” This sentence is a simple natural law with the theory and hypothesis characteristics. To put it simply, to understand Popper's critique, one must note that the nature of “**proposition**” and “**experience**” are fundamentally different. Propositions depend on concepts, while concepts are formed based on information, thoughts, and **previous findings**. It is

²³. Zibakalam, Saeid, *Ration, reason and rationality*, 1st Edition, Tehran, Esm publication, p. 137.

²⁴. Popper, Op. cit., PP. 75-76.

believed that the text as a representation creates a gap between words and the events.²⁵

Chalmers, another theorist of the philosophy of science, also illustrates the trans-empirical nature of propositions with a simple, conventional example to debunk the belief that science begins with sensory observation. The simple sentence, "Beware, the wind blows on the stroller on the edge of the precipice," contains simple theories: a wind exists, and it can move objects such as strollers; the baby-carrying stroller may fall off the precipice and shatter on the boulders below, and the baby will be severely injured if the stroller falls. The phrase "gas does not light up" also implies that elements in the world can be classified as "gas." "Gas" is a concept that did not always exist, and before the 18th century, all kinds of gases were considered pure air samples. These are quite common propositions, which questioning their foundation might not seem rational from a customary perspective.

Nevertheless, the propositions that typically exist in science are based on more unusual theoretical presuppositions that can be challenged. In short, Chalmers argues that theories precede observations, not the other way around and that a theory-kind language must construct observational propositions.²⁶ There is a similar analysis in comparative law. According to Legrand, knowing another legal culture is not a **raw observation** but a kind of **construction and invention** due to crossing the researcher's cognitive network.²⁷

It is a modified belief that no proposition can be 100% empirical and objective and that every proposition is general and subjective to some extent. Positivists are at one end of this spectrum and limit the meaning to **objective experience**. They interpreted meaning very narrowly, and issues outside the sensory experience realm were fundamentally meaningless in their view.²⁸ At the other end of the spectrum are philosophers like Humboldt, who believe that meanings never exists "outside the mind" as an objective reality, but the meanings are **merely in the man's mind** and within his speech.²⁹

In any case, the third way, psychologism, is rejected by philosophers such as Popper and Chalmers. So, only dogmatism and infinite regress remain. To avoid getting caught up in these two ways, Popper chooses a method which can be called an agreement-based approach. In short, there is logically no rule that requires scientists to stop experiments at a certain stage or certain basic statement; this is a process with no natural end. The only proper way, according to Popper, is for scientists to **agree** on the acceptance of basic statements. If this agreement is not reached, the experiments will continue until scientists agree. If experiments never lead to an agreement, scientific exploration will become null

²⁵. Legrand, Pierre, *Comparative law*, Translated by Alireza MohammadZade Vadeghani, 2nd Edition, Tehran, Mizan publication, pp. 78, 79.

²⁶. Chalmers, Ibid, pp. 42-43.

²⁷. Legran, Ibid, p. 81.

²⁸. Popper, Op. cit., PP

²⁹. Sherratt, Yvonne, *Continental philosophy of social science*, translated by Hadi Jalili, 7th Edition, Tehran, Ney publication, p. 98.

and void, the foundation of science will collapse, and nothing but ruin will remain.³⁰

Discovering Reality, a Sacred but Bound Goal

John Finnis, a natural law theorist, points to knowledge among the seven fundamental and universal goods, which is desirable not for being a **means** to achieve an end.³¹ In other words, he thinks that knowledge, for example, is not merely a means to increase wealth, power, or technological advancement, but it is an independent value in-itself. Man's endeavors to advance science and its reform are in line with the realization of this natural right. However, along with these natural rights, he also has God-given dignity, which must be respected.

The rules that determine how to reach the truth in the knowledge of law are not only for discovering the truth, reducing error, or increasing the objectivity of proof since other moral and social considerations are included in the criterion of proof. For example, if the consequence of a court's decision is severe for the defendant, it may be more stringent to prove it.³² It is even possible that the legislator's inner intention is exactly against the objectivity and discovering the truth; in fact, he may try to hide the incident in order to preserve the dignity of several individuals (e.g., in sexual crimes, the number of witnesses should be more and if some strict conditions are not met, false accusation of unlawful intercourse should be punished).³³ However, empirical science is often free from such ethical considerations, and even if scientists adhere to certain legal or moral constraints to prove a fact, these constraints are **outside empirical science** and exist in the realm of law or ethics. Some believe that ethics should limit empirical science because awareness is valuable, but not to the extent that moral values are violated, and the protection of fundamental human rights is more superior than scientific freedom.³⁴ Given this opinion that points to a hierarchy among rules, International courts should not accept scientific evidence that has been obtained through the violation of fundamental human rights, especially rules such as the prohibition of torture, which are considered as peremptory rules in international law.

Psychological evidence is a kind of scientific evidence. Article 1 of the Convention against Torture refers to mental suffering in addition to physical pain.³⁵ In some scientific experiments there is a risk of psychological damage. For example, several humans were tested in an experiment about obedience to authority. The experiment was designed in a way that could involve deceiving its subjects, and they were in danger of psychological harm.³⁶ Proving these psychological damages is more difficult than physical damages.

The necessity to reject evidence obtained by violating international law is based on the argument that no one can benefit from his illegal action. This rule has been entered into the international law from some domestic legal systems (e.g. the

³⁰ . Popper, Op. cit., P. 86.

³¹ . Finnis, J., *Natural Law and Natural Rights*, 2nd Edition, Clarendon Law Series, Oxford university press, 2011, P. 87.

³² . Loevinger, Op. cit., PP. 330, 335.

³³ . *Iran criminal code, approved by 2013, Articles 199, 200.*

³⁴ . Singer, P. "Ethics and the Limits of Scientific Freedom" *The Monist*, 79(2), 1996, P. 219.

³⁵ . See Convention against Torture and Other Cruel, Inhuman or Degrading Treatment or Punishment, 1987, Retrieved June 30, 2021, from <<https://www.ohchr.org/en/professionalinterest/pages/cat.aspx>>, Art. 1.

³⁶ . Singer, Op. cit., P. 220.

United States), but there is little practice in this area, and cases are limited.³⁷ It is easier to accept this argument if it is accepted that there is a hierarchy among rules in international law, but if the hierarchy among the rules of international law is rejected, it becomes difficult to accept the above rule. In any case, the above rule must meet the criteria of a customary rule.

Challenges of Scientific Proof in Litigation

The role of the philosophical challenges of scientific proof in litigation can be potential or actual. Some challenges may become apparent in future lawsuits without a history of litigation. The penetration of these philosophical challenges may also be hidden or overt.

Article 64 of the rules of court International Court of Justice, a manifestation of the gap between legal proof and scientific proof

In Article 64 of the rules of court of International Court of Justice, a witness and an expert must utter the same declarations before making their statement, except one more sentence for the expert. Both the witness and expert must utter these words, "I solemnly declare upon my honour and conscience that I will speak the truth, the whole truth and nothing but the truth." The expert should state an additional sentence: "and that my statement will be in accordance with my sincere belief".³⁸ In other words, the expert has to say something he really believes in. This difference stems from the fact that the opinion of an expert, like a witness, is not a purely objective description. Of course, the statements of the witness can not be a purely objective description due to the trans-empirical nature of propositions. However, what distinguishes an expert's opinion from that of a witness is that the expert is equipped with theories and assumptions that the general public are unaware of, while the trans-empirical assumptions of the witness's statements are **essentially** customary assumptions. Article 64 of the regulations can be considered as a manifestation of the gap between legal proof and scientific proof.

Given this article and previous statements about the agreement-based nature of basic statements, it is possible for a scientist in court to maliciously deny the basic statements that he has always believed in under normal circumstances in his scientific research. In this case, referring to former works and writings of the scientist may be helpful. A scientist who has never questioned a basic statement in his books and articles, and has repeatedly argued based on it, speaks against his sincere belief if he takes the path of skepticism in the court and questions the same proposition.

Another point is that what matters is the true opinion of the expert – his perception of reality – which may differ from one expert to another. Article 64 implies that an expert's opinion is not completely objective but subjective to some extent. It should be noted that for various reasons other than malice, a scientist may not express his true opinion. For example, if a scientist has reached a deep

³⁷ . Sadat Meidani, Doctoral thesis, Ibid. pp. 123-124

³⁸ . ICJ, Rules of court (1978), Retrieved July 1, 2021 from <<https://www.icj-cij.org/en/rules>>, Art. 64.

inner sense of certainty about something but cannot explain his intuitive understanding for logical reasons, he may suffice to reason in the customary way.

Philosophical Challenges as an Opportunity for Fabrication of Obscurity

In legal cases before international courts, the inadequacy of scientific evidence is a recurring theme and one of the most serious challenges. Some authors and even judges of the International Court of Justice criticize issues like the lack of uniformity of the Court's approach to scientific evidence and the absence of technical rules of the procedure for judging scientific matters.³⁹ It should be noted that the root of many of these obscurities, especially the boundary between sufficient and insufficient evidence, is not related to law but related to the philosophy of science. The epistemological problems of the philosophy of science - some described in the preceding speech - can become fertile ground in litigation for fabrication of obscurity, excuse, and abuse by litigants. If judges are unaware of these issues, they may be misled by both parties' experts.

Fabrication of obscurity means that the judge, arbitrator, or expert of the other party, attributes his own subjective obscurities to the offered evidence, resists understanding the other party's scientific reasoning, or pretend that he does not understand the offered scientific evidence. This kind of excuse-making easily works in situations where the litigant is unaware of these philosophical challenges. If informed, the problem becomes more acute since this excuse-making is no longer epistemologically illusory but based on sound logical arguments. The problem with this excuse-making is not that it is incorrect, but that these problems are always present in scientific matters, and if the judges decide to attend them, no scientific evidence can be invoked.

The trans-empirical nature of the propositions and the infinite regress discussed by Popper could be a significant opportunity for abusing, especially in environmental claims. Outside the realm of litigation, scientists are more inclined to agree on basic statements since the main goal is the advancement of science, and scientists are not willing to obstruct the development of science. In a lawsuit, however, Popper's consensus approach may be completely ineffective because the experts appointed by the parties each seek to defend their national interests. Making obstructions in a lawsuit is perfectly desirable for a denying litigant and an environmental pollutant.

Scientists can resolve their scientific disputes by accessible methods, however, in a litigation non-specialist elements, such as lawyers and judges, are involved. A judge, who is added to the scientific discussion as a non-expert element, is not a subsidiary element but a central figure since his opinion determines the result. The tendency of the claim-denier to excuse-making, along with the lack of expertise of the judge, tempts the parties to increase the quantity of their evidence in an unreasonable way instead of providing real, concise, and useful scientific argument.

³⁹ . Mbengue, M. "Scientific Fact-finding at the International Court of Justice: An Appraisal in the Aftermath of the Whaling Case", *Leiden Journal of International Law*, vol. 29, no. 2, 2016, PP. 530, 535.

If the judge lacks proper criteria, he may wish to overestimate the quantity of evidence because the judge cannot assess the evidence's quality in the absence of a standard. If a judge approaches in such a way, the behavior of the litigants will also change. It is conceivable that the litigants would increase the volume of their evidence to give a more justified appearance to their claims. Thus, a strange competition may begin between the litigants to increase the quantity of scientific evidence unreasonably. This situation is similar to a student who increases the volume of his answer to get a higher grade instead of writing a brief and useful explanation. A professor may psychologically tend to give more value to a seemingly detailed answer instead of evaluating its quality.

The unreasonable increase of the evidence quantity may have a negative effect. In the case EC-Biotech, for example, according to an analysis by an author, the European countries increased the amount of scientific information provided to the panel to justify their sanitary measures too much in a way that their false, weak claims overshadowed their true, strong reasons. Fading of convincing arguments due to other false claims has been likened by these writers to the story of the boy who cried wolf and is considered as a cause of the failure of European community.⁴⁰ One of the reasons for the unprecedented length of the trial process in this lawsuit is the misconception that increasing the quantitative amount of claims, evidence, and documents will increase the probability of victory.

Finally, it should be noted that the tendency to increase the quantity of evidence has roots in the problem of induction. The greater the quantity of evidence, the stronger the probability of the correct results, but total certainty can never be reached. That is why the tendency to increase the quantity of evidence has no reasonable end limit, but its end limit is a customary matter. In the Korea-Radionuclides case in the World Trade Organization, South Korea was demanding to increase the sampling process in an unusual way to ensure that fishes were not contaminated with radioactive material. This demand was so extreme that one expert replied that there would be no fish left to eat if they were to test all the fish.⁴¹

Neglecting the Distinction between scientific laws and specific data

In the World Trade Organization panels, regarding the two cases of EC-Hormones and EC-Biotech, the main subject of scientific proof is a cause-and-effect relationship between two phenomena. These relationships are expressed in general propositions and are a **scientific laws**. Claims such as using meats grown with certain hormones cause cancer or using biotech products upset the balance in the environment are not mere propositions that refer merely to a specific event in a certain time and space. They contain the traits of law and prediction. In the case of Korea-Radionuclides, on the other hand, Japan's claim **does not contain a scientific law**. In this case, there is **no** dispute between Japan and Korea about whether the radioactive material is hazardous to human health and the environment. Both countries agree on a scientific law, which is not

⁴⁰ . Eliason, A. "Science Versus Law in WTO Jurisprudence: The (Mis)Interpretation of the Scientific Process and the (In)Sufficiency of Scientific Evidence in EC-Biotech", *New York University Journal of International Law and Policy*, 2009, P. 389.

⁴¹ . Korea — Import Bans, and Testing and Certification Requirements for Radionuclides (Korea — Radionuclides)- Report of the panel (22 February 2018) WT/DS495/R, Paras. 7.203- 7.204.

a point of dispute. It is clear to both parties and the scientific community that radioactive substances are harmful to health.

On the one hand, the fundamental difference between the case of Korea-Radionuclides and the two cases of EC-Hormones and EC-Biotech products is due to the distinction between a scientific law and scientific fact. Scientific facts are simple specific observations. In this case, there is no significant difference between a scientific fact and what jurists consider to be a fact. The problem arises when scientific law is regarded as fact in the realm of law, and this statement is even legally correct, but this view hides the difference between a scientific law and scientific fact. Just as in law, there is a distinction between law and fact; fact and law are distinct in empirical science. In jurisprudence, what is called law is a norm, while in empirical science, a law is not a norm to regulate the individuals' or governments' behaviors. Law in empirical science does not create rights or obligations for anyone. This is why scientific law is considered a fact from a legal point of view. It is very important to attend to this distinction because a lawyer may forget what he calls a fact to prove a claim scientifically is not a fact but a law in an expert's view.

The practical benefit of noting the above difference is that proving a law of empirical science is fundamentally different from proving a specific event in a certain time and space. Proving a scientific law is a very heavy and methodological matter, and basically, it should be said that the court is not a place to prove a **scientific law**. If a government has a scientific claim in a lawsuit, the law on which that scientific claim is based must have **already** been proven by the relevant scientific community. In other words, it is not right for a state to prove a scientific law to a judge **in a court**. Proving a scientific law in a court for a judge is an unbearable task. Lawyers often understand facts as specific matters that occur in a given time and space. If a lawyer has this mindset and seeks to prove a scientific law in a place like the court, he will fail almost without any doubt. In this regard, it can be analyzed why in the cases EC-Hormones and EC-Biotech products, the European Community failed to prove its scientific claim, why the time taken to deal with the case EC-Biotech products was unusually long, and how Japan managed to prove its claim scientifically in the case of Korea - Radionuclides in the primary proceeding.

Conclusion

The discovery of a natural law in science is associated with practical difficulties. This is because a scientific hypothesis brings up a natural law which must be falsifiable, repeatable and predictive with cause-and-effect relation. An important part of the difficulties associated with scientific proof arises from fundamental issues such as the problem of induction and the trans-empirical nature of propositions. These issues in the philosophy of science create a gap between legal proof and scientific proof. Neglecting the philosophical issues of scientific proof may lead judges to expect more from the experts than their ability. If the claim-denying party is aware of these philosophical issues, an opportunity for misuse may be created, and presenting scientific proof may become impossible for the claimant. Judges must be familiar with these issues in order to prevent abuse. They especially should know that the definite, completely empirical proof of a

scientific law means imposing something that is not fundamentally within the potential of science. It should also be emphasized that the trial process is not a suitable position to prove a theory not already proven in scientific community. Attending to the distinction between a scientific hypothesis and a legal claim is also necessary. Proving a **scientific hypothesis**, opposed to proving a **legal claim**, is a **heavy and methodological** matter, and the overlap of these two concepts should not lead to consider them identical or even similar phenomena. The confusion of these concepts is the harm of scientific proof that should be avoided in court.

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