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INVISIBLE BORDERS: MAPPING OUT VIRTUAL LAW?

Kathleen Claussen*

I. OVERVIEW

In his preface to a 1945 treatise on international borders, S. Whittemore Boggs opened with this historical overview:

Boundaries and boundary problems have undergone great changes. When Marco Polo crossed frontiers from one jurisdiction to another there were no precise boundaries like those of our time. Even a century and a half ago the international boundary picture bore little resemblance to that of today. In Asia there were few treaty or other definite lines, but only fluctuating limits of various kingdoms. . . . European boundary concepts have proliferated until they now extend to nearly all international boundaries in all continents.¹

Since Boggs penned those words over sixty years ago, more than ninety states have made their (re-)introduction to the global landscape.² United Nations membership has expanded in forty-two of the last sixty-three years as state borders have been drawn and reconfigured.³ Independence movements, changes in natural landscapes, and shifting populations as a result of war, famine and disease are among the many causes for border (re-)drawing.

Much is at stake in these cartographic revisions, as made evident by the proliferation of border dispute resolution commissions and the many cases related to territorial sovereignty initiated in the International Court of Justice. For this reason among others, border disputes are some of the most hotly contested controversies to arise in international arbitration.⁴ Yet, the 1945 treatise is the most recent comprehensive examination of international law on delimitation and demarcation processes.⁵

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1. S. Whittemore Boggs, *Foreword* to STEPHEN BARR JONES, *BOUNDARY-MAKING: A HANDBOOK FOR STATESMEN, TREATY EDITORS AND BOUNDARY COMMISSIONERS*, at vi (1945).

2. United Nations Member States, <http://www.un.org/members/growth.shtml> (last visited Nov. 23, 2008).

3. *See id.*

4. SURYA PRAKASH SHARMA, *INTERNATIONAL BOUNDARY DISPUTES AND INTERNATIONAL LAW* 13 (1976).

5. *Id.*

Despite the evolution of the law in other areas of science,⁶ the technology of border drawing has advanced significantly while the legal guidelines have not changed. In the absence of any impetus from states or international organizations, the legal norms for demarcation remain the same as those that were used at the time of the Roman Empire.⁷ This Essay aims to draw attention to this discrepancy between science and the law on international boundaries and proposes the development of an institutional mechanism that would harness the potential of the recent advances in border technology and assist in ameliorating ongoing boundary-related controversies.

The Essay begins with an overview of the intersection between law and the scientific enterprise. It suggests boundary-marking as a test case for the self-updating prerogative of the law by shedding light on the antiquated and inefficient methodology currently employed by states in demarcating borders. Part II provides a brief overview of the science of demarcation. It addresses the history of demarcation, changes in the methodology, and the terminology used by boundary engineers—geographers, surveyors and cartographers. The third Part takes up changes in the law through the perspective of boundary architects—diplomats and state leaders. It reviews the international law on demarcation by focusing on three boundary commissions and their reasoning in adopting a particular approach to boundary-marking.

I conclude by proposing the creation of a central depository for border information that would serve as the authoritative source of boundary demarcation data. Although some states keep their own records of boundary demarcation data for other states, many of these records contain conflicting information and perpetuate the problematic discrepancies in determining border locations. A central depository within the United Nations that uses the latest technology to effectuate precise and accurate boundaries would help to put an end to measurement error and incongruities in the location of contentious borders.

Note that this Essay is directed at *boundary-marking*, rather than *boundary-making*, but, at the same time, it argues that by drawing upon the most updated technology in the field, these two processes will become inseparably integrated; in other words, through marking the boundary using the most modern technology, delimitation and demarcation will finally produce single, coherent outcomes.

II. LAW AND TECHNOLOGY – AT THE MACRO LEVEL

Domestic legal processes are constantly adjusted with respect to the latest technologies. The development of the “electronic courtroom,” for example, has facilitated the use of video conferencing for special hearings over the last ten to twenty years.⁸ Everyday tools in legal processes, such as the use of word-

6. See, e.g., KEITH E. MASKUS, *INTELLECTUAL PROPERTY, GROWTH AND TRADE* (2008) (describing how intellectual property rights affect the provision of public goods and influence prospects for economic development); DAN JERKER B. SVANTESSON, *PRIVATE INTERNATIONAL LAW AND THE INTERNET* (2007) (discussing characteristics of internet communications relevant to legal processes).

7. A.O. CUKWURAH, *SETTLEMENT OF BOUNDARY DISPUTES IN INTERNATIONAL LAW* 11 (1967).

8. See, e.g., Fredric Lederer, *The Road To the Virtual Courtroom? A Consideration of Today's –*

processing in the taking of depositions, are in fact relatively recent additions to the way in which law is practiced. Likewise, science is continually incorporated into the substance of the law. In both domestic and international realms, the law is constantly bringing itself up-to-date. The propagation of international agreements such as the Cartagena Protocol on Biosafety,⁹ the Stockholm Convention on Persistent Organic Pollutants,¹⁰ and the U.N. Convention on the Use of Electronic Communications in International Contracts¹¹ confirms this anecdotal trend.

Although many of these international conventions aim to restrict the use of technological innovations for malevolent purposes, scientific advances in other areas may ease and empower states and individual actors. The advent of communications technology in the nineteenth century, for instance, vastly changed the framework of admiralty law by giving individuals means to settle disputes through deliberate, immediate and regulated dialogue, rather than resort to complex state negotiations or violent retribution.¹² Looking beyond the restrictive legal mechanisms according to which technology is regulated, lawmakers should be equally interested in exploiting the potential of technological advances in order to realize desired social outcomes.¹³

At first glance, overlaying the scientific agenda on the legal agenda may reveal disparate, though not mutually exclusive, goals. Insofar as both aim to enhance the quality of life for their constituencies, the scientific and legal agenda should be integrated. Some scholars have painted the relationship between law and science as conflictual or problematic, suggesting that technology has the power to destroy international law or that international law and technology will “collide”¹⁴; however, other areas of the law as noted above and below suggest that this antagonistic relationship is not pre-determined. The Law of the Sea Convention, for example, undertakes to govern states’ use of and access to “marine genetic resources” realized by advances in technology.¹⁵ As a result of these developments, the definition of “resource” was expanded; the law was shaped by ingenuity and need.

And Tomorrow's – High Technology Courtrooms, 50 S.C. L. REV. 799, 801-802 (1999).

9. Cartagena Protocol on Biosafety to the Convention on Biological Diversity, Jan. 29, 2000, 39 I.L.M. 1027.

10. Stockholm Convention on Persistent Organic Pollutants, May 22, 2001, U.N. Doc. UNEP/POPS/CONF/2, 40 I.L.M. 532.

11. United Nations Convention on the Use of Electronic Communications in International Contracts, G.A. Res. 60/21, U.N. GAOR, 60th Sess., Supp. No. 17, U.N. Doc. A/RES/60/21 (Nov. 23, 2005).

12. Joseph W. Dellapenna, *Law in a Shrinking World: The Interaction of Science and Technology with International Law*, 88 KY. L.J. 809, 817-19 (2002).

13. See W. Michael Reisman, *The View from the New Haven School*, 86 AM. SOC'Y INT'L L. PROC. 118, 121-22 (1992).

14. Colin B. Picker, *A View from 40,000 Feet: International Law and the Invisible Hand of Technology*, 23 CARDOZO L. REV. 149, 151 (2001).

15. Press Release, Countries to Address Marine Genetic Resources, at United Nations 25-29 June, U.N. Doc. SEA/1889 (June 21, 2007).

Similarly, in boundary-marking, technology and necessity have produced an alternative methodology and, therein, a new modality for international law in this area, though it has not been widely embraced. One explanation for states' reluctance to pursue changes to the status quo is that the science of boundary-marking is intimately interwoven with concerns about sovereignty.¹⁶ The intersection of diplomacy and earth science is inevitably implicated in delimitation and demarcation. Thus, there is not only a delay but also a general reluctance to draw from the inventive solutions geographical positioning and imaging systems might offer.¹⁷ Only a few boundary dispute commissions have employed readily available technologies for the purpose of demarcating the border.¹⁸ The next Part explains demarcation, delimitation and their historiographies in more detail.

III. THE SCIENCE OF DEMARCATION

*"The best boundary is one which would promote both minimum world public order, understood as a prohibition of unlawful coercion across adjacent boundary lines, and optimum order, in the sense of the promotion of the greatest cooperation in common interest on both sides of international boundaries."*¹⁹

A. Definition

Border determination involves a multi-step process: allocation of territory, delimitation, demarcation, and ongoing administration.²⁰ Allocation, as the name suggests, refers to the initial political division of territory.²¹ To allocate the territory means to use diplomatic channels to reach an agreement regarding which general area belongs to each state.²² Delimitation refers to the selection of the boundary site and its written *definition* in words or measures in a treaty or other formal document.²³ In contrast, demarcation refers to the *construction* of the boundary on the ground, originally conceived as the erection of monuments along the line defined in the delimitation process.²⁴ The final step, administration, is a continuing project of managing the border; administration here does not necessarily refer to the management of goods and people that cross the border, but rather it refers to the physical maintenance of the boundary itself as demarcated.²⁵

16. See generally Steven R. Ratner, *Land Feuds and Their Solutions: Finding International Law Beyond the Tribunal Chamber*, 100 AM. J. INT'L L. 808 (2006).

17. Ron Adler, Presentation at the Forum of International Geography: Surveyors Role in Delineation and Demarcation of International Land Boundaries 5 (Apr. 19, 2002) (on file with the author), available at http://www.fig.net/pub/fig_2002/Js20/JS20_adler.pdf.

18. See *id.* at 4-5.

19. JONES, *supra* note 1, at 37.

20. K.T. Chao, *Legal Nature of International Boundaries*, 5 CHINESE TAIWAN Y.B. INT'L L. & AFF. 29 (1985).

21. *Id.* at 30.

22. See generally *id.*

23. CUKWURAH, *supra* note 7, at 27.

24. *Id.* at 28.

25. *Id.* at 83; see also Chao, *supra* note 20, at 30.

The terms “delimitation” and “demarcation” became terms-of-art upon their use by Sir Henry McMahon in an 1897 lecture.²⁶ Although delimitation was designed to be the final political act of the states party engaged in border negotiations and demarcation was its realization by way of monumentation, the Jones treatise outlines the traditional methods of delimitation, all but the first of which indicate that political decisions will be required in later steps.²⁷ The first method is “complete definition” in which surveying is completed to the highest level of precision possible.²⁸ Second, and much more common, is “complete definition with the power to deviate” which allows flexibility for natural boundaries not accounted for at the negotiating table as well as for accommodating personal properties along the boundary.²⁹ Third is boundary definition based on major turning points along an estimated route.³⁰ Each of the final four methods becomes less precise; the last and most vague delimitation specification is delimitation based on natural features.³¹

Thus, demarcation—the translation of the delimitation agreement onto the landscape—is also a political act that requires real-time decision-making premised on law. In the past, greater precision was inevitably given at this stage to the definition carried out at the delimitation stage when it was otherwise unavailable.³² But the search for codified and concrete guidance on the *law* governing demarcation is somewhat futile. One might look to the many commission and tribunal decisions overseeing boundary disputes; however, these do not constitute a comprehensive and coherent legal doctrine. Nonetheless, it is instructive to look to history in order to identify state practice, outlined in the following section with greater detail.

B. Derivation

The most common method of marking an international border, introduced by the Roman Empire and still used today, is by means of erecting monuments from concrete or another durable material available in the region.³³ States formally mark their borders with actual monuments built along the delimited line.³⁴ The

26. Dennis Rushworth, *Mapping In Support of Frontier Arbitration: Delimitation and Demarcation*, IBRU BOUNDARY AND SECURITY BULLETIN, Spring 1997, at 61.

27. JONES, *supra* note 1, at 58.

28. *Id.*

29. *Id.*

30. *Id.*

31. *Id.*

32. See, e.g., Gbenga Oduntan, *The Demarcation of Straddling Villages in Accordance with the International Court of Justice Jurisprudence: The Cameroon-Nigeria Experience*, 5 CHINESE J. INT'L L. 79 (2006).

33. “It is to be doubted if, today, there is much difference of opinion on this subject, as the monumentation of boundaries is an established practice in all but the wildest lands.” JONES, *supra* note 1, at 210; see also Dr. Alec McEwen, Presentation at a Training Workshop on The Demarcation and Maintenance of International Boundaries at the University of Durham: The Demarcation and Maintenance of International Boundaries (July 8-10, 2002).

34. There are a few exceptions. Some treaties used maritime delimitations to allocate land territories. See, e.g., Lucius Caflisch, *A Typology of Borders* 7 (2006) (unpublished manuscript, on file with the author) (noting how the Treaty of Tordesillas of 1494, which marked out the territory

composition of the monuments varies from place to place depending on the materials available for their construction.³⁵ For example, Canada and the United States use more than twenty-one types of monuments, including iron, granite, aluminum, concrete, stainless steel, and bronze markers.³⁶ They also allow for "special types" of markers such as lake buoys as necessary.³⁷

The monumentation method has always posed some difficulties and is necessarily incomplete. Throughout history, in areas where the physical construction of monuments was not possible, straight lines or physical features, which change over time, were used as reference points.³⁸ The 1884 Berlin Conference that divided Africa into spheres of control relied on astronomically based straight lines, though technological advances since the time of the Conference have rendered these measurements obsolete.³⁹ Such a physical manifestation on the ground might have made sense when no other means were available and when passage by foot or animal-back was the norm. The monuments were thought to serve an important function in helping states avoid future disagreement.⁴⁰ Still today, the monuments are intended to serve a practical purpose of defining the boundary for inhabitants and travelers on both sides.⁴¹

Despite their seeming durability and permanency, monuments do not always reflect the exact intention of the parties. Their deviation from the stated terms of an agreement arises at three levels: first, at the stage of surveyance as the boundary engineers attempt to implement the delimitation decision; second, in the time that follows their emplacement; and third, in the years that follow as technology furnishes additional data to boundary-makers.

First, in his 1945 treatise, Jones outlines the legally sanctioned means by which demarcation by surveyance may take place.⁴² He locates the earliest and only general instructions to demarcation commissions in the Paris Treaties of 1783.⁴³ The Treaties specify that the demarcation commission will be responsible for representing the specific definition of the boundary based on the direction provided in the delimitation documents.⁴⁴ They provide, in vague terms, the methods available to the commission to account for necessary on-the-ground modifications: adjustment with natural points of reference, geographic coordinates, rectangular coordinates, comparison with neighboring markers, marking on a map, and photographs "taken in known directions."⁴⁵ Thus, surveyors are sometimes

belonging to the Spanish and the Portuguese, relied on a longitudinal line running through water).

35. McEwen, *supra* note 33, at 6.

36. *Id.* at 5-6.

37. *Id.* at 6.

38. Pierre Englebert, Stacy Tarango & Matthew Carter, *Dismemberment and Suffocation: A Contribution to the Debate on African Boundaries*, 35 COMP. POL. STUD. 1093, 1096 (2002).

39. *Id.*

40. *See id.*

41. McEwen, *supra* note 33, at 5.

42. *See JONES, supra* note 1, at Part III.

43. *Id.* at app. 1.

44. *Id.*

45. *Id.*

forced to make decisions and place monuments off the intended course due to limits on their measurements or natural features. In so doing, they often have the liberty to adjust the borders agreed to the delimitation decision—they create their own boundary absent official authorization.

Second, despite their intended resilience, border monuments frequently fall victim to vandalism, theft, or natural disruption of some sort, causing the border states to have to repair and rebuild them as often as every five years.⁴⁶ Animals have uprooted pillars and caused their disintegration by trampling on them. Property owners along the border have been known to secretly shift boundary marks. Natural forces like rainfall and water flow in lakes and rivers have caused markers to crumble. In certain environments, border markers have fallen victim to unintending hunters who spray them with bullets. With these problems in mind, surveyors have sought other means by which to demarcate or to replace the marker without delay. For example, placing a “subsidiary mark,” such as a metal bar in concrete buried below the original marker, from which an expert can restore the monument should the need arise has become common practice.⁴⁷

Third, as noted above with respect to the Berlin Conference, measurements based on antiquated surveying techniques quickly become outdated.⁴⁸ Extensive exploration in colonial territories coincided with the advent of aerial photography, allowing colonizers to create more precise boundaries by learning more about the terrain before placing monuments.⁴⁹ Since that time, however, additional developments in technology have made it possible to calculate distances and specify locations with significantly higher degrees of precision using global navigation satellite systems. These developments will be detailed in the following Section.

In light of these concerns regarding the unauthorized, impermanent, and imprecise emplacement of markers, Alex McEwen concedes that “[a]n argument could be made for greater standardization of monumentation,” though he suggests doing so “by reducing the variety of types and materials used for demarcation.”⁵⁰ While this solution may help reduce the need for boundary maintenance, it fails to eliminate the potential for conflict and the discrepancies noted above. Current practice in delimitation agreements is to not specify a plan for the maintenance of a boundary.⁵¹ Because neither side takes ownership of this important task, many monuments disappear or become obscured.⁵²

46. McEwen, *supra* note 33, at 5.

47. *Id.*

48. Englebert, et al., *supra* note 38, at 1096.

49. *Id.*

50. McEwen, *supra* note 33, at 6.

51. *Id.* at 7.

52. *Id.*

C. Denotation

As a result of the challenges outlined in the preceding Section, there are neither any official nor truly authoritative lengths for international boundaries.⁵³ Today, most states keep demarcation reports that describe their boundaries as they believe them to exist.⁵⁴ The reports consist of photos of monuments that have been erected to mark out the border as well as their corresponding latitudinal and longitudinal coordinates calculated with reference to whichever datum, or reference point, is selected by the state.⁵⁵ These calculations of the monument locations pose still more challenges for universal harmonization of boundary information.

Some states use a national datum, though many apply the WGS84 which is the model used by the United States and its Global Positioning System.⁵⁶ When a GPS device computes the coordinates of a particular location on the ground, it is compiling data reflected from five different satellites as calculated with reference to the WGS84 geoid.⁵⁷ As mentioned above, some countries use their own points of reference (datums). Kosovo, for example, established its own datum in 2007 for the purpose of carrying out a mass survey of its territory; previously, all calculations were based on the Serbian datum to which Kosovo no longer has access.⁵⁸ Japan recently switched its entire system from its own datum to the WGS84 by way of a complex mathematical transformation.⁵⁹

Even in 1945, Jones recognized the limitations on the demarcation methods used at that time:

The difficulties in defining geometrical boundaries arise from [the fact that] few statesmen or treaty editors possess the technical knowledge of geodesy to frame a precise definition It is also necessary to

53. Email from Ray Milefsky, Specialist, Office of the Geographer and Global Issues, U.S. Department of State (July 16, 2007) (on file with author).

54. *See id.*; Telephone Interview with Ray Milefsky, Specialist, Office of the Geographer and Global Issues, U.S. Department of State (Mar. 31, 2008) (on file with author).

55. Telephone Interview with Ray Milefsky, *supra* note 54.

56. Though the U.S. datum is widely accepted and used by many states around the world, it is still just a reference coordinate and, therefore, subject to abuse. *See* Rushworth, *supra* note 26 (noting that the ideal solution of every point on the earth's surface having a unique set of geographic coordinates has been achieved). This potential for mischief, or system failure, is part of the reason Europe has developed the Galileo system which derives coordinates off of its own datum. In the years ahead, using these two different languages to identify points along the border, states might need to maintain two coordinates to refer to the same point. There will likely be a period of translation during which both sets of coordinates will be made to complement one another. Telephone Interview with Ray Milefsky, *supra* note 54.

57. The Global Positioning System is a system of 24 satellites that transmit signals to a handheld device, enabling the determination of location, speed, direction, and time. It is managed by the United States Government and is the only fully functional global navigation satellite constellation. The geoid is an extremely precise mathematical model of the shape of the earth.

58. Telephone Interview with Ray Milefsky, *supra* note 54.

59. *Id.*

distinguish between geodetic and astronomic positions. The North American datum differs from that determined astronomically.⁶⁰

However, the real problem for harmonization and universalization of boundary-marking emerges when states and boundary dispute commissions rely on treaties and other documents that include reference coordinates without an indication as to which datum those coordinates are calibrated or if the treaty uses coordinates that are calibrated to an outdated datum for which there is no longer any record. For a stable definition of the interstate boundary, we must turn to the technological advances available to states today for the purposes of standardizing border demarcation and maintaining permanent points of reference for interstate boundaries.

The development of the Global Positioning System technology by the United States, and its European parallel expected to be operational in 2010, has made it possible to calculate, view and monitor borders with significantly greater precision than ever before. More precision at the delimitation stage should lead to fewer controversies at the demarcation stage. Through GIS imagery, for example, states could re-define their borders down to thousands of an inch while being able to view exactly what is located at that point. Additional techniques of higher sophistication are available to those states that can afford them, as described later in this Essay. Regardless of these advances, border discrepancies and disputes continue to pose senseless difficulties at the local and national levels.⁶¹ The distinct, ad hoc methods used by states today perpetuate discrepancies where the development of international law in this area mandating states to utilize the GPS coordinate scheme would harmonize and universalize boundary-marking. The next Part of the Essay examines how boundary commissions have begun to drawn upon these technologies in an effort to put an end to particularly intractable border disputes.

IV. BORDER DISPUTES AND THE LAW

*"A new international law on boundaries and borderlands is urgently needed."*⁶²

In their appraisals of relevant international law for delimitation and demarcation, many boundary dispute commissions, the Permanent Court of Arbitration, and the ICJ have handed down varying opinions regarding *not* which sources of international law are authoritative in boundary determination but rather on *how to interpret* those sources and accurately represent them on the ground.⁶³

60. JONES, *supra* note 1, at 151. "Geodetic" positions are defined through the use of a geoid, an extremely precise mathematical model of the earth.

61. See, e.g., Englebert, et al., *supra* note 38, at 1097-98.

62. Nsongurua J. Udombana, *The Ghost of Berlin Still Haunts Africa! The ICJ Judgment on the Land and Maritime Boundary Dispute Between Cameroon and Nigeria*, 2002 AFR. Y.B. OF INT'L L. 13, 59.

63. See Eritrea-Ethiopia Boundary Commission: Decision Regarding Delimitation of the Border Between the State of Eritrea and the Federal Democratic Republic of Ethiopia, 41 I.L.M. 1057, 1074-75 (Apr. 13, 2002) [hereinafter 2002 EEBC]; see also *Land, Island and Maritime Frontier Dispute (El Sal. v. Hond.)*, 1992 I.C.J. 351, 390-92 (Sept. 11).

Each adjudicatory body has employed different principles of interpretation on a case-by-case—and sometimes a judge-by-judge—basis. In the *Case Concerning Kasikili/Sedudu Island* (Botswana v. Namibia), for example, the International Court of Justice indicated that the “present-day state of scientific knowledge” could be used in order to illuminate the terms of the relevant treaty, a document from 1890.⁶⁴ By contrast, Judge Higgins noted in her Declaration in that case that the task of the Court in resolving the dispute was to determine the general idea of the parties at the time of signing the treaty and to realize their original idea through the use of contemporary knowledge.⁶⁵ In another case, *Cameroon v. Nigeria*, the Court relied, in part, on the principle of contemporaneity—drawing upon the circumstances prevailing at the time the treaty was concluded.⁶⁶ Other decisions make relevant the subsequent practice of the parties, while still others indicate that demarcation is not necessary at all.⁶⁷

I will examine the decisions of three specialized boundary-dispute bodies in detail: the Taba Tribunal (Egypt-Israel, 1988); the Iraq-Kuwait Boundary Dispute Commission (1991); and the Eritrea-Ethiopia Boundary Commission (2006). In each of these cases, the arbitrators confronted the challenge of discrepancies between the delimitation agreements and the corresponding demarcation. The overview and analysis carried out here demonstrate a trend on the part of ad hoc commissions to give shape to the international law on demarcation and attain coherence through an updated means of boundary-marking.⁶⁸

A. *Taba*: juris vel factis

In 1986, Egypt and Israel jointly agreed to set up a binding arbitration mechanism to resolve the boundary dispute involving fourteen demarcation pillars along their shared border.⁶⁹ Their conflict emerged from miscalculations and manipulations regarding the border's demarcation over the previous eight decades.⁷⁰ Eighty years prior, in 1906, diplomatic representatives of the Ottoman Empire and Britain, which at the time maintained control over Egypt, signed a treaty requiring that telegraph poles be used to demarcate the boundary between

64. *Case Concerning Kasikili/Sedudu Island* (Bots. v. Namib.), 1999 I.C.J. 1045, 1060 (Dec. 13).

65. *Id.* at 1114 (separate declaration of Judge Higgins).

66. *Land and Maritime Boundary between Cameroon and Nigeria* (Cameroon v. Nig.), 2002 I.C.J. 303, 346 (Oct. 10).

67. Delimitation need not be formally marked out, contrary to popular belief. Rao notes that the ICJ has held in the *Las Palmas* decision that delimitation may be achieved “either by so-called natural frontiers as recognized by international law or by outward signs of delimitation that are undisputed or else by legal engagements.” In other words, demarcation is not necessary, as a legal requisite for boundary definition. K. Krishna Rao, *The Sino-Indian Boundary Question and International Law*, 11 INT'L & COMP. L. Q. 375, 376-77 (1962).

68. It should be reiterated here that this analysis focuses on which technological medium constitutes the legally authoritative representation of the border. The trend that emerges from the commissions studied in this section is that *methods* of demarcation have shifted and simultaneously, the degrees of legitimacy as representative of the official border of the various media employed in each method shifted.

69. Haihua Ding & Eric S. Koenig, *Boundary Dispute Concerning the Taba Area*, 83 AM. J. INT'L L. 590, 590 (1989).

70. *Id.* at 592-94.

what would later become Egypt and Israel.⁷¹ The surveyor responsible for the original markers noted in his report that his margin of error between where the treaty intended and the coordinates determined using astronomical surveying techniques could be up to twelve meters on either side of the delineated straight line.⁷² He also conceded that the poles themselves deviated from the intended line in some places by as much as five hundred meters; while some were corrected or accepted by the Commissioners present at the time as placed; others may not have been addressed.⁷³

After the first set of poles was constructed, the Egyptian Office of Public Works undertook to further mark the boundary with its own additional pillars.⁷⁴ Commissioners from both sides agreed to this plan and signed off on the proposal to construct supplementary stone markers.⁷⁵ In the initial years that followed the construction of the pillars between December 1906 and February 1907, both sides helped to maintain them.⁷⁶ Shortly thereafter, however, reports of foul play began to surface.⁷⁷ British authorities, among others, were accused of removing border markers in an attempt to monopolize control in the region.⁷⁸

In 1981, new surveys were conducted to re-establish the boundary according to the guidelines of the 1979 Treaty of Peace between Egypt and Israel.⁷⁹ The Treaty instructed a Joint Commission to demarcate the boundary by locating existing border stones based on aerial photographs and the descriptions laid out in the 1906 Agreement.⁸⁰ The Joint Commission was unable to agree on the location of some of the missing pillars and thus turned to the Tribunal to adjudicate the dispute.⁸¹

The Taba Tribunal was charged with a very narrowly defined task: “to decide the location of the boundary pillars of the recognized international boundary between Egypt and the former mandated territory of Palestine, in accordance with the Peace Treaty, the April 25, 1982 Agreement, and the Annex.”⁸² In its decision, the majority deduced that the location of the existing boundary pillars constituted a legally authoritative depiction of the boundary “even if deviations may have occurred or if there are some inconsistencies with maps.”⁸³ Based on an

71. *See id.* at 594.

72. *See* Location of Boundary Markers in Taba between Egypt and Israel, 20 R. INT’L ARB. AWARDS 1, 21 (Sept. 29, 1988) [hereinafter Taba].

73. *Id.*

74. *Id.* at 20.

75. *Id.* at 30.

76. *Id.* at 56.

77. *Id.* at 22.

78. *Id.*

79. *See* Treaty of Peace Between the Arab Republic of Egypt and the State of Israel, art. I, Mar. 26, 1979, 18 I.L.M. 362.

80. *Id.* at art. IV (“organize the demarcation of the international boundary and all lines and zones described in Annex I and this Appendix”).

81. Taba, *supra* note 72, at 30-31.

82. *Id.* at 111.

83. *Id.* at 56.

interpretation of an earlier treatise on boundary-making and the *Temple* Judgment by the International Court of Justice,⁸⁴ the majority concluded that, in case of contradiction, a *demarcated boundary line prevails over the text of an agreement*.⁸⁵ In other words, in case of a discrepancy, the location of the monumentation pillars would trump the language of the treaty and indications made on maps.

In her dissenting opinion to the Award, Ruth Lapidoth argued that the authoritative and proper boundary should be demarcated according to the originally intended location of the 1906 telegraph poles and that, despite their apparent resilience and greater durability, the concrete pillars erected since that time were not recognized by both parties.⁸⁶ Lapidoth contended that the majority assumed, erroneously, that "in international law[,] demarcation prevails over delimitation."⁸⁷ She based her decision on the parties' textual affirmation rather than the physical manifestations of at least one side's subsequent practice.⁸⁸ Cognizant of the potential for manipulation of the boundary markers, Lapidoth relied on the written understanding.⁸⁹

Lapidoth's interpretation of the legal norms on boundaries was rooted in the principle of *uti possidetis juris* according to which "preeminence [is] accorded to legal title over effective possession as a basis for sovereignty."⁹⁰ The majority placed heavy weight on the existence of stone pillars in 1906 and cited their appearance in later photographs. Lapidoth, by contrast, emphasized the statements in the agreements between the two sides about where the original pillars were intended to be located.⁹¹ While the majority stressed that when there is a discrepancy its authority rests on the pillars themselves (according to the opposing principle of *uti possidetis factis*), Lapidoth looked mainly to treaty text, declaratory statements, and other records maintained by Egypt and Israel.⁹²

The Taba Award is not the only place where the precedence of boundary monuments has been disputed, though it is most clearly seen in these two arguments. Many delimitation agreements fail to specify whether the demarcated boundary or its theoretical position prevails should a conflict arise between them.⁹³ The discrepancy that develops may be the result of natural causes (such as the effect of gravity), human interference as discussed above, the use of astronomic rather than geodetic coordinates or the limitations of the technology available at the time of the original survey.⁹⁴ In arbitration on this point, tribunals and courts

84. *Temple of Preah Vihear (Cambodia v. Laos)*, 1962 I.C.J. 6 (June 15).

85. *Taba*, *supra* note 72, at 57.

86. *Id.* at 75 (dissenting opinion of Prof. Lapidoth) ("There is thus no reason to prefer pillars . . . over the line described in the [1906] Agreement").

87. *Id.*

88. *Id.* at 76 (dissenting opinion of Prof. Lapidoth).

89. *Id.* at 75 (dissenting opinion of Prof. Lapidoth).

90. *Id.* at 75 (dissenting opinion of Prof. Lapidoth) (quoting *Frontier Dispute (Burk. Faso v. Mali)*, 1986 I.C.J. 554, 566 (Dec. 22)).

91. *Id.* at 76 (dissenting opinion of Prof. Lapidoth).

92. *See id.* at 76-77.

93. *See* McEwen, *supra* note 33, at 5.

94. *Id.*

have more often than not considered the existing monuments on the ground to be controlling.⁹⁵ While some have called this a “commonsense approach” necessary for achieving “stability,”⁹⁶ this approach is in fact highly susceptible to abuse and potentially ineffective for achieving finality due to the manipulability of the monuments.

The Taba Award prioritized the pillar locations over not only treaty language but also over maps.⁹⁷ Maps, while useful for general guidance and occasionally more helpful than the textual agreement if very precise, are also easily manipulable and therefore unreliable.⁹⁸ Most maps are made by a single state and do not represent any kind of joint understanding between the parties.⁹⁹ Additional problems that maps introduce include different coordinate reference terms, different names for places, and different cartographic symbols.¹⁰⁰ Furthermore, cartographic techniques change rapidly such that levels of precision and accuracy have been vastly improved in the last thirty years.¹⁰¹ Older maps lack the exactitude required for effective boundary maintenance.¹⁰²

The two opposing opinions from the Taba Tribunal outline the dispute within international law on demarcation.¹⁰³ The next section presents another iteration in the controversy through the work of the Iraq-Kuwait Boundary Commission which came on the heels of the Taba Tribunal in the early 1990s.

B. Iraq-Kuwait: dedicated to demarcation

Following the cessation of hostilities in the Gulf War, the UN Security Council passed Resolution 687 (1991) which called upon the Secretary-General to “lend his assistance to make arrangements with Iraq and Kuwait to demarcate the boundary between them, drawing on appropriate material.”¹⁰⁴ Pursuant to the resolution, the Secretary-General appointed the Iraq-Kuwait Boundary Dispute Commission (IKBDC). The Commission was uniquely charged with *establishing* the boundary (not delimiting, but rather demarcating) using coordinates of latitude

95. *Id.*

96. *Id.*

97. Taba, *supra* note 72, at 56. With reference to the precedence of existing pillars over maps the tribunal says: “If a boundary line is once demarcated jointly by the parties concerned, the demarcation is considered as an authentic interpretation of the boundary agreement even if deviations may have occurred or if there are some inconsistencies with maps.” *Id.*

98. CUKWURAH, *supra* note 7, at 224.

99. *Id.* at 223.

100. *See id.* at 220.

101. *See* Ray Milefsky & William B. Wood, *GIS as a Tool for Territorial Analysis and Negotiations*, in *THE RAZOR’S EDGE* 107, 108-09 (Clive Schofield et al. eds., 2002).

102. *See, e.g.*, Taba, *supra* note 72, at 48 (“The Tribunal does not consider these map based indications to be conclusive since the scale of the map (1:100,000) is too small to demonstrate a location on the ground as exactly as required . . .”); *see also* Dispute Between Argentina and Chile Concerning the Beagle Channel, 21 R. Int’l Arb. Awards 53 (Feb. 18, 1977) [hereinafter Beagle Channel]. This approach is also reflected in Burk. Faso v. Mali, *supra* note 90, at 583, where the Court notes that a map “can still have no greater legal value than that of corroborative evidence endorsing a conclusion at which a court has arrived by other means unconnected with the maps.”

103. *See generally* Taba, *supra* note 72.

104. S.C. Res. 687, ¶ 3, U.N. Doc. S/RES/687 (Apr. 8, 1991).

and longitude as well as representing those coordinates through markers on the ground.¹⁰⁵

The IKBDC faced the same the challenge of interpreting vague treaty language. It relied on the 1963 "Agreed Minutes Between the State of Kuwait and the Republic of Iraq Regarding the Restoration of Friendly Relations, Recognition and Related Matters" which referred to points in generalities.¹⁰⁶ For example, the Agreed Minutes make reference to a point "south of . . . Um Qasr"; it is unclear whether the parties meant the Umm Qasr as it existed in 1963 or as it existed in 1932 (the time of the original treaty at issue).¹⁰⁷

Independent surveyance experts assisted the Commission in its work.¹⁰⁸ They proposed a new survey and mapping of the entire border area to enable the Commission to be as precise as possible, using new and improved technology, and to guide the Commission's work with relevance to the ground situation.¹⁰⁹ Following the Security Council's instructions to draw upon "appropriate technology,"¹¹⁰ much of the experts' proposed methods were implemented.¹¹¹ For example, their proposal included the establishment of a "geodetic control network and ground control points for mapping, using satellite-based ([GPS] and Doppler) methods," using satellite-based technologies, as well as aerial photography.¹¹²

At the conclusion of the Commission's work, 106 boundary pillars were erected, and twenty-eight intermediate boundary markers and other points along the sea were organized;¹¹³ though it included little legal justification for its selections, the Commission maintained a list of geographic coordinates for each pillar and point as instructed.¹¹⁴ The Secretary-General specified that "[t]he *coordinates* established by the [IKBDC] Commission *will constitute the final demarcation* of the international boundary"¹¹⁵ It is not explicitly clear whether the Council intended for the coordinates to serve as the source of legal authority for the boundary, though that is a feasible interpretation of these instructions.¹¹⁶

105. S.C. Res. 833, U.N. Doc. S/RES/833 (May 27, 1993). As discussed above, however, in carrying out the surveyance work, the Commission did inevitably define the border to some extent.

106. *Id.*

107. See Adler, *supra* note 17.

108. *Id.* at 6.

109. *Id.*

110. The Secretary-General, *Report of the Secretary-General Regarding Paragraph 3 of Security Council Resolution 687* ¶¶ 3-4, U.N. Doc. S/22558 (May 2, 1991).

111. *Id.* at ¶ 4.

112. Adler, *supra* note 17, at 7 ("Four datum stations, 25 geodetic control stations and 137 photogrammetric control points were established toward the end of 1991, by GPS and Doppler survey methods").

113. *Id.* at 9.

114. Jan Klabbbers, *No More Shifting Lines? The Report of the Iraq-Kuwait Boundary Demarcation Commission*, 43 INT'L & COMP. L.Q. 904, 906 (1994).

115. *Report of the Secretary-General Regarding Paragraph 3 of Security Council Resolution 687*, *supra* note 110, at ¶ 3 (emphasis added).

116. Here, some scholars have raised concern about the Security Council's exercise of power in determining borders. This international organizational dilemma goes beyond the scope of this Essay,

Following the IKBDC, the Israel-Jordan Boundary Dispute Commission adopted a similar approach in 1995.¹¹⁷ In that situation, the instructions given to the Commission required the emplacement of boundary pillars, but also clearly invested legal authority in the satellite coordinates determined by the Commission.¹¹⁸

Thus, the decisions rendered in the Taba Tribunal, IKBDC and Israel-Jordan Commission reveal a tension and responding shift in the law of boundary-marking. The Taba decision and Lapidoth's dissenting declaration frame the legal dispute debating the authoritative role of the pillars.¹¹⁹ From there, the IKBDC required coordinates as well as pillars to ensure permanency and to avoid dispute like that which arose in Taba and, under one interpretation, also placed legal authority in the coordinates.¹²⁰ The Israel-Jordan Commission, while also emplacing monuments, affirmed the authoritativeness of the coordinates.¹²¹ As the scientific and geographic communities became more comfortable with the technologies, these border commissions incorporated their added accuracy and durability. The inclinations on the part of the IKBDC and the Israel-Jordan Commissions to sustain the legal authority of the coordinates demonstrate the start of a pattern which culminated with the Eritrea-Ethiopia Boundary Commission.¹²² The next section investigates how the EEBC drew from the trend out of necessity, and in so doing, may have augured its completion and the effective establishment of an emergent legal norm, rendering the need for pillars moot and utilizing the latest technologies available to design binding demarcation outcomes.

C. Eritrea-Ethiopia and virtual demarcation

The Eritrea-Ethiopia Boundary Commission (EEBC / the Commission) was established in 2000 pursuant to the Algiers Agreement—the culmination of a lengthy negotiation process designed to put an end to the hostilities that broke out in the region from May 1998 to June 2000.¹²³ In addition to mandating the Commission to adjudicate the delimitation of the shared border, the Algiers Agreement called upon the Commission to “arrange for expeditious demarcation” though it did not specify the means or medium according to which demarcation

but is highly relevant for both the IKBDC and the EEBC. *See, e.g.,* Klabbers, *supra* note 114, at 911.

117. *See* Adler, *supra* note 17, at 10 (stating the Israel-Jordan boundary was established through the use of advanced technology such as orthophotos).

118. *Id.* at 10-11 (“The boundary pillars shall be defined in a list of geographic and UTM coordinates based on the joint boundary datum (IJB 94) to be agreed by the Joint Team of Experts appointed by the Parties using Global Positioning System measurements This list of coordinates . . . shall be binding and shall take precedence over the maps as to the location of the boundary line of this sector”).

119. *See* Taba, *supra* note 72, at 75 (dissenting opinion of Prof. Lapidoth).

120. Adler, *supra* note 17, at 5.

121. *Id.* at 10-11.

122. *See* 2002 EEBC, *supra* note 63; *see also*, 2006 EEBC Statement, *infra* note 127.

123. Ethiopia-Eritrea: Agreement Between the Government of the Federal Democratic Republic of Ethiopia and the Government of the State of Eritrea (Peace Agreement), Eth.-Eri., Dec. 12, 2000, 40 I.L.M. 260 (2001).

would be carried out.¹²⁴ Still, in the Agreement, Ethiopia and Eritrea committed to “cooperate with the Commission . . . in all respects during the process of delimitation and demarcation.”¹²⁵ Moreover, the parties agreed that “the delimitation and demarcation determinations of the Commission [would] be final and binding.”¹²⁶

When both parties later refused to respect the Commission’s determination, the Commission turned their earlier agreement back to them, relying on the *Beagle Channel* tribunal decision which held: “It is not admissible that, because of the total non-cooperation of one of the Parties, contrary to its obligation under a valid Award, the Court should be compelled to remain indefinitely in existence in a state of suspended animation.”¹²⁷ In the case of Ethiopia and Eritrea, the Commission noted that the same principle would apply in light of the non-cooperation of both parties.¹²⁸

On July 8, 2002, the Commission promulgated its Demarcation Directions¹²⁹ which instructed the parties to appoint appropriate representatives in order to identify sites for the demarcation pillars.¹³⁰ What might otherwise be a simple process of placing pillars in the locations identified by the Delimitation Decision became a controversial ordeal yet to be resolved at the time of writing. In the Commission’s attempts to demarcate the central and west sectors of the border, both parties refused to allow the appointed representatives to carry out their work.¹³¹ They proceeded to obstruct the Commission from holding negotiations to resolve the dispute.¹³² Resolved against making any progress on the decision of the Commission, Ethiopia and Eritrea disregarded fourteen Security Council resolutions calling for their joint cooperation.¹³³

After nearly four years of stalemate, the Commission issued a statement at the end of 2006, following the refusal of Eritrea and Ethiopia to attend the Commission’s dispute resolution meeting.¹³⁴ In the statement, the Commission revisited its original mandate instructing it to demarcate the boundary.¹³⁵ It noted

124. *Id.* at art. 4, ¶ 13.

125. *Id.* at art. 4, ¶ 14.

126. *Id.* at art. 4, ¶ 15.

127. Permanent Court of Arbitration: Eritrea-Ethiopia Boundary Commission Statement by the Commission, Nov. 27, 2006, 46 I.L.M. 155, n.1 [hereinafter 2006 EEBC Statement].

128. *Id.*

129. *Id.* at 155.

130. *Id.* Interestingly, the Commission originally notes that it must specify the boundary reference point coordinates as measured from satellite imagery based on the WGS84 datum. The principal reason, it notes, for using this specification is due to the limited availability of information on the (updated Soviet edition) maps available to the Commission. In its decision, the Commission cautions that “All coordinates will be recalculated and made more precise during the demarcation as the commission acquires the additional necessary information.” Herein both parties were put on notice of potential changes in the location of the border. 2002 EEBC, *supra* note 63, at ¶ 8.3.

131. 2006 EEBC Statement, *supra* note 127, at 156.

132. *Id.* at 156-57.

133. *Id.* at 159.

134. *Id.* at 157-58.

135. *Id.* at 157.

that it had previously interpreted the mandate to mean that it must oversee the actual emplacement of pillars at turning points of the boundary; however, in order to carry out this task, the Commission assumed it would receive the proper funding and support from the parties and from the United Nations Mission in Eritrea and Ethiopia (UNMEE).¹³⁶ In the absence of the parties' cooperation, the Commission found it necessary to interpret its mandate in such a way so as to discharge all its functions effectively.¹³⁷ It derived a new interpretation on the basis of changed facts to which it had to adapt and announced its decision to "adopt another approach to effect the demarcation of the boundary."¹³⁸ The Commission declared:

If, by the end of [the twelve-month] period, the Parties have not by themselves reached the necessary agreement and proceeded significantly to implement it . . . the Commission hereby determines that the boundary will automatically stand as *demarcated by the boundary points* [determined by the Commission] and that the mandate of the Commission can then be regarded as fulfilled.¹³⁹

To this end, the Commission discussed how modern techniques of "image processing and terrain" facilitate demarcation by geographical coordinates with incomparable accuracy that would achieve most of the same goals as monument emplacement in the field.¹⁴⁰ It drew in large part from the IKBDC decision noting how, in the aftermath of its decision, the Security Council supported the legal principle that coordinates could and would be authoritative boundary markers.¹⁴¹ By way of filling in the legal reasoning lacking in the IKBDC and Israel-Jordan decisions, the Commission also referred to two comparable situations where relevant principles have been asserted. First, it made reference to the *Argentina-Chile Frontier Case* (1966) in which aerial photography was used to specify the boundary points.¹⁴² The Argentina-Chile Tribunal held that points indicated on aerial photographs would constitute "the sole authority for the exact location of the points."¹⁴³ Second, the Commission noted how maritime boundaries, as specified in the Law of the Sea Convention, rely on a coordinate-only demarcation system.¹⁴⁴

Following this proclamation, neither side attempted to emplace pillars as instructed and the Commission's decision became final and binding in November 2007 at which point the Eritrea-Ethiopia Boundary Commission (EEBC) officially dissolved itself.¹⁴⁵ As no further action would convince the parties to fulfill their

136. *Id.* at 158.

137. *Id.*

138. *Id.*

139. *Id.* at 159 (emphasis added).

140. *Id.* at 158.

141. *Id.* at 159.

142. *Id.* at 156, n.4.

143. *Id.* (quoting *Argentina-Chile Frontier Case*, 38 I.L.R. 10 (1966)).

144. *Id.* at 159.

145. The Secretary-General, *Report of the Secretary-General on Ethiopia and Eritrea*, ¶ 26 & Annex II, paras. 1, 3-4, 10-11, 40, delivered to the Security Council, U.N. Doc. S/2008/40 (Jan. 23,

obligations under the terms of their prior agreement, the Commission followed through with its intended plan to disband.¹⁴⁶ With the stroke of a pen, it reported to the Secretary-General and to the world that the new boundary between Eritrea and Ethiopia had been defined and, regardless of the lack of physical manifestations of it on the ground or the consent of the parties, the coordinates the EEBC had finalized would serve as authoritative markers of the international border.¹⁴⁷

Although the international media reported that the Commission chose to “leav[e] the two states to work it out alone,”¹⁴⁸ the Commission was clear about the significance of its conclusions.¹⁴⁹ Leaving behind an Annex containing the results of its Delimitation Decision set out in geographic coordinates, the Commission had “virtually” demarcated the boundary.¹⁵⁰ The Annex includes detailed specifications regarding where the border between Eritrea and Ethiopia stands in terms of GPS satellite coordinates.¹⁵¹ It instructs the demarcators on 146 boundary points, plus seven pages of comments, on how to place each marker and how to move from one to the next.¹⁵²

It is important to note that the Commission expressed its support for the monumentation principle and emphasized its attempt to enforce the principle, but in light of the lack of cooperation of the parties to fulfill their obligations, it used the coordinate-only demarcation method of equal validity.¹⁵³ Rather than reject the monumentation concept, the Commission affirmed it but found another method to be equally sufficient.¹⁵⁴ In a letter to the President of the Security Council dated January 18, 2008, the President of Ethiopia decried the Commission’s decision as having “no validity in international law.”¹⁵⁵ Despite the legal reasoning outlined in the decision with reference to the *IKBDC* and *Argentina-Chile* decisions, Ethiopia maintains that the coordinates are invalid “because they are not the product of a demarcation process recognised by international law.”¹⁵⁶ As shown above, however, while monumentation may be considered evidence of an accepted practice, not all international borders are demarcated with monuments and there is

2008).

146. *Id.*

147. *See id.*

148. Daniel Wallis & Andrew Cawthorne, *U.N. Probes Eritrea-Ethiopia Border Gunfire* (Dec. 27, 2007), <http://www.alertnet.org/thenews/newsdesk/L27074831.htm>.

149. *See Report of the Secretary General on Ethiopia and Eritrea*, *supra* note 145.

150. Eritrea-Ethiopia Boundary Commission Annex to the Commission’s Statement of 27 November 2006 List of Boundary Points and Coordinates, http://www.pca-cpa.org/showfile.asp?fil_id=110.

151. *See id.*

152. *Id.*

153. 2006 EEBC Statement, *supra* note 127, ¶ 20.

154. *See id.*

155. *Report of the Secretary-General on Ethiopia and Eritrea*, *supra* note 145, ¶ 23 (quoting portions of the Foreign Minister’s letter).

156. *Id.* ¶ 41. Notably, no other states have spoken in support of this position. *See* 2006 EEBC Statement, *supra* note 127, at 159.

no source of legal authority suggesting it is required.¹⁵⁷ For its part, Eritrea has accepted the Commission's decision as binding, though it has not made efforts to emplace pillars as instructed.¹⁵⁸

V. A MAP FOR THE FUTURE?

Developing norms of precedence and interpretation for boundary determination is a daunting task particularly in light of the conflictual holdings by the International Court of Justice and the various border dispute tribunals.¹⁵⁹ The first step in border maintenance or border dispute resolution is to look for existing, authorized documentation agreed to by both sides. The majority in the Taba Tribunal, as well as the IKBDC, pursued such authorization, but found conflicting information.¹⁶⁰ Written documentation, authorized by both states, regarding the location of the border should be legally binding, but this clarification does not necessarily solve boundary disputes where documentation conflicts, as was seen in the case of the IKBDC.¹⁶¹ Next, the Taba Tribunal looked to monuments along the border.¹⁶² The boundary pillars, preferably accompanied by at least partial documentation, represent the *de facto* situation which supports a claim under the principle of *uti possidetis factis*.¹⁶³ Although the Taba arbitrators attempted to identify which monuments were the original monuments from the 1906 replacement, it was nearly impossible to do so.¹⁶⁴

These practical challenges precipitated a call to consider other methods of demarcation. The monumentation approach might have made sense when no other means were available; however, in the twenty-first century, when the law has kept pace with technology in other areas of science, border demarcation should do the same. Moreover, inconsistencies among boundary commissions and the variety of state methodologies indicate a need for harmonization in order to clarify and establish coherent legal norms in this field. Virtual demarcation achieves this goal.

The actual process of carrying out all the calculations and measurements necessary for virtual demarcation varies depending on the technology employed. The most accurate and reliable method available today is stereophotogrammetry.¹⁶⁵ Stereophotogrammetry is commonly used for marking points where it would be

157. See *supra* notes 140-144 and accompanying text.

158. See *Report of the Secretary-General on Ethiopia and Eritrea*, *supra* note 145, ¶¶ 26, 41 & Annex II, para. 4.

159. Cf. Convention Revising the General Act of Berlin and the Declaration of Brussels (Treaty of St. Germain-en-Laye) art. 28, Sept. 10, 1919, 49 Stat. 3027, 8 L.N.T.S. 25 (declaring clear interpretive rule that "[i]n case of differences between the text and the map, the text will prevail.").

160. See Taba, *supra* note 72, at 44-45; The Secretary-General, *Letter Dated 21 May 1993 from the Secretary-General Addressed to the President of the Security Council*, ¶¶ 27-45, U.N. Doc. S/25811 (May 21, 1993).

161. See *Letter Dated 21 May 1993 from the Secretary-General Addressed to the President of the Security Council*, *supra* note 160, ¶¶ 27-45.

162. See Taba, *supra* note 72, at 47-67.

163. See *id.* at 44-45.

164. *Id.* at 48-49.

165. Interview with Laurent Bonneau, Research Associate for Geology and Geophysics, Yale University, in New Haven, Conn. (Mar. 28, 2008) (on file with author).

impossible to emplace monuments, such as on mountain tops. Geographers use stereophotogrammetry to ascertain a point that parties agree to on the basis of a particular set of stereo reference data. Thus, Ethiopia's claim that there is no precedent for this *type* of demarcation is incorrect to the extent that stereophotogrammetry is used in these remote areas.¹⁶⁶

Despite its value for stability and finality, stereophotogrammetry is also grossly expensive. Another process known as orthorectified aerial photography is more commonly used through means of either airplane or satellite. At high levels of resolution, satellites and traditional aerial photography offer sub-decimeter resolution. Still, "complete and uniform coverage at the appropriate resolution is often lacking for much of the developing world."¹⁶⁷ Moreover, full coverage of a long boundary even using this less complicated technology can cost millions of dollars.

While resources might not be available for all states to carry out these methods on their own, there are fewer obstacles preventing an international institution from taking on this responsibility and serving as the central depository for international boundary coordinates. The United Nations, or an affiliated intergovernmental organization, should develop a shared informational and standardized system, based on a single datum, that lists all the international boundaries on record. Resembled after the international treaty series, it need not be more than a simple list of coordinates that serves as the authoritative source of coordinate information, demarcating all boundaries with the same (highest available at the time) level of precision, but with the express purpose of finalizing the location of international boundaries. Moreover, although the states between whom the border divides the territory have the most immediate interest in the delimitation and demarcation processes, these processes have *erga omnes* effect such that all states must respect and accept the boundary as recognized; thus, it becomes increasingly obvious that an international record should be maintained.¹⁶⁸ Boundaries remain even if treaties that created them are no longer in force.¹⁶⁹

With the precision and permanency of these geographic coordinates, this system would far out-last any monument and be less subject to abuse. Still, it would likely face challenges, at least in the short-term. First, as shown in the case of Ethiopia, it is unlikely that states would willingly surrender their border-marking authority.¹⁷⁰ Second, if an intergovernmental organization such as the United Nations were to assume control for boundaries and institute a system of

166. *Id.*

167. Milefsky & Wood, *supra* note 101, at 116.

168. A related theme meriting further research is the strategy used by states to recognize third-party (non-bordering states) boundaries; the central boundary depository would harmonize recognition methodologies with the long-term goal of eliminating the need for "recognition" of contentious borders since all would be officially recorded.

169. ANTONIO CASSESE, INTERNATIONAL LAW 83-84 (2d ed. 2005).

170. Given military concerns over border regions, both parties are unlikely to be willing to use imagery as part of their negotiations. *See id.* at 423-24.

virtual demarcation, it could instigate an eruption of minute and large-scale border disputes as states rush to update and clarify their records.

Although it is an area where technology has the potential to play a significant role in the creation and modification of international law, boundary-marking has received little attention in this respect.¹⁷¹ The systematic transition suggested herein will undoubtedly take considerable time and effort.¹⁷² Just as the GPS coordinate system would eliminate the need for street addresses, this Essay is not suggesting that we re-design the postal system. Rather, it aims to harmonize and remodel boundary-marking in such a way that will avoid conflict – physical as well as numerical.

VI. BORDER-MARKING MEETS BORDER-MAKING

*“La caractere marquant de la notion de frontiere est son universalite d’acception.”*¹⁷³

Although the technology for “virtual demarcation” is available, it produces a sort of cognitive dissonance for geographers who have relied on grounded monuments. As one geographer notes, “demarcation, by definition, means ‘mark on the ground.’”¹⁷⁴ On the other hand, many international lawyers concede that the monumentation principle is not, in fact, required by law.¹⁷⁵ It is a purely technical operation of minor importance. In fact, most boundaries are not demarcated due to expense, effort, adverse climate, or emotions of local inhabitants as to the erection of monuments.¹⁷⁶ In his 1928 treatise, de Lapradelle asserted that “[l]a demarcation, si elle est utile, d’est pas, en droit, necessaire.”¹⁷⁷

Thus, the controversy over virtual demarcation oversubstantiates the nature of any potential contradiction in international law. While monumentation may be preferable at some levels, a universal, coordinate-based system, maintained by an

171. But see Martin Pratt, *The Role of the Technical Expert in Maritime Delimitation Cases*, in MARITIME DELIMITATION 79, 80 (Rainer Lagoni & Daniel Vignes eds., 2006) (“[S]tates are becoming increasingly aware of the need for geodetically precise boundaries . . . [Boundary] courts and tribunals are coming under closer . . . scrutiny by technically-proficient analysts, and errors or deficiencies in the definition of a . . . boundary are sure to be exposed . . . [I]t is recommended that a) adjudicators ensure that they have adequate technical support themselves, and b) they encourage the parties . . . to agree [on] technical standards for delimitation before the adjudicators begin their deliberations.”).

172. See Dennis Rushworth, *Mapping in Support of Frontier Arbitration: Coordinates*, IBRU BOUNDARY AND SECURITY BULLETIN, Autumn 1997, at 55, 56 (“[I]t will be many years before all current mapping is compatible with WGS coordinates. Since older mapping and survey data is never likely to be converted, frontier arbitration proceedings will have to take into account the existence of incompatible coordinate values for the foreseeable future.”).

173. P. G. DE LAPRADELLE, *LA FRONTIER: ETUDE DE DROIT INTERNATIONAL* 9 (1928), *quoted and translated in* Ron Adler, *Geographical Information in Delimitation, Demarcation and Management of International Land Boundaries*, 3 IBRU BOUNDARY AND TERRITORY BRIEFING No. 4 (2001), at 1 & n.1 (“The notable characteristic of the idea of a frontier is its universality.”).

174. Telephone Interview with Ray Milefsky, *supra* note 54.

175. See discussion *supra* note 67.

176. Adler, *supra* note 173, at 10–11.

177. DE LAPRADELLE, *supra* note 173, at 143 (*quoted and translated in* Adler, *supra* note 173, at 10 & n.5 (“Demarcation, although useful, is not necessary in law.”)).

international institution would achieve more uniformity and cultivate worldwide acceptance of exactly where international boundaries lie.

Although here I have examined the hybrid process of boundary-marking through the lens of international law, it is the role and purpose of borders that rightly dominates much of the social science literature on boundaries. After all, "a boundary is not an idea, nor a paragraph in a treaty, nor a line on a map, but a functional feature on the face of the earth."¹⁷⁸ The importance of border security with respect to both people and goods obliges states to keep careful watch over their boundaries; even in the absence of any controversy between them, neighboring states often construct multiple legislative and law enforcement mechanisms for border management. For example, in order to determine and maintain their border, France and Italy have three treaties, four demarcation agreements, a maintenance agreement which establishes a binational border commission, and no fewer than five state agencies responsible for geodetic measurements, mapping and documentation.¹⁷⁹ Still, adjoining states will sometimes publish differing lengths for common boundaries which may never be resolved or may go unnoticed.¹⁸⁰

This Essay has evaluated the current state of affairs with respect to the technology/supranational law-making nexus in an area that has a significant bearing on the fundamental values of the discipline. It has argued that a normatively coherent techno-legal regime in this field is only achievable by integrating the work of the boundary engineers into the work of the boundary architects. As long as boundary architects and engineers remain captive to the monumentation principle as a necessary legal tool in boundary dispute resolutions, they perpetuate the possibility for further controversy as discrepancies develop outside their control. The Eritrea-Ethiopia Boundary Commission has signaled a new approach for border-marking that, at the very least, merits jurisprudential and institutional consideration and has the potential to revolutionize boundary-marking *and* boundary-making.

178. JONES, *supra* note 1, at 6.

179. Michael Bacchus, The Maintenance of Boundary Pillars and Boundary Lines in France (Dec. 12, 2006) (unpublished conference presentation, *available at* http://www.dur.ac.uk/resources/ibru/conferences/thailand/france_1.pdf).

180. Email from Ray Milefsky, *supra* note 53; *see also* Interview with Kakha Khandolishvili, Chief of Internal Affairs, Georgian Border Police, in Tbilisi, Geor. (June 27, 2007) (on file with author).