Ozone, Iteration, and International Law

John K. Setear*

The set of treaties governing the production and consumption of ozone-depleting substances is generally considered to have been an extremely successful response to a problem of great scientific and political complexity. Stratospheric diffusion ensures that the benefits of a thicker ozone layer will be a pure public good, and anthropogenic ozone-depleting substances have long played a variety of important (and low-cost) roles in developed economies. Nonetheless, dozens of developed nations have agreed to dramatic reductions in the use of such substances, and well over 100 developing nations have agreed to a more lenient schedule of reductions. In addition, in an unprecedented example of North-South redistribution, the developed nations have as a group agreed to pay 100% of the compliance costs incurred by their poorer counterparts.

Furthermore, the implementation of the relevant treaties has been nearly as successful as the formulation of the rules themselves. First, the formal assent of nations to the obligations of the various treaties has been widespread, especially among the developed nations currently responsible for producing the lion's share of the regulated substances. Second, disputes over treaty interpretation have been essentially non-existent. Third, and perhaps most importantly, compliance with both the letter and the spirit of the treaties appears to have been high. In terms of both promise and performance, therefore, the treaties on ozone-depleting substances appear to be a successful example of international cooperation.

Scholars have offered a variety of explanations for the success of these treaties. Some have argued that an early US statutory ban on certain ozone-depleting substances in the US marketplace pushed US businesses to seek a global ban as a way to reduce the domestic markets of overseas competitors; the resulting pressure on the US government from US chemical companies was, in this view, responsible for allowing or compelling the US government to push (successfully) for global reductions. Those adopting a collective-action perspective might instead emphasize that, in an important sense, relatively few actors were truly relevant: only a handful of companies in a handful of countries produced ozone-depleting substances when international negotiations on the topic began. Those emphasizing the difficulties of redistributing wealth through bargaining might note that those companies were able to develop relatively low-cost alternatives as the international legal regulation of ozone unfolded. Still other analysts have emphasized the role of an "epistemic community"—a trans-national collection of scientists and policy-makers who, in the case of

* Professor of Law, University of Virginia School of Law. I am grateful for the comments of Rachel Setear and of participants in the Legal Studies Workshop at the University of Virginia School of Law, and for the research assistance of Michael C. Pflieger.

ozone, rapidly came to share a common perception of the causes and proper solution of the problem. One might even explain the outcome of the ozone treaties in terms of the balance of politically prominent synecdoches. Spray cans, which came to stand for the production of ozone-depleting substances, often propel relatively frivolous products into the air; while skin cancer, which came to stand for the effects of ozone depletion, carries with it the much graver implications of malignancy and mortality. Or perhaps there is not really much metaphorical balancing to be done at all: the idea that invisible substances will rise into the atmosphere and create a "hole" in the sky, through which invisible radiation passes to harm us, might stir irrational fears at once both primeval and post-nuclear.

This article explores an alternative explanation, which I call the "iterative perspective," for the success of the ozone treaties. National governments chose to address the problem of ozone depletion through international legal means, in the form of a series of treaties that I collectively call "the ozone-treaty regime" or "the ozone treaties." As a result both of the default rules implicit in choosing treaties as an instrument of international legal cooperation, and as a result of the particular rules explicitly specified in the ozone treaties, the ozone-treaty regime has promoted a wide variety of repeated, formalized interactions between nations—"iterations," for short. The temporal boundaries of these interactions are clear. The mechanisms for formally signaling an intention to participate in the cooperative endeavor set forth in these treaties, as well as the substantive behavior comprising actual cooperation (as opposed to an uncooperative "defection"), are clear as well. As I have argued at greater length elsewhere, high-definition iterations like those created by the ozone treaties provide the ideal backdrop for the evolution of cooperation among parties facing a Prisoner's Dilemma and lacking a centralized enforcement system—the standard description of international political cooperation adopted by scholars of international relations (and the description adopted here).

From the iterative perspective, then, the success of the ozone treaties is the result of a series of policy choices that promote temporally well-defined iterations with clear mechanisms for signaling formal consent, and clear rules for determining actual compliance, by nation-states seeking a cooperative solution to a difficult problem of international politics.

The iterative perspective is distinctive in three ways from the typical explanations advanced in connection with the success of the ozone treaties. The iterative perspective is a *dynamic* explanation of international cooperation with respect to ozone-depleting substances, in that it examines interactions through time and postulates increasing cooperation over time; it is a *legalistic* explanation of ozone-oriented international cooperation, in that it examines the general and specifically tailored rules of international law as factors in international politics; and it is a *textually oriented* explanation of ozone-oriented cooperation, in that it takes seriously and examines closely the particular words set forth in the international legal enactments specifically addressed to the problem of ozone depletion. In its examination of the dynamics of international cooperation, this article is much more detailed than most studies

of the evolution of cooperation. In its examination of a legalistic explanation for international cooperation, this article is part of a slowly growing body of scholarship that attempts to integrate international politics and international law within a contextualized but rationalistic and rigorous framework. In its focus on the text of the ozone treaties as an explanation for their success, the article takes seriously the notion that nations might take seriously their international legal obligations—although the article does not ignore the issue of actual compliance with the rules specified in the text of the ozone treaties.

I do not claim that this iterative perspective is the only viewpoint that offers any explanatory utility with respect to the success of the ozone treaties. The views described above each have something to contribute to the analysis. Any monocausal argument seems unlikely to be truly persuasive when examining an issue area as complex as ozone depletion, with its aspects of politics, economics, science, and law.

Nor do I claim that this article's application of the iterative perspective conclusively demonstrates some general superiority of that perspective in explaining international cooperation. I examine only one case study. It is a case study that involves both extensive iteration, on the one hand, and increasing and eventually extensive cooperation over time, on the other. The correlation is suggestive of a broader utility, and this article develops a number of tools that one might use in future efforts along these lines. Nonetheless, any advancement of general claims about the consistency of the iterative perspective with the empirics of international relations would obviously require additional case studies: perfect consistency between this theory and the practical workings of international politics would require a demonstration that *all* cases of minimal iterativeness led to minimal and static (or even declining) levels of cooperation, and that *all* cases of extensive and increasing cooperation occurred against a densely iterative background. Perfect consistency, of course, seems unlikely in the complex world of international relations, but even a casually plausible *generality* for the iterative perspective as an explanation for the differential success of various treaties requires more than the study of one particular issue in international relations.

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Parts One and Two of this article focus directly on the iterative perspective, while Parts Three and Four examine the broader utility of the data derived from an iterative focus. Part One examines the choice of treaties as the relevant form of international law, as well as the particular textual choices made in the first two ozone treaties, in order to evaluate the degree to which these choices promote iteration. Part One concludes that the general choice of treaty law as the relevant policy instrument, and especially the particular textual choices made in the earliest ozone treaties, both display a very high concern for promoting iteration. If one analogizes the international cooperative process to a production process, then one might call the choices examined in Part One the "inputs."

Part Two examines what one might call the "outputs" of that process—the changes in the regulations on ozone-depleting substances made in subsequent versions of the treaty texts, the formal pledges of adherence made by various nations to the treaties, the actual degree of behavioral compliance with the relevant textual provisions, and so on. Part Two concludes that the iteration-promoting choices discussed in Part One in fact led to a series of additional iterations resulting in a series of additional international legal enactments and, more importantly, in a great deal of international cooperation in terms of the rules set forth therein and the actual behavior of the parties formally consenting to those rules.

Part Two also examines the detailed dynamics of the ozone treaties as they have unfolded one after another, and reaches some conclusions about the flexibility and persistence of various types of provisions. The ozone treaties reflect an early and undisturbed decision about their core regulatory approach to the consumption and production of ozone-depleting substances; a persistent effort to calibrate the proper exceptions to the strictures set forth in that core approach; a monotonic increase in both the number of chemicals within the ambit of the treaty scheme and the strictness of regulation concerning already-included chemicals; a bi-annual alternation between periods of major enactments and quiescence; a tentative but innovative movement towards explicitly addressing problems of non-compliance with the treaties; and a broad maturation in the system as a whole as the second decade of the international cooperative scheme embodied in the ozone treaties began.

Part Three revisits the "outputs" data derived in Part Two to test some non-iterative hypotheses put forward by legal academics and political scientists interested in international legal cooperation. Using one portion of that data (the formal expressions of consent by nation-states to the rules of the ozone treaties, which I call the "coverage" of the ozone treaty regime), I test a pair of hypotheses derived from sharply contrasting views of international legal cooperation. One hypothesis, derived from the "Liberal" view of international relations, predicts that democracies are more likely than autocracies both to join the ozone-treaty regime at all and to participate extensively therein. Another hypothesis, derived from the "Realist" view of international relations, asserts that nation-states construct international legal regimes that do not actually require any changes in their behavior. As it has been presented by others, this hypothesis is not falsifiable. Part Three nonetheless attempts to nudge the Realist hypothesis in directions that allow it to be susceptible of empirical proof or disproof—especially with the coverage data developed in Part Two. Part Three concludes that there is significant support for the Liberal hypothesis and somewhat muddied support for the hypothesis derived from the Realist view of international relations—although it should be emphasized at the outset that the paper does not undertake tests of statistical significance with respect to *any* hypothesis.

Part Four argues that this article's derivation and analysis of data concerning the ozone treaties is likely to be profitably adapted to analyze several sets of international agreements, which I dub "treaty sets," that have previously garnered little scrutiny in terms of their

possibility for providing detailed insights into the evolution of international cooperation as effected through legal texts. Treaty regimes such as those governing whaling or nuclear arms control between the superpowers, like the ozone treaties, present the opportunity to examine a series of distinct international legal enactments all concerned with the same subject matter. The formality of the international legal process, and the presence of a sequence of distinct international legal enactments expressly concerned with the same subject matter, allows a detailed examination of the dynamics of international cooperation in a fashion otherwise likely to be thwarted by the breadth and temporal indistinctness of international relations. Furthermore, at least for the treaty set concerned with superpower arms control, there is a good deal of pre-existing work addressed to the degree of actual compliance with the strictures of the relevant treaties.

I.
The Inputs of Iteration in the Ozone Treaties

In previous work, I have argued that the law of treaties—the set of general procedural rules governing the degree of obligation imposed upon nations by the text of any particular treaty—is consistent with an institutional design aimed at promoting a formally delineated series of structured interactions between parties ("iterations"), and that such an institutional design promotes the evolution of cooperative behavior against the backdrop of the Prisoner's Dilemma typically thought to describe the incentives facing nation-states considering international political cooperation.[1] I have also previously argued that, in addition to the generally iterative structure that the law of treaties imposes upon the interactions of states with respect to each particular treaty instrument ("intra-instrument iteration"), the texts of some particular treaties erect a series of iterations across treaties by facilitating or even requiring the parties' participation in *subsequent* treaties concerned with the same subject matter ("inter-instrument iteration"). (The ozone treaties provide an example of inter-instrument iteration.)

Here, I first place the law of treaties within the larger framework of international law, arguing in Part A that the choice of a treaty as an instrument of international legal cooperation is more consistent with the iterative perspective than the choice of other instruments of international legal cooperation, such as customary international law. I then move from this relatively high level of abstraction to consider, in Part B, the particulars of the treaties governing the production and consumption of ozone-depleting substances, especially the degree to which the two earliest texts in the ozone-treaty regime promote iteration compared

[1] John K. Setear, *An Iterative Perspective on Treaties: A Synthesis of International Relations Theory and International Law*, 37 HARV. INT'L L.J. 139 (1996).

to an idealized "typical" treaty. (In Part Two, I delve into the dynamics of the later texts in the ozone-treaty regime.)

A. Iteration and the Instruments of International Law

I have argued in an earlier article that a concern for promoting iteration, which one may easily derive from the theories of rationalist scholars of international relations known as "neoliberal Institutionalists," can provide international lawyers and legal academics with a fresh perspective on the rules and rationales of that body of international law known as the law of treaties.[2] Codified in the Vienna Convention on the Law of Treaties[3], the law of treaties sets forth the procedural rules by which nations indicate varying degrees of consent to the rules of a treaty, the conditions under which the obligations nominally triggered by formal consent are excused as a result of such phenomena as fraud or breach by another party, and the rules to be used in interpreting the provisions of valid treaties. Viewed from an iterative perspective, a number of aspects of the law of treaties make at least as much sense as when viewed from more traditional (and more legalistic) perspectives, and a number of ambiguities in the law of treaties may be resolved by reference to the iterative perspective. Furthermore, the iterative perspective may be attractive, at least to some, in resting upon an instrumental desire to promote international cooperation rather than upon slightly more mystical appeals to such concepts as "consent" or "legitimacy."

In a piece conceptually complementary to the article described in the previous paragraph, I have asserted that neoliberal Institutionalists can advance the degree of contact between their theories and international political realities by examining a particular portion of international law—the "treaty process" governed by the law of treaties and related provisions in particular treaties—as the sort of real-world source of well-defined iterations that neoliberal Institutionalists must examine if their theories are not to be consigned to irrelevance as vague metaphors providing no predictive purchase.[4]

In both of these pieces, I examined the treaty process without any explicit discussion of other sources of international legal rules. Treaties are the form of public international law

[2] John K. Setear, *Responses to Breach of a Treaty and Rationalist International Relations Theory: The Rules of Release and Remediation in the Law of Treaties and the Law of State Responsibility*, 83 VA. L. REV. 1 (1997).
[3] Vienna Convention on the Law of Treaties, *opened for signature* May 23, 1969, 1155 U.N.T.S 331 [hereinafter Law of Treaties].
[4] John K. Setear, *An Iterative Perspective on Treaties: A Synthesis of International Relations Theory and International Law*, 37 HARV. INT'L L.J. 139 (1996).

most prominent in modern international political discourse. Furthermore, as will perhaps become apparent from the discussion below, other forms of international law are not especially likely to convince skeptics that international law is a panacea, or indeed even a palatable instrument of policy, in international relations. Nonetheless, treaties are not the only source of international legal rules, and a failure even to address those other sources of international law is at least a lacuna in any comprehensive effort to pool the studies of international law and international relations.

In this section, I make a comparison between treaties and other sources of international law, and argue that, from the iterative perspective, treaties are the best international legal instrument for promoting international cooperation. The implication for the topic most specifically at hand is that the choice of treaties as the international legal method for regulating the consumption and production of ozone-depleting substances was the choice most consistent with a desire to promote iteration, and thus that the success of international cooperation on ozone-depleting substances flowed in part from this choice.

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The proper categorization of the "sources" or forms of public international law is partly contested, but a commonly cited listing appears in Article 38 of the "Statute" of the International Court of Justice (ICJ)[5], which denominates the sources that the ICJ may consult in rendering its decisions:

> 1. The Court, whose function is to decide in accordance with international law such disputes as are submitted to it, shall apply:
>
> a. international conventions, whether general or particular, establishing rules expressly recognized by the contesting states;
>
> b. international custom, as evidence of a general practice accepted as law;
>
> c. the general principles of law recognized by civilized nations;
>
> d. subject to the provisions of Article 59, judicial decisions and the teachings of the most highly qualified publicists of the various nations, as subsidiary means for the determination of rules of law. [6]

[5] Statute of the International Court of Justice, 59 Stat. 1055. By operation of the U.N. Charter, Art. 93, all U.N. members are *ipso facto* parties to the Statute.
[6] *Id.*, art. 38, at ____.

The international "conventions" mentioned above in sub-paragraph 1(a) are what most would call "treaties." The law of treaties specifies a set of rules for their promulgation that results in a highly structured and iterative process in several ways. First, the process involves several different phases, with relatively clear boundaries between each phase.

Initially, potential parties to a treaty meet in formalized international negotiations, during which they are under a (relatively vague) duty to conduct negotiations in good faith.

At the conclusion of such negotiations, the representatives of the participating nations decide whether to adopt the resulting text. A nation's adoption of a proposed text may occur either as a result of the signature or the vote of one of its authorized representatives.[7] Adoption, in contrast to the role of signature in the typical domestic contract, does not convert a negotiated text into a fully binding legal instrument.[8] Instead, signatories or adopting nations are typically bound simply to refrain from taking actions that defeat the object or purpose of the adopted text.[9]

The third phase of the treaty process begins when a treaty enters into force, an event that typically occurs a specified period of time after a specified number of nations have formally given their full consents to the treaty. The necessary number of fully consenting nations—who are said either to "ratify" the treaty (if they have previously adopted its text) or to "accede to" the treaty (if they have not)[10]—and the necessary interval between the triggering ratification and initial entry into force, are both typically specified in the text of the relevant treaty. Ratification or accession, in contrast to signature or adoption, signals a nation's intention to consent in full to all of the terms of the treaty.[11] (Any pre-conditions attaching to the head of state's ratification or accession are a matter of domestic law; frequently, the executive branch must obtain the consent of the legislature before ratification.)

The law of treaties thus involves three phases and a corresponding set of three obligations—negotiations, signature, and entry into force, on the one hand; and, for those participating in each phase, corresponding obligations to negotiate in good faith, to refrain from actions that defeat the object or purpose of the treaty, and to comply in good faith with all the terms of the treaty, on the other. As I have argued at greater length elsewhere, the treaty process thereby consists of at least three distinct iterations, with relatively well-defined

[7] Law of Treaties, *supra* note __, art. 10, 1155 U.N.T.S. at 335 (establishing procedures for authentication of treaty text).
[8] "The consent of a State to be bound by a treaty may be expressed by signature, exchange of instruments constituting a treaty, ratification, acceptance, approval or accession, or by any other means if so agreed." *Id.*, art. 11, at 335. However, the signature of a representative serves as consent to be bound only when the treaty provides that signature shall have this effect, it is otherwise established that the negotiating States were agreed that signature should have this effect, or the intention of the State to give this effect to the signature appears from the full powers of its representative or was expressed during the negotiation. *Id.*, art. 12(1), at 335.
[9] *Id.*, art. 18, at 336.
[10] *See id,* art. 14-15, at 335-36 (distinguishing ratification and accession).
[11] *See id,* art. 11, at 335.

temporal boundaries, clear mechanisms for indicating consent (and thus for formally indicating participation in the cooperative endeavor), and a relatively clear set of substantive obligations imposed upon the parties at each iteration by some combination of the law of treaties and the text of the treaty itself. Additionally, the treaty text may suggest a period for subsequent iterations, as when a treaty specifies that the parties shall decide whether to renew it after the passage of a particular interval (else the treaty lapses), or when the treaty specifies that the parties shall meet at specified intervals to evaluate its effectiveness. The clarity of the relevant behaviors, and the temporal boundaries thereof, makes the treaty process an especially suitable backdrop for the pursuit of international cooperation in practical terms and an especially suitable obejct of study in academic terms.

Each of the sources of international law described in the three other sub-paragraphs of Article 38(1), in contrast, fails to create a series of temporally distinct, highly structured interactions among nations. International cooperation is thereby more difficult to achieve in practical terms and more difficult to study in academic terms. Below, I address each sub-paragraph in turn.

Custom. Sub-paragraph 1(b) of Article 38 describes "international custom, as evidence of a general practice accepted as law."[12] The second clause of this phrase sets forth the two elements of customary rules of international law: a behavioral element involving the widespread observance of a given behavior by a large number of nation-states, and a psychological element involving a self-conscious belief that adherence to the relevant behavior is a matter of international *legal* obligation rather than entirely a matter of legally unconstrained choices.[13] (The psychological element, typically known as *opinio juris*, suggests some logical difficulties—circularity, the need to impute "intentions" to a nation-state, and so on—but these are not directly relevant to the comparison undertaken here.)

From the iterative perspective, there are three difficulties with customary law in comparison to laws derived from treaty texts. One such difficulty involves the poor temporal definition of iterations under customary international law; the second difficulty is the potential problem of determining whether a nation has actually consented to a rule of customary international law; and the third difficulty is that of clearly specifying the substantive customary rule itself, and thus of clearly determining whether a nation's actual behavior constitutes cooperation with (rather than defection from) the relevant attempt at international political cooperation.

As I have argued at length elsewhere, and as I have briefly mentioned above, treaty law involves particular temporal periods defined with some clarity. Negotiations are convened at a particular time and conclude with the signature of the treaty text, an act that occurs at a relatively well-defined point in time. (One might think that signature is an act that

[12] Statute of the International Court of Justice, art. 38(1)(b), 59 Stat. 1055, ____.
[13] *Id.*

occurs at a nearly exact point in time, e.g., the small number of minutes required for a parade of ministers or heads of state to affix their signatures to paper beneath an elegant chandelier. In fact, however, a treaty may be "open for signature" for a significant interval, frequently a full year.) The subsequent iteration in the treaty process occupies the time between signature and entry into force, an act that occurs at a particular instant defined by the treaty itself. The third iteration in the treaty process begins at that same well-defined moment—though its termination is a matter of some complexity depending upon whether the treaty is of indefinite duration, whether the treaty itself suggests particular periods of special relevance, and so forth.

The formulation of rules of customary international law lacks any such procession of temporally well-defined interactions among nations. The practice-oriented component of customary rules of international law requires that the relevant national practice persist in time and across a significant segment of the international community before it becomes a binding legal rule. Customary law therefore involves a temporal aspect. Nonetheless, there is no structure within the required period of persistent practice. Customary rules frequently impose duties that must be continually discharged, such as abstention from the use of force against the civilians of foreign nations or (in the twentieth century) against a government's own citizens, respecting the diplomatic immunity of the accredited representatives and embassy property of foreign nations, and refraining from interference with freedom of navigation on the high seas. In such situations, no naturally well-defined interval to define the boundaries of an iteration exists. This contrasts with treaties, at least in a formal sense, in light of the well-defined boundaries of the iterations involved in negotiation, adoption, and entry into force. The customary international legal process may be dynamic, but the fuzziness of the temporal boundaries separating one interaction from the next means that the customary international legal process is not particularly iterative.

The mechanisms for determining whether a nation has consented to a rule of customary international law also lack the clarity of the mechanisms imposed by the law of treaties upon potential adherents to a particular treaty. In some cases, a nation's consent to a rule of customary international law is unambiguous: a nation that undertakes affirmative actions, and accompanies those actions with explicit official statements that the actions are undertaken as a matter of legal compulsion, clearly signals its support for a pre-existing rule of customary law. Conversely, a nation that persistently fails to behave consistently with the rule, and accompanies those failures with explicit official statements that its behavior is undertaken to demonstrate disagreement with the rule, clearly signals its opposition to a given rule of customary international law.

A number of problematic intermediate cases occur with some frequency, however. Some of these relate to the continuous nature of rules of restraint as described above. Even a proposed rule as apparently quixotic as "refrain from warfare" accurately describes the practice of a majority of nations a majority of the time. There may almost always be several

wars ongoing at any particular time around the globe, but rules are judged on a national rather than a global basis, and almost every nation—except Vietnam, perhaps—has been at peace for a super-majority of years during even the violent twentieth century. Is peace then a "practice" to which nations adhere, even though those same nations seem also to undertake wars from time to time without explicitly intending to protest the development of a rule banning warfare? Conversely, must a nation that desires to signal its consent to a "rule of peace" issue daily bulletins proclaiming that its behavior for the day rests upon its *opinio juris* with respect to that rule?

A partially independent difficulty with consent regarding rules of customary international law stems from the ambiguity with which silence is treated. Consent to a treaty requires a formal and affirmative statement by a government of its intention to comply in part (by signature) or in full (by ratification or accession) with the obligations of the treaty at issue. With customary international law, in contrast, one may *infer* a nation's consent. A nation that fails to object to an international practice accompanied by *opinio juris* on the part of other nations may find itself ostensibly bound to the resulting rule of customary law, despite the fact that the nation in question has never expressed an opinion on the matter. A relatively dramatic example involves a new nation-state, which is typically thought to enter the international legal realm having consented *in advance* to the entire body of widely accepted rules of customary international law—despite its lacking, by definition, any prior opportunity to announce its official views on the relevant rules through either action or expression.

Customary international law thus suffers both from a lack of temporally distinct iterations and from ambiguous mechanisms for indicating formal consent. The remaining criterion of special relevance to the iterative perspective is the clarity of the substantive rule itself. A clearly specified rule eases the determination of whether a nation is in fact cooperating with the international political endeavor at hand. On this criterion as well, customary international law falls short.

The crucial role of practice in defining customary rules means that any *change* in the rules of customary law can be effectuated only after a period during which neither the old nor the new rule is clearly in force. While a new rule set forth in a treaty takes full effect only upon the entry into force of the treaty, the system of customary international law provides no clear date on which the new rule will come into force. Instead, the new rule of customary international law accretes from the scattered choices of innovative nation-states who shed their previous practice for the newer practice (and thereby "legislate by doing," as it were). The initial innovator rarely generates an instantaneous, universal rush to the new practice, however; some nations affirmatively resist the implicit suggestion to alter their practices, while other nations simply continue their previous silence on the matter. The result, at least for some interval, is that the innovator is also a violator, with the resultant difficulties for other nations in terms of determining a proper response. Furthermore, a claim of "innovation" is distinguishable from an unalloyed violation only in retrospect (when one knows whether

the "proposed" rule has been accepted as a result of widespread adoption by other nations); this ambiguity further increases the difficulty of determining a proper response to the innovator/violator's deviation from the accepted norm of cooperation.

One might also note that the unwritten nature of customary law contributes to the difficulty of judging whether a nation's behavior actually complies with its obligations under customary international law. Treaties are prospectively oriented exercises, while customary law depends crucially upon the retrospection of observed behavior; treaties are almost invariably written down, while customary law derives its norm from behavior. To the extent that the prospective, written specification of rules makes them clearer, compliance with a cooperative norm set forth in treaty law should be easier to determine than compliance with a cooperative norm of customary law.

General principles of law. "General principles of law," the subject of sub-paragraph 1(c) of Article 38, involves the inference of international legal rules from the widespread practices of *domestic* legal systems; these inferences tend to be limited to procedural questions in cases of international litigation or arbitration. If dozens of nations provide a civil defendant with the ability to cross-examine the plaintiff's witnesses, for example, then an international civil court might allow cross-examination as a general principle of law. To the degree that domestic legal systems clearly specify their rules, then the determination of general principles of international law from such legalistic specifications will be an easier task than the ever-tricky inference of rule from behavior that is necessary to determine rules of customary international law. Nonetheless, a number of similarities between customary law and general principles of law remain. The determination that a principle of law is "general" across domestic legal systems requires the same judgment about prevalence, and thus presents the same difficulties of aggregation, that one must face in determining that a practice commands "general" acceptance by nations in the international political system. Additionally, there is no particular temporal structure imposed upon the evolution of general principles of law, just as customary international law evolves without recognized starting and stopping points.

Judicial opinions and the writings of publicists. Sub-paragraph 1(d) of Article 38 actually describes two separate sources: the opinions of courts concerning matters of international law, and the writings of qualified publicists.[14] That sub-paragraph expressly describes these two sources of law as "subsidiary,"[15] a description consistent with the broad consensus of international legal scholarship as well. Nonetheless, a "subsidiary" source of law is not a forbidden source of law, and an examination of these two sources of law from the iterative perspective is worth undertaking.

[14] Statute of the International Court of Justice, art. 38(1)(d), 59 Stat. 1055, ____.
[15] *Id.*

Viewed as a series of separate judgments, judicial opinions in some sense present an intriguing opportunity for formalized iterations. Each opinion issues at a particular time and sets forth, in writing, one or more legal rules—presumably with sufficient clarity to allow a determination as to later compliance with that rule. The difficulty with legal opinions in the international legal system, in contrast to laws based in either custom or treaty, is that such opinions generally lack precedential value—and thus do not formally apply to the international politico-legal system as a whole. Article 59 of the Statute of the ICJ, for example, states (in its entirety): "The decision of the Court has no binding force except between the parties and in respect of that particular case."[16] Those citing such a decision must therefore worry not simply that the case is fact-bound but also that its rule and reasoning are not applicable to non-parties even on exactly the same facts. (The ICJ may also issue advisory opinions in addition to the "judgments" that issue in so-called "contentious" cases; if judgments in contentious cases bind only the parties, however, then advisory opinions would appear reliably to bind absolutely no one.) One should also note from a practical standpoint that resort to judicial resolution of disputes, at least with respect to the ICJ, is relatively rare: the ICJ has rendered decisions in fewer than 100 cases (including both advisory and non-advisory opinions) in its fifty-plus years of existence. Given the broad range of international legal issues, two decisions per year is not the sort of pace likely to produce a set of rules upon which nations can base their foreign relations. National courts are another potential source of decisions concerned with international legal questions, but the degree to which the opinions of one nation's courts can bind other nation-states is problematic. The development in recent decades of international courts with the power to issue opinions with precedential effects, such as the European Court of Justice (ECJ) or the Appellate Body of the World Trade Organization (WTO), is promising. The WTO's "court" is only a few years old, however, and the ECJ obviously has a limited (if nonetheless important) geographical jurisdiction.

As to the writings of expert publicists, one need not have a specialist's experience with the international legal literature to imagine that a collection of academics spanning the globe does not cohere around well-established procedural rules that lead to temporally distinct specifications of agreed-upon substantive conclusions. Even without the overlay of vastly different national cultures, after all, the marketplace of academic ideas often fails to produce an intellectual equilibrium. In any event, the "source" of law stemming from professorial opinion is in the view of some commentators no more than a marginal supplement to other sources, especially custom, rather than an independent category of rules. (Fans of logical paradoxes may wish to ponder what one is to make of those publicists who write that the makers of international legal rules should pay little attention to the writings of publicists.)

One may therefore conclude, with a fair degree of comfort, that treaties are an instrument of international policy more firmly undergirded by an iterative process than are other forms of international law. The temporal boundaries of the iterations set forth by the

[16] Statute of the International Court of Justice, art. 59, 59 Stat. 1055, ____.

law of treaties are relatively clear; the mechanisms for determining whether a nation has consented to the relevant rules are clear and formal; and the prospective, written format of treaties makes them the best medium for the specification of rules that serve as clean-edged templates against which to compare the actual behavior of consenting nations.

B. Iteration and the Texts of the Ozone Treaties

The international legal rules that regulate the consumption and production of ozone-depleting substances take the form of a series of treaties. As argued above, the use of treaties as a source for international legal rules is more consistent with a desire to promote formalized iterations than is the use of other forms of international law. The choice of treaties to regulate the consumption and production of ozone-depleting substances is thus consistent with the promotion of structured, formalized iterations. From the iterative perspective, such consistency serves as at least a partial explanation for the success of the ozone treaties.

Nonetheless, the comparison of the iterative utility of treaties to the iterative utility of other sources of international law must occur at a fairly high level of generality. The rules of public international law cover a great deal of ground, and dividing those rules into just a few categories reduces the degree of aggregation only slightly. A wide variety of rules exists within the rules of each of treaties, customary law, and so on. To note that treaties set forth the rules governing the consumption and production of ozone-depleting substances cannot by itself, of course, distinguish the ozone treaties in form from rules contained in *other treaties*. If the ozone-treaty regime is "the" success story of international environmental law but not the only regime of international cooperation to be embodied in a treaty, then one must examine the particular features of the ozone treaties, especially in comparison to other treaties, in order to explain the particular success of the ozone-treaty regime. This section of Part One undertakes this task.

(This section compares the ozone treaties to other treaties in a rather subjective way. At various points, I compare the features of the initial ozone treaties to my own impressions of analogous features in a "typical" treaty. An actual census of treaties, even one limited to those signed in the latter portion of the twentieth century, would involve literally thousands of separate agreements. The discussion of "typical" treaties below tends to focus on environmental treaties, with less attention to arms-control agreements and general treaties (such as the UN Charter), with the least attention devoted to trade-oriented treaties. The focus on environmental treaties makes some obvious sense in a discussion centered on the treaties

about ozone-depleting substances, while arms-control agreements are similarly technical (and relatively recent) endeavors. The short-shrifting of trade treaties in comparison to general treaties is largely the result of the author's own limitations of knowledge.)

Sub-section 1 of this Section provides an overview of the ozone-treaty regime, including a description of the core regulatory approach of the regime and the scientific underpinnings thereof. Sub-section 2 discusses the first two enactments in the ozone-treaty regime as an example of the much-discussed "convention-protocol" approach to problems of international legal cooperation, and briefly describes the consistency of this general approach with the iterative perspective. In an effort to address in more detail the degree to which a greater consistency with the iterative perspective might explain the unusual success of the ozone-treaty regime in effecting international cooperation, sub-section 3 compares a variety of particular features of the first two enactments in the ozone-treaty regime with analogous features in the typical treaty. (Part Two then examines the degree to which, and the manner in which, the "inputs" specified in the first two enactments led to the "outputs" specified in later enactments in the ozone series.)

1. An Overview of the Ozone-Treaty Regime

The ozone-treaty regime is complex. It involves seven distinct enactments creating or modifying treaty texts in the regime. The same enactment may not only set forth a variety of substantive rules but also use a variety of procedural rules to determine which nations are partly and fully bound. The core of its approach to the preservation of the ozone layer is a complex vector of calculations that includes a factor representing the best efforts of scientists to reduce the intricacies of atmsopheric chemistry to a single number for each regulated substance. A brief overview of the regime and the relevant science is therefore in order.

The "ozone layer" is a colloquial expression for a portion of the atmosphere several miles above the surface of the earth and relatively rich in ozone, a molecule consisting of three atoms of oxygen. Ozone reflects ultra-violet radiation emitted by the sun. Ultra-violet radiation that strikes the earth can cause skin cancer and cataracts in humans, and, of indirect concern to humans, a wide variety of potentially harmful mutations in plants and animals, including some species identified both as especially sensitive to ultra-violet radiation and especially important to the ecosystems of which they are a part. Certain substances containing atoms of chlorine or bromine serve as catalysts for chemical reactions in the atmosphere that lead to the destruction of stratospheric ozone. (Catalysts, in the chemical sense, are substances that increase the rate of a particular reaction without themselves being consumed in the reaction.) These ozone-depleting substances are man-made; they serve a

wide variety of functions as (among other things) refrigerants and fire retardants and propellants; they are capable of being transported from the surface of the earth into the stratosphere by naturally occurring air currents; and, once in the stratosphere, the relevant molecule typically remains in the stratosphere to catalyze the destruction of ozone molecules for many years or even many decades.

In terms of international cooperation, the anthropogenic response to this anthropogenic problem has been the enactment of the series of international legal enactments that constitutes the ozone-treaty regime.

The first such enactment was the Vienna Convention for the Protection of the Ozone Layer (Convention), signed in 1985 and entering into force in late 1988. See Table 1. This treaty set forth some vague promises of international cooperation and some concrete procedural rules to govern future enactments.[17]

[17] Vienna Convention for the Protection of the Ozone Layer, Mar. 22, 1985, 26 I.L.M. 1529 (entered into force September 22, 1988) [hereinafter Vienna Convention].
[18] Montreal Protocol on Substances That Deplete the Ozone Layer, September 16, 1987, 26 I.L.M. 1550 (entered into force January 1, 1989) [hereinafter Montreal Protocol].

TABLE ONE –
THE ENACTMENTS OF
THE OZONE TREATIES

Document	Year of Enactment
Vienna Convention	1985
Montreal Protocol	1988
London Revisions	1990
Copenhagen Revisions	1992
Nairobi Addition (Annex D)	1994
Vienna Adjustments	1995
Montreal Revisions	1997

The second enactment in the ozone-treaty regime was the Montreal Protocol on Substances that Deplete the Ozone Layer (original Protocol), signed in 1987 and entering into force in early 1989. This treaty set forth some concrete substantive obligations based on a core regulatory approach described almost immediately below.[19] I refer to the combination of the Convention and the original Protocol as "the Initial Enactments."

Each enactment after the Initial Enactments has been a revision to the original Protocol. (When referring to an individual Revision, it is designated herein by the city in which the parties to the Protocol signed the relevant revisions, e.g., the London Revisions or Copenhagen Revisions; collectively, I refer to these subsequent enactments as the Revisions.) The Revisions have broadened and deepened the core regulatory approach of the original Protocol, and have adopted some supplemental approaches to the core regulatory approach, in a fashion that will be described in some detail in Part Two. Part One views the initial enactments as the "inputs" of the iterative process, while Part Two treats the Revisions as the "outputs" of that process.

The core regulatory approach of the ozone-treaty regime involves setting yearly national quotas for the consumption or production of ozone-depleting substances. For each year, the quotas are set for each "group" of chemicals of similar molecular composition as a percentage of the consumption or production of that group compared to a baseline year.[20] I designate this percentage the "Allowable Percentage." The Allowable Percentage may vary from group to group and from year to year, but the Allowable Percentage for a given group in a given year is the same for every nation. The baseline year remains the same across agreements for any given group of ozone-depleting substances. The relevant formulae in both the year of the quota and the baseline year account for the possibility that different chemicals *within* a group might differentially harm the ozone layer by applying a factor to each chemical's consumption or production that varies proportionally with the ozone-depleting potential (ODP) of that chemical (as determined by the best scientific evidence).

A numerical example may be useful. Group II of annex A of the original Protocol consists of "halons," ozone-depleting substances that may be familiar to anyone who has ever read the frightening signs in rare-book libraries warning of asphyxiation in the event of fire. (Halon is an excellent fire-fighting agent because it smothers fire, and everything else, quite efficiently.) Halon-1211 has an ODP of 3[21]; halon-1301, which is likely to lead to the demise of more than three times as many ozone molecules as halon-1211 during each molecule's time in the stratosphere, earns an ODP of 10.[22] The baseline year for halons is 1986.[23] Assume that, in that year, a particular nation produced 10 tons of halon-1211 and 5 tons of halon-1301

[19] Montreal Protocol on Substances That Deplete the Ozone Layer, September 16, 1987, 26 I.L.M. 1550 (entered into force January 1, 1989) [hereinafter Montreal Protocol].
[20] Montreal Protocol, *supra* note __, art. 2, 26 I.L.M. at 1552.
[21] Montreal Protocol, *supra* note __, annex A, 26 I.L.M. at 1560.
[22] *Id.*
[23] Montreal Protocol, *supra* note __, art. 2(2), 26 I.L.M. at 1552.

(and none of any of the other halons). Its ODP-weighted Group II baseline-year index would then be 80. (10 tons x 3 for halon-1211, and 5 tons x 10 for halon-1301; (10 x 3) + (5 x 10); 30 + 50 = 80).

Now assume that the Allowable Percentage for halons in the year 2000 is "50%.". For any nation with an ODP-weighted Group II baseline index of 80, as in the example above, the resulting permissible ODP-weighted Group II index in the year 2000 would then be 40. (50% x 80 = 40.)

Because of the aggregation of chemicals within a group, and because of the use of the ODPs, a nation can exactly satisfy its obligations in a given year in a variety of ways. Continuing with the example of a baseline index of 80 and a permissible index of 40 in a given year, one scheme exactly satisfying a nation's treaty obligations would be a reduction of 50% in the production of both chemicals whilecontinuing to produce none of any of all the other Group II chemicals. Such a scheme in fact yields an index of 40 in the relevant year. (5 tons x 3 for halon-1211, and 2.5 tons x 10 for halon-1301; (5 x 3) + (2.5 x 10); 15 + 25 = 40.)

Another permissible scheme for the year 2000 would be to continue production of halon-1211 at exactly the level produced in the baseline year, but to reduce dramatically the production of halon-1301. Suppose, for example, that the production of halon 1211 continued at 10 tons in 2000, while the hypothetical nation reduces its halon-1301 production by 80%, to just one ton. The nation in question would in such a case also be complying with its obligations to produce halons in such a way as to yield an index of 40. (10 tons x 3 for halon-1211, and 1 ton x 10 for halon-1301; (10 x 3) + (1 x 10); 30 + 10 = 40.)

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2. The Convention-Protocol Approach and the Ozone-Treaty Regime

Scholars of international law have noted the development in the late twentieth century of what is in some ways a meta-treaty: the "convention-protocol" approach to a particular subject matter of international cooperation.[24] The convention-protocol approach involves at least two separate enactments, one "convention" and one or more "protocols." The convention sets forth vague substantive provisions that serve mainly to acknowledge the subject of that treaty as a matter worthy of serious further consideration. The convention includes procedurally oriented provisions that, in contrast, are quite specific. The convention contemplates one or more subsequent protocols, to be created and administered largely under

[24] *See, e.g.,* John K. Setear, *An Iterative Perspective on Treaties: A Synthesis of International Relations Theory and International Law*, 37 HARV. INT'L L.J. 139, 217-223 (1996).

the procedures set forth in the convention. The protocols provide the substantive detail of the treaty regime.

The Convention on Long-Range Transboundary Air Pollution (LRTAP Convention) is an example of the convention-protocol approach, and it has led to the creation under its procedural provisions of numerous, detailed protocols.[25] (Each protocol concentrates on a particular category of pollutant, such as sulfur oxides or volatile organic compounds.) The Framework Convention on Climate Change has so far led to the creation of only one follow-on text, the Kyoto Protocol; that protocol faces significant obstacles to its ratification in the United States[26] but does set concrete targets for reductions in greenhouse-gas emissions by developed countries and does include a market-mimicking scheme related to carbon emissions.[27]

From an iterative perspective, the convention-protocol approach is sensible. Full and formal consent to a convention serves as a nation-state's cooperative response to an initial, formalized interaction regarding a particular subject matter. The convention at least contemplates future iterations, and sets forth the procedural rules to be used in determining the substantive standards against which cooperation will be measured in future iterations, if any. To some extent, scholarly enthusiasm for the convention-protocol approach depends upon phenomena (such as the acquisition over time of scientific knowledge) that straightforward descriptions of the iterated Prisoner's Dilemma do not incorporate, but the general flavor of the convention-protocol approach contains more than a dash of the iterative perspective.

Proponents of the iterative perspective would, however, do well to note that a convention typically contains no more than a *contingent* specification of future iterations even as a matter of international law. A convention sets forth rules that will govern future protocols *if* the parties agree upon such protocols; a convention does not typically involve a

[25] Protocol to the 1979 Convention on Long-Range Transboundary Air Pollution on Long-Term Financing of the Co-Operative Programme for Monitoring and Evaluation of the Long-Range Transmission of Air Pollutants in Europe (EMEP), Sept. 29, 1984, 27 I.L.M. 701; Protocol to the 1979 Convention on Long-Range Transboundary Air Pollution on the Reduction of Sulphur Emissions or their Transboundary Fluxes by at least 30 per cent, July 8, 1985, 27 I.L.M. 707; Protocol to the 1979 Convention on Long-Range Transboundary Air Pollution on Further Reduction of Sulphur Emissions, June 14, 1994, 33 I.L.M. 1540; Protocol to the 1979 Convention on Long-Range Transboundary Air Pollution Concerning the Control of Emissions of Nitrogen Oxides or their Transboundary Fluxes, Oct. 31, 1989, 29 I.L.M. 212; Protocol to the 1979 Convention on Long-Range Transboundary Air Pollution Concerning the Control of Emissions of Volatile Organic Compounds or their Transboundary Fluxes, Nov. 18, 1991, 31 I.L.M. 573. For a description of these protocols on monitoring pollutants and limiting emissions of sulfur and nitrogen compounds, see Sean D. Murphy, *Prospective Liability Regimes for the Transboundary Movement of Hazardous Wastes*, 88 AM. J. INT'L L. 24, 61 (1994).

[26] *See* S. Res. 98, 105th Cong., 1st Sess. (1997) (resolving that the United States should not agree to a protocol that would mandate new commitments to reduce greenhouse gas emissions for developed countries unless the agreement "also mandates new specific scheduled commitments to limit or reduce greenhouse gas emissions for Developing Country Parties within the same compliance period").

[27] Kyoto Protocol to the United Nations Framework Convention on Climate Change, Dec. 11, 1997, art. 3-5, (visited Apr. 5, 1998).

promise that such interactions *will* occur. Nonetheless, from an iterative perspective, the convention-protocol approach is, as Shaw said about turning eighty, better than the alternative; in the international legal context, of course, the alternative is not death but rather the traditional treaty, which does not explicitly even contemplate the future construction of separate, more detailed agreements.

The Convention and the original Protocol, true to their names, together embody a "convention-protocol" approach to ozone depletion. The Convention's chief substantive requirement is appropriately, perhaps even excessively, cautious about imposing particular duties upon its adherents: the parties pledge that, "in accordance with the means at their disposal and capabilities," they will "adopt appropriate legislation or administrative measures [to] reduce or prevent human activities … should it be found that these activities have or are likely to have adverse effects resulting in modification or likely modification of the ozone layer."[28] The Convention also includes some promises of similar generality regarding scientific cooperation among the parties.[29]

The drafters of the Convention expressly recognized the possibility of future protocols: Article 8 notes that the parties may "adopt protocols pursuant to" the general provisions described just above in this paper.[30] Consistent with the formative role of a convention, the Convention also sets forth a variety of concrete procedural rules—applicable both to itself and to future protocols— that govern dispute resolution[31], amendments[32], voting rights[33], and such purely administrative aspects of the treaty as the provision of notice for future meetings[34] and the specification of a depositary for ratifications[35].

I have already provided an extended example of the operation of the Protocol's core regulatory approach, with its baselines and ODPs and groups of ozone-depleting substances and Allowed Percentages. That example should be sufficient to demonstrate that the original Protocol's regulatory scheme possesses a degree of concreteness that is a far cry from the vagaries of the Convention.

As a general matter, then, the substantive platitudes and procedural precision of the Convention, paired with the well-specified substantive regulation of the Protocol, are consistent with the convention-protocol approach and, thereby, with a generally iterative approach to international cooperation effectuated through (a series of) treaties.

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[28] Vienna Convention, *supra* note __, art. 2, 26 I.L.M. at 1530.
[29] Vienna Convention, *supra* note __, art. 4, 26 I.L.M. at 1530-31.
[30] Vienna Convention, *supra* note __, art. 8, 26 I.L.M. at 1532.
[31] *Id.*, art. 11, at 1533-34.
[32] *Id.*, art. 9, at 1532-33.
[15] *Id.*, art. 15, at 1534-35.
[34] *Id.*, art. 6(2), at 1531.
[35] *Id.*, art. 20, at 1535.

I turn now to a closer analysis of a variety of features in the Convention and original Protocol in order to compare those particulars to the typical treaty and to an idealized, maximally iterative version of an international treaty. The ozone treaties prove to be less than maximally iterative but generally more encouraging of iteration than the typical treaty.

3. Specifically Iterative Features of the Initial Enactments

a. Meetings

Perhaps the most straightforward method of encouraging formalized interactions between the parties is simply to state that such interactions shall occur. Like the typical treaty, the Convention includes provisions of this sort. Article 6 of the Convention describes the "Conference of the Parties." The Conference of the Parties (CoP) is a body of general purpose, charged with ongoing responsibility for gathering scientific information on the ozone layer and adopting necessary textual changes to the Convention.[36] (As is common with respect to treaties, an additional body known as the"Secretariat" also performs certain administrative functions.[37]) In pursuit of these general purposes, the Conference must meet within one year of the treaty's entry into force, and meet afterwards "at regular intervals."[39]

Such provisions appear in almost every treaty. The typical treaty thereby encourages some degree of iteration, with a specification of the relevant interval that should be easy to determine in retrospect though not necessarily in prospect. A few treaties explicitly specifiy the length of the regular intervals, typically at one or two years.[40] Sucha provision that would seem to encourage iteration more thoroughly, or at least more precisely, than a specification of the meeting interval as simply "regular."

A treaty may delineate not only the intervals at which parties are to meet but also the subject matter of those meetings. The specification of topics for subsequent iterations presumably encourages cooperation. A completely general and open-ended treatment of future iterations might be taken as a lack of true commitment to future interactions between the parties, while some specificity regarding future discussions is more consistent with a serious commitment by the parties as a group to the future of the enterprise—the difference between "Let me get back to you on that as soon as I can," on the one hand, and setting an

[36] Vienna Convention, *supra* note __, art. 6, 26 I.L.M. at 1531.
[37] *Id.*, art. 7, at 1532.
[38] *Id.*, art. 7, at 1532.
[39] *Id.*, art. 6(1), at 1531.
[40] For example, the Treaty Concerning the Reciprocal Encouragement and Protection of Investments, Sept. 29, 1982, U.S.-Egypt, art. VI(2), 21 I.L.M. 927, states that meetings between parties are to occur once every two years, and the Convention on International Civil Aviation, Dec. 7, 1944, art. 48(a), 61 Stat. 1180, 15 U.N.T.S. 295, states that meetings among parties are to occur not less often than once every three years.

agenda and a time certain for another meeting, on the other. On the other end of the spectrum, the immediate, irreversible, and exhaustive specifications of future topics seems inconsistent with a convention-protocol approach in an area of technological and scientific uncertainty: if the parties could be so precise so immediately with the specification of topics for future meetings, they presumably could also dispense with the convention stage and proceed directly to the precise specification of the relevant substantive rules.

The Convention in fact reflects virtually no advance specification of topics for future meetings, consistent with its general vagueness. Its only such specification, consistent with the Convention's generally greater concern with procedural versus substantive rule-making, is that the first meeting of the Conference shall determine the procedures governing the arbitration option in the dispute-resolution mechanism (DRM).[41] (The Convention also expressly delegates to the Conference, though not to any particular meeting thereof, the designation of the forms and intervals in which and at which, respectively, a party is to transmit to the Secretariat information concerning the party's efforts to implement the provisions of the Initial Enactments.)[42]

The original Protocol, in contrast, designates each of its meetings as a Meeting of the Parties (MoP) and assigns a somewhat greater number of particular functions for the first meeting of the MoP after the Protocol's entry into force than does the Convention's specification of the topics for the CoPs.[43] The first meeting of the MoP is obliged to "consider and approve procedures and institutional mechanisms for determining non-compliance with the … Protocol and for treatment of Parties found to be in non-compliance."[44] That first meeting is also to adopt rules governing its meeting procedures, to make rules relating to the finances necessary to administer the original Protocol, to establish panels in connection with the assessment of the control measures, and to begin preparation of work-plans relating to technical assistance.[45]

The original Protocol also sets up a number of specific future obligations relating to meetings to occur after a particular lapse of time.[46]

As enacted, the original Protocol requires parties eventually to "ban the import of controlled substances from any State not party to this Protocol."[47] Articles 4(3) and 4(4) contemplate expansions of this ban, to be effectuated by additional, specified meetings of the MoP.[48] Article 4(3) of the original Protocol requires the MoP to meet within *three* years of

[41] Vienna Convention, *supra* note __, art. 6, 26 I.L.M. at 1531-32.
[42] *Id.*
[43] Montreal Protocol, *supra* note __, art. 11, 26 I.L.M. at 1557-58.
[44] *Id.*, art. 8, at 1556.
[45] *Id.*, art. 11, at 1557-58.
[46] *Id.*, art. 11(4), at 1558.
[47] Montreal Protocol, *supra* note __, art. 4(1), 26 I.L.M. at 1554.
[48] *Id.*, art. 4(3), 4(4), at 1555.

the original Protocol's entry into force to produce a list of banned products *incorporating* the substances controlled by the original Protocol[49], while article 4(4) of the original Protocol requires the MoP to meet within *five* years of the original Protocol's entry into force to produce—if feasible—a list of banned products *produced with*, but not actually containing, the substances controlled by the original Protocol.[50] (These products were eventually listed, in a rather general fashion, in Annex D of the Protocol.) Taken together, these provisions imply two additional, mandatory meetings of the MoP, with each meeting focused on its particular extension of the ban on the pure forms of the controlled substances set forth in the original Protocol. (The parties could, of course, also comply with the terms of the original Protocol by holding a single meeting, within three years of entry into force, that addressed *both* incorporated and produced-with substances, but the drafters of the treaty seem to have considered the two extensions to be at least textually distinct.)

A broader but still partly specified sbuject matter for future MoPs is set forth in article 6 of the original Protocol, which requires periodic meetings at a specified regular interval—four years—for the rather comprehensive purpose of "assess[ing] the control measures provided for in Article 2 on the basis of available scientific, environmental, technical and economic information."[51] Since Article 2 is clearly the heart of the original Protocol, this mandate is tantamount to requiring the MoP to reconsider the effectiveness of the original Protocol at four-year intervals.

(The original Protocol also requires each party to submit a bi-annual summary of its activities relating to ozone research, development, public awareness, and exchanges of information, but there is no requirement that the parties meet to discuss these activities.[52] Similarly, if a bit more stringently, the original Protocol requires an annual submission from each party of controlled-substance statistical data on its production, approved-process destruction, imports, exports to other parties, and exports to non-parties.[53])

b. Textual Modifications

The substantive rules governing the parties' cooperative preservation of the ozone layer are of course found in the ozone treaties. The rules for textual modifications of those treaties are especially important in light of the emphasis of the convention-protocol on later enactments and in light of the actual history of the ozone-treaty regime, which has yielded nearly half a dozen distinct Revisions.

[49] *Id.*, art. 4(3), at 1555.
[50] *Id.*, art. 4(4), at 1555.
[51] *Id.*, art. 6, at 1556.
[52] *Id.*, art. 9, at 1556-57.
[53] *Id.*, art. 7, at 1556.

The Convention sets out the rules for its own textual modification.[54] The Convention also sets out default rules for any subsequent protocols[55], and the original Protocol has not modified these rules.[56]

With the important exception of "adjustments," which are described in more detail below, all changes to the text of the Convention or the original Protocol occur according to essentially the same rules. All amendments to the Convention or Protocol are to be adopted at a CoP or MoP, respectively.[57] At such a meeting, nations are bound to make "every effort to reach agreement on any proposed amendment to this Convention by consensus," but the parties may instead adopt amendments by a three-fourths majority vote (for Convention amendments) or a two-thirds majority vote (for amendments to the Protocol) so long as "all efforts at consensus have been exhausted."[58]

"Consensus," it should be noted, is a unanimity-like requirement in which any explicit objection by a party blocks the proposal under consideration. It differs from strict unanimity in two, somewhat subjective ways. First, there is said to be a presumption against expressing objections in consensus-based systems. Second, a failure to object is clearly the equivalent of an affirmative vote in a consensus-based system, while a non-vote by a present member in some unanimity-oriented systems is equivalent to a negative vote.

If an amendment is adopted, a party is fully bound only if, and when, it later affirmatively ratifies that amendment. There is a shift in the procedural presumption with respect to amendments to "annexes": such amendments are binding upon a party unless it objects. (The annexes of the Convention and Protocol are an "integral part" of the document to which they relate, but are "restricted to scientific, technical, and administrative matters.")

The original Protocol (though not the Convention) also recognizes a category of textual modifications known as "adjustments" rather than "amendments."[59] An "adjustment" may take either of only two forms: it may be a change in the ODP of an already-controlled substance, or it may be a reduction in the Allowable Percentage of an already-controlled substance.[60] As with amendments to the Protocol, all adjustments are to be made at a MoP, with the member nations obliged to make "every effort" to adopt adjustments only by consensus[61]; as with amendments to the original Protocol, a two-thirds majority vote of the Conference is necessary for adoption of an adjustment once efforts to achieve a consensus

[54] Vienna Convention, *supra* note __, art. 9, 10, 26 I.L.M. at 1532-33.
[55] *Id.*
[56] Montreal Protocol, *supra* note __, art. 14, 26 I.L.M. at 1559 (stating that "[e]xcept as otherwise provided in this Protocol, the provisions of the Convention relating to its protocols shall apply to this Protocol").
[57] Vienna Convention, *supra* note __, art. 9, 10, 26 I.L.M. at 1532-33; Montreal Protocol, *supra* note __, art. 11, 26 I.L.M. at 1557-58.
[58] Vienna Convention, *supra* note __, art. 9(3), 9(4), 26 I.L.M. at 1533.
[59] Montreal Protocol, *supra* note __, art. 2(9), 26 I.L.M. at 1553.
[60] *Id.*
[61] *Id.*, art. 2(9)(c), at 1554.

have failed.[62] Beyond these requirements, the adoption of an adjustment requires *separate* (simple) majorities of each of the developed and developing nations voting on the adjustment.[63]

Surmounting these procedural hurdles brings with it an important benefit, at least from the standpoint of imposing binding legal obligations upon parties to the Protocol: six months after adoption, adjustments become binding on *all* parties to the adjusted instrument.[64] In contrast, as previously discussed, amendments are binding only on *ratifying* parties (or, if an amendment to an annex, only on parties that fail to object).[65] An adopted adjustment therefore leads to a rule applying uniformly to *all* parties to the adjusted Protocol, while adopted amendments bind only those parties taking the necessary steps to express their approval of the relevant amendment (or, in the case of an amendment to an annex, by failing to object).

Binding parties who do not adopt a text is unusual in international law. The presence of such a mechanism for textual modification in the ozone-treaty regime is thus an indicator of an atypical willingness by participants in the regime to change the terms of their initial cooperative bargain. As will be seen in more detail below, adjustments have been used to effect important changes in the rules of the ozone treaties, and they have been used exclusively to increase the degree of cooperation embodied in the regulations of the ozone treaties.

c. Duration and Membership

From an iterative perspective, a treaty of indefinite duration is best; the shadow of the future is thereby maximally lengthened. Both the Convention and the original Protocol fail to state their duration explicitly and thus, under the default rule generally applicable to treaties, are of indefinite duration.

Multilateral treaties raise issues relating not only to the duration of the instrument as a whole, but also to the entry and exit of individual nations. The entry requirements of the Convention and the original Protocol are for the most part those imposed by virtually all multilateral treaties: the signature of an authorized representative of the relevant nation-state, together with subsequent ratification by the relevant head of state.[66] As with most modern

[62] *Id.*
[63] *Id.*
[64] *Id.*, art. 2(9)(d), at 1554.
[65] Vienna Convention, *supra* note __, art. 9, 10, 26 I.L.M. at 1532-33.
[66] Vienna Convention, *supra* note __, art. 12-14, 26 I.L.M. at 1534.

treaties, the Convention and the original Protocol also permit non-signatories to "accede" and thus be treated as if they had both signed and ratified.[67]

Compared to entry, the rules on exit are both generally more subject to variation and specifically of somewhat greater interest with respect to the ozone treaties. From the iterative perspective, any limitation on the exit of individual parties is useful. Indeed, an outright bar against exit is presumably best, for the same reasons that support an indefinite duration as the default length of time during which a treaty is effective after its entry into force. The default rule of the law of treaties comes quite close to the ideal rule relating to withdrawal although that default rule does not bar exit, it does condition a party's withdrawal upon the unanimous consent of the other parties to the treaty.[68]

The typical practice of treaty drafters, however, has been to override the default rule with a provision allowing any party to withdraw unilaterally after the lapse of a brief notification period. Indeed, although a requirement that a withdrawing party meet some substantive pre-condition—or at least state its reasons for withdrawal—might serve as a partial equivalent to a no-withdrawal rule, most treaties allow withdrawal upon nothing more than a bare-bones notification and the lapse of the requisite time.

The ozone treaties are more consistent with the iterative perspective on withdrawal than the typical treaty. A party may not withdraw *at all* from either the Convention or the original Protocol for the first four years after the relevant agreement binds that party.[69] After the expiration of the four-year no-withdrawal period, a party must provide a full year's notice before its withdrawal from the relevant agreement becomes effective.[70]

If one believes that the first rounds of participation by a party in an iterative process are especially important, then the first-four-years no-withdrawal provisions are especially useful. In any case, these no-withdrawal provisions distinguish the ozone treaties from many other international agreements. And while the one-year notification provision subsequently applicable is not qualitatively different from the typical treaty, one may at least say with confidence that the notification period is longer (and thus presumptively better from the iterative perspective) than that of manyother treaties. Indeed, I am not aware of any treaty with a longer mandated notification period. Like most treaties, however, the ozone treaties do not require a withdrawing party to possess or to state any particular reason for its withdrawal; in this aspect, the ozone treaties are no more consistent with the iterative perspective than are many other international agreements.

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[67] *Id.*, art. 14, at 1534.
[68] Law of Treaties, *supra* note __, art. 54, 1155 U.N.T.S at ___.
[69] Vienna Convention, *supra* note __, art. 19, 26 I.L.M. at 1535; Montreal Protocol, *supra* note __, art. 19, 26 I.L.M. at 1560.
[70] Vienna Convention, *supra* note __, art. 19, 26 I.L.M. at 1535; Montreal Protocol, *supra* note __, art. 19, 26 I.L.M. at 1560.

d. Interpretation, Compliance, and Enforcement

A treaty crafted with attention to the iterative perspective should reflect the possibility that a party will initially cooperate with the treaty regime by formally consenting to its terms, but later defect by failing to perform its obligations. Those who implicitly analogize international law to domestic criminal law call such behavior a treaty "violation," and they wonder about what "sanction" or "punishment" is appropriate in order to solve the problem of "enforcement" or "deterrence." Other scholars—perhaps sympathetic to the almost-inevitable disappointment that such an analogy will generate, yet desirous for one reason or another not to abandon the field of international law as a hopeless cesspool of illegality— have analogized international law to a complex regulatory regime, in which "compliance" with the treaty regime is a product of the unfolding interactions of rules that may be poorly specified, on the one hand, and behavior that may be motivated by ignorance or incapacity as well as by intentional disobedience, on the other.

International environmental treaties (along with arms-control treaties) are a favored topic of the compliance-oriented group, and the ozone treaties are frequently cited as an example of a complex regulatory treaty. As discussed in more detail below, the structure of the ozone treaties' mechanisms for resolving disputes about the consistency between text and behavior are certainly much more tentative (and iterative) than they are decisive and definitive, and are thus more consistent with the compliance-oriented than with the enforcement-oriented school. I therefore tend herein to use the vocabulary, and with it whatever substantive biases might inevitably follow, of the compliance-oriented school rather than the enforcement-oriented school.

The Convention devotes an article explicitly to the specification of a dispute-resolution mechanism. That mechanism is plainly iterative. It involves several choices by the parties rather than a mandatory linear progression, however, and it need not lead to an actual resolution of every dispute. Under Article 11 of the Convention, parties to a dispute must first attempt to resolve their differences through negotiation between themselves.[71] If negotiation fails, then the parties may (but need not) seek the mediation of a third party.[72] If mediation fails (or is not attempted), then parties who have not agreed otherwise in advance must submit their dispute to a "conciliation commission," which in turn is to issue "a final and recommendatory award, which the parties shall consider in good faith."[73] Even if parties adhere to their legal obligations under Article 11, therefore, the dispute-resolution mechanism may fail to resolve a dispute—if, for example, one party considers the final and recommendatory award in good faith but rejects that award nonetheless.

[71] Vienna Convention, *supra* note __, art. 11(1), 26 I.L.M. at 1533.
[72] *Id.*, art. 11(2), at 1533.
[73] *Id.*, art. 11(5), at 1534.

While recommendatory conciliation is the default mechanism of last resort for resolving disputes, the drafters of the Convention also allowed for compulsory dispute resolution. At or after the time a party consents to be fully bound by the Convention, a party may commit itself to one (or both) of two forms of compulsory dispute resolution: binding arbitration, or submission of the dispute to the International Court of Justice.[74] If both parties have committed themselves to the same form (or to both forms), then a compulsory form of dispute resolution is used instead of recommendatory conciliation.[75]

All of these dispute-resolution provisions in the Convention apply as well to disputes under the original Protocol and the Revisions. The Convention made its provisions presumptively binding on all protocols, and the original Protocol does not override this presumption.

As mentioned above, the original Protocol also requires the parties, at their first meeting of the MoP, to consider and approve "procedures and institutional mechanisms for determining non-compliance with the provisions of the Montreal Protocol and for the treatment of Parties that fail to comply with its terms."[76]

With the exception of the last-discussed non-compliance mechanism, the Convention and original Protocol are typical of recent treaties in the depth and focus on iteration of their dispute-resolution mechanisms. As discussed below, the non-compliance mechanism actually developed for the ozone-treaty regime is more extensive than that associated with the typical treaty. That mechanism evolved after the enactment of the Convention and original Protocol, however, and so I defer an extensive discussion of that mechanism. One might note, however, that the seed of the Protocol has blossomed into a mechanism that the parties regularly employ.

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Surveying the various input-oriented provisions related to iteration, the ozone treaties demonstrate a greater concern for iteration than the typical treaty—not a dramatically greater encouragement of iteration than any other treaty or than typical treaties along every possible dimension, but a good deal of concern for iteration across a wide variety of dimensions. A formal convention-protocol approach is relatively rare, yet the ozone treaties display a thoroughgoing convention-protocol approach. The ozone treaties are banal in the general structure of meetings and organizations, but the details evince some freshness in fleshing out that structure with particular topics and time lapses. The duration of the treaty is as favorable

[74] *Id.*, art. 11(3), at 1534.
[75] *Id.*
[76] Montreal Protocol, *supra* note __, art. 8, 26 I.L.M. at 1556.

as one may have, though not atypically so. While many of the exit provisions are nearly as *in*consistent with the implications of the iterative perspective as one can imagine, similar provisions appear in nearly every other treaty; the limitation on any withdrawals at all during the first few years of operation of each instrument, however, are both relatively rare, and consistent with the implications of the iterative perspective. The procedures for textual modifications are different only in degree, not in kind, from the typical provisions on modifications, but those differences favor iteration: affirmative unanimity is never necessary, while adjustments are unusual in binding all parties. The dispute-resolution mechanism is relatively rich in iterations, though it hardly displays the degree of definitiveness evident in the dispute-resolution mechanisms of the European Union (EU)[77] or the World Trade Organization (WTO)[78]. In this aspect, it is the ozone treaties, rather than the EU or the WTO, that are typical.

[77] Treaty on European Union and Final Act, Feb. 7, 1992, 31 I.L.M. 247.
[78] **[DSU of theWTO]**