

UIC School of Law

UIC Law Open Access Repository

UIC Law Open Access Faculty Scholarship

1-1-1992

Game Theory, Signalling, and International Legal Relations, 26 Geo. Wash. J. Int'l L. & Econ. 33 (1992)

William B.T. Mock

John Marshall Law School, wmock1@uic.edu

Follow this and additional works at: <https://repository.law.uic.edu/facpubs>



Part of the [International Law Commons](#)

Recommended Citation

William B.T. Mock, Game Theory, Signalling, and International Legal Relations, 26 Geo. Wash. J. Int'l L. & Econ. 33 (1992).

<https://repository.law.uic.edu/facpubs/236>

This Article is brought to you for free and open access by UIC Law Open Access Repository. It has been accepted for inclusion in UIC Law Open Access Faculty Scholarship by an authorized administrator of UIC Law Open Access Repository. For more information, please contact repository@jmls.edu.

GAME THEORY, SIGNALLING, AND INTERNATIONAL LEGAL RELATIONS

WILLIAM B.T. MOCK*

TABLE OF CONTENTS

I. Introduction	34
II. An Introduction to Game Theory and Signalling	35
A. Basic Concepts of Game Theory	35
1. Preliminary and Anteriority	36
2. Signalling	38
B. How Signalling Contributes to Our Understanding of International Legal Relations ..	40
C. Application of Game Theory to International Issues	42
III. International Relations Examples to Consider	45
A. Establishing the Authority of the International Court of Justice	46
B. Rationalizing International Agricultural Trade	49
C. Protecting the Global Atmosphere	52
D. Recognizing and Supporting Occupied Nations ..	54
IV. Conclusion	57

* Director, International Law Program, and Professor of Law, The John Marshall Law School. B.A. 1973, Haverford College; J.D. 1979, Georgetown University.

The author wishes to thank Professor Paul B. Stephen III of the University of Virginia School of Law for his comments on a draft of this Article. The author also wishes to thank the following research assistants at The John Marshall Law School (JMLS): Gail Ludvigson, JMLS 1989; Sharon Baker, JMLS 1991; Herbert Smith, JMLS 1991; Joseph Vallort, JMLS 1992; Natalie Koga, JMLS 1993; and Andrew Enschede, JMLS 1994. Finally, the author wishes to thank his wife, Laura Lynn Michaels, Esq., for her support and encouragement in the researching and drafting of this Article.

I naturally said to him, since I am an enthusiastic chess player, "You mean, the theory of games like chess." "No, no," he said. "Chess is not a game. Chess is a well-defined form of computation. You may not be able to work out the answers, but in theory there must be a solution, a right procedure in any position. Now real games," he said, "are not like that at all. Real life is not like that. Real life consists of bluffing, of little tactics of deception, of asking yourself what is the other man going to think I mean to do. And that is what games are about in my theory." Jacob Bronowski, describing a conversation with John von Neumann.¹

I. INTRODUCTION

Is consistency a proper goal of international relations? If not, when is inconsistency appropriate? In particular, under what circumstances is it appropriate for the United States² to act in a manner which makes it impossible to derive any clear, principled basis for their actions? Where two essentially identical situations arise, can inconsistent responses be justified, or is such inconsistency merely a demonstration of erratic policies and special pleading?

This Article proposes that inconsistent responses to essentially identical situations in international relations can indeed be justified on a principled basis—when certain conditions have been satisfied. In establishing this premise, and in identifying those conditions, this Article uses various analytic tools developed in recent decades in the field of game theory, a mathematical discipline that seeks to examine the interactions of "players" pursuing individual or collective goals within a framework of formalized rules.

Accordingly, this Article commences with a summary of the game theoretical tools that will be used. It presents some useful distinctions in game theory—cooperative versus competitive games, preliminary versus anteriority, and direct versus inverted signalling. The concept of inverted signalling is particularly important to the thesis of this Article. Next, this Article considers various examples of U.S. international relations, with specific reference to several areas in which mixed signals are apparently being sent by the United States.

This Article addresses the overall appropriateness of the sig-

1. JACOB BRONOWSKI, *THE ASCENT OF MAN* 432 (1973), *quoted in* WILLIAM POUNDSTONE, *PRISONER'S DILEMMA* 6 (1992).

2. While this Article addresses the specific question of when it is appropriate for the *United States* to take inconsistent positions with respect to similar circumstances in the international setting, the analysis set forth in this Article is plainly applicable to the conduct of any country.

nalling inherent in U.S. international relations. In particular, the author proffers possible reasons for the apparent inconsistencies in the varied responses by the United States to similar international situations. This Article posits that, based on the application of the concept of inverted signalling, inconsistency may actually be appropriate in certain well-defined settings. Finally, this Article concludes with a suggestion for further analysis in order to determine the types of situations appropriate for such inverted signalling.

II. AN INTRODUCTION TO GAME THEORY AND SIGNALLING³

A. *Basic Concepts of Game Theory*

In this section, certain concepts from the discipline known as game theory⁴ will be considered—concepts that will be important

3. The seminal work by John von Neumann and Oskar Morgenstern in mathematical and sociological game theory provides much of the foundation for the analysis in section II of this Article. See JOHN VON NEUMANN & OSKAR MORGENSTERN, *THEORY OF GAMES AND ECONOMIC BEHAVIOR* 51-55 (3d ed. 1953) [hereinafter VON NEUMANN & MORGENSTERN (3d ed.)]; *infra* notes 4-40 and accompanying text. In addition to being the youngest professor named to the Princeton Institute for Advanced Studies at its 1933 inception, von Neumann was a major figure in the development of both digital electronic computers and the hydrogen bomb. POUNDSTONE, *supra* note 1, at 17, 76, 179. He and Morgenstern first published their work in 1944. JOHN VON NEUMANN & OSKAR MORGENSTERN, *THEORY OF GAMES AND ECONOMIC BEHAVIOR* (1st ed. 1944).

4. Although von Neumann and Morgenstern's *Theory of Games and Economic Behavior* is still the most influential work applying modern game theory to the social sciences, the growth of game theory can be seen throughout the twentieth century. In 1956, one author described game theory as "the most promising mathematical tool yet devised for the analysis of man's social relations." James R. Newman, *Commentary on the Social Application of Mathematics*, in 2 JAMES R. NEWMAN, *THE WORLD OF MATHEMATICS* 1264 (1956).

Game theory has proven to be influential, and its application of economic analysis has found applications beyond mathematics and economics in such fields as (1) politics, see R.J. Aumann, *Game Theory*, in 2 *THE NEW PALGRAVE: A DICTIONARY OF ECONOMICS* 460-79 (John Eatwell et al. eds., 1987) [hereinafter *THE NEW PALGRAVE*]; (2) biology, see, e.g., Colin W. Clark, *Bioeconomics*, in 1 *THE NEW PALGRAVE*, *supra*, at 245-46 (discussing the application of game theoretical models with respect to Darwin's theory of natural selection); Gordon Tullock, *Biological Applications of Economics*, in 1 *THE NEW PALGRAVE*, *supra*, at 246-47 (noting that the "structural similarity between biology and economics is extremely strong" and that the study of this area of science would be susceptible to economic analysis); (3) military strategy, see, e.g., Martin C. McGuire, *Defence Economics*, in 1 *THE NEW PALGRAVE*, *supra*, at 760-62 (indicating that the "need for economic analysis became crucial from the early days of the strategic nuclear era"); R.P. Smith, *Military Expenditure*, in 3 *THE NEW PALGRAVE*, *supra*, at 463-65 ("Economists have also played an important, though controversial, role in the technical development of strategic doctrine, deterrence theory, nuclear targeting and other aspects of the uses to which military expenditure is put."); and (4) law, William B.T. Mock, *Game Theory, Signalling, and International Legal Relations*, 26 *GEO. WASH. J. INT'L L. & ECON.* 33 (1992). For a technical historical summary of the development of game theory, see Aumann, *supra*, at 460-79.

in the remainder of this Article. It is important that the reader be familiar with, and understand, the central concepts of competitive games, cooperative games, direct signalling, and inverted signalling. Before an understanding of these central concepts is possible, however, two related game theoretical concepts, anteriority and preliminaryity, will need to be considered. While these concepts are useful as intermediate tools, they are introduced solely for the purpose of understanding the central concepts, and they will not appear in later sections of this Article.

1. Preliminaryity and Anteriority

Before applying game theory to international relations, it is necessary to review some game theoretical terminology. Assume a game in which players take their moves in some order, and not simultaneously. Consider one particular move, M . If M is not a purely chance move, then it requires some decision making personal to the player, P , who is to make M . In that case, what P knows is of great importance. The most that P could know is all the moves which have occurred before M ; but P may know less than that. If P knows less than all moves prior to M , we will say that P knows all moves in the class M_k , for known moves, and none of the moves in the class M_u , for unknown moves, where M_k and M_u together constitute all prior moves.

Given these definitions, two intermediate terms which are useful in understanding signalling—preliminaryity and anteriority—can now be defined. Preliminaryity is a characteristic of all the moves in class M_k , but not of any of the moves in class M_u . Stated another way, all known moves are preliminary considerations for P in deciding what move, M , to make.⁵ Anteriority, however, is a characteristic of each of the moves in either class. That is, all prior moves, whether known or unknown to P , are anterior to M simply because they occurred prior in time to M .⁶ An anterior move is also preliminary if P knows the move while deliberating on what move, M , to make. In other words, while preliminaryity necessarily implies anteriority, anteriority does not necessarily imply preliminaryity.⁷ These two concepts are important under-

Finally, for an approachable review that is roughly contemporary with von Neumann & Morgenstern's work, see Leonid Hurwicz, *The Theory of Economic Behavior*, in 2 NEWMAN, *supra*, at 1267.

5. See VON NEUMANN & MORGENSTERN (3d ed.), *supra* note 3, at 51.

6. *Id.* at 52.

7. *Id.* at 51-52.

pinnings of the central concepts of direct and inverted signalling.⁸

In some games, like chess,⁹ preliminary and anteriority are the same. This is indicative of a game of "perfect knowledge,"¹⁰ because every prior move—the notion of anteriority—is available for a player's consideration—the notion of preliminary. In other games, however, anteriority and preliminary do not coincide, and players are therefore not aware of the contents of all prior moves. This describes a situation of "incomplete knowledge,"¹¹ from which some interesting results follow. To begin with, anteriority is necessarily transitive.¹² By contrast, preliminary need not be transitive.

Poker and bridge provide examples of intransitivity, albeit in different ways. In poker, player 1 makes move 1, such as a bet, aware of the contents of his or her hand. Player 2 then makes move 2, another bet, aware of move 1 but not of the contents of player 1's hand. This is intransitivity in preliminary of knowledge with respect to the moves of two *different* players. That is, knowledge of a prior move by an opponent does not imply knowledge of what the opponent knew when choosing his or her move. Put another way, information can contribute to a player's decision without being revealed to opponents by that decision.

In bridge, the game must be viewed as between two players, North-South and East-West, each of which has two agent-personalities, with imperfect communication between them.¹³ In this

8. See *infra* text accompanying notes 15-24.

9. It is assumed throughout this Article that readers are familiar with chess, poker, and bridge. For those readers who are not familiar with these games, however, a basic discussion of the fundamental concepts of these games can be found in ALBERT H. MOREHEAD ET AL., *THE NEW COMPLETE HOYLE* 2-15, 118-66, 581-608 (1964) (discussing the rules of poker, bridge, and chess, respectively).

10. See VON NEUMANN & MORGENSTERN (3d ed.), *supra* note 3, at 51.

11. *Id.*

12. Three items— α , β , and δ —are transitive with respect to some ordering principle, such as size, where $\alpha > \beta$ and $\beta > \delta$, which necessarily means that $\alpha > \delta$. Given three game moves, it can be said that if α is anterior to β and β is anterior to δ , then α is anterior to δ . This is so because anteriority is simply a determination of which move was played before what other move in a given game. See *id.* at 52. It does not follow, however, that if α is preliminary to β and β is preliminary to δ , α is therefore preliminary to δ . This is so because preliminary arises from a combination of anteriority and awareness of the anterior move. *Id.* at 52-53. It is the latter element that destroys transitivity in games of imperfect knowledge.

13. In bridge terminology, the four people who are playing a hand are designated as North, East, South, and West. They compete as two pairs of partners, North-South and East-West. This is tantamount to saying that, for analytic purposes, there are two "players," each of whom has two human embodiments striving to communicate with

game, North would make a bid, aware of the contents of his or her hand. Later, South would make a bid, aware of North's bid but not of the contents of North's hand. This is intransitivity in preliminary knowledge with respect to two moves of the *same* player. That is, the player called North-South has to make the second bid—to be uttered by the South component of this player—without knowing the cards that led to North-South's first bid, which were uttered by the North component of this same player. Poker and bridge illustrate the principle that information can contribute to a player's decision at one stage of a game, yet be unavailable or, in some sense, forgotten by that player at a later stage of that same game.¹⁴

2. Signalling

These examples illustrate the potential for signalling. In each case, the preliminary move may contain some clue about the nature of the anterior, but non-preliminary, information. In such a case, it becomes possible for the player making the preliminary move to adjust his or her choice of move in order to provide additional clues about the anterior, non-preliminary information, or to obscure the anterior information through scrambling of the clues that are already present. In bridge, additional clues are indicated through the use of bidding conventions or artificially high discard cards.¹⁵ In poker, clues about the contents of one's hand are obscured through bluffing.¹⁶ In chess, a non-signalling game, each move speaks for itself, and therefore no clues about unknown information are necessary or possible.¹⁷

In general, games of imperfect information will lead to signalling. Cooperative settings will promote affirmative acts of signalling, known as "direct" signalling.¹⁸ Explicit or implicit

each other. Such communication is necessarily imperfect because each human partner is left somewhat uncertain as to the contents of his or her partner's hand of cards. *See id.* at 53.

14. *See id.*

15. For example, it is proper for the two members of one bridge team to agree, *prior* to the game, as to how a certain bid by one component of the team should be interpreted by the other component. In contrast, the use of vocal inflections, or tapping on the table, as a means of conveying strategy *during* the game, is inappropriate and would be considered cheating. *See id.* at 53 n.2.

16. *See id.* at 54.

17. *See id.* at 51-52. It is possible to argue that a chess player's strategy can be an unknown item of information to the opposing player. As is demonstrated most clearly by chess-playing computers, however, strategy can be understood as the set of options inherent in the existing, and hence known, position.

18. *See id.* at 51-55.

agreement on a common language will be followed by clear and consistent statements of information. This direct signalling will presumably be understood and will form the basis of the next player's actions. Bidding conventions in bridge illustrate direct signalling because of the cooperative nature of the North-South relationship.¹⁹

In contrast to cooperative settings, competitive settings tend to promote obscurative acts of signalling, known as "inverted" signalling.²⁰ This too requires a common language, but the signalling player's use of that language is very different from such use in cooperative settings. In a game of finite duration, it may be useful to communicate a clear pattern that contains false information. This would normally be followed by a sudden reversal of position from that indicated by the prior signalling, with that reversal occurring when the time for payoff is reached. Bluffing on a single hand of poker provides an example of this type of behavior.

In a game of indefinite or infinite duration, however, a clear pattern of false information is inadequate to ensure success. For example, in an ongoing or regularly repeated poker game, a player who always bets heavily on a worthless hand would soon become very popular with the other players. Instead, inverted signalling in a game of indefinite or infinite duration must be achieved through irregular and apparently illogical behavior²¹ that makes it difficult or impossible for the other players to draw

19. *Id.* at 53. It is true that North-South is competitive with East-West and that such competition would tend to produce inverted signalling. In the bidding phase of a bridge game, however, it is generally more important to be clear in communicating with the other member of one's team than to confuse the opposing team. For this reason, the incentive to engage in direct signalling is stronger than the incentive to engage in inverted signalling. Once the trick-taking phase of a bridge game has been reached, inverted signalling will often occur as the defenders seek to mislead the declarant and to defeat the contract. For example, a defender might discard a high card instead of a low one in an effort to mislead the declarant as to the distribution of the cards in a particular suit.

20. *See id.* at 51-55.

21. One could view a "good cop, bad cop" treatment of a criminal suspect as an example of inverted signalling. The Supreme Court's regulation of police custodial conduct in *Miranda v. Arizona*, 384 U.S. 436 (1966), and the development of the exclusionary rule for illegally obtained evidence, beginning with *Mapp v. Ohio*, 367 U.S. 643 (1961), have effectively turned an isolated series of one-time, finite duration custodial games played between "suspect" and "police," with the latter player having two components—the "good cop" and the "bad cop," into a repeated custodial game of indefinite duration between suspects and police. The inverted signalling in this game is intended to confuse suspects as to the intentions of, and the information possessed by, the police player, especially in cases of separate interrogation of co-criminals. Notwithstanding the

any accurate inferences.²²

Of course, both direct and inverted signalling carry transaction costs. Unsophisticated play, which is play designed without regard to any intention to signal, and which is intended to maximize the expected payoff, including limiting expected losses in light of known facts and optimal play by all other players, provides a baseline for measurement.²³ Intentional signalling²⁴ necessarily requires deviation from unsophisticated play. As a result, the most immediate consequence of signalling is a decline in expected payoff—a signalling cost. The advantages derived from the signalling, through increased or accelerated payoff to the signalling player, must more than compensate for the costs of signalling; otherwise, the signalling is unwise and unwarranted.

B. *How Signalling Contributes to Our Understanding of International Legal Relations*

The concept of inverted signalling supplies a valid rationale for inconsistent behavior. Where a game is

fact that most suspects know the “rules” of “good cop, bad cop,” inverted signalling is effective, as demonstrated by the continuing use of this game by police forces.

22. In fact, in games of indefinite duration, it is possible to derive an optimal strategy, as far as the proportion of hands on which to bluff. The player, however, must not reveal to his or her opponent what strategy is being used on any particular hand or run of hands; this would render the inverted signalling worthless. For detailed proof that an optimal strategy is obtainable in the context of simplified poker, see VON NEUMANN & MORGENSTERN (3d ed.), *supra* note 3, at 186-219.

23. See generally *id.* at 53-55. In chess, such unsophisticated play is determined by finding the move that minimizes the harm that can be caused by your opponent's best response, a kind of least-worst or “minimax” strategy. In poker, “correct” play results from a simple calculation of the odds of winning. This calculation involves an evaluation of the player's own cards and those cards showing from other players' hands, the size of the expected pot, and the amount the player is expected to contribute to that pot. In the bidding phase of bridge, unsophisticated play would require making only those bids that are genuinely being offered as potential contracts and not those that are simply elements in an ongoing conversation with one's partner and opponents. Only in chess, with its lack of signalling, see *supra* text accompanying note 17, is unsophisticated play completely rational.

24. In a sense, every move in a game of imperfect knowledge involves at least some unintentional signalling, because even unsophisticated play provides information to other players. It is intentional signalling, however, that bears special costs and must provide sufficient rewards to overcome those costs. For an example from bridge, a higher than necessary discard might have been used at a later moment to take a trick that will now go to one's opponents. This is the signalling cost that must be recouped from the benefits of the opponent's misplays that may have been produced by the deception. In poker, betting more than is warranted on a weak hand is costly, unless such bluffing eventually leads to some wins unwarranted by the quality of the winning hands.

- (i) competitive,
- (ii) repeated indefinitely, and
- (iii) based upon incomplete knowledge,

inverted signalling may be appropriate. In judging the actions of the United States and other major nations or coalitions of nations in international settings, it is normal to complain about any apparent inconsistency of actions, or of statements²⁵ and actions taken together. These complaints may be unfounded, however, if inverted signalling is considered. Moreover, if the international setting can be modelled as a game, and that game satisfies the three conditions indicated above, inconsistent actions in similar situations may actually be appropriate responses. It is beyond the scope of this Article to consider whether particular actions or inconsistencies *are* appropriate responses to particular international situations. Rather, this Article attempts to establish the criteria used for determining when inconsistent responses *may* be appropriate.

Instead of requiring analysts to investigate the fine distinctions between circumstances to determine which distinctions justify differing responses, analysis under a game theoretical approach would permit the debate to center on the question of whether the circumstances are part of a larger game fitting the three conditions noted above. In the absence of a game theoretical approach, differing responses to similar situations would have to be justified, as before, solely on the basis of distinctions between the situations. If, however, the approach set forth in this Article is employed, then an apparent randomness or irrationality of response may indeed be justifiable.

This is not simply a well-couched version of circumstances altering cases. That slogan suggests situational ethics at its crudest—a kind of Realpolitik²⁶ that mocks efforts at consistent analytic justification. Analysis based upon game theory and the concept of inverted signalling justifies the obscurantism of inconsistent actions in situations where one opponent would gain valuable information from an opponent's consistent course of behavior. The identification of the necessary conditions that a game be competitive, repeated indefinitely, and based upon

25. Statements may be considered, for analytic purposes, as merely verbal actions.

26. Realpolitik, a term widely associated with Bismarck's policies following German unification in the 19th century, is pragmatic "power politics," dealing predominantly with realities rather than principles. WILLIAM L. SAFIRE, SAFIRE'S POLITICAL DICTIONARY 599-600 (1978).

incomplete information sets limitations on the range of situations in which inconsistent action might be an appropriate response.

C. *Application of Game Theory to International Issues*

Game theory requires that games, players, and moves be identified in order for them to be analyzed. By creating a structured view of the world, game theory allows for an analysis of the logic and rationality of actions and reactions of parties motivated to achieve certain defined ends. The history of game theory has been one of continual expansion of the structured situations susceptible to cogent analysis.²⁷

In applying game theory to international economic and political relations, certain obvious problems present themselves: what is the game?; who are the players?; what are their goals?; and what constitutes a move? It is as though we are seeking to take the complexity of the whole world and describe it in stick-figure drawings and one-word captions. For the game theoretical analysis in this Article to have any relevance to the world from which the examples herein are drawn, simplifying assumptions and definitions, carefully chosen, must be made. A functional definition of the game will need to simplify the definitions of the players, goals, and moves.

Unfortunately for present purposes, only one large game really exists in international political and economic relations. This is because of the trade-offs that are made so frequently between resources and goals in the different areas of national interest. Examples of such trade-offs include military support in exchange for economic goals, and human rights waivers in exchange for political allegiance. It is, however, beyond the analytic scope of this Article, this author, and perhaps game theory itself, at its current level of development, to undertake an analysis of the complexity that such a game demands.

It is therefore necessary to define as separate games those reasonably discrete areas of national interest wherein debate and planning are usually concentrated, and where goals are reasonably well identified. It must be recognized that these games, so defined, are not totally distinct; the cross-flow of resources and goals between such closely-defined games will be substantial enough to leave many of the conclusions of such analysis open to

27. For a review of the scope of this expansion, see Aumann, *supra* note 4, at 460-79.

continuing debate. Nevertheless, limited definitions will permit some analysis to take place and some tentative conclusions to be reached.²⁸

This Article will use, as examples of games fitting the modestly functional definition of the preceding paragraph, the following areas to illustrate the practical application of the game theoretical analysis set forth above: (a) establishing the authority of the International Court of Justice;²⁹ (b) rationalizing international agricultural trade;³⁰ (c) protecting the global atmosphere;³¹ and (d) supporting and recognizing occupied nations.³² Many other games could be chosen and should be analyzed in future articles by other authors. Since the goals of this Article are simply to introduce game theoretical techniques to this area of law and to use those techniques to place certain international problems in a new perspective, however, neither a broader range of games nor a more in-depth analysis of any one of these games is necessary.

It is obvious that there is more than one "round" of play for each of these games. They are complex and long-term games, with several chances for the "players," however defined, to take actions that can be identified as moves. After any move or group of moves, a new game scenario develops, requiring a new set of game decisions. These games are called "repeated games," a term referring to games which evolve into different states as the history of the cumulative impact of the players' moves is developed.³³ Analysis of repeated games is closest to the realities of the games chosen in the preceding paragraph,³⁴ particularly in considering the role of signalling in determining returns to the

28. For a fine statement of the need to approach discrete problems before attempting any grand theoretical unification of analysis, see VON NEUMANN & MORGENSTERN (3d ed.), *supra* note 3, at 2-7.

29. See *infra* notes 42-52 and accompanying text.

30. See *infra* notes 53-66 and accompanying text.

31. See *infra* notes 67-74 and accompanying text.

32. See *infra* notes 75-88 and accompanying text.

33. See Jean-François Mertens, *Repeated Games* [hereinafter Mertens, *Repeated Games*], in 4 THE NEW PALGRAVE, *supra* note 4, at 151. A related term, "supergames," is generally reserved for situations in which a game is repeated many times, but always from the same base situation. Jean-François Mertens, *Supergames*, in 4 THE NEW PALGRAVE, *supra* note 4, at 551. In both repeated games and supergames, the players seek to maximize their long-term average payoffs. In fact, supergames are merely a special case of repeated games. See Mertens, *Repeated Games*, *supra*, at 151.

34. The first major study of repeated games with incomplete information was undertaken, in part, as a response to concerns of the United States Arms Control and Disarmament Agency about disarmament negotiations. See Mertens, *Repeated Games*, *supra* note 33, at 205, 208 n.2 (discussing the first study undertaken in this area by R.J. Aumann and M. Maschler).

player-nations involved in those games.³⁵

Who are the players in these games? In particular, is it appropriate to identify each country as a player separate from other players and cohesive in itself? If there is one payoff, or a sequence of payoffs in a repeated game for a group of countries, those countries could be analyzed as one player—as where two people playing as partners in a bridge game could be considered one player for game analysis—or they could be analyzed as a “coalition” of players. A coalition is a group of players that seeks to increase its payoffs by group strategy and, perhaps, private understandings on allocating an increased group payoff. Examples in international economic relations would be producer cartels, such as OPEC in the 1970s. In development politics, the Group of 77³⁶ nations could be viewed as a coalition formed to increase their communal payoff through coordinated action.

Notwithstanding the existence of international coalitions, and the complexities of domestic politics and economics,³⁷ the proper entity to identify as the player in the games discussed in this Article is the nation. As one commentator noted, “In much of international economics, the country is treated as the unit of analysis; it is as though each country consisted of a single decision-maker.”³⁸ Although there is substantial evidence that foreign decision makers differentiate between interest groups within the United States,³⁹ it is both simpler and more desirable to consider the United States as providing a unitary face to the world. Moreover, this position is supported by the implicit constitutional grant of essentially all foreign relations authority to the

35. *Id.* at 152.

36. The objective of the Group of 77, a coalition of developing nations, is to protect the interests of developing countries. In the United Nations Conference on Trade and Development (UNCTAD), the Group of 77 presented a unified front against the Organization for Economic Cooperation and Development (OECD). See A.I. MACBEAN & P.N. SNOWDEN, *INTERNATIONAL INSTITUTIONS IN TRADE AND FINANCE* 100 (1981).

37. “Group choice-making processes notoriously fail to satisfy the canons of rationality, most fundamentally owing to disparities among the interests of the individual members.” Jack Hirshleifer, *Conflict and Settlement*, in 1 *THE NEW PALGRAVE*, *supra* note 4, at 567.

38. John McMillan, *Game Theory in International Economics*, 1 *FUNDAMENTALS OF PURE AND APPLIED ECONOMICS* 86 (J. Lesourne & H. Sonnenschein eds., 1986).

39. For example, the People's Republic of China repeatedly warned Congress not to establish conditions that would make it difficult for President George Bush to renew its Most Favored Nation (MFN) status. See, e.g., Keith Bradsher, *House Votes Curbs on Chinese Imports*, N.Y. TIMES, July 11, 1991, at A3; *Bush Administration to Review Red China's MFN Status*, Central News Agency, Mar. 29, 1990, available in LEXIS, Nexis Library, CENEWS File.

president.⁴⁰

For each of the international games chosen for discussion in this Article, one could identify and defend as appropriate several goals or desired game payoffs. Often, nations may pursue multiple goals simultaneously and shift their emphasis among goals over time. These realities will necessarily frustrate any analyst seeking absolute precision. The use of broadly-understood, although somewhat fuzzy, goals, however, will permit the development of worthwhile analysis pending the development of more precise methods of goal identification and formulation.

In poker, bridge, and chess, moves are defined by the rules of the game. In international relations, an analyst has no such luxury of definition. For that reason, this Article will define a move as any national act or statement of sufficient relevance and importance in the identified game that other players take notice of and as a result feel impelled to respond to with some act or statement of their own. In effect, the players identify moves by reacting to them with moves of their own.

III. INTERNATIONAL RELATIONS EXAMPLES TO CONSIDER

Each of the following examples demonstrates a conflict between the statements or actions of the United States in two or

40. Although Article II of the United States Constitution does not use the phrase "foreign relations authority," it is generally accepted that the president possesses this power. Such authority is generally considered an implicit power emanating from various enumerated grants of other powers which are related to the foreign arena, and which are vested in the president throughout Article II. *See* U.S. CONST. art. II, § 1 (mandating that "[t]he executive Power shall be vested in a President of the United States of America"); *id.* art. II, § 2 (providing that "[t]he President shall be Commander in Chief" and granting the president the "Power . . . to make Treaties"); *id.* art. II, § 3 (indicating that the president "shall receive Ambassadors and other public Ministers" and that "he shall take Care that the Laws be faithfully executed"). Moreover, this view is entirely in accord with an early interpretation of the foreign relations authority, made by then-Congressman John Marshall. *See* 6 ANNALS OF CONG. 596, 613-614 (1800) (advocating that the president is the "sole organ of the nation in its external relations . . . [who] possesses the whole Executive power"). The Supreme Court has also interpreted Article II of the Constitution as granting the foreign affairs power to the president. *E.g.*, *United States v. Curtiss-Wright Export Corp.*, 299 U.S. 304, 318-20 (1936) (indicating that the Constitution grants the president the "plenary and exclusive power . . . as the sole organ of the federal government in the field of international relations"). Some commentators, however, do not agree with this broad, plenary view of the foreign affairs power. *See* Gerhard Casper, *Responses*, 61 VA. L. REV. 777, 778 (1975) (noting that "the Framers . . . chose to grant Congress the dominant role in foreign affairs"). Nevertheless, it can be said that at the very least the player in international matters is the federal government, *see* U.S. CONST. art. II, § 2 (providing that the Senate shall give its "Advice and Consent" before treaties become binding), and not the states, *see id.* art. I, § 10 (providing that "[n]o State shall enter into any Treaty").

more essentially similar situations. By acting inconsistently, the United States may seem to undermine the effectiveness of its positions. Usually, such situations produce loud, critical comparisons from those who oppose such actions, either situationally or in principle. As noted above, however, application of game theoretical analysis suggests that inconsistency is not necessarily inappropriate.

These examples may simply be cases of inverted signalling. As discussed previously, such signalling can be appropriate in a multi-player game in which players gain some advantage by preventing competitors from adopting strategies which are based upon full knowledge of the resources and intentions of the players' game strategies.⁴¹ Rather than rail against inconsistencies, observers who analyze the actions of the United States would be wiser to consider whether the preconditions of inverted signalling are present.

A. *Establishing the Authority of the International Court of Justice*

The United States has long espoused the use of the rule of law and the legal process in resolving both private and international disputes. Indeed, U.S. recognition of its position as a role model for the rule of law has been long and widespread.⁴² The United States has also been one of the earliest and strongest supporters of the use of international fora for the resolution of disputes between nations. This is evident from its position as a founding member of the International Court of Justice (ICJ), accepting its compulsory jurisdiction on August 26, 1946.⁴³ Additionally, the United States is one of only forty-four member states of the United Nations to have accepted the ICJ's compulsory jurisdiction.⁴⁴

41. See *supra* text accompanying notes 20-22.

42. As one example, the United States managed the difficult feat of forcing the resignation of its own chief executive through the use of its legal process. On January 31, 1974, impeachment proceedings were initiated against President Richard M. Nixon. See H.R. RES. 803, 93d Cong., 2d Sess. 1 (1974). On August 8, 1974, after several months of proceedings in the House of Representatives, President Nixon gave a televised speech in which he announced his resignation as president. See John Herbers, *The 37th President Is First to Quit Post*, N.Y. TIMES, Aug. 9, 1974, at A1.

43. Declaration by the President of the United States of America August 14, 1946 Respecting Recognition by the United States of America of the Compulsory Jurisdiction of the International Court of Justice, Aug. 14, 1946, 61 Stat. 1218.

44. U.S. Withdrawal from the Proceedings Initiated by Nicaragua in the ICJ, DEP'T ST. BULL., Mar. 1985, at 64.

We recognize . . . that this Nation has a special obligation to support the ICJ and all other institutions that advance the rule of law in a world full of terror

The action allegedly inconsistent with this acceptance of jurisdiction occurred in a recent case concerning military and paramilitary activities in and against Nicaragua.⁴⁵ In that case, Nicaragua sued the United States in the ICJ for mining Managua Harbor and for other related transgressions against Nicaragua's sovereignty.⁴⁶ The United States attempted to remove itself from these proceedings by relying on a strained interpretation of its own accession to the ICJ's jurisdiction.⁴⁷ The ICJ, in interpreting its own jurisdictional provisions, including accession by the United States, determined that the United States had properly been brought before it.⁴⁸ It then rendered a judgment that the United States has refused to recognize.⁴⁹ This action by the

and disorder. Our belief in this obligation is what led us to set an example by accepting the court's compulsory jurisdiction and by continuing that acceptance long after it became clear the world would not follow suit and that our acceptance had failed to advance our interest in any tangible manner.

U.S. Decision to Withdraw from the International Court of Justice: Hearing Before the Subcomm. on Human Rights and International Organizations of the House Comm. on Foreign Affairs, 99th Cong., 1st Sess. 16 (1985) (statement of Abraham D. Sofaer, Legal Advisor, U.S. Department of State).

45. *Military and Paramilitary Activities in and Against Nicaragua (Nicar. v. U.S.)*, 1984 I.C.J. 392 (Nov. 26).

46. *Id.* at 397.

47. The United States relied upon five independent arguments in attempting to avoid the jurisdiction of the ICJ. The defenses, raised in oral argument at the Hague on October 15, 1984, by Davis R. Robinson, Legal Adviser of the United States Department of State, were that: (1) Nicaragua had never accepted the ICJ's compulsory jurisdiction and therefore could not invoke its jurisdiction against the United States, *id.* at 400; (2) the United States had not consented to adjudication in the circumstances of this case, *id.* at 421; (3) Nicaragua's claims fell within the terms of an April 6, 1984 notification to the United Nations Secretary-General modifying the terms of the United States' acceptance of the ICJ's jurisdiction in 1946, *id.* at 415; (4) Nicaragua was asking the ICJ to perform a function that the United Nations Charter confided to political organs, particularly the Security Council with respect to an ongoing conflict, *id.* at 431; and (5) regardless of whether the ICJ literally has jurisdiction, Nicaragua's application was inadmissible, *id.* at 429, because it (i) presented interests of non-party states, *id.* at 430; (ii) interfered with presently ongoing negotiations, *id.* at 431-32; (iii) disrupted the political mechanisms that were currently working to resolve this conflict, *id.*; and (iv) required adjudication of claims during ongoing hostilities, thereby presenting obstacles to the role of the ICJ in discovering the truth and providing an effective remedy, *id.* at 436. *See generally* Davis R. Robinson, ICJ Hears U.S. Argument Against Nicaraguan Claim, DEP'T ST. BULL., Jan. 1985, at 24-29.

The April 6, 1984 letter of then-Secretary of State George P. Shultz is particularly noteworthy. The United States attempted to modify its 1946 acceptance of the ICJ's compulsory jurisdiction by stating that such acceptance "shall not apply to disputes with any Central American State or arising out of or related to events in Central America." *Declarations Recognizing Jurisdiction*, 1984-1985 I.C.J.Y.B. 99-100. Moreover, the April 6, 1984 declaration also attempted to deprive the ICJ of jurisdiction to consider the Nicaragua matter itself for two years, effective immediately. *Id.*

48. 1984 I.C.J. at 442-43.

49. *Id.* at 392-443.

United States was widely criticized for undermining the rule of law and the efforts of the ICJ in disputes between nations.⁵⁰

In modelling this sequence as a game, there are two major possibilities. First, this could be seen as a game involving all the member states of the United Nations, with the communal goal of defining the proper role of the ICJ in world affairs. This model includes aspects of cooperation and competition. The cooperative goal would be one where all nations work to find peaceful means of resolving international disputes. The competitive goal would be one between nations with competing views of the proper role of the ICJ in world affairs. For a country such as the United States, which encourages all nations to adopt a broad view of the value of the rule of law embodied in acceptance of the ICJ's jurisdiction, the cooperative aspect of this model seems to dominate. In a largely cooperative game of advancing recognition of the ICJ's jurisdiction, each player-nation would appear to have full knowledge of each other player's resources and viable alternatives. Even if it is then accepted that this model is one of indefinite duration, major inconsistencies in response to either generic or specific calls to accept the jurisdiction of the ICJ would appear to be unwarranted obfuscation of the United States' basic position.⁵¹

As a second possibility, U.S. rejection of the ICJ's jurisdiction in the Nicaragua case could be viewed as part of a game of competitive conflict between the United States and the Sandanista Government of Nicaragua. At the time the United States declared its withdrawal from the ICJ's compulsory jurisdiction, the conflict game appeared to be one of indefinite duration, and the parties seemed to have imperfect knowledge of one another's resources and options. In such a game, the three conditions for

50. E.g., John N. Moore, *The Secret War in Central America and the Future of World Order*, 80 AM. J. INT'L L. 43 (1986). Professor Moore was special counsel for the United States in the case of *Nicaragua v. United States*. Ironically, while he criticized the United States for not going forward on the merits of the case, he also argued that the case should have been dismissed: "Once the Court decided to go forward to the merits, I believe the United States would have been better advised to pursue the proceedings. U.S. withdrawal could only hand the Sandanistas a propaganda windfall by further confusing world opinion about the Cuban-Nicaraguan secret war against neighboring states." *Id.* at 93. But see James P. Rowles, "Secret Wars," *Self-Defense and the Charter—A Reply to Professor Moore*, 80 AM. J. INT'L L. 568, 568-83 (1986) (criticizing the United States' action against Nicaragua as contravening the United Nations Charter).

51. Since under this model each nation has full knowledge, one of the three necessary conditions for inverted signalling is absent, and as a result, inconsistent stances cannot be justified.

inverted signalling—competitiveness, indefinite repetition, and incomplete knowledge—are met. It might have been appropriate therefore for the United States to have reversed its long-held position by rejecting the ICJ's jurisdiction in order to confuse, frustrate, and eventually defeat its competitive opponent.⁵²

To a certain extent, both models are valid. The U.S. decision to reject its long-held support for the compulsory jurisdiction of the ICJ suggests that the competitive model of the United States against the Sandanista Government prevailed among policy makers. Arguments that the United States was merely using the opportunity presented by the Nicaraguan submission to the ICJ to advance a common global understanding of the rule of law would therefore best be seen as a camouflage in the continuing conflict between the United States and Nicaragua. A claim that the United States was working to advance the global rule of law would merely be rhetoric, designed to distract observers from the roots of the U.S. withdrawal, which should instead be found in the ongoing conflict with Nicaragua.

B. *Rationalizing International Agricultural Trade*

In the Uruguay Round of the General Agreement on Tariffs and Trade (GATT), the United States strongly espoused the position that all nations should gradually abolish agricultural subsidies.⁵³ Examples of existing subsidies include the European Community's Common Agricultural Policy⁵⁴ and other agricultural trade distortions, such as Japan's rice import barriers.⁵⁵

52. See *supra* text accompanying notes 20-22.

53. The GATT, an institution set up after the Second World War, provides rules which contracting parties agree to observe and acts as a forum for the negotiation of reductions in trade barriers. The process of eliminating trade restrictions under the GATT framework has been spread over eight rounds. See *infra* note 64. The Uruguay Round, launched in 1986, is the latest of these rounds. In the Uruguay Round, the United States made a radical proposal for the elimination of all policies which distort agricultural trade. See H. WAYNE MOYER & TIMOTHY E. JOSLING, *AGRICULTURAL POLICY REFORM: POLITICS AND PROCESS IN THE EC AND THE USA* 181, 185 (1990).

54. The Common Agricultural Policy (CAP) was created by countries in Western Europe in an effort to manage the integrated European market for farm goods and eliminate the need for national price support schemes. Its principal purposes are to stabilize markets and support farmers' incomes. See MOYER & JOSLING, *supra* note 53, at 23-24. The provisions creating the CAP can be found in the TREATY ESTABLISHING THE EUROPEAN ECONOMIC COMMUNITY arts. 39-44.

55. Japan's rice market is closed to imports. Members of the GATT, particularly the United States, have demanded that Japan reopen its rice market. See, e.g., *Japan's Farm Ministry Plan Aims to Boost Productivity of Rice Farmers*, 9 Int'l Trade Rep. (BNA) No. 25, at 1060 (June 17, 1992); *Japan Urges U.S., European Community to Settle GATT Dispute, Lower Barriers*, 9 Int'l Trade Rep. (BNA) No. 17, at 726-27 (Apr. 22, 1992); *USDA's Madi-*

Agricultural trade barriers have also been targeted under Super 301 legislation.⁵⁶

At the same time that it has been espousing the removal of agricultural trade barriers, however, the United States has been one of the major parties guilty of utilizing such barriers. Programs such as those under the Agricultural Adjustment Act,⁵⁷ agricultural produce price support mechanisms,⁵⁸ sugar price supports,⁵⁹ and involvement in international agreements distorting trade in sugar,⁶⁰ coffee,⁶¹ and cotton⁶² all appear inconsistent with the U.S. position in the GATT negotiations.

Several choices are available in modelling this situation. One choice would be to define the game as the Uruguay Round of the GATT negotiations themselves, with inconsistent national actions, external to the GATT setting, serving as mixed signals about negotiating intentions within the Uruguay Round itself. These negotiations are largely competitive, with concessions being traded for counter-concessions. Within the negotiations, each party has good but imperfect knowledge about what effects proposed concessions will have within the economies of the nations offering those concessions. This game model is not, by itself, however, of indefinite duration. Because the Uruguay Round will eventually conclude, a time for final results will be

gan Praises Certain Provisions in Draft GATT Agreement Offered by Dunkel, 9 Int'l Trade Rep. (BNA) No. 2, at 65 (Jan. 8, 1992).

56. For example, § 310(a)-(b) of the Trade Act of 1974 sets forth the procedures for identifying and investigating practices by any foreign nation that impinge on U.S. trade liberalization priorities. See Omnibus Trade and Competitiveness Act of 1988, Pub. L. No. 100-418, sec. 1302, § 310(a)-(b), 102 Stat. 1107, 1176-78 (codified as amended at 19 U.S.C. § 2420 (1988)). Section 310(b) indicates that the United States Trade Representative (USTR) may initiate investigations pursuant to § 302 of the Trade Act of 1974 (codified as amended at 19 U.S.C. § 2412(b)(1)(A) (1988)). The USTR then determines whether the matter is actionable under § 301 of the Trade Act of 1974 (codified as amended at 19 U.S.C. § 2411 (1988)). The statute is clear that § 301 is intended to promote and protect U.S. trade liberalization policies against any "act, policy, or practice of a foreign country [which] violates, or is inconsistent with, the provisions of, or otherwise denies benefits to the United States under, any trade agreement, or . . . is unjustifiable and burdens or restricts United States commerce." 19 U.S.C. § 2411(a)(1)(A)-(B) (1988).

57. Agricultural Adjustment Act of 1938, 7 U.S.C. §§ 1281-1282a (1988).

58. 7 U.S.C. §§ 1421-1429 (1988).

59. *Id.* § 1446g.

60. International Sugar Agreement, *done* Oct. 7, 1977, 31 U.S.T. 5135.

61. International Coffee Agreement, *approved* Sept. 16, 1982, T.I.A.S. No. 11,095 (entered into force Sept. 11, 1985).

62. Articles of Agreement of the International Cotton Institute, *opened for signature* Jan. 17, 1966, 17 U.S.T. 83, 592 U.N.T.S. 171 (entered into force Feb. 23, 1966). For information on U.S. cotton price support levels, see 7 U.S.C. § 1441 (1988).

reached. Therefore, a strategy of consistent posturing—complete deception about economic effects and negotiating positions—may be appropriate, but a strategy of engendering doubts in other parties through the confusing tactics of inverted signalling would not be appropriate.⁶³

A second alternative would consider the Uruguay Round as merely the eighth in a series of negotiating rounds under the GATT,⁶⁴ with an indefinite number of rounds yet to come. If this is understood to be a competitive game of imperfect information, the three conditions preliminary to inverted signalling are present. The only difficulty with this model is understanding the larger, multi-round negotiation game to be a competitive one. While a single round, with its pattern of concessions, is clearly competitive, an indefinite series of rounds aimed to free world trade on a multilateral, universal basis would seem to possess much stronger cooperative elements, thereby eliminating the need for inverted signalling.

A third modelling option could be derived from one of the acknowledged reasons for the U.S. GATT position. The United States has aligned itself with the developing world against the positions of most of the developed world on the issue of abolishing a large portion of the world's agricultural trade barriers.⁶⁵ The purpose of such a position is to encourage the countries of the developing world to consider intellectual property issues in the Uruguay Round context.⁶⁶ This rationale implies that the

63. Consider a poker game that has reached the final hand. The incentive to employ inverted signalling to confuse opposing players about how one plays various cards has now passed. Instead, the time has come to reap the benefits of earlier deceptions—the inverted signalling of various past bluffs used intermittently—by taking a consistent position in playing the final cards. That position may be false in the sense of reflecting a bluff as to the value of the hand; but this bluff is an attempt to reap a reward on this hand only, not to set up future benefits. Because of the limited remaining duration of this game, this final bluff cannot be considered inverted signalling.

64. The previous GATT rounds were the Geneva Round (1947), the Annecy Round (1949), the Torquay Round (1951), the second Geneva Round (1956), the Dillon Round (1960-61), the Kennedy Round (1964-67), and the Tokyo Round (1973-79). See generally JAGDISH BHAGWATI, *PROTECTIONISM* 3-4 (1989).

65. See Delbert Fitchett, *Agriculture*, in *THE URUGUAY ROUND: A HANDBOOK ON THE MULTILATERAL TRADE NEGOTIATIONS* 162, 170 (J. Michael Finger & Andrzej Olechowski eds., 1987) (stating that both the United States and developing countries "need a stable macroeconomic environment to provide an aura of stability and confidence that can underpin further development").

66. See Frank Emmert, *Intellectual Property in the Uruguay Round—Negotiating Strategies of the Western Industrialized Countries*, 11 *MICH. J. INT'L L.* 1317, 1385-91 (1990) (discussing the U.S. negotiating position and the possibility of dealing with agriculture in a "package deal" along with other Uruguay Round negotiating topics).

United States views the game as one of bargaining for admissions in the Uruguay Round itself. Although such a game would be competitive in its pattern of demands and concessions, it would be of only finite duration. Inverted signalling would therefore be inappropriate.

Moreover, under this third model, inverted signalling may not even have occurred. Under the earlier models, the mixed signals related to the message: "The United States is in favor of free agricultural trade." Under the third model, the U.S. GATT position may simply be a strongly-worded version of the statement: "The United States is willing to negotiate for the removal of international agricultural trade barriers." The negotiation-specific nature of this message would mean that various barrier-producing acts by the United States do not provide contrary messages. If that is so, then there has been no inverted signalling.

C. *Protecting the Global Atmosphere*

The United States has proclaimed itself a major proponent of protecting the global atmosphere. Substantial grants have been made available to developing countries for environmental programs, including programs to limit airborne pollution.⁶⁷ Diplomatic efforts have been made to improve environmental conditions, including those relating to the atmosphere.⁶⁸ In addition, the United States is a signatory to the Montreal Protocol on Substances That Deplete the Ozone Layer.⁶⁹

67. For example, 7 U.S.C. § 1738k(d) (1988) authorizes federal grants from a national environmental fund to foreign local, regional, or other governmentally designated groups which are formed for environmental purposes. *Id.*

68.

[The] leadership [of the United States] is . . . reflected in our participation in some 20 international treaties, ranging from the Convention on International Trade in Endangered Species to the Cartagena Convention for the Protection and Development of the Marine Environment of the Wider Caribbean Region.

The United States cooperates with over 70 countries through 275 bilateral agreements which either are wholly environmental in scope or which have significant environmental components—for example, one with China on acid rain research, another with Nigeria on water quality. The United States also contributes funds or support in kind to 70 specialized environmental or natural resource programs carried out in 40 international or regional organizations, such as the International Register of Potentially Toxic Chemicals and the International Union for the Conservation of Nature.

Richard E. Benedick, *Environment in the Foreign Policy Agenda*, DEP'T ST. BULL., June 1986, at 55-56.

69. Montreal Protocol on Substances That Deplete the Ozone Layer, Sept. 16, 1987, S. TREATY DOC. NO. 10, 100th Cong., 1st Sess. 1 (1987), 26 I.L.M. 1550 (entered into force Jan. 1, 1989) [hereinafter *Montreal Protocol*]. The Montreal Protocol prohib-

On the other hand, the United States has been inconsistent in its support for international efforts to protect the atmosphere.⁷⁰ Moreover, under different but analogous circumstances, the United States has refused to support substantial funding for an accelerated program to cut the use of those same ozone depleting chemicals.⁷¹ The United States has also consistently refused to take seriously any action to resolve transborder acid rain issues with Canada.⁷² Additionally, the United States has generally failed to prevent the wholesale destruction of its own old-growth forests.⁷³

its signatories from importing from any state that is not a party to the Protocol products containing chlorofluorocarbons (CFCs) and halons, both of which have severe ozone-depleting characteristics. The Montreal Protocol added more rigorous emission targets to the 1985 Vienna Convention for the Protection of the Ozone Layer. Vienna Convention for the Protection of the Ozone Layer, *done* Mar. 22, 1985, T.I.A.S. No. 11,097, 26 I.L.M. 1529.

On March 14, 1988, the United States Senate debated, and subsequently ratified, the Montreal Protocol. 134 CONG. REC. 3717-24 (1988). By a vote of 83-0, with 17 abstentions, the United States joined Mexico as the only nation to have ratified what one commentator called an "historic international agreement to limit global use of chemicals that are believed to be destroying the earth's ozone shield." Philip Shabecoff, *Treaty on Ozone Is Backed in Senate*, N.Y. TIMES, Mar. 15, 1988, at C2.

70. A recent newspaper editorial illustrates this inconsistency:

The U.S.'s record on ozone depletion has been mixed. On the plus side, it helped produce the Montreal protocol of 1987, which mandated a 50 percent reduction in CFC's by the year 2000. Three years later, confronted with even more alarming evidence, it agreed with other Western nations to eliminate CFC's by the year 2000. American industry swiftly developed substitutes.

Since then, however, the [Bush] Administration has faltered. In 1990, developing nations asked for a modest \$20 million to convert to substitutes for CFC's. Washington refused . . .

And last November, when a United Nations panel suggested that ozone depletion was occurring three times faster than previously supposed, the Administration remained silent.

The Ozone Hole Over Mr. Bush's Head, N.Y. TIMES, Feb. 5, 1992, at A22.

71. In May 1991, the United States opposed an attempt to require industrialized countries to establish a fund to assist developing countries in paying for the use of more expensive ozone-friendly substitutes. It later reversed that position, however, due to intense diplomatic pressure. Larry B. Stammer, *Conferees Optimistic About New Ozone-Layer Controls*, L.A. TIMES, June 21, 1990, at A7. At the 1991 Nairobi talks, which were intended to prepare a treaty for signature at the June 1992 environmental summit in Rio de Janeiro, the United States was the sole opponent to setting carbon dioxide emissions targets. See William K. Stevens, *At Meeting on Global Warming, U.S. Stands Alone*, N.Y. TIMES, Sept. 10, 1991, at C1.

72. A 1987 Reagan administration report on acid rain, issued by the National Acid Precipitation Assessment Program, significantly downplayed the risks of acid rain and the current extent of lake acidification. Canada's environment minister, Tom McMillan, however, called the report "voodoo science." See Philip Shabecoff, *Government Acid Rain Report Comes Under Sharp Attack*, N.Y. TIMES, Sept. 22, 1987, at C1.

73. The harvesting of old-growth timber on certain "unreserved" federal lands—those lands remaining available to lumber interests—has greatly accelerated over time. Lumber companies are trying to meet a national timber target established by Congress

A model of this issue as a game would reveal the elements of incomplete knowledge and indefinite duration. While nations may be aware of some of each other's resources and resolves for dealing with atmospheric degradation, they are far from knowing all of the important scientific mechanisms involved, or the economic consequences of proposed approaches to the common problem. Furthermore, no nation can predict with any certainty how long this game of "atmospheric clean-up" will continue. Thus, two of the elements for inverted signalling are present.

The mixed signals sent to the world community by the varied U.S. positions would therefore be appropriate under a game theoretical analysis if, and only if, the atmospheric clean-up game is competitive, and not cooperative.⁷⁴ The competitive aspect of this game enters the analysis primarily from the standpoint of costs. Thus, mixed positions from the United States on reversing atmospheric degradation are appropriate if the emphasis of our national policy is convincing other nations to bear the costs of improvements. From the standpoint of a shared atmosphere, an airy global commons, however, it would appear that atmospheric clean-up is an inherently cooperative endeavor. Thus, if the U.S. national policy instead emphasizes the clean-up on an expeditious, cooperative basis, with a reasonable allocation of costs among countries, then direct signalling of that position would be appropriate.

D. *Recognizing and Supporting Occupied Nations*

When Iraq invaded Kuwait in 1990, the United States was swift in its condemnation of Iraq and took strenuous efforts to eject Iraq from the territory it had occupied and annexed⁷⁵ in what was known as Operation Desert Storm.⁷⁶ Those efforts were undertaken at both the diplomatic⁷⁷ and military levels.⁷⁸ In the end,

from an ever-dwindling supply. "In some places, harvest levels have been unsustainable, the forest has been exploited, and the stewardship mandate has been violated. The land looks abused to all who view it . . ." Neil Sampson, *Managing Change by Changing Management*, 96 AM. FORESTS 6 (Nov./Dec. 1990).

74. See *supra* text accompanying notes 20-22.

75. See, e.g., Michael R. Gordon, *Iraq Army Invades Capital of Kuwait in Fierce Fighting*, N.Y. TIMES, Aug. 2, 1990, at A1; John Kifner, *U.S. May Send Saudis a Force of 50,000; Iraq Proclaims Kuwait's Annexation: 'Merger' Declared—Mubarak's Summit Call Gets Quick Response from Arab Leaders*, N.Y. TIMES, Aug. 9, 1990, at A1.

76. See *The General: 'A Fire of Determination'*, N.Y. TIMES, Jan. 17, 1991, at A17 (statement of General H. Norman Schwarzkopf).

77. For a summary of the various U.S.-sponsored Security Council resolutions that made demands of, and imposed sanctions on, Iraq and Saddam Hussein, see *Comprehen-*

these efforts resulted in the returning of Kuwait's complete territorial independence.⁷⁹

In 1940, when the Soviet Union invaded the Baltic nations of Latvia, Lithuania, and Estonia, the United States refused to recognize their incorporation into the Soviet Union.⁸⁰ Once these three nations were able to reestablish a degree of territorial sovereignty in 1990, their leaders eagerly sought diplomatic recognition from the United States,⁸¹ as well as economic and political support.⁸² In contrast to the support the United States was providing to Kuwaiti efforts to reestablish sovereignty, the United States declined to recognize or to establish diplomatic relations with the three Baltic countries.⁸³ In fact, some observers noted

sive Mandatory Sanctions Imposed Against Iraq, 27 U.N. CHRONICLE 5-7 (Dec. 1990). For a concise description of the diplomatic efforts undertaken by the United States and other nations between the invasion of Kuwait and the commencement of military actions against Iraq, see *Diplomatic Chronology of the Gulf War*, N.Y. TIMES, Feb. 22, 1991, at A7.

78. On January 17, 1991, United Nations-authorized coalition forces, consisting of many United States troops and commanding officers, commenced a military attack on Iraqi positions in both Kuwait and Iraq. See Andrew Rosenthal, *U.S. and Allies Open Air War on Iraq; Bomb Baghdad and Kuwaiti Targets; 'No Choice' But Force, Bush Declares: No Ground Fighting Yet; Call to Arms by Hussein*, N.Y. TIMES, Jan. 17, 1991, at A1. Military operations ceased on April 6, 1991, with Iraqi acceptance of the United Nations' cease-fire terms. See Patrick E. Tyler, *Baghdad Formally Agrees to 'Unjust' U.N. Conditions for Permanent Cease-Fire: Punished But Hanging On*, N.Y. TIMES, Apr. 7, 1991, at A1.

79. *Transcript of President's Address on the Gulf War*, N.Y. TIMES, Feb. 28, 1991, at A12.

80. BRONIS J. KASLAS, *THE BALTIC NATIONS—THE QUEST FOR REGIONAL INTEGRATION AND POLITICAL LIBERTY* 276-83 (1976) (discussing the U.S. reaction to the Soviet annexation of the Baltic States); see also BRONIS J. KASLAS, *THE USSR-GERMAN AGGRESSION AGAINST LITHUANIA* 430-73 (1973) (containing copies of original documents which deal with Western nonrecognition of the incorporation of Lithuania, Latvia, and Estonia into the Soviet Union). In addition, the U.S. Senate found it important to repeat the rejection of the incorporation of the Baltic States into the Soviet Union in the context of the treaty ending Allied post-war responsibility over Germany. See 136 CONG. REG. S14,873 (daily ed. Oct. 10, 1990) (statement of Sen. Bradley).

81. See John E. Yang, *President Seeking Way to Help Gorbachev Ease Food Shortage*, WASH. POST, May 9, 1991, at A30.

82. Lithuanian Prime Minister Kazimiera Prunskiene asked the United States for "concrete political and economic support" in Lithuania's struggle for independence from the Soviet Union. See Don Oberdorfer, *Lithuania Opposes Most-Favored Status for Soviets*, WASH. POST, May 5, 1990, at A16. Prime Minister Prunskiene planned on meeting with members of Congress and business executives in search of support for Lithuanian independence. See *Lithuania Considers Changes to 3 Laws*, L.A. TIMES, Apr. 28, 1990, at A13.

83. The United States did not accord full recognition to these Baltic republics within the months following their declarations of independence and sovereignty, as well as their first democratic governmental elections. "A number of Congressional members of the United States Commission on Cooperation and Security in Europe have been urging for *eight months* that the Administration provide diplomatic recognition to the Baltic republics." David Binder, *Baltics' Campaign Is Gaining in West*, N.Y. TIMES, Aug. 23, 1991, at A9 (emphasis added).

increased Soviet military efforts to reestablish control over the three Baltic states during the period the United States was involved in efforts with the United Nations to resolve the Kuwaiti crisis.⁸⁴

Throughout the Kuwaiti crisis, the United States claimed that it was leading the coalition against Iraq for the purpose of preventing an aggressor nation from preying on its weaker neighbor;⁸⁵ control of the Kuwaiti oil fields was mentioned only as a supporting consideration.⁸⁶ If prevention of territorial acquisition through armed aggression was actually the primary consideration—the goal of the game—then the Baltic situation presents a comparable context for application of game theoretical analysis.

An international game of armed territorial acquisition and its prevention would be one of indefinite duration, as history amply demonstrates. It is clearly also a competitive game, almost by definition, as territorial acquisition involves the exclusion of one party's interest. Finally, it is a game of incomplete knowledge, because of the uncertainties each participant would have about the military strength and resolve of their opponents. In short, it is a game in which inverted signalling is theoretically appropriate.

Therefore, it may have been appropriate to act differently in the Kuwaiti and Baltic situations because, as modelled, the overall game that includes both situations appears to be one of indefinite duration, incomplete knowledge, and a competitive nature. Whether it was appropriate to behave differently in the Kuwaiti and Baltic situations would therefore be a strategic decision.⁸⁷

84. Members of Congress, "speaking at a session of the United States Commission on Security and Cooperation in Europe, pointed repeatedly to what they perceived as a link between the moves of Soviet military units in Lithuania and Latvia at the very time the United States had mounted air strikes against Iraq." David Binder, *Baltic Crackdown Angers Congress*, N.Y. TIMES, Jan. 18, 1991, at A7.

85. See, e.g., Rosenthal, *supra* note 78, at A1 (noting that President Bush's goals in invading Iraq were to liberate Kuwait and destroy Saddam Hussein's nuclear facilities).

86. There are differing views with respect to the role that foreign oil played in Operation Desert Storm. While one commentator categorized the oil issue as an "undisclosed US objective," Adam Pertman, *Envoy Says Iraq Is Ready for Mideast Regional Talks*, BOSTON GLOBE, Oct. 12, 1990, at 16, many Americans disagreed and considered oil "the paramount issue . . . [and] the overriding cause for the war." David Wald, *Somebody Has to Pay for Our Cheap Oil*, N.Y. TIMES, Apr. 8, 1991, at A14 (editorial).

87. By comparison, we know that bluffing is an appropriate strategy in poker. See *supra* text accompanying note 16. The separate question of whether bluffing is a good approach in a particular hand, however, is not answerable by an analysis of poker as a game, but must depend upon the particular circumstances of the hand being played and the other players participating in the hand.

Under this analysis, the president should have decided whether to act consistently with a prior diplomatic position on the basis of whether the goal of unsettling the potential aggressor's plans would be advanced, and territorial seizures limited, by leaving unclear just when the United States will take diplomatic and military action in favor of nations that have been annexed. If it would render potential aggressors uncertain whether to act, then the apparent Kuwaiti-Baltic discrepancy may have been justified.⁸⁸

This example reveals one of the inherent limitations of game theory analysis of signalling inconsistencies in similar international situations. Game theory can indicate that signalling inconsistencies are inappropriate in certain circumstances, or it can indicate which aspects of given situations must be considered dominant if inconsistencies are possibly appropriate. Game theory, however, cannot ratify any particular act of inverted signalling. Game theory can create a restraint upon, but not grant an *imprimatur* to, incompatible policies.

IV. CONCLUSION

It is easy to criticize the actions of the United States in each of these examples as being hypocritical or unprincipled. To make such a criticism is simply to miss the point. If the characteristics of the international games in which the United States took these actions warrant inverted signalling, then these actions may be completely appropriate and justified.

According to the earlier analysis under game theory, inverted signalling may be an appropriate strategy in a competitive game of incomplete information of indefinite duration. Arguably, international relations is a game of infinite duration (or is at least of indefinite and very long-term duration), satisfying one of the three conditions for inverted signalling. If the other two conditions—competitiveness and incomplete knowledge—are satisfied, inverted signalling could reasonably occur and would take

88. It may also be justified on the basis that the two circumstances are not truly comparable. That the Baltic annexation had been *de facto* successful for 50 years as compared with Iraq's relatively short annexation of Kuwait may provide a basis for the apparently disparate approaches taken by the United States. While this author personally believes that the long delay in U.S. diplomatic support for Lithuania, Latvia, and Estonia was an unwise policy, he acknowledges that the brief signalling analysis undertaken in this Article fails to establish that it was unsound.

the form of somewhat unpredictable behavior undertaken at a cost over simple, "unsophisticated" play.

Thus, in analyzing international relations, the proper question is whether the contexts in which the United States has taken inconsistent actions fit into an appropriate game model. More precisely: (1) are the games involved competitive rather than cooperative in nature; and (2) are the games of incomplete information? If the games involved are essentially cooperative in nature, then such inverted signalling will diminish the overall expected payoff and would therefore be an inappropriate strategy. If the games are ones of perfect knowledge, then signalling is unnecessary and will only serve to diminish the overall payoff in a cooperative game, or the individual player's payoff in a competitive game.⁸⁹

It is beyond the scope of this Article to attempt a thorough analysis of these two questions. Instead, the aim of this Article is merely to establish these as fundamental questions to any critique of the international actions of the United States or, indeed, of any other nation. It would be inappropriate to conclude, however, without pointing out a few issues that could prove to be fundamental to answering the competitive/cooperative and complete/incomplete information questions.

First, these questions cannot be answered without initially defining the game involved. Most game modelling seeks to define the situation under analysis narrowly, so that quantifiable goals can be established, strategic payoffs compared, narrow strategies defined, and actual payoffs reviewed. Such analytic isolation is impossible in the examples set forth above. In the broad fields of international economic and political relations, certain goals may be defined, but not in isolation from one another. For example, it would be unrealistic to assert that increasing our balance of trade could be pursued independent of promoting global development or diminishing damage to the global environment.

Nevertheless, a game theoretical analysis that seeks to understand the relationships between such broadly defined goals could build an understanding of areas of strategic overlap, where stra-

89. An example of a competitive game of perfect knowledge is, as we have seen, chess. *See supra* text accompanying notes 9-10. Therefore, inverted signalling is not possible in a chess game since an opponent is capable of "reading" the board accurately. One could argue that inverted signalling, through attracting the opponent's attention to the wrong corner of the chessboard by a feinting attack, is possible with a markedly inferior opponent. That would appear to alter the game to one of imperfect knowledge, however, due to one competitor's inadequacies.

tegic means of achieving several of these goals could coincide. Such analysis could also allow, over time, a more complex understanding of our motives and our means than has heretofore been evident. Even if inverted signalling is found to be an appropriate strategy in U.S. global relations, game theoretical analysis may permit a sounder application of this strategy.⁹⁰

Second, the game identified or defined in this analysis is likely to have both cooperative and competitive aspects. The example of protecting the global environment clearly illustrates this point. On a cooperative level, it is in every nation's best interest to ensure that the global environment is cleaned and preserved. In the same game, however, it is in each nation's best interest, on an elementary level, to externalize these costs. In other words, there is a competitive element in each country's attempt to force other nations to bear all the costs associated with such cleaning and preservation. In general, it would seem that environmental and peace-promoting games would be primarily cooperative, whereas territorial acquisition and cost avoidance games would be primarily competitive. In reality, these interests will overlap to a great degree. Any game theoretical analysis must, over time, develop the sophistication necessary to deal with such mixed purpose games.

Third, the question of whether the game is one of complete or incomplete information raises difficult questions involving modern patterns and techniques of information flow and with analyses deriving from modern information theory. Information that is protected from public viewing by governments or corporations may or may not be of sufficient importance to render a given game one of incomplete information. The sheer volume and overwhelming quantities of information available in published reports and open databases may render a game one of paradoxically incomplete information, in a practical sense, where some of the players have limited resources for gathering and analyzing the available information. This might be so where some of the players are smaller or less developed countries that lack large quantities of advanced information processing equipment and personnel. Finally, because of the significant role available infor-

90. In poker, all players know that inverted signalling—bluffing—is an appropriate strategy. Universal knowledge that every player will bluff at some time does nothing to diminish the effectiveness of the bluffing when it actually occurs. An efficient bluffing strategy therefore remains useful in concealing the contents of a player's hands. Merely knowing that an inverted signalling strategy will be adopted does not provide a player with the information needed to decipher the strategy when it is adopted.

mation plays in determining the utility of inverted signalling, analysis of these issues from a game theoretical perspective may carry implications for national information policies.