

# Tit-for-tat and the Negotiation of Nuclear Arms Control

George Bunn\* and Rodger A. Payne\*\*

Robert Axelrod's *The Evolution Of Cooperation* has been widely acclaimed in the few years since its publication.<sup>1</sup> Given its promise for promoting cooperation in 'prisoner's dilemma games' (PDGs), such praise is unsurprising. The purpose of this paper is to consider whether the tit-for-tat (TFT) strategy Axelrod recommends for achieving an evolution of cooperation in PD situations has application to the negotiation of arms control treaties.

The structure of many important social and political problems resembles the PDG interaction (see the Appendix for a brief description of PDGs). For instance, many competitive bilateral situations – including arms races – are said to share the logic of the PDG. Two states in an arms race have incentives to continue the competition, although they will be worse off if they escalate the race than if they agree to stop it.<sup>2</sup> Each state fears it will suffer a 'sucker' payoff should it practice restraint while the opponent continues escalating the competition. Likewise, each is tempted to seek unilateral advantage when the opponent practices restraint.

In all PD situations, individually rational decisions can lead to inferior group outcomes. Searching for ways that players can overcome the dilemma and receive high payoffs, social scientists have thoroughly examined various strategies that can be employed in the PDG. Axelrod, among others, recognized that players have an incentive to cooperate over repeated plays of the game.<sup>3</sup> In an iterated PDG (a so-called 'supergame'), players eventually discover that non-cooperative behavior yields poor payoffs for all. They also learn that mutual cooperation provides the greatest rewards over time.

Axelrod finds that players in a PD supergame should adopt a tit-for-tat (TFT) strategy so long as a few basic pre-requisites are met. Assuming players are rational egoists who do not greatly discount the value of future payoffs, all players should make moves based on an opponent's previous move.<sup>4</sup> TFT can provide the large payoffs promised by cooperation; yet, at the same time, players retain the option to defect when faced with an uncooperative opponent. Using a computer tournament,

\* Member in Residence, C.I.S.A.C., Stanford University.

\*\* C.I.S.A.C., Stanford University.

Axelrod discovered that TFT performs better than virtually any other strategy in a PD supergame between two players. Tit-for-tat is robust and stable. Over time, it can 'invade' a world of non-TFT strategies and prove successful. In this way, cooperation can evolve in almost any PD situation.

#### TFT IN THE LITERATURE

Because of TFT's apparent ability to yield cooperative results when competition seems rational, many international relations scholars have applied Axelrod's findings to their own work. Even Axelrod says that states in a bilateral relationship can escape the temptations of the prisoner's dilemma. Rivals locked into an ongoing competition can learn to cooperate using a tit-for-tat strategy. Axelrod cites specific examples from international relations history where TFT-like cooperative behavior might explain the course of events. For instance, he devotes a chapter to the evolution of cooperation between opposing forces in the trenches of the First World War.<sup>5</sup>

Taking his argument several steps further, some scholars argue that competition in the U.S.-Soviet relationship can be eased via the application of tit-for-tat strategies. A few have even argued that TFT is sometimes employed by the superpowers. For instance, Nye says that the U.S.-Soviet relationship reflected in the current 'Non-Proliferation Treaty loosely represents a situation that game theorists call *iterated prisoner's dilemma*. Each has learned that cheating and taking short-run advantage could lead to similar behavior by the other and loss of their common interest in slowing the spread of nuclear weapons.<sup>6</sup> Nye is referring not to the 'offer and acceptance' bargaining which produced the text of the NPT, but to the trial-and-error, action-reaction process which convinced each superpower that such a treaty and other related agreements and practices which comprise the non-proliferation regime were in its interests.

The offer-and-counteroffer-or-acceptance bargaining which produces a specific agreement is often difficult to distinguish from the action and reaction which brings participants to the bargaining table, and which influences them later to implement what they have negotiated. As Alexander L. George suggests, however, such distinctions are essential for proper consideration of the usefulness of game theory strategies such as TFT in the negotiation of U.S.-Soviet treaties and the building of U.S.-Soviet regimes.<sup>7</sup> The difference is relatively clear. In bargaining, two players come to agreement on what they will do before they act. In action-reaction, the two players act independently without talking - although each knows the other's prior moves.

TFT is a behavior modification, or 'action' strategy for strategic interaction. It demands that players take their cues from their opponent's actions, without reaching explicit agreements. Bargaining participants attempt to resolve problems with discussions before acting. One party says, 'If you will give me X, I will give you Y.' The other counters with, 'No, you give me Y and I will give Z.' And so it proceeds, offer and counteroffer, until agreement is reached or negotiations break down. By contrast, PDG situations do not generally allow communication between players; each adopts strategies knowing only the opponent's prior moves.

The structure of a typical two-by-two prisoner's dilemma game is quite different from the interaction of two negotiators in other important respects. In a PDG of this type, each player has only two options, to cooperate or to defect. The opponent's two options are known, along with a rough idea of the preference orderings. By contrast, arms bargainers have many more options. In addition to the choice between accepting and rejecting an offer, a bargainer may make a counteroffer, retract a prior position, or simply talk without making an offer. Moreover, many issues must somehow be linked if an agreement is to be reached. These dramatically increase the options and complicate all predictions of an opponent's next move. Indeed, during arms bargaining between suspicious superpower rivals, misperception of an opponent's intentions is quite likely despite communication.<sup>8</sup>

Nonetheless, we believe that a discussion of TFT as an arms control bargaining strategy is justified. Several reasons are offered here:

1. First, a recent analysis of TFT strategy – which explicitly considered Axelrod's experimental results – argues that the prisoner's dilemma offers some good advice for negotiators, even though it may not accurately model the negotiation process. Lax and Sebenius believe that Axelrod's TFT strategies offer the 'most powerful advice for managing the tension between creating and claiming value' which negotiators face.<sup>9</sup> Negotiators create value when they formally secure common or complementary interests which they could not assure without agreement. In the Limited Test Ban Treaty (LTBT), for example, Kennedy and Khrushchev found common interests in improving relations, preventing radioactive fallout, and erecting barriers to atmospheric testing by other countries. Each had a competing preference for limiting his opponent's testing but not his own; thus, self interests had to be restrained via parallel limitations on testing. Using the Lax and Sebenius terminology, the two parties overcame the tension between creating value produced by common interest and claiming value produced by limitations on the opponent. As in the prisoner's dilemma, the tension is between each

side's 'cooperative impulses' to find an agreement leaving both better off, and its 'competitive impulses' to get more than an opponent from the situation. Neither Kennedy nor Khrushchev could gain desired results without acceding to a ban on atmospheric testing in his own country. Thus, each faced a 'negotiator's dilemma' not unlike the prisoner's dilemma.

2. Second, the action and reaction which often precedes serious bargaining may be better modeled as employment of TFT strategy in a PDG, than as offer-counteroffer bargaining at a negotiating table. The payoff structure states seem to perceive in pre-negotiation action-reaction may resemble a PDG, and the cooperative strategies they use to begin negotiations share many characteristics with TFT. This notion is explained below in the section on 'nice' characteristics.

3. Next, the claimed benefits of arms control justify a thorough examination of alternative means of achieving it. A large number of scholars now assume that PDGs accurately model arms races, and a growing number believe TFT induces cooperation in PDGs, even between states.<sup>10</sup> For our purposes, we have assumed that PDG accurately models the arms race in order to examine whether TFT strategy can contribute to arms control negotiation. If the prisoner's dilemma game accurately models the competition of arms races, perhaps the tit-for-tat strategy can suggest how to slow them. After all, TFT can apparently induce an evolution of cooperation in many otherwise competitive environments.

Some important scholars have explicitly called for an application of TFT to arms control bargaining. Duncan Luce argues forcefully that TFT should be applied to superpower arms control: 'For the arms race, it may be that Mr. Axelrod's teaching approach is our best hope, provided decision makers on both sides . . . adopt explicitly his Tit for Tat strategy.'<sup>11</sup>

4. Fourth, an examination of tit-for-tat seems worthwhile because empirical studies of past arms control negotiations find that TFT-like reciprocity often describes superpower behavior in this situation. Interestingly, studies testing (and supporting) two divergent theories of negotiation behavior commonly find that TFT-like reciprocity occurs when parties reach agreement. Both are described here.

Frequently, studies of nuclear arms negotiations seem to assume that the first of these, the concession/convergence bargaining model, is a good 'fit'. This model suggests that each side starts negotiating from a position different from the opponent. Agreement is reached by exchanging concession for concession until the positions converge.

Empirical studies of the concessions and retractions in nuclear test ban negotiations and SALT (Strategic Arms Limitation Talks) conclude that they were characterized much of the time by reciprocity in concessions, or 'various forms of tit for tat'.<sup>12</sup> It should be noted, however, that the test ban studies were based almost entirely on the unsuccessful attempts to achieve a comprehensive treaty banning all tests, rather than the successful negotiations which led to the LTBT.<sup>13</sup>

Despite an assumption of concession/convergence from the beginning, some studies of SALT concessions and retractions show generalized reciprocity, though not exactly Axelrod's TFT. Studies by Jensen, and by Stoll and McAndrew, weigh and analyse the moves which produced four agreements: the SALT I Interim Agreement, the Anti-Ballistic Missile (ABM) Treaty, the 1974 Vladivostok formula agreement, and the SALT II Treaty. For the first two agreements, Stoll and McAndrew found TFT-like cooperative reciprocity in that concessions begat concessions. However, this cooperation was usually more like tit-for-two-tats, or even tit-for-three-tats. For the latter two agreements, they found inverse reciprocity – concessions begat retractions more often than concessions. Overall, the correlation between a single concession and a responding concession (which would be quite like TFT) was not strong. However, a trend of concessions or a group of concessions on one side seemed to make a difference to the other – though it did not always produce cooperation. Despite this mixed evidence, Stoll and McAndrew conclude that 'U.S.–Soviet interactions were characterized more often by cooperative reciprocity (various forms of tit for tat) than by inverse reciprocity (various forms of exploitation)'.<sup>14</sup>

In the literature concerned with international negotiations, 'formula' approaches are contrasted to concession/convergence theories. Scholars subscribing to the formula approach believe that negotiators usually strive to find an initial formula for agreement which will link issues to meet interests sought by both sides. This is especially typical in the beginning stages, when many outstanding issues exist.<sup>15</sup>

William Zartman's analyses of case studies and interviews with international negotiators suggest that formula/detail models better describe international negotiation than do concession/convergence models. When only one important quantifiable issue was on the table – a wage rate, for instance – concessions and convergence were obvious, but always in reference to an accepted standard or formula (like the cost of living). With many issues on the table, and not all of them quantifiable on the same scale, the use of a formula to link them was even more evident. While not rejecting concession/convergence models, especially for negotiating details after a formula has been chosen, Zartman found the formula/details approach dominant in international negotiations.<sup>16</sup>

Several arms control case studies seem to support his position. In the successful 1963 Moscow LTBT negotiation, a formula which had been suggested in 1962 by the Americans and British was later accepted by the Soviets. Once Khrushchev accepted this formula in 1963, the Moscow negotiators agreed to the treaty details fairly quickly. Both sides made concessions, generally suggesting cooperative reciprocity, but not precisely TFT.<sup>17</sup>

Moreover, insider accounts of the negotiation of the SALT I Interim Agreement and the ABM Treaty – cases where Stoll and McAndrew found cooperative reciprocity on both sides – suggest that Zartman's formula/details bargaining was dominant. The first significant formula was a Kissinger–Dobrynin negotiated press release with accompanying Nixon–Brezhnev letters. These established a loose linkage between a limited freeze on the numbers of offensive missiles and a more comprehensive ban on national ABM systems. This formula created the first joint goals for the American and Soviet negotiating delegations who later reached agreement on most of the details of the two agreements. Both sides employed cooperative reciprocity in reaching the formula and in negotiating the details.<sup>18</sup> Thus, both the formula/details model and the concession/convergence approach are useful in describing superpower behavior at arms control negotiations. Since both models likewise seem to be accompanied by reciprocity, they also justify a further exploration of Axelrod's TFT as a means of achieving arms control.

With this review of the empirical evidence, a couple of important reservations should be entered. Clearly, in modeling arms control bargaining isolated from other events in the world, all these studies leave out important variables which may affect bargaining. For example, Americans perceived Soviet 'misbehavior' in the mid-1970s in Angola and the Horn of Africa, and in their accumulation of accurate MIRVed ICBMs. Both kinds of misbehavior had major impacts on American arms control bargaining. Similarly, the studies showing SALT reciprocity do not model the internal negotiations within each country (and sometimes with allies) which produce instructions to the negotiators on responding to concessions, retractions and other events. We question the usefulness of theories which purport to explain bargaining but that do not account for events of this sort occurring away from the negotiating table. This paper elaborates these concerns.

5. Finally, the tit-for-tat strategy seems worth exploring as a potential avenue for arms control because some see a place for TFT in what Khrushchev called 'mutual example' arms control. Axelrod himself thinks that such 'tacit' arms control can evolve, and this would seem

to offer the best application of TFT strategy to arms control.<sup>19</sup> Proponents foresee mutual restraint which occurs without formal agreement through action and reaction. It is therefore closer to the TFT strategy than the offer and counteroffer of treaty negotiation. Scholars (principally Schelling) and policymakers (including former ACDA Director Adelman) have seriously considered tacit arms control.<sup>20</sup> Nonetheless, we do not place much emphasis on this kind of restraint.<sup>21</sup>

'Mutual example' restraints are unlikely to yield much more than temporary halts in weapons testing and the like. Formally negotiated arms control treaties have come to wield considerable symbolic significance. Meaningful reductions seem quite improbable in the absence of a formal treaty. Only certain types of restraint, perhaps involving new areas of the arms race – such as the mutual reluctance to test submarine missiles in depressed trajectory flights, or ASAT test moratoria – seem likely to 'evolve' tacitly.<sup>22</sup> Today's pressing issues, like warhead limits, de-MIRVing, and deep reductions, would probably require formal treaties.

The United States' legal framework also makes eventual congressional approval of agreements to limit or reduce arms a necessity.<sup>23</sup> Certain types of arms control are illegal in the absence of treaties or congressional legislation. Further, verification problems cast doubt on the desirability of tacit arms control agreements. What constitutes a violation of an agreement that has not been formalized? How can tacit agreements survive 'minor' defections? The formal process at least has a Standing Consultative Commission (SCC) to institutionalize punishment and forgiveness.

Thus, we focus on whether policymakers seeking arms control treaties can or should adopt TFT strategy to initiate or conduct *negotiations*, although some of the discussion applies to tacit agreement. Our analysis covers two primary areas of interest. Initially, we look at the four key substantive characteristics of TFT strategy identified by Axelrod which help make it a useful action strategy. It is clear, nice, reciprocal (or retaliatory) and forgiving. We ask how readily nuclear arms bargaining can share these characteristics. Next, a few process questions are considered. We analyse the potential problems faced by the bureaucracy, the Congress, and the President in employing TFT, especially given public opinion. Throughout the argument, both theoretical and practical objections are raised.<sup>24</sup>

## THE FOUR CHARACTERISTICS OF TFT

*Clear*

First, Axelrod argues that the tit-for-tat strategy is unambiguous and that such clarity is a strength. Simply, it allows ready recognition by the players. Opponents expect both cooperative and uncooperative strategies to be reciprocated because their moves are recognizable.

However, clarity is actually highly problematic given the difficulty of defining bargaining moves in a TFT context of strategic choice. What offers reflect cooperation or defection in a negotiating forum? Cooperation might mean acceptance of offers, although a TFT strategist could argue that it also included some counteroffers, or even willingness to continue talking without reaching agreement. Defection could perhaps include rejection of the other side's offers, *withdrawn offers*, or introduction of unreasonable offers. However, as will be argued below, defection would probably also be symbolized by actions outside the negotiating forum. At the most basic level, players may not be able to interpret even what entails a move or response. There is no easy solution to this problem of definition.

To test whether TFT would remain robust when clarity is imperfect, Axelrod included a tournament round in which there was a one per cent chance of misperception by one player of the other's intention to cooperate or defect. TFT remained the best strategy in this round, though it 'got into a lot of trouble when a single misunderstanding led to a long echo of alternating retaliations'.<sup>25</sup>

Suppose, however, the chance of misperception is 25 per cent, or more.<sup>26</sup> In the real world of superpower relations, clarity may be no better. One cannot look simply at the offer and counteroffer at a bargaining table to determine whether to respond cooperatively or to defect. For example, intelligence failures, whether of commission (analysis) or omission (detection) can lead to misperceptions. The status of the Soviet phased array radar in Krasnoyarsk during the ongoing strategic arms reduction talks (START) illustrates this problem. What does this radar symbolize? Should the U.S. have ignored it and concentrated on the cooperative signals it received at the bargaining table? The Soviets denied the ABM tracking capabilities of the radar and apparently agreed to delay construction to allow for negotiations. Thus, though no 'defection' may have been intended, non-cooperative signals were received by the U.S., which formally charged the Soviets with an ABM Treaty violation. The data about other alleged instances of Soviet cheating are even more ambiguous and reflect the continuing

problem of judging whether such Soviet moves are 'defections' or unrelated events.

Next, the breadth of the international agenda assures ambiguity in superpower arms control bargaining. Certainly, states like the U.S. and the Soviet Union have extremely wide-ranging global interests. These vast agendas increase the likelihood that one state or the other will take actions that the opponent will find offensive, and as a result, clarity in negotiating forums would be difficult to achieve. The disparate effects of the Soviet invasion of Afghanistan in 1979 and the U.S. bombing of Vietnam demonstrate the unpredictability of this ambiguity problem. The former drove the final stake through the heart of SALT II, and led to the cancellation of ongoing arms control talks over anti-satellite devices, while the latter had virtually no deleterious effect on the outcome of the Non-Proliferation or ABM Treaties. How can the decision maker interpret moves clearly? The U.S. may have difficulty separating future arms control from Soviet shootings of civilian airliners, support for martial law imposed in Eastern Europe, or construction of Siberian radars. The Soviets may similarly have trouble isolating arms bargaining from American intervention in Caribbean islands, bombing of Middle Eastern terrorist bases, or plans to test and deploy space-based laser ABM technologies.

Further complicating clarity, policymakers often intentionally link seemingly distinct issues together. Kissinger and Nixon explicitly attempted to achieve linkage in their detente strategy. Thus, the Soviets may have had difficulty understanding U.S. strategy; they may have sensed cooperation on arms control, but found noncooperation in other areas. Moreover, American domestic audiences assumed that Soviet worldwide behavior would become more cooperative if SALT succeeded. Political opponents of arms control could make arguments about tangential issues, regardless of attempts to limit debate. This assured ambiguity and later complicated SALT II for the Carter Administration. SALT II's opponents, for instance, argued that Cuban troops in Africa were important because they symbolized the underlying problem of making deals with an enemy. Because of linkage, the TFT strategy may need alteration if it is to be effective in arms control bargaining. A general prescription of strategy needs to outline optimal moves in simultaneous PD supergames. Further, the payoff structures in some games need to depend on outcomes in others.

Game theorists have sometimes argued that issue linkage can foster cooperation. They conjecture, for instance, that states can 'trade off' defections, just as legislators often trade votes on bills. Moreover, theorists have argued that issue linkage can help create widespread cooperation – similar to the 'universalism' effect that Barry Weingast

has noted on pork-barrel legislation. Simply stated, broad packages offer something for everyone, reducing incentives to defect.<sup>27</sup> However, despite some talk of linkage, arms control policymakers do not always exhibit a willingness to trade votes. For instance, Secretary of State George Shultz readily linked Soviet human rights behavior to arms control, noting that 'Soviet abuses can only jeopardize efforts to make progress in all areas of U.S.-Soviet relations'. However, Shultz refused to accept Soviet linkage demands. Despite 'their efforts to link a possible INF [intermediate nuclear force] agreement with our acceptance of their position on SDI,' he said, 'we don't see any reason why these issues should be linked.'<sup>28</sup>

Another clarity problem concerns the role of superpower communication. Both the U.S. and Soviet Union do some of their arms control bargaining outside the negotiating rooms – seeking a public relations effect – which can render interpretation of real offers problematic. Moreover, persuasive communication can be used to alter payoff structures – often by attempts to link or 'de-link' issues. Some research suggests that seemingly slight changes in the way choices are 'framed' can greatly affect outcomes.<sup>29</sup> In short, through both verbal and written discourse, the superpowers often transmit threats, bargains, 'policy positions', and intended actions; yet, superpower communication can also serve propaganda or public relations goals.<sup>30</sup> The nuclear age can be considered a rhetorical age, but what rhetoric is important and what is not? Leaders can find it nearly impossible to distinguish among intentions, hyperbole, and actions.

The U.S. also has difficulty making its positions clear because of its pluralistic government. The executive and legislative branches, for instance, are often in disagreement about the course of U.S. arms policy. Sometimes it seems as if these two policy actors share the role of the 'U.S. player' versus the usually more unified 'Soviet player'.<sup>31</sup> Although not a bargaining example, different opinions on the fate of SALT II illustrate the magnitude of disagreement. Just in this decade, the Reagan Administration denounced SALT II as 'fatally flawed' (despite voluntarily complying with its provisions for about five years), while the Congress voted for bills to force U.S. compliance. Likewise, the Administration condemned Soviet anti-satellite (ASAT) devices and called for a U.S. counterpart, even as Congress voted to deny funds for testing the U.S. system, and numerous members of Congress called for negotiations. These examples illustrate the problem of achieving clarity within the relatively narrow realm of nuclear arms control. In short, even if most of the political differences between the U.S. and the Soviet Union can be isolated from arms bargaining, ambiguity is still possible, if not likely.

*Nice*

TFT is said to be nice because a player employing this strategy cooperates in the initial move. According to Axelrod's computer PDG competition results, nice strategies consistently scored higher than did those beginning with unfriendly moves, during iterated play. However, in the context of the nuclear arms race, nice strategies in Axelrod's sense are impossible to implement. The opportunity to make the initial nice move is long past for either state. For our purposes, we will assume that a state beginning a TFT strategy via cooperative moves is 'nice'. Still, we would argue that such a strategy may be impossible to implement and some observers would say nice strategies are dangerous to national security.

The practical problem is the easiest to demonstrate, but not necessarily the simplest to overcome. The U.S. and the Soviet Union have been locked into competition for over forty years. Therefore, a history of defections must be considered when approaching nuclear arms bargaining, whether tacit or formal.<sup>32</sup> Indeed, although instances of cooperation are sprinkled throughout the history, the periods of great tension have been longer than the periods of detente. Theorists might argue that greater cooperation will eventually evolve as opponents learn the folly of their ways, but practice in this instance suggests scepticism.

Can credible cooperative plays be implemented during uncooperative periods? Would the opponent exploit them, or choose instead to cooperate? Decision makers attempting to integrate an explicit TFT strategy into policy would face questions like these. Some theorists might argue that several consecutive cooperative plays following a period of defections would convince an opponent of one's sincerity and lead to mutual cooperation.<sup>33</sup> Alternatively, others might call for a GRIT strategy (graduated reduction in tensions) to initiate cooperation, based on carefully planned and announced conciliatory moves.<sup>34</sup> However, any decision maker would be faced with a dilemma. If cooperative plays are insignificant, the opponent can readily dismiss them as propaganda. The fact that cooperative moves have been sprinkled throughout the arms race compounds the problem because few would believe that the current moves are any more indicative of cooperation. If the cooperative plays are significant, the opponent can exploit them. Neither fate seems particularly promising.

The risk – and promise – of cooperative plays following long periods of hostility are illustrated by President Kennedy's efforts to achieve a nuclear test ban treaty. Clearly he faced an uphill battle. After a brief thaw in U.S.–Soviet relations produced the first serious test ban negotiations near the end of the Eisenhower Administration, Khrushchev

aborted a Paris summit meeting when an American U-2 spy plane was downed over Soviet territory.

In this inherited context, Kennedy attempted a cooperative strategy. Determined to secure a treaty banning nuclear tests in all environments, he offered concessions that reduced on-site inspection requirements and control posts for identifying underground tests. Soviet negotiators rejected most of the proposals and Khrushchev 'responded' by bullying Kennedy at a Vienna summit, by building the Berlin wall, and by resuming atmospheric testing – the latter move ending a three-year period of mutual restraint. Kennedy then resumed American testing, but offered new test ban concessions towards the end of 1961. Soviet negotiators answered by withdrawing an earlier offer of two or three inspections made at the end of the Eisenhower Administration! In 1962, Kennedy offered still further concessions despite congressional concern. He also offered a treaty which would not ban underground nuclear tests and would not therefore require on-site inspections. Both were rejected as propaganda by Soviet negotiators.

The Cuban Missile Crisis then occurred. Afterward, Kennedy reduced to seven the number of on-site inspections required by the U.S. – a move made in the face of congressional rebellion. Khrushchev renewed his offer for 2–3 inspections, but neither leader seemed able to move further. Finally, Kennedy offered kind words about Russian achievements, a moratorium on atmospheric tests, and high-level negotiations to gain some kind of test ban. Khrushchev accepted, and the LTBT was quickly negotiated. Only one new cooperative move had been announced – the moratorium, and it was seen by American negotiators as *less* significant than earlier concessions!

Kennedy's repeated cooperative plays finally resulted in success.<sup>35</sup> Many point to Kennedy's last offer to Khrushchev: the kind words and moratorium offered in the American University speech of 1963. This 'unilateral initiative' is seen as the nice play which induced cooperation from Khrushchev and produced the LTBT.<sup>36</sup> But the political risks Kennedy took were extraordinary, and he probably could not have taken the final ones but for his successful response to the missile crisis. His own credibility on these issues had peaked. Additionally, the LTBT might not have been negotiated in the summer of 1963 but for Chinese retaliations against what they perceived as hostile Soviet plays against them.<sup>37</sup>

Anyone trying to fit TFT strategy to this real world bargaining situation would have an extremely difficult task. Someone trying generally to draw 'lessons' about the utility of cooperative moves would have only marginally more success. Putting aside third-party (Chinese) influence, one might say this example best represents a strategy 'that begins with firmness – including the threat or use of coercion [JFK's actions in

the Cuban Missile Crisis] – in the early stages of a dispute and then switches to conciliation'.<sup>38</sup> Lessons learned from analyses of games, experiments, and real life case studies collected by Patchen suggest the utility of such a strategy for beginning the cooperation which can lead to serious bargaining in some circumstances.

Finally, the initiation of cooperative arms bargaining ploys might be perceived as dangerous and naive by foreign policy actors in the U.S., particularly during some future period of tension. Many decision makers, for instance, have long advocated bargaining chip theories in nuclear arms negotiating situations. The Reagan Administration's strategy has explicitly been to bargain with the Soviets from a position of strength. Weapons are developed or deployed before they are bargained away. Given the claimed success in the area of intermediate nuclear forces, this strategy will probably gain in popularity among foreign policy elites. It is not difficult to imagine negotiators resisting attempts to adopt nice strategies by arguing that their bargaining positions would be undercut.

### *Reciprocal*

Axelrod states that another strength of the TFT strategy is its promise of reciprocal punishment. Retaliation is required in-kind for any defection, thus the provokable threat of defection serves to induce cooperation. Again, however, the achievement of true reciprocity is problematic in the real world of nuclear arms control bargaining.

The vast agendas of the superpowers complicate reciprocal bargaining. Just as diverse interests confound clarity, they make reactions difficult to interpret. Which 'bad' actions merit punishment? What defections would be recognized as punishment by the opponent? In a complex world, these are questions that are not readily answered. For instance, how should the Soviets have interpreted the Reagan Administration's reaction to their downing of Korean Air Lines flight 007 in 1983? Few specific sanctions were enacted and the President soon delivered a fairly conciliatory speech at the United Nations calling for arms control. Yet the Administration initially employed very hostile rhetoric, calling the incident a massacre of innocent civilians.

This example is not atypical. Policymakers usually rely on rhetoric to explain their retaliatory moves, although verbal descriptions are inherently imprecise. For instance, the Carter administration said that it would not accept the *status quo* in Cuba upon discovery of the Soviet brigade there, but little more than one month later it basically did accept the *status quo*, despite making claims to the contrary.

Appropriate reciprocal moves might be difficult to determine even if the context is confined to nuclear arms. Limiting the appraisal to the offers and counteroffers at the bargaining table would not stop

the inevitable linkages with other issues. How, for example, should a state respond to cheating? Should all ongoing negotiations be cancelled? Should the opponent cheat as well? If so, should its cheating be 'proportional' to the first cheating, as the Reagan Administration suggested in the case of SALT II? Obviously, each of these questions invokes a series of difficult problems, not all of them directly related to arms bargaining. If cheating is merely taken to the SCC, it might not be resolved satisfactorily for some time. Yet, reciprocal cheating might lead to the collapse of all arms control, as could withdrawal from ongoing negotiations. Thus cheating, though dealing with treaty implementation, clearly affects what happens at the bargaining table. Even Axelrod recognizes that retaliation must not be too great, lest it lead to an unending echo of defections.<sup>39</sup>

Finally, the U.S. might find it politically impossible to implement TFT strategies because of the timing demands. Axelrod says that some defections must be answered immediately, and other scholars have also noted the importance of prompt retaliatory responses.<sup>40</sup> Unfortunately, neither the bureaucracy nor the Congress of the U.S. are especially well known for their ability to respond quickly to foreign policy demands. Even a president can fail to act quickly in the face of apparent defection, perhaps delayed by inadequate information. For instance, SALT II suffered during Carter's long delay before responding to the Soviet brigade in Cuba. Discovery was revealed in August, but Carter did not deliver his speech on this issue until October.

### *Forgiving*

Finally, Axelrod argues that the TFT strategy is useful because it is forgiving. Players need not find themselves locked into defection even though payoff temptations may occasionally result in uncooperative plays.

Nuclear arms bargainers are typically not very forgiving. Defections are exploited politically by the opponent. For example, when the U.S. refuses to concede on a Soviet bargaining point, it is likely to be attacked publicly as the obstacle to agreement. Beyond the bargaining table, cases of cheating are often highly politicized. In the U.S., the existence of third parties – public opinion, Congress, allies – provides ample opportunities to exploit defections and makes forgiveness more difficult. The Reagan administration continually pointed to the Krasnoyarsk radar, along with a few other alleged Soviet arms control violations, to demonstrate Soviet non-compliance. In turn, it used this cheating as an argument for larger U.S. defense budgets and justified some potentially uncooperative positions in ongoing negotiations by highlighting these violations. For instance, an oft-repeated U.S. demand for on-site inspection techniques

was frequently supported by pointing to Soviet arms control violations. However, the Soviets undercut this charge by accepting the intrusive verification method in the recent INF Treaty.

Moreover, the broad agenda contributes to an inability to forgive. Occasionally, some transgressions are likely to be so politically devastating that further cooperation on arms control becomes impossible in the short run. The U.S. reactions to the Soviet invasions of Czechoslovakia in 1968 and Afghanistan in 1979 illustrate this problem. Less egregious acts might not have such devastating impacts, but they can still slow arms control bargaining to a snail's pace at almost any time.

Finally, the long history of defections between the superpowers also clouds the ability of both to forgive. Who should forgive first? Strictly, the TFT strategy assumes that a player chooses the move his opponent made in the last round. Obviously, this will not produce cooperation from a string of defections. Additionally, even after cooperation begins, either state might decide that an uncooperative play would represent a return to feuding, potentially triggering the feared echo effect. How many years of cooperation might be needed to make the history of defection fade from memory?

#### DECISION MAKERS

This section discusses U.S. decision makers in order to explain why the tit-for-tat strategy might be difficult to implement, thus making TFT an impractical strategy for achieving an evolution of cooperation in nuclear arms bargaining. Similar problems very likely complicate the Soviets' ability to implement TFT; however, we do not discuss them here. We are not as familiar with Soviet politics, useful information is not as readily available, and the details of Soviet decision making may be changing with Gorbachev's 'new thinking'. In general, however, U.S.-Soviet arms talks consist of many negotiations, including several within the governments of each country. With many actors involved, having different interests, negotiated outcomes are likely to be modest products of internal, as well as external bargaining.<sup>41</sup> Achieving a consensus to implement TFT is unlikely on either side.

In our examination of actors in the U.S. process, we first examine the general public as a 'decision maker', focusing on the impact of popular will (or public opinion) on negotiation and ratification of arms control. Then, our analysis turns toward two actors that do not receive as much attention as they deserve in most arms control discussions – the bureaucracy and Congress. Finally, we discuss the decision maker usually assumed to be in charge of arms control policy, the president and his appointees.

Because formal arms control processes are the most likely, the general public, the bureaucracy, and the Congress, as well as the president, take on important roles. In short, the political significance of a treaty (as opposed to merely tacit restraint) virtually assures the active participation of all the actors. Yet, TFT cooperative strategies cannot readily emerge out of a system that features a somewhat 'schizophrenic' public, an entrenched bureaucracy, an independent Congress, and a strong president. Axelrod himself recognized that 'bureaucratic politics' was not incorporated in his PDG tournaments and that political leaders with strong self interest, especially lame ducks, can easily choose to 'seek private goals rather than maintain a pattern of cooperation'.<sup>42</sup>

### *Public Opinion*

Obviously, members of the general public do not formally participate in the arms control negotiation process. Nonetheless, as discussed above, popular opinion can have a significant impact on the fate of treaties by influencing the negotiation and ratification processes. Put simply, Congress and the President alike take public opinion into account when planning arms control policy. Because public opinion can vary greatly on these issues, however, a TFT negotiating strategy would be difficult to implement.

Public opinion certainly seems 'schizophrenic' on arms control issues.<sup>43</sup> For the most part, this is because diverse members of the general population hold widely different views on the superpower arms competition. Many seem to believe, for instance, that the control of nuclear weapons is a very high priority. They may advocate unilateral U.S. restraint even if the Soviets do not reciprocate. During the peak of the anti-nuclear weapons movement in the early 1980s, 45 per cent of the public supported a nuclear freeze even if it was to be a unilateral U.S. effort.<sup>44</sup> This portion of the population apparently felt that the accumulation of arms was more likely to lead to disaster than would unilateral Soviet arms increases. Those who hold this view would be generally un-supportive of a TFT strategy. If their views were implemented into policy, the U.S. would probably adopt cooperative strategies even in the face of Soviet defections. This would endanger reciprocity.

Still other views on arms issues are at the other extreme of the scale. A significant portion of the public consistently supports increased defense spending because of fear of the Soviet Union, even at great cost. For instance, opinion polls taken after the Reykjavik summit showed that most people support continued SDI funding even if this action leads to deployment and assures that no arms control agreement can be achieved.<sup>45</sup> Many of these members of the general population believed President Reagan when he referred to the USSR as the 'evil

empire', and consequently do not support cooperative measures. Their views are generally inconsistent with TFT strategies. If these ideas were implemented into policy, the U.S. would probably adopt defection strategies even in the face of Soviet cooperation. Policy would be neither nice nor forgiving.

Of course, there is a range of public opinion about arms control falling between these two extremes. However, some views carry more weight when they are upheld by organized interest groups like the Committee on the Present Danger or the Council for a Livable World. U.S. arms control policy is influenced when political leaders pander to one or more of the particular views. Undoubtedly, public protests against the MX slowed the system's deployment, and theoretically had an impact on U.S. arms negotiation positions. President Reagan argued against MX limits by saying that the Soviet Union would not cooperate on arms control if it knew that the U.S. would unilaterally cooperate. Similarly, public outrage at the Soviet invasion of Afghanistan and troop presence in Cuba during 1979 influenced the fate of SALT II and ultimately slowed all arms bargaining for years.

Some leaders attempt to be 'all things to all people' and design strategies that baffle Soviet leaders. These unclear approaches are no better than those that tilt toward special interests. Seemingly, President Carter's ill-fated 1977 arms control proposal was of this sort. Carter tried to appease conservatives (especially Senator Jackson) and liberals alike by designing a new deep reductions arms control proposal. The Soviets were shocked and confused by the plans and immediately rejected them.<sup>46</sup>

### *The Bureaucracy*

When it comes to arms control negotiations, the U.S. does not bargain as an individual rational actor would, but is instead a victim of bureaucratic politics. American negotiators are typically messengers, not movers. Their instructions are usually developed through a bureaucratic wrangle which often gives key agencies, senators, and allies an effective veto over them.<sup>47</sup> In terms familiar to rational choice theorists, this unanimity rule makes interest aggregation a substantial problem.<sup>48</sup> For example, it is the conventional wisdom of experienced arms control negotiators that no significant arms control treaty can get a two-thirds vote in the Senate if it is opposed by the Joint Chiefs of Staff. Thus, the Chiefs, among others, have a very powerful voice in this in-house negotiation.<sup>49</sup>

The overall result is that American negotiators often begin with an agency-consensus position which would give up little on the U.S. side to gain a great concession from the Soviets. This negotiating stance might be called a 'lowest common denominator'. Bargainers

are typically told that they cannot significantly alter these ideas without bureaucratic approval. No American position which the Soviets would perceive as clearly cooperative is likely to emerge unless the president takes a personal hand in uniting the bureaucracy (perhaps by dictating to them), and negotiating with influential senators and allies. Given the requirement of two-thirds Senate approval for any arms control agreement, and the impact of arms control proposals on defense planning and alliance relations, even a strong president with broad public support can have difficulty producing cooperative plays.

Obviously, tit-for-tat bargaining would be strained in this situation. Some members of the bureaucracy, with their parochial interests, quite often advocate strategies that would violate one or more of the four characteristics of TFT. The DoD might push for bargaining from strength and thereby reject cooperative moves in favor of political gambits. ACDA officials might be troubled by alleged Soviet arms control violations and advocate consecutive defections, rather than forgiveness. Conceivably, the State Department might choose to ignore these same violations and thus reject reciprocity. The possible permutations are obviously considerable.

### *Congress*

The role of the U.S. legislature in arms control policymaking also complicates the implementation of a TFT bargaining strategy. Congress has historically been a very active participant in arms control policy. For instance, by controlling the DoD budget in specific ways, Congress recently legislated ASAT test bans and reductions in the size of the planned MX force. Both houses have also voted to require compliance with SALT II and restrictions on SDI (Strategic Defense Initiative) testing. All of these moves were vigorously opposed by the Reagan Administration, which hardly leads to clarity in U.S. nuclear arms policy. Additionally, because Congress tends to focus on particular bills, it can not react responsively as an ongoing negotiator would, though House Speaker Jim Wright and others have gone to Moscow in attempts to do so.<sup>50</sup> Neither forgiveness nor retaliation can be easily achieved by a legislature.

Congress is also integral to the formal arms control process because the Senate must provide two-thirds 'advice and consent' approval to any treaty. This role can be decisive – Carter 'was able to resolve the SALT II game with the Soviets, but not with the Senate'.<sup>51</sup> Because relatively small coalitions can block treaties, any administration is forced to 'sell' arms control with hyperbolic rhetoric. This complicates the TFT strategy. Clarity is sacrificed when the administration promises to build new weapons to appease conservative senators. The Soviets could

easily see development of new weapons as defections. Moreover, either reciprocity or forgiveness is likely to be jeopardized in this process if any Soviet actions during the ratification debate, or even during negotiation, anger senators. Failure to respond would potentially signal weakness to conservative senators and simultaneously threaten reciprocity. Strong response might pacify senators, but endanger forgiveness.

### *The President*

The president and his appointed advisors obviously have a strong stake in arms control negotiations. However, it is not clear that their position makes TFT practical.

First, since the president cannot unilaterally make arms control treaties, clarity is always uncertain. This has already been explained in the above sections dealing with the bureaucracy and Congress. Second, even a president in control of the bureaucracy could easily adopt a strategy that does not reflect TFT. In fact, there are often great temptations to reject cooperative reciprocal strategies. Competing political interests – especially public opinion – can lead any president away from adopting TFT.

Domestic political incentives can push the president and his immediate advisors to an uncooperative negotiating stance. The U.S. polity has been described as schizophrenic in its attitudes towards the Soviet Union and arms control. Members fear (and distrust) the Soviets, but also usually support the control of nuclear weapons through agreements. As Anthony Downs explained in his classic argument, these kinds of competing political forces invite politicians to take median positions while trying to outflank all political opposition.<sup>52</sup> Downs said that politicians tend to react to voter attitudes in much the same way that resource allocations in the economy respond to changes in consumer demand. Thus, whenever public fear of the Soviet Union is thought to be more important than pressure for arms control, political leaders seek to reflect that sentiment, thereby outmaneuvering opponents, but rejecting cooperative arms control strategies. TFT cannot succeed if it is held hostage to political whims of this sort.

Next, presidents can have alternative preference structures that would prevent their application of TFT strategies. For instance, some may desire U.S. strategic superiority, if such a goal is attainable. The Reagan Administration's early bargaining appeared to have been based on this approach.<sup>53</sup> In game theoretic terms, this strategy would make the U.S. a difference maximizer, rather than a utility maximizer.<sup>54</sup> An advantaged position is sought even if it means a suboptimal outcome. As potentially measured by an interval payoff schedule after an iterated PDG, a 10 (U.S.) to 5 (Soviet) arms race payoff is preferred to a

greater – although more equitable – outcome obtained through arms control bargaining, perhaps utilizing TFT strategies (such as 14 to 13).

The employment of other non-utility driven bargaining schemes could conceivably make the implementation of TFT difficult, if not impossible. For instance, an egalitarian bargainer seeks equal outcomes, even sometimes at the expense of his own utility. If a president seeks any equivalence, rather than the best long-run U.S. payoffs, skewed outcomes may result. Carter's SALT II negotiating result could be called egalitarian. For many critics, Carter accepted some equal numerical arms limits for the sake of obtaining agreement, although the ceilings were not necessarily in the best interests of the U.S.<sup>55</sup>

Neither difference maximizing nor egalitarian strategies are very compatible with TFT. A basic reason players employ TFT strategies in PDG situations is that they are trying to maximize their own payoffs in iterated play. However, those who hold alternative preference structures reject the logic of rational egoism. In standard PDG formats, two rational egoists prefer a cooperate/cooperate payoff over iterated play, but an egalitarian seeks any result approximating equality (including potentially a defect/defect payoff), and a difference maximizer seeks a 'temptation' outcome.<sup>56</sup> Thus, a president with one of these alternative preference structures would conduct arms control negotiations very differently than would a rational egoist employing TFT.

#### IMPLICATIONS

This essay has argued that TFT strategies cannot be easily implemented in nuclear arms control negotiations. Both theoretical and practical objections were raised. The purpose has not been to dismiss Axelrod's 'evolution of cooperation' idea. Rather, we have attempted to demonstrate the difficulty faced by arms control negotiators attempting to implement such plans. Unfortunately, interesting theoretical constructions sometimes cannot be readily applied to practice. This section discusses a few implications of our argument for policymakers and scholars.

#### *Policymakers*

We agree with many analysts that the iterated PDG is suggestive though imperfect in modeling the superpower arms race.<sup>57</sup> Additionally, the implementation of some U.S.–Soviet arms control arrangements – such as the non-proliferation regime – resembles employment of TFT strategy in iterated PDGs. Moreover, assuming sufficient common interest to support negotiation of a U.S.–Soviet arms control agreement, and a relationship permitting joint action, techniques for eliciting cooperation

from an adversary may be essential. TFT and related ideas (such as GRIT) to produce cooperation – combining conciliation with assurance against exploitation – can be helpful to get serious negotiations started.<sup>58</sup> The empirical evidence cited earlier in this paper supports this conclusion.

Some form of cooperative reciprocity, not exactly TFT, seems to prevail in many successful arms control negotiations. Does this mean that the arguments in this essay are meaningless? No, we think the points are still valid. Indeed, negotiators must strive to overcome the problems we note regarding clarity, reciprocity, etc. For instance, as has often been argued in other contexts, the bureaucracy needs to be brought under greater control. Appropriate members, such as negotiators, might be given more authority, while the role of others would be sharply reduced. Additionally, Congress and the executive branch might strive for increased cooperation on goals and strategy. This might be accomplished via more consultations between the president and key legislators, as well as the creation of more bipartisan mediating panels (like the Scowcroft Commission) to resolve difficult defense and arms control problems.

Second, policymakers should try to change the arms competition game from PDG to something more cooperative. It is quite possible that arms control will significantly slow the arms race *only* when the structure of the game is changed from PD to cooperation. Plous offers evidence that each side may perceive that the other prefers unilateral armament to mutual restraint, or to all other choices, even though that may be a major misperception.<sup>59</sup> In any event, the minimization of temptation and sucker payoffs would make for large cooperative incentives. Strategies would change in this new game. Defection might be an inferior choice.

Conceivably, communication could be a method of transforming the PD game. This is especially true if Plous' point about misperception is accurate. If the current game is what he calls a perceptual, not prisoner's, dilemma, then cooperation is more likely. Clarification might be the key to ending competition. Better communication might convince each side that all the defection payoffs are unsatisfactory (and probably about equivalent).<sup>60</sup>

Case studies support this idea of transformation. Practitioners and scholars often see a point in negotiations when both sides become 'serious' in that they sense the opponent's desire for cooperation within negotiable bounds.<sup>61</sup> Cooperation is then enhanced. Potentially, this point occurs when the parties overcome the perceptual dilemma. For instance, Reagan's about-face about Soviet intentions near the end of his administration may demonstrate such a turning point. Reagan's preferences did not change. Rather, his perceptions about Soviet preferences

changed. This came about in part through better communication during frequent summits and foreign ministers' meetings. Thus, Reagan altered his own strategy to deal with this different game.

### *Scholars*

Our arguments suggest a number of implications for scholars. For instance, we think there is an important need for greater linking of theory to practice. In other words, theorists need to become more involved with empirical data about negotiations. Several options come to mind. First, simulated negotiations could be conducted by scholars and practitioners. Greater realism might be achieved in devising complex simulations. If useful war games can be designed, surely arms control bargaining can be simulated realistically.<sup>62</sup> Second, more interaction between experienced negotiators and theoreticians seems worthwhile. Each might come to better understand the others' problems, and solutions might then be discovered. Along these same lines, more case studies that attempt to study successful negotiations in a theoretical framework would be helpful. There may be valuable lessons in this rich history. 'Structured, focused comparisons' can be quite useful for developing theory and explaining practice.<sup>63</sup>

Furthermore, theories need to be modified to take into account practical problems and solutions. Both theorists and practitioners might find studies that include communication variables very useful. Additionally, more work on 'perceptual dilemmas' might improve scholarly understanding. Furthermore, some models should account for the interactive effects of having many domestic political actors influencing decision outcomes. Can interests be aggregated in a way that reflects cooperation? In all, stronger theoretical development will help scholars more accurately describe, explain and predict events in the real world and make the theories more useful for practitioners. Clearly, game theorists recognize this need and are developing models to account for greater complexity. For instance, some scholars are trying to develop cooperative reciprocal models that are successful even given great uncertainty.<sup>64</sup>

### SUMMARY AND CONCLUSIONS

This paper has argued that TFT strategies are not easily applied to arms control negotiations. Because of various contextual factors, bargainers cannot readily implement a strategy that is clear, nice, reciprocal and forgiving. Moreover, decision making processes weigh against the effective implementation of TFT. A diverse public, entrenched bureaucracy, aggressive Congress, and exasperated executive cannot act together to utilize TFT strategy in arms control bargaining.

Nonetheless, our argument offers some advice for the achievement of cooperative reciprocity. Policymakers should seek to minimize the restraints on TFT-like bargaining. Greater cooperation and clarity within a government, for instance, might lead to improved negotiations with parties outside that government. Communication strategies should be explored which might facilitate cooperation, especially if they attempt to alter perceptions in the current prisoner's dilemma game. Scholarly theory builders can help generate useful information for policymakers by integrating real world data into their research agendas.

#### APPENDIX

In the classic PDG, a prosecuting attorney separately confronts two prisoners suspected of being partners in crime. Each prisoner is offered the same deal. If he 'squeals' on his partner, he will receive no prison sentence (0 years) while the partner will get a very long sentence (10 years). However, if both confess each will receive fairly heavy sentences (5 years). Finally, if neither testifies in the case they will receive a light sentence (2 years) because the evidence is limited. Neither can talk to the other before acting.

If prisoner A thinks his partner B is going to squeal, A should also squeal to avoid being the sucker. Similarly, if A thinks B will not testify, the temptation is great to squeal anyway and make B the sucker. Thus, each player has a self-interested incentive to testify against his partner; yet, these same plays will lead to unsatisfactory outcomes (5 years' imprisonment) when selected by both. They could receive better payoffs if both remain silent. In the classic language of PD, mutual cooperation assures the highest joint payoff, but the temptation to defect can often lead to a greatly reduced outcome.

#### NOTES

1. Robert Axelrod, *The Evolution of Cooperation* (New York: Basic Books, 1984).
2. For one argument against using PDG to model the arms race, see S. Plous, 'Perceptual Illusions and Military Realities, The Nuclear Arms Race', *Journal of Conflict Resolution*, 29:3 (Sept. 1985), 363-89; and Plous, 'Perception Illusions and Military Realities, Results From A Computer-Simulated Arms Race', *Journal of Conflict Resolution*, 31:1 (March 1987), 5-33. Plous also reviews the literature that models the superpower arms race as a PDG (1985, 365-6).
3. Michael Taylor is often noted for his earlier work on this issue. See his *Anarchy and Cooperation* (London: Wiley, 1976).
4. Axelrod, 1984, pp.6, 20, 22.
5. For more cases, and Axelrod's own mention of some of the communication, misperception and bureaucratic politics problems we discuss, see Robert Axelrod and Robert

- O. Keohane, 'Achieving Cooperation under Anarchy: Strategies and Institutions', *Cooperation Under Anarchy*, ed. by Kenneth A. Oye (Princeton, NJ: Princeton University, 1986), pp.245-6. For a broader discussion of reciprocity, see Robert O. Keohane, 'Reciprocity in International Relations', *International Organization*, 40:1 (Winter 1986), 1-27.
6. Joseph S. Nye, Jr., 'The Superpowers and the Non-Proliferation Treaty', in *Superpower Arms Control: Setting the Record Straight*, ed. by Albert Carnesale and Richard N. Haas (Cambridge, MA: Ballinger, 1987), p.188. Emphasis in original.
  7. Alexander L. George, 'Strategies for Facilitating Cooperation', in *U.S.-Soviet Security Cooperation: Achievements, Failures, Lessons*, ed. by George, Philip J. Farley, and Alexander Dallin (New York: Oxford University, 1988), pp.693, 707.
  8. George, 1988, p.704; Plous, 1985 and 1987.
  9. David A. Lax and James K. Sebenius, *The Manager as Negotiator* (New York: The Free Press, 1986), pp.160, 163, 181. See also pp.41, 154-64.
  10. Many of the questions about the applicability of the PDG to arms races have been explored elsewhere. See Plous, 1985 and 1987.
  11. R. Duncan Luce, 'How Both Sides Can Win', *New York Times Book Review* (26 Aug. 1984), p.10.
  12. Richard J. Stoll and William McAndrew, 'Negotiating Strategic Arms Control, 1969-1979', *Journal of Conflict Resolution*, 30:2 (June 1986), p.325. See also P. Terrence Hopmann and Theresa C. Smith, 'An Application of a Richardson Process Model, Soviet-American Interactions in the Test Ban Negotiations, 1962-1963', *Journal of Conflict Resolution*, 21:4 (Dec. 1977), 701; Lloyd Jensen, 'Soviet-American Bargaining Behavior in the Post-War Disarmament Negotiations', *Journal of Conflict Resolution*, 7:3 (Sept. 1963), 522-41; Jensen, 'Approach-Avoidance Bargaining in the Test Ban Negotiations', *International Studies Quarterly*, 12:2 (June 1968), 152-60; and Jensen, 'Negotiating Strategic Arms Control, 1969-1979', *Journal of Conflict Resolution*, 28:3 (Sept. 1984), 535-59.
  13. The test ban studies were conducted before the important insider's account of the secret Moscow negotiations had been published. See Glenn T. Seaborg, *Kennedy, Khrushchev and the Test Ban* (Berkeley, CA: University of California, 1981). The studies are based on transcripts of the debates at the Geneva conference, which sometimes included 14 nations in addition to the U.S., U.K. and USSR. The Soviets rejected a U.K.-U.S. draft of the LTBT in Geneva in 1962, and almost all debates were about proposals for a comprehensive treaty. Bunn participated in both the Geneva and Moscow negotiations as a member of the delegation or as a Washington backstopper. He believes that the Geneva debates do not teach much about the reciprocal concessions at the Moscow negotiations.
  14. Stoll and McAndrew, 1986, p.325; and Jensen, 1984.
  15. I. William Zartman and Maureen R. Berman, *The Practical Negotiator* (New Haven: Yale University, 1982), pp.87-191; and Fred C. Ikle, *How Nations Negotiate* (New York: Harper and Row, 1964), p.215.
  16. See I. William Zartman, 'Negotiation as a Joint Decision-Making Process', *Journal of Conflict Resolution*, 21:4 (Dec. 1977), 619-38; Zartman and Berman, 1982, pp.87-94.
  17. Seaborg, 1981; and George Bunn, 'Finding a Test Ban Formula', unpublished manuscript, 1987.
  18. Henry A. Kissinger, *White House Years* (Boston: Little, Brown and Co., 1979), pp.810-21; Gerard C. Smith, *Doubletalk: The Story of SALT I* (New York: Doubleday, 1980), pp.233, 248, 252, 254-5, 274, 276-7, 332-3, 349-50, 369-72. See also George Bunn, 'SALT I: Achieving a Framework for Agreement', unpublished manuscript, 1988.
  19. Axelrod, 1984, pp.132, 181.
  20. See Thomas C. Schelling and Morton H. Halperin, *Strategy and Arms Control* (New York: Pergamon-Brassey's Classic, 1985), pp.77-80; and Kenneth L. Adelman, 'Arms Control With and Without Agreements', *Foreign Affairs*, 63:2 (Winter 1984/85), 240-63.

21. George Bunn, 'Missile Limitation: By Treaty or Otherwise?', *Columbia Law Review*, 70:1 (Jan. 1970), 1-46.
22. Theodore A. Postol has noted apparent superpower tacit restraint on depressed trajectory tests. Postol, 'Trident and Strategic Stability-View II', *Oceanus*, 28:2 (Summer 1985), 49.
23. Bunn, 1970.
24. See Scott Brown, 'The Superpowers' Dilemma, Can Game Theory Improve the U.S.-Soviet Negotiating Relationship?', *Negotiation Journal*, 2:4 (Oct. 1986), 371-84; and George, 1988, pp.702-7.
25. Axelrod, 1984, p.183.
26. A study of crises found that nations 'usually misperceive their opponent's intentions, misinterpret his messages, [and] miscalculate the effects of their actions on the opponent', Glenn H. Snyder and Paul Diesing, *Conflict Among Nations: Bargaining, Decision Making and System Structure in International Crises* (Princeton, NJ: Princeton University, 1977), p.81. See also George, 1988, p.704; and Joanne Gowa, 'Anarchy, egoism, and third images: *The Evolution of Cooperation* and international relations', *International Organization* 40:1 (Winter 1986), 184-5; and George W. Down and David M. Rocke, 'Tacit Bargaining and Arms Control', *World Politics*, 40 (April 1987), 301-5.
27. Michael D. McGinnis, 'Issue Linkage and the Evolution of International Cooperation', *Journal of Conflict Resolution*, 30:1 (March 1986), 141-70; William J. Dixon, 'Reciprocity in United States-Soviet Relations: Multiple Symmetry or Issue Linkage?', *American Journal of Political Science*, 30:2 (May 1986), 421-45; and Barry R. Weingast, 'A Rational Choice Perspective on Congressional Norms', *American Journal of Political Science*, 23:2 (May 1979), 245-62.
28. The Soviets rejected U.S. linkage of human rights and arms control. See George Shultz, 'Reykjavik: A Watershed in U.S.-Soviet Relations,' *Current Policy*, 883 (31 Oct. 1986), 3,4. See also, Edward L. Rowny, 'Effective Arms Control Demands a Broad Approach', *Current Policy*, 995 (27 April 1987).
29. Amos Tversky and Daniel Kahneman, 'The Framing of Decisions and the Psychology of Choice', in *Rational Choice*, ed. by Jon Elster (Oxford: Basil Blackwell, 1986), pp.123-41.
30. For instance, Reagan's 23 March 1983 'Star Wars' address served both policy and public relations goals, and it certainly had an effect on arms control, but various audiences interpreted it differently. Arguably, the speech was not needed to accelerate BMD research, but primarily served to mollify the domestic freeze movement. Robert C. Rowland and Rodger A. Payne, 'The Effectiveness of Reagan's "Star Wars" Address', *Political Communication and Persuasion: An International Journal*, 4:3 (1987), 161-78.
31. Soviet internal politics are mysterious in many ways. However, fewer personnel changes among Soviet negotiators throughout the arms race period might account for greater perceived 'unification'.
32. Brown, 1986, pp.378-9. Downs and Rocke say this history creates only a 'trivial' problem. See Downs and Rocke, 1987, p.300.
33. Martin Patchen, 'Strategies for Eliciting Cooperation from an Adversary', *Journal of Conflict Resolution*, 31:1 (March 1987), 183. Compare to Plous, 1987.
34. Charles E. Osgood, 'Disarmament Demands GRIT', in *Toward Nuclear Disarmament*, ed. by Burns H. Weston (Boulder, CO: Westview, 1984), p.337.
35. For the history of the test ban negotiations, see Seaborg; Bunn, 1987; and National Academy of Sciences, *Nuclear Arms Control. Background and Issues* (Washington, D.C.: National Academy Press, 1985), pp.187-95.
36. See Osgood, 1984, pp.337, 342-3; and Amitai Etzioni, 'The Kennedy Experiment', *Western Political Quarterly*, 20:2 (June 1967), pp.361-80.
37. Seaborg, 1981, pp.172-3, 198, 230, 300; and Gordon Chang, 'JFK, China and the Bomb', *Journal of American History*, 74:4 (March 1988), 1287-1310.
38. Patchen, 1987, p.182.
39. Axelrod, 1984, p.186.

40. Axelrod, 1984, p.44; and Gowa, 1986, p.182.
41. See Coit D. Blacker and Gloria Duffy, eds., *International Arms Control, Issues and Agreements* (Stanford: Stanford University, 1984), p.34.
42. Axelrod, 1984, pp.183-4, 190.
43. Steven E. Miller, 'Arms Control in American Domestic Politics: Impediments to Progress', in *The Nuclear Reader*, ed. by Charles W. Kegley, Jr., and Eugene R. Wittkopf (New York: St Martin's, 1985), p.144; and Michael Nacht, 'The Role of Arms Control in Defense Planning: Integration, Subordination, or Obliteration?' in *Defense Planning and Arms Control*, Conference Proceedings, National Security Affairs Institute (Washington, D.C.: National Defense University, 1980), p.19.
44. 'Nuclear Freeze', *Gallup Report*, 206 (Nov. 1982), p.8.
45. See the poll by Yankelovich Clancy Shulman in 'Assessing the Summit', *Time* (27 Oct. 1986), 27.
46. Everything from missile flight test bans to limits on heavy missiles was considered. See Strobe Talbott, *Endgame, The Inside Story of SALT II* (New York: Harper and Row, 1979, 1980), pp.38-67; and Richard E. Neustadt and Ernest R. May, *Thinking in Time. The Uses of History for Decision Makers* (New York: Free Press, 1986), pp.111-33.
47. At the most basic level, the Arms Control and Disarmament Agency, the Departments of Defense and State, the intelligence community, the Joint Chiefs and the White House all have important interests within the U.S. bureaucracy. See Strobe Talbott, *Deadly Gambits* (New York: Knopf, 1984). Half a dozen or more important senators and several key allies also have obvious interests in this area.
48. For a discussion of Arrow's 'possibility theorem', or 'impossibility theorem' as it is sometimes called, see Dennis C. Mueller, *Public Choice* (Cambridge, MA: Cambridge University, 1979), pp.185-201.
49. Neustadt and May, 1986, p.131; Kissinger, 1979, pp.41, 542-3; Jonathan Dean, 'East-West Arms Control Negotiations', in *A Game for High Stakes: Lessons Learned in Negotiating With the Soviet Union*, ed. by Leon Sloss and M. Scott Davis (Cambridge, MA: Ballinger, 1986), pp.79, 88-9, 102; Herbert F. York, 'Bilateral Negotiations and the Arms Race', *Scientific American*, 249 (Oct. 1983), pp.149, 155; and Harold K. Jacobson and Eric Stein, *Diplomats, Scientists and Politicians* (Ann Arbor: Michigan, 1966), pp.471-2.
50. Speaker Wright told Soviet Foreign Minister Shevardnadze that if the Soviets continued to observe SALT II, Congress would almost certainly prevent the Reagan Administration from building new weapons that exceeded SALT II limits. See Bill Keller, 'House Group in Soviet Hopeful on Arms', *New York Times*, Western edit. (19 April 1987), 8. Both houses of Congress later voted for the promised legislation, but President Reagan threatened a veto. Marcel Bryar, 'Senate Supports ABM Treaty, SALT; Other Arms Control Measures Fail', *Arms Control Today*, 17:8 (Oct. 1987), 25. A compromise was negotiated which will keep the U.S. close to the SALT II limits for a year and within the 'restrictive' interpretation of the ABM Treaty. However, the fiscal restraints did not specifically refer to the treaties. Michael R. Gordon, 'A Compromise on Arms Reached in Washington', *New York Times*, Western edit. (8 Nov. 1987), 10.
51. Axelrod and Keohane, 1986, p.241.
52. Anthony Downs, *An Economic Theory of Democracy* (New York: Harper and Row, 1957).
53. The 1980 Republican platform called for superiority. More recently, George A. Keyworth, the then Science Advisor to President Reagan, noted that SDI could provide a significant bargaining advantage: 'Once we've proven that we have the technology in hand, we have a tremendous lever with which to negotiate the reductions of ICBMs.' Keyworth, 'Remarks to the U.S. Congressional Advisory Board of the American Security Council Foundation', White House Press Office (4 June 1985), p.13.
54. Stephen J. Majeski, 'Technological Innovation and Cooperation in Arms Races', *International Studies Quarterly*, 30:2 (June 1986), 188.

55. Limited altruistic bargaining is also conceivable. Again, a president would construe U.S. interests narrowly for the sake of agreement. See Norman Frohlich and Joe Oppenheimer, with Pat Bond and Irvin Boschman, 'Beyond Economic Man, Altruism, Egalitarianism, and Difference Maximizing', *Journal of Conflict Resolution*, 28:1 (March 1984), 3-24; and Howard Margolis, *Selfishness, Altruism and Rationality* (Cambridge, MA: Cambridge University, 1982). A bargainer would not seek to maximize the opponent's preferences, but would willingly concede some advantages. Nixon's Interim SALT I deal reflected this kind of altruism to some domestic observers, including Senator Jackson, because of the various numerical advantages it granted to the Soviets. Some conservatives accused Carter of employing this strategy in SALT II negotiations, leading to an outcome assuring Soviet superiority. In both cases, opponents argued that the U.S. conceded Soviet advantages to achieve agreement.
56. Two-by-two PDG matrices do not readily illustrate the fundamental differences in outcomes achieved by the employment of these strategies. 'Sliding scale' PDGs, with payoffs earned over time in iterated play, work much better to demonstrate this point. The strategies of players with alternative preference structures can be easily shown by using PDG computer programs like 'Cooperation and Conflict'. See Joe Oppenheimer, Mark Winer, Hsiu Lu, and Ouqi Wu, *Manual for Cooperation and Conflict: An Authoring System for Simulations* (Chevy Chase, MD: PDS Software Company, 1987). Likewise, the vastly different payoffs achieved are readily apparent at the conclusion of these computer PDGs.
57. Gowa, 1986, p.181; Steven J. Brams, *Superpower Games. Applying Game Theory to Superpower Conflict* (New Haven, CT: Yale, 1985), pp.86-115; and Bruce Russett, *The Prisoners of Insecurity. Nuclear Deterrence. The Arms Race, and Arms Control* (New York: Freeman, 1983), pp.99-112.
58. Patchen, 1987.
59. See Plous, 1987.
60. Formal models might help explain this possibility, and experiments and case studies could perhaps demonstrate it. See Martin Shubik, *Game Theory in the Social Sciences* (Cambridge, MA: MIT Press, 1982), pp.205, 255, 258, 398, 410.
61. Zartman and Berman, 1982, p.87; Bunn, 1987; Bunn 1988; and Bunn, 'NPT: Tight, or Loose Reins on the Negotiator?', unpublished manuscript, 1988.
62. Granted, some useful simulations exist. For example, both the Foreign Service Institute and the Center for International Security and Arms Control at Stanford University have conducted U.S.-Soviet simulated negotiations which include bureaucratic politics, allied concerns, etc.
63. See Alexander L. George's 'Case Studies and Theory Development', 2nd Annual Symposium, *Information Processing in Organizations*, Carnegie-Mellon University (15-16 Oct. 1982).
64. In addition to several works cited in this paper, see Jonathan Bender, 'In Good Times and Bad: Reciprocity in an Uncertain World', *American Journal of Political Science*, 33:3 (Aug. 1987), 531-58.

The authors would like to thank Coit D. Blacker, Alexander L. George, Joe Oppenheimer, Scott Plous, Steve Weber and William Wohlforth for reading and commenting on various drafts of this paper.

The authors would also like to acknowledge that this research was assisted by awards of an SSRC-MacArthur Foundation Fellowship in International Peace and Security (Payne), and from the Research and Writing in International Security program of the MacArthur Foundation (Bunn).