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To Mobilize or Not to Mobilize: Catch 22s in International Crises

by

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Abstract

In his classic novel, *Catch-22* (1961), Joseph Heller describes a thoroughly frustrating situation faced by a combat pilot in World War II. This is generalized to a "generic" 2 x 2 strict ordinal game, in which whatever strategy the column player chooses, the best response of the row player is to inflict on the column player a worst or next-worst outcome, and possibly vice versa. The 12 specific games subsumed by the generic game are called *catch-22 games*. These games, along with 4 *king-of-the-mountain games*, turn out to be the only games in which moving power is "effective," based on the "theory of moves" (TOM).

A generic "Mobilization Game" applicable to international crises, in which some of the rules of play of TOM are modified, is used to divide the catch-22 games into three mutually exclusive classes. Predictions for each class are compared with the behavior of decision makers in two Egyptian-Israeli crises. In the 1960 Rotem crisis, Egypt retracted its mobilization after a discreet countermobilization by Israel, which is consistent with being in a class I game. In the 1967 crisis, escalation moved up in stages from a class I to a class II to a class III game, which precipitated war and is consistent with cycling in such games. It is argued that the catch-22 and king-of-the-mountain games better model the *dynamics* of conflict spirals than does the usual static representation of the security dilemma as a Prisoners' Dilemma.

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To Mobilize or Not to Mobilize: Catch-22s in International Crises[1]

1. Introduction

In Joseph Heller's classic novel, *Catch-22*, a World War II combat pilot faces the following predicament: "If he flew them [more missions] he was crazy and didn't have to; but if he didn't want to he was sane and had to" (Heller, 1961, p. 52). Taking their cue from this novel, Brams and Jones (1997) generalized the pilot's predicament to a class of situations they modeled by a "generic" 2 x 2 catch-22 game: whatever strategy the column player C chooses (c_1 or c_2), the best response of the row player R (r_1 or r_2) inflicts on C a worst or next-worst outcome, and possibly vice versa.[2]

More descriptively, the generic catch-22 game can be characterized by the following four properties, based on the *theory of moves*, or TOM (Brams, 1994):

1. Cyclicity. The game is *cyclic* (Brams, 1994, ch. 4): there is one and only one direction—clockwise or counterclockwise—in which neither player, when it has the next move, ever departs from its best outcome as the players alternately move and countermove around the matrix. Because each player must always move to try to attain this outcome, cycling in this direction is rational.

2. Frustration for C. When it is R's turn to move during this cycling (by switching from r_1 to r_2 or from r_2 to r_1), these moves induce C's two worst outcomes. If forced to choose between them, it is rational for C to choose its next-worst outcome (call this outcome x).

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[1]I thank Ben D. Mor for valuable comments on an earlier draft of this paper and gratefully acknowledge the support of the C. V. Starr Center for Applied Economics at New York University.

[2]This, of course, is not the way dictionaries define a catch-22, but this game seems to capture the spirit of being enmeshed by "a supposed law or regulation containing provisions which are mutually frustrating . . .; a set of circumstances in which one requirement, etc., is dependent on another, which is in turn dependent upon the first" (*Oxford English Dictionary*, 2d ed., 1989).

3. Incentive of R to Frustrate C. R prefers *x* to either of the outcomes when it is its turn to move, giving R an incentive always to move to try to attain *x* .

4. Power of R to Frustrate C. R has *moving power*—it can continue the move-countermove process when C no longer has the wherewithal or the will to continue moving and must, consequently, stop—forcing C to choose *x* .

Of the 57 distinct 2 x 2 strict ordinal games in which there is no mutually best outcome (*conflict games*),[3] 36 are cyclic and 12 of these are *catch-22s.* In 4 of these games, C can also induce a catch-22 if it, rather than R, has moving power.

The catch-22 games illustrate how frustration can arise in a dynamic setting, whereby players are free, according to TOM, to move and countermove from outcomes in 2 x 2 matrix games (as opposed to choosing strategies simultaneously, according to standard game theory). In sections 2 and 3, I describe the rules of play of TOM and aspects of moving power that are relevant to the analysis of catch-22 and related games.

These are modified in section 4 to construct a model of mobilization decisions in international crises. In contrast to Brams and Jones (1997), I do not focus on the frustration of persons—the antihero of *Catch-22* and accused witches in medieval witch trials—but on the dissatisfaction of nation-states (specifically, their leaders). I posit a state dissatisfied with the status quo (revisionist state, R) in conflict with a satisfied state (status-quo state, S), whose leaders' *initial* calculations run as follows:

- *For R*: by mobilizing, I will be in a better position to change the status quo by (i) threatening to attack S or—if this is not successful—(ii) actually doing so.
- *For S (in response to this threat)*: by countermobilizing, I will be in a better position (i) to deter R from attacking me or (ii) to protect myself if attacked.

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[3]If the 21 games with a mutually best outcome are included, there are a total of 78 distinct 2 x 2 strict ordinal games (Rapoport and Guyer, 1966).

The so-called *security dilemma* shows that these calculations are too simple—they do not take into account the possible untoward consequences that might befall each state, posing a dilemma for each:

- *For R:* by not mobilizing, it remains dissatisfied; by mobilizing, it may provoke S to countermobilize.
- *For S (if R mobilizes)*: by not countermobilizing, it remains vulnerable; by countermobilizing, it may ignite rather than prevent a war that could prove disastrous to both countries.[4]

While the security dilemma is usually identified with conflicts, like arms races, that may spiral out of control (Jervis, 1976, 1978), standard models of this dilemma, including Prisoners' Dilemma, say nothing about the *dynamics* of spiraling.[5] By contrast, the rules of play of TOM that I will present in section 2 capture the dynamics of mobilization and countermobilization decisions in catch-22 games—none of which is a Prisoners' Dilemma—especially if one or both states believes it possesses "moving power" (defined and illustrated in section 3).

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[4]While R's initial provocation is usually aimed at one country, it may have a cascading effect, involving others as well. Consider the note that an astonished Kaiser Wilhelm II wrote on the margin of a message from Czar Nicholas II on July 30, 1914: "And these measures [military preparations by Russia, instituted in secret almost a week before Germany's] are for a *defense* against *Austria*, which is *in no way* attacking him!!!" Incredulous that the Russian Czar would see the much smaller Austria as a threat to Russia, the German Kaiser concluded that Russia's mobilization was really aimed against Germany. He responded accordingly: "Begin [preparations]! Now!" (quoted in Holsti, 1965, p. 368).

[5]Zagare and Kilgour (1998) propose a more elaborate game-theoretic model that reconciles conflict spirals and deterrence theory, but "dynamics" in the sense of possible cycling is not modeled. A different kind of dynamics is modeled by repeated play of games and evolutionary game theory, but the assumption that the same game, except for possible mutations, is played *de novo* again and again seems unrealistic in most international relations applications.

In section 4, I define a generic "Mobilization Game" under modified TOM rules, dividing the 12 specific catch-22 games subsumed by the generic game into three mutually classes. These classes provide conditions under which countries would be expected to mobilize their forces to fight a war. They depend on whether a country expects its mobilization to (i) be reciprocated by its opponent, (ii) not reciprocated, or (iii) be uncertain about reciprocation. These expectations will be conditioned not only by the preferences of the two players but also by which, if either, possesses moving power.

In section 5 I apply the Mobilization Game to two cases of crisis escalation in the Egyptian-Israeli conflict, one that occurred in 1960 and the other in 1967.[6] In both, Egypt was the revisionist player and began by mobilizing its forces. Israel reciprocated, but in varying degrees in each crisis. Whereas the Rotem crisis in 1960 quickly subsided after both sides pulled back their forces from a confrontation, there was no such resolution in 1967, which culminated in the Six-Day war that also involved Jordan and Syria as allies of Egypt. I analyze three stages of the latter crisis, based on Mor (1993), to suggest why Israel was not provoked to attack until the third phase of this crisis.

In section 6, I examine the milder dissatisfaction of players in four "king-of-the-mountain games" (Brams and Jones, 1997), indicating why these games are less dangerous than a catch-22 games. Indeed, the Rotem crisis may be better approximated by one of these games than by one of the catch-22 games. On the other hand, the evidence seems overwhelming that the antagonists in the 1967 crisis were caught up, at least toward the end, in catch-22 games.

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[6]The classic example of crisis escalation is the July 1914 crisis, which has the earmarks of a *series* of catch-22s that proceeded from Austria and Serbia to the great powers, enveloping in succession Russia, Germany, France, and Great Britain. It is too complicated a case to analyze within the compass of this paper, but I agree with Trachtenberg (1990/91) and Levy (1990/91) that the war that resulted from the mobilization decisions that each country made was not inadvertent; see also Levy, Christensen, and Trachtenberg (1991). A game-theoretic model showing how these decisions were interconnected, and why war emerged as an equilibrium or a power-induced outcome, has yet to be developed.

The 16 catch-22 and king-of-the-mountain games exhaust the 2 x 2 cyclic games in which moving power is "effective." In these games, which constitute 28% of all conflict games and 44% of the cyclic games, each player will be motivated to move—especially if it thinks it has moving power—in order to try to wear down its opponent and come out on top. Surprisingly, perhaps, at least one and sometimes both of the outcomes induced by moving power are not associated with Nash equilibria, demonstrating that this static equilibrium may be dynamically unstable and fail to predict the shifting positions that players take in catch-22 and king-of-the-mountain games.

2. Theory of Moves (TOM)[7]

The starting point of TOM is a payoff matrix, or *configuration*, in which the order of play is not specified. In fact, players are assumed not even to choose strategies but, instead, to move and countermove from outcomes in a game of *complete information* (they know their opponent's payoffs as well as their own).

Under one set of rules of TOM, players look ahead and use backward induction to determine the rationality of not only their moves but also those of an opponent. The backward-induction calculations assume that players do not cycle in a payoff matrix.

In the case of catch-22 and king-of-the-mountain games, however, I assume that cycling is possible and, accordingly, postulate rules of play that allow for cycling as well as the exercise of moving power. Implications of these alternative rules are developed in Brams (1994, ch. 4), which I will summarize and illustrate in this section and section 3. First, however, I discuss the rules of play that are common to games that cycle and games that do not.

Because game theory assumes that players choose strategies simultaneously,[8] it does not raise questions about the rationality of moving or departing from outcomes—at

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[7]This and section 3 are adapted from Brams and Jones (1997) and Brams (1994).

least beyond an immediate departure, à la Nash. In fact, however, most real-life games do not start with simultaneous strategy choices but commence at outcomes. The question then becomes whether a player, by departing from an outcome, can do better not just in an immediate or myopic sense but, rather, in an extended or nonmyopic sense.

In the case of 2 x 2 games, in which each of two players chooses between two strategies, TOM postulates four *rules of play*, which describe the possible choices of the players at different stages:

l. Play starts at an outcome, called the *initial state*, which is at the intersection of the row and column of a 2 x 2 payoff matrix.
2. Either player can unilaterally switch its strategy, and thereby change the initial state into a new state, in the same row or column as the initial state.[9] The player that switches, which may be either R or C, is called player l (Pl).
3. Player 2 (P2) can respond by unilaterally switching its strategy, thereby moving the game to a new state.
4. The alternating responses continue until the player (Pl or P2) whose turn it is to move next chooses not to switch its strategy. When this happens, the game terminates in a *final state*, which is the *outcome* of the game.

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[8]Strategies may allow for sequential choices, but classical game theory does not make endogenous who moves first, as TOM does, but instead specifies a fixed order of play (simultaneous or sequential). In the case of the alternative rules allowing for cycling that I apply here, however, which player moves first, and the initial state from which it moves, have no bearing on the outcome. But which player possesses moving power, and can thereby force termination of play, is critical, as I will show in section 3.

[9]I do not use "strategy" in the usual sense to mean a complete plan of responses by the players to all possible contingencies allowed by rules 2-4, because this would make the normal form unduly complicated to analyze. Rather, *strategies* refer to the choices made by players that define a state, and *moves and countermoves* to their subsequent strategy switches from an initial state to a final state in an extensive-form game, as allowed by rules 2-4. For another approach to combining the normal and extensive forms, see Mailath, Samuelson, and Swinkels (1993, 1994).

Note that the sequence of moves and countermoves is strictly alternating: first, say, R moves, then C moves, and so on, until one player stops, at which point the state reached is final and, therefore, the outcome of the game.[10]

The use of the word "state" is meant to convey the temporary nature of an outcome, before players decide to stop switching strategies. I assume that no payoffs accrue to players from being in a state unless it is the final state and, therefore, becomes the outcome (which could be the initial state if the players choose not to move from it).[11]

Rule l differs radically from the corresponding rule of play in classical game theory, in which players simultaneously choose strategies in a matrix game, which determines an outcome. Instead of starting with strategy choices, I assume that players are already in some state at the start of play and receive payoffs from this state if they stay. Based on these payoffs, they decide, individually, whether or not to change this state in order to try to do better, which may involve either mental moves or physical moves.

To be sure, some decisions are made collectively by players, in which case it would be reasonable to say that they choose strategies from scratch, either independently or by coordinating their choices. But if, say, two countries are coordinating their choices, as when they agree to sign a treaty, the most important strategic question is what individualistic calculations led them to this point. The formality of jointly signing the treaty is the culmination of their negotiations, which reveals nothing of the move-

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[10]An emendation in the rules of TOM that allows for backtracking would be appropriate in games of incomplete information, wherein players may make mistakes that they wish to rectify. For more on possible rules changes under TOM, see Brams (1994); on rules that allow for backtracking, see Willson (1998). I will return to the issue of backtracking in section 4.

[11]However, players do suffer costs from moving, which is how moving power comes into play: it distinguishes which, if either, player can better endure these costs and, consequently, hold out longer. In section 4, I will incorporate such costs into play of the Mobilization Game.

countermove process that preceded it. This is precisely what TOM is designed to uncover.

In summary, play of a game starts in a state, at which players accrue payoffs only if they remain in that state so that it becomes the outcome of the game. If they do not remain, they still know what payoffs they would have accrued had they stayed; hence, they can make a rational calculation of the advantages of staying versus moving. They move precisely because they calculate that they can do better by switching states, anticipating a better outcome if and when the move-countermove process finally comes to rest.

Rules l–4 say nothing about what causes a game to end but only when: termination occurs when a “player whose turn it is to move next chooses not to switch its strategy” (rule 4). But when is it rational not to continue moving, or not to move in the first place from an initial state?

The rules of TOM that preclude cycling, and the return of play to the initial state, include two so-called rationality rules: a termination rule (rule 5) and a two-sidedness rule (rule 6), which lead to the definition of “nonmyopic equilibria,” based on backward induction. I will not discuss this equilibrium concept here—it does not capture the cyclicity of catch-22 and king-of-the-mountain games. Instead, I define a different solution concept, based on alternative rules 5' and 6'; rule 5' permits players to cycle in a matrix, and rule 6' enables one player, if it possesses moving power, to terminate the cycling.

To model the cyclic aspect of certain conflicts and also give players the ability to make choices in which they repeat themselves (why they may do so will be considered shortly), I next define a class of games in which cycling is possible by precluding a class of games in which it is not. Rule 5' provides a sufficient condition for cycling *not* to occur:

5'. If, at any state in the move-countermove process, a player whose turn it is to move next receives its best payoff, it will not move from this state.

In the subsequent analysis, I will focus exclusively on 2 x 2 strict ordinal games, in which each player ranks the four possible outcomes as follows: 4 = best; 3 = next best; 2 = next worst; 1 = worst. Rule 5', which says that a player will never move from a state in which it receives a payoff of 4, precludes cycling in 42 of the 78 distinct 2 x 2 strict ordinal games, 21 of which contain a mutually best (4,4) state. Excluding the latter games, there are 57 conflict games, 36 of which are cyclic, as defined by property 1 in section 1.

Because only 12 of the cyclic games are *catch-22 games*, properties 2 and 3 have bite—they confer catch-22 status on only one-third of cyclic games. In these games, the incentive that players have to cycle to try to attain their best outcomes creates frustration when the player with moving power uses it to force the other player to choose between its two worst outcomes.

As an illustration of one game that does not cycle and one that does, consider the two games shown in Figure 1 (these are games 22 and 35 in the Appendix of Brams,

Figure 1 about here

1994). Starting from (4,2) in each of these games, neither player has an incentive to move, according to both standard game theory (it is a Nash equilibrium) and TOM (it is a nonmyopic equilibrium).[12]

But, in fact, there is a significant difference between these two games: game 35 is "cyclic," whereas game 22 is not. To illustrate this distinction, first consider game 22.

[12]Nash equilibria are usually defined in terms of the strategies that yield particular outcomes, not the outcomes themselves. Because only pure-strategy equilibria are defined in ordinal games, however, Nash-equilibrium strategies can be referenced by the outcomes they produce.

Cycling will not occur—in either a clockwise or counterclockwise direction—in this game because moves from any state eventually bring the process to a state where the player who moves next receives its best payoff of 4, making a move from this state irrational, according to rule 5' . Thus, for example,

- in a clockwise direction, the move by R from (2,l) to (l,4) gives C its best payoff, so C will not move from (l,4), as shown by the blocked arrow emanating from (l,4); and
- in a counterclockwise direction, the move by C from (2,l) to (4,2) gives R its best payoff, so R will not move from (4,2), as shown by the blocked arrow emanating from (4,2).

Now consider game 35 in Figure l. Although a counterclockwise move by C from (2,l) to (4,2) gives R its best payoff, preventing cycling in a counterclockwise direction—as shown by the blocked arrow emanating from (4,2)—moves in a clockwise direction never give a player its best payoff when it has the next move: R at (2,l), C at (l,3), R at (3,4), and C at (4,2) never receive payoffs of 4, making cycling in a clockwise direction possible, according to rule 5', as shown by the clockwise arrows in Figure 1.

The fact that clockwise moves around the payoff matrix of game 35 do not violate rule 5' renders this game *cyclic*. In cyclic games, it turns out, cycling can occur in only one direction—either clockwise or counterclockwise, but not both (Brams, 1994, Theorem 4.1, pp. 90-91).

Game 22, in which cycling in *both* directions runs amok of a player receiving its best payoff (4) when it is its turn to move, makes it *noncyclic*. The 42 2 x 2 noncyclic games include all 12 *symmetric games* (e.g., Prisoners' Dilemma and Chicken), wherein the payoffs of the players can be arranged so that their ranks along the main diagonal are the same and those on the off-diagonal are mirror images of each other (Brams, 1994, Corollary 4.1, p. 91).[13]

To summarize, no symmetric game is cyclic; if an asymmetric game is cyclic, cycling can go in only one direction. As I will illustrate in section 6, cyclic games can be divided into three classes—strongly cyclic, moderately cyclic, and weakly cyclic—but first I analyze moving power in these games.

3. Moving Power

In cyclic games, under what circumstances would players have an incentive to cycle to try to outlast an opponent? By "outlasting" I mean that one (stronger) player can force the other (weaker) player to stop the move-countermove process at a state where the weaker player has the next move.

Forcing stoppage at such a state involves the exercise of moving power. One player (P1) has *moving power* if it can force the other player (P2) to stop, in the process of cycling, at one of the two states at which P2 has the next move. The state at which P2 stops, I assume, is that which P2 prefers.

Recall that rule 5′ specified what players would *not* do—namely, move from a best (4) state when it was their turn to move. However, this rule did not say anything about *where* cycling would stop, which the exercise of moving power determines by enabling the player who possesses it (I assume there is at most one player who does) to break the cycle of moves.

Rule 6′ ensures that there will be termination:

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[13]Because Prisoners' Dilemma, in particular, is not cyclic—much less a catch-22 game—the frustration it gives rise to is very different from that induced by a catch-22 game. In my view, it does not create a security dilemma in the sense described in section 1, because no movement from its noncooperative (2,2) Nash equilibrium, either by R or by S, is justified. By contrast, in the Mobilization Game, movement by the dissatisfied player may well be justified—at least in the class I catch-22 games described in section 4—to try to improve on the status quo.

6'. At some point in the cycling, P2 must stop.

This is not to say that P1 will always exercise its moving power. In some games, as I will show, it is rational for P1 to terminate play, even though it can always force P2 to stop first.

Moving power is *effective* if the outcome that a player can induce with this power is better for it than the outcome that the other player can induce. To illustrate when moving power is effective, consider game 56 in Figure 2a. The arrows shown in Figure

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Figures 2a and 2b about here

2a (ignore for now the distinction between the single and the double arrows) illustrate the cyclicity of game 56 in a counterclockwise direction: starting in the upper right-hand state,

- C benefits by moving from (4,2) to (2,4);
- R does not benefit by moving from (2,4) to (1,1)—which is what I later call an "impediment"—but it departs from a 2, not a 4, state so does not violate rule 5';
- C benefits by moving from (1,1) to (3,3); and
- R benefits by moving from (3,3) to (4,2).

Because neither player, when it is its turn to move, ever departs from its best state of 4 (C departs from 2 or 1, R from 2 or 3), game 56 is cyclic.

To show what outcome R can induce if it has moving power, which might be thought of as greater stamina or endurance—in the sense that R can continue moving when C must eventually stop—let R's moves (vertical, as illustrated on the left side of Figure 2a) be represented by double arrows. C, whose (horizontal) moves are represented by single arrows, must stop in the cycling at either (1,1) or (4,2), whence its single arrows emanate that indicate it has the next move. Since C would prefer to stop at (4,2) rather than (1,1), R can induce its best state of (4,2) if it has moving power.

On the other hand, if C has moving power (right side of Figure 2a), it can force R to stop at either (2,4) or (3,3), whence its single arrows emanate that indicate it has the next move. Since R would prefer to stop at (3,3) rather than (2,4), C can induce its next-best outcome of (3,3) if it has moving power. Thus, the possession of moving power benefits the player who possesses it—compared with the other player's possession of it—so it is effective in game 56.

This is not the case in a game in which 1 and 2 are interchanged for C in game 56, which defines game 49 in Figure 2b. Applying the foregoing reasoning to game 49, we see that R can induce only (1,2), because C prefers this state to (4,1), the other state from which it can move.

On the other hand, C can induce (3,3), because R prefers this state to (2,4), the other state from which it can move. Hence, moving power is not effective in game 49: R *cannot* induce a better outcome when it has moving power than when C has it. Instead, moving power in game 49 is "irrelevant," because it would be in R's interest to stop at (3,3), even if it has moving power, rather than to force C to stop at (1,2). More generally, moving power is *irrelevant* when the outcome induced by one player is better for both.[14]

In many real-world conflicts, there may be no clear recognition of which, if either, player has moving power. In fact, there may be a good deal of uncertainty or misinformation. For example, if both players believe they can hold out longer in a game in which moving power is effective, cycling is likely to persist until one player succeeds

[14]There is a third possibility: moving power is *ineffective* for a player when the outcome its opponent can induce is better than the outcome the player in question can induce with this power. Moving power is ineffective in only 4 of the 36 cyclic games, whereas it is irrelevant in 16 games and effective in 16 games. As I will show later, 12 of the 16 games in which moving power is effective are catch-22 games; the remaining 4 games are king-of-the-mountain games.

in demonstrating its greater stamina, or both players are exhausted by the repeated cycling.

4. The Mobilization Game

The 12 catch-22 games that meet the four conditions given in section 1 are shown in Figure 3.[15] In fact, the cyclicity condition (condition 1) is redundant—it is implied by

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Figure 3 about here

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the three other conditions. Put another way, if moving power is effective, which these conditions ensure, a game is always cyclic (Brams and Jones, 1997, Theorem 1).

The generic Mobilization Game shown in Figure 3, in which cycling occurs in a clockwise direction, gives a first cut at the mobilization decisions two countries might face. In modeling mobilization decisions, it is useful to divide the 12 catch-22 games subsumed by the generic Mobilization Game into three mutually exclusive classes (see Figure 3), for each of which we indicate levels of satisfaction/dissatisfaction and likely moves by the players:

I. R and C **satisfied** (rank 3 or 4) after C's mobilization—either no movement (stay at *c* state) or backtracking (return to *r* state) (4 games)[16];

II. R **dissatisfied** (rank 2) after C's mobilization—likely movement to *c* or *r* states (2 games);

III. R **very dissatisfied** (rank 1) after C's mobilization—very likely movement to

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[15]See Brams and Jones (1997) for a precise definition of the generic catch-22 game and a demonstration that these 12 games meet the aforementioned conditions. The breakdown of these games into three classes will be explained shortly.

[16]The possibility of backtracking, not permitted so far, will be discussed shortly. The superscripted *c* and *r* states indicate the outcomes that C and R, respectively, can induce with moving power. Note that in only 4 of the 12 catch-22 games (42, 43, 44, 45) is C, too, able to put R in a catch-22, whereby R receives its next-worst (2) rather than its next-best (3) payoff at the *c* state.

c or *r* states (6 games).

Because the TOM rules given in sections 2 and 3 seem too rigid to model the mobilization decisions that countries make, I next introduce both more options and more ambiguity into the countries' strategic situation. To wit, instead of assuming that R has moving power (condition 4), assume

A1. Either player might possess moving power, or neither might.

In addition, to give impetus to the countries' need to make decisions in a problematic situation, I assume play begins when C is caught in a catch-22:

A2. Play starts in the upper left cell in Figure 3 (*status quo*, or SQ), which is the moving-power outcome that R can induce (*r* state);

A3. C is *dissatisfied* at SQ (by receiving 2), and R is *satisfied* (by receiving 3 or 4).

A glance at Figure 3 confirms that all 12 catch-22 games contain a (4,2) or (3,2) *r* state, rendering R satisfied and C dissatisfied at the status quo.

Whatever the initial state of the game, rule 6' in section 3 says that at some point in the cycling the player without moving power (P2) must stop. But if there is no consensus as to which player, if either, possesses moving power by assumption A1, then one cannot specify which moving-power outcome will be implemented (the *c* state or the *r* state).

I introduce further indeterminateness into the Mobilization Game model by making two additional assumptions:

A4. There is an (unspecified) cost to the players in "passing through" inferior states.

A5. A player can, after moving, either (i) backtrack or (ii) make a second consecutive move to a new state if the other player does not move next.

In the Mobilization Game, assumption A5 allows C, after mobilizing, to retract its decision and return to the *r* state if R does not countermobilize first. But if R countermobilizes and thereby precipitates a war, assumption A5 allows R to be the first to retreat (which may be interpreted as retracting its prior countermobilization) if C does not do so first.

Despite the ambiguity introduced by not specifying which player, if either, has moving power, I assume

A6. One of the two moving-power states (either the *c* state or the *r* state) will be the outcome of the game.

Assumption A6 says, in effect, that the expectations of the player will converge on the game's "coming to rest" at one of the two moving-power states.

These assumptions permit more free-flowing moves than were permitted by the earlier TOM rules. In the case of the Mobilization Game, the players' possible moves are depicted in the following flow diagram:

		Possible Backtracking	
Class I	Status Quo (SQ)	-------------------------	C mobilizes—crisis
	Retreat by C to old SQ (*r* state)		
Classes II & III			R countermobilizes—war
	Retreat by R to new SQ (*c* state)		

Once C mobilizes and R countermobilizes, it should be noted, retreat decisions are not exactly "free" choices: they depend on which country wins or loses the war, assuming there is no stalemate.[17] Consequently, the countries must try to anticipate the results of a war—should the crisis escalate to this level—which will presumably depend on which country has moving power. If this is uncertain, the countries may go to war to find out. C, especially, will be motivated to do so to the extent that it considers the status quo intolerable.

Several conclusions follow from the foregoing assumptions, including why class I games, as suggested in the flow diagram, are not likely to escalate beyond the crisis stage, whereas class II and class III games are likely to lead to war and, subsequently, to either the old or a new status quo.

Class I: Crisis likely. In these four games, both the *c* and *r* states fall in the first row, suggesting that because of the costs of war for both players—giving either a (1,1) or a (2,1) state—R will have a strong incentive *not* to countermobilize. Thus, if C mobilizes and creates a crisis, the game is likely to stay in this state if C has moving power, or backtrack to the status quo if R has moving power.[18] Not only does neither player want to suffer the costs of war at states (1,1) or (2,1), but *both* players are satisfied (by receiving either a 3 or 4) in the crisis state, which is not true of any other state in these four games. If the *c* state is indeed the one that is implemented, its choice can be interpreted as leading to an "adjustment" favorable to C. On the other hand, if R prevails—possibly by inducing cycling through war but, more likely, by forcing C to

[17]The country that loses will presumably retreat first, which will not necessarily be C even though it has the next move, following war, in the 2 x 2 generic Mobilization Game. In effect, strategies in the Mobilization Game are suppressed in the flow diagram in order to allow for the possibility that R will retreat first.

[18]True, the players may need to cycle to discover which player, if either, has moving power, as happened in the 1967 war. But the Rotem crisis demonstrates that war can be avoided if there is a common perception that C, once it escalates, anticipates it would suffer if it does not back down.

backtrack if C believes that R possesses moving power—there would be no adjustment and play would return to the status quo (*r* state).

Class II: War likely. In these two games, the war state is the mutually worst (1,1) state, but the crisis state for R is only one rank better (2).[19] If R elects to countermobilize and precipitates war, it can force a return to the status quo and obtain its best outcome (4) at the *r* state if it has moving power. If, by contrast, C has moving power and consequently prevails in the war, it can force R to retreat to the *c* state. In the latter case, R still receives a satisfactory 3; in fact, this *c* state is the only one that is satisfactory for *both* players in these two games. Thus, whichever player thinks it has moving power, the game is likely to pass through war before going to the *r* or *c* state.

Class III: War very likely. In these six games, moves in a clockwise direction from *every* state lead to an immediately better state for the mover, so there is an incentive for C to mobilize and R to countermobilize, especially if they are myopic (unlike in the class I and class II games, in which the strategies associated with the *c* state constitute a Nash equilibrium).[20] Whichever player prevails in the resulting war can induce its preferred state (*c* state if R retreats first, *r* state if C does), obviating the need for complete cycling.[21]

It is instructive to contrast these results with the answer that the earlier TOM rules would give to the following question:

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[19]To be sure, these rankings say nothing about the difference in magnitude, as measured by cardinal utilities, between a 1 and a 2 state. Because R is “dissatisfied” in either state, however, I assume it would be more ready to move to a 1 state from a 2 state (class II games) than from a 3 state (class I games).

[20]As I will show in section 6, there are no “impediments” in these six games, making moves “frictionless.”

[21]The fact that R ranks war 3 or 4 in four of the six class III games might be interpreted to mean that R expects to win in these games; in fact, in the case of rank 4, R prefers war to a return to the status quo (*r* state).

> When will C move from the status quo, when will R reciprocate this move, and when will possible cycling ensue?

The answer to this question is unambiguous, in fact, only if one player possesses moving power *and* both players believe it:

- C will *never* move from the status quo if both players believe R possesses moving power, because R can induce moves that return play to it (the *r* state);
- C will *always* move from the status quo if both players believe C possesses moving power, because C can induce moves that carry play to the new status quo (the *c* state).

These stark answers, however, cover up what might happen in the more ambiguous and probably more common situation in which the player that possesses moving power, if either, is not apparent. Furthermore, the earlier TOM rules do not take into account the fact that one or both players might prefer not to cycle—because of the costs of war—or that the war will not always entail C's retreating first (by retracting its prior mobilization) if it should possess moving power.

To sum up, I have suggested that a dissatisfied country often faces a catch-22 in deciding whether or not to mobilize its forces against an opponent. If the dissatisfied country possesses moving power, it can always induce a better outcome for itself, but sometimes at the cost of going to war (in class II and III games). Assumptions about this cost and about the ambiguity of which, if either, country possesses moving power—and can force retreat by the other if war breaks out—were introduced to try to mirror the realities of mobilization decisions in catch-22 games.

Countries are likely to refrain from war in four or the 12 catch-22 games (class I), whereas in 2 of these games they are likely to be pushed over the edge, even though war is the worst outcome for both (class II). In the remaining 6 games (class III), war is all but certain to be precipitated by the dissatisfied country's mobilization.

The rationality of these decisions depends on where the countries anticipate the moves will eventually carry them (either to a *c* or an *r* outcome, based on the earlier TOM rules). To be sure, they will not necessarily realize this outcome as an immediate payoff from making a move. Thus in class II games, R is likely to countermobilize and thereby instigate a war, even though R would be immediately better off staying at the Nash equilibrium resulting from C's initial mobilization.

I next examine some empirical evidence on mobilization decisions in the 1960 and 1967 Egyptian-Israeli crises. I break the latter crisis down into three different phases, which correspond to being in, successively, each of the three classes of the Mobilization Game.

5. Mobilization Games Actually Played

The 1960 Crisis

The so-called Rotem crisis occurred in January 1960, when Egyptian president Gamal Abdoul Nasser moved 50,000 troops and 500 tanks into the Sinai peninsula in reaction to an Israeli strike against the Syrian village of Tawfik. When Israel responded with the secret mobilization of an armed brigade that it deployed near the Egyptian border but "refrained from acts or utterances that could escalate the crisis" (Yaniv, 1987, p. 85), Nasser withdrew his troops from the Sinai 32 hours later.

The "discreet" nature of Israel's countermobilization (Mor, 1993, p. 120) suggests that neither Egypt's nor Israel's intent was mobilization *for war*, which is the interpretation I give to mobilization and countermobilization in the flow diagram in section 4. In this diagram, Nasser, after moving to mobilize *to create a crisis*, was evidently deterred from escalating further—in fact, induced to deescalate—by his perception of prime minister David Ben Gurion's no-compromise attitude and Israel's perceived military prowess (demonstrated four years earlier in the 1956 Suez war).

These actions square with the preferences of Israel (row player) and Egypt (column player) in class I games. In these games, both sides do badly (rank 1 or 2) if there is a war. In particular, Egypt would prefer to return to the status quo, especially if—as was the case—it anticipates it will lose a war it might spark. Thus, Egypt was led to backtrack, which is a rational move in class I games, even though Nasser, it seems, remained quite dissatisfied by the status quo.

The 1967 Crisis

This crisis has been studied in detail by Mor (1993), who develops a model, based on TOM, to analyze nonmyopic equilibria in a set of "crisis games." His model allows for both misperception and deception. It also permits learning, whereby the players observe the consequences of their early actions and then use this information to update their knowledge when they make choices later in the crisis.

Mor's (1993) model accurately predicts the choices of Egypt and Israel, based on the specific games that he reconstructs they played. Unlike Mor (1993), I will not reconstruct specific games but instead will attempt to show that, whatever the specific game played, it was probably a catch-22 game. Moreover, *perceptions* of this game changed over the course of the crisis, moving it from class I to class II to class III.[22]

The choices of players in Mor's (1993) 25 crisis games are the generic strategies of cooperation or defection, compared with the choices of mobilization and, if there is countermobilization and a war, retreat in the 12 catch-22 games. While the crisis games have no overlap with the 12 catch-22 games, I will argue that the generic Mobilization Game, and the classes of specific games subsumed by it, help to explain why decision-

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[22]Later I will discuss *why* both sides' perceptions of the game changed, but suffice to say here that learning by the leaders on both sides seemed overwhelmingly driven by evidence, not wishful thinking.

makers made different choices in the early and later stages of this crisis. Their perceptions at each stage of the crisis, and the outcomes of games that they played, are recounted below:

Stage 1: Egyptians mobilize. On May 14, 1967, Nasser placed the Egyptian army on alert and sent 50,000 troops into the Sinai. Until this move, neither side expected or desired war (Khouri, 1968, pp. 224-225; Yost, 1968, p. 304; Dawn, 1968, p. 202).

Mor (1993) disputes the claims of several analysts that Nasser was irrational. He argues, among other things, that Nasser was not impulsive or rash, not paranoiac, did not lack foresight, and did not lose control (some details on Nasser's reasoning will be given shortly). Indeed, as Mor (1993) points out, Nasser was fully aware of his weak military position vis-à-vis Israel, which was aggravated by his having already committed 50,000 United Arab Republic troops to bolster Egypt's interests and position in Yemen.

Nasser, on numerous occasions, had expressed his dismay at Arabs who, he claimed, irresponsibly called for a war with Israel without preparing properly for it. Moreover, he backed his words with deeds by not coming to the aid of either Jordan or Syria when Israel launched attacks against each in the year preceding the 1967 crisis. In sum, "Nasser, however dissatisfied he was with the status quo, still preferred it to war with Israel" (Mor, 1993, p. 119; see also Yaniv, 1987, p. 118; Nutting, 1972, p. 367; Safran, 1969, p. 273).

By all accounts, Nasser was the sole decision-maker on the Egyptian side. On the Israeli side, there were several key decision makers; each held somewhat different views of the Egyptian leader, and his motivations, ranging from relatively benign to relatively ominous.[23]

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[23]For details, see Brecher (1972, 1975); Prittie (1969); and Stein and Tanter (1980).

There was, nonetheless, a consensus among Israeli leaders that Nasser's objectives were limited in the first stage of the crisis. Both sides realized that Israel's defense forces could defeat not only Egypt but, almost surely, the combined forces of its Arab neighbors as well. However, there was fear on the part of Israelis that they might suffer major casualties if attacked first, unlikely as that seemed in the first part of the crisis.[24]

As in the Rotem crisis, Israel saw Egypt as seeking an adjustment in the status quo—or at least a demonstration of its solidarity with its Arab neighbors, which had taunted it for its previous inaction against Israeli incursions into their territory. Thus, Egypt did not position its 50,000 troops in the Sinai in a forward deployment but, rather, in the center of the Sinai, as if signaling that it did not desire war (Slater, 1977, p. 121).

Israel responded mildly to the Egyptian deployment, as it had in the Rotem crisis: it alerted regular army units, deployed some forces to its southern border, and mobilized a few additional units. Also, it informed Egypt through UN channels that it did not intend to invade Syria. These moves are consistent with Israel's playing a class I game, in which both sides receive payoffs of 3 or 4 after C's mobilization, and there is no countermobilization for war by R. It is also consistent with Egypt's improving on the status quo by deterring Israel from further escalation and, consequently, not provoking war.

Stage 2: Withdrawal of UNEF. On May 16, just two days after Egypt had sent forces into the Sinai, it requested a redeployment to backward positions of United Nations Emergency Force (UNEF) troops, which, after the 1956 war, had assumed positions as a buffer between Egypt and Israel. Notably, Nasser did not request the redeployment of UNEF troops at Tiran (or Sharm el Sheikh), because he did not want his move to be seen as presaging the closure of the Straits of Tiran, which Israel might interpret as a *casus belli* (Mor, 1993, p. 132).

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[24]Nasser later estimated the likelihood of war at 20% in the first stage (Laqueur, 1968, pp. 197-207).

When UN Secretary-General U Thant threw down the gauntlet and responded that either all UNEF forces would have to be withdrawn or none, Nasser was forced to make a choice. On May 18, after it became clear that he would request that the entire UNEF force be withdrawn, Israel followed on May 19 with a large-scale mobilization of its reserves and planning for a preemptive strike into the Sinai (Brecher, 1980, pp. 109-111).

Why did Nasser escalate the crisis on May 18? It appears that he interpreted Israel's response in stage I as sufficiently timid that Egypt could afford to go one step further without seriously risking war. Another explanation for Egypt's boldness is that Israel's prime minister, Levi Eshkol, was known as "a man of compromise." Eshkol certainly did not have the formidable reputation of Israel's founding prime minister, David Ben-Gurion, whose resolve at the time of the Rotem crisis nobody doubted (Prittie, 1969).

Despite Israel's mobilization on May 19,[25] Israel did its best to conduct business as usual, playing down the threat to its territory and calling, at the UN and in other arenas, for a withdrawal of forces and a return to the status quo. But more hawkish elements in Israel saw its position as eroding and called for stronger measures against Egypt.

At a minimum, it seems fair to say, UNEF's withdrawal lowered Israel's preference ranking from 3 in class I games to 2 in class II games. With the elimination of the buffer between Egyptian and Israeli forces, war seemed more likely. Still, there was deep concern on the part of some Israeli leaders about moving closer to the brink, so war was not yet foreordained.

While sure that Israel could prevail in a war, especially if it preempted, Israeli leaders conceded that the costs of war could be great. A return to the status quo, as had occurred in the Rotem crisis, remained the preferred solution of most of its leaders.

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[25]It fell short of full-scale preparation for war, so I do not consider its counter-mobilization tantamount to war.

Because the Egyptian army continued to be deployed in a defensive formation, an attack was not seen as imminent. Consequently, Israel decided to give international diplomacy more time, even though class II games certainly make war more likely.

Stage 3. Blockade of the Straits of Tiran and the Egyptian-Jordanian Defense Agreement. On May 22, Nasser announced that he would blockade the Straits of Tiran, restoring the pre-1956 conditions that closed the Gulf of Aqaba to Israeli shipping. Up until this escalation, Meir Amit, then head of Mossad, the Israeli intelligence service, recalled that

> until May 23, I thought there was a possibility for maneuver, that there is a leeway for alternatives. But when Nasser closed the Straits, I said: "This is it, there is no way to avoid war" (Brecher, 1980, p. 104).

Nasser was under great pressure, especially after his UNEF decision, to demand still more of the Israelis and show that he was not just bluffing. These demands reached a fever pitch when inflammatory broadcasts of Radio Cairo and other Arab stations triggered mass hysteria throughout the Arab world.

Nasser, however, was not swept away by the war fever. Later he reported that after the closure of the Straits of Tiran, his earlier estimate of a 20% probability of war had increased to 50% (Laqueur, 1968, pp. 197-207).

Despite the growing odds that war was unavoidable, it was difficult for Nasser to back down. After all, he had achieved so much—in the apt phrase of Israel's foreign minister, Abba Eban, a "victory without war" (Evan, 1977, p. 360). Moreover, should a war break out, Nasser reasoned, the UN would intervene to stop the fighting, so his losses would be cut.

Nasser's calculations are in line with the possible outcomes of class III games.

1. In all these games, C (Egypt's) escalation leads to the worst state (1) for R

(Israel), so Israel has no choice but to countermobilize for war.

2. While the war outcome is immediately better for Israel, varying in rank from 2 to 4, and worst for Egypt (1), it is only temporary (as it turned out, the war lasted only six days).
3. If Egypt, perhaps with the help of the UN, can induce the *c* state (even while losing the war), then it improves on the status quo.
4. At worst, the status quo is restored if Israel triumphs (*r* state), but Nasser would have shown courage in the face of adversity. Thereby he could polish his somewhat tarnished pre-war image, becoming a leader steadfast in his pursuit of the Arab cause.

As for the Israelis, after they received a stern warning on May 28 from President Lyndon Johnson not to strike preemptively, the Israeli cabinet supported a two- to three-week delay in order to give the United States a chance to work out a possible compromise that would open up the Straits of Tiran to Israeli shipping (Brecher, 1980, p. 144). But two days later, Nasser dropped another bombshell—the signing of the Egyptian-Jordanian Defense Agreement in Cairo. The euphoric reaction of both leaders and masses in the Arab world created a frenzy to complete the destruction of Israel.

Astonishingly, Nasser at this point stopped his belligerent pronouncements and attempted to persuade Israel that a diplomatic solution could be found. With his seeming political objectives achieved, he gave orders that Egyptian forces assume strictly defensive positions in the Sinai and that there be no military provocations. He initiated a series of diplomatic moves in search of a political compromise (Nutting, 1972, p. 408; Bar-Zohar, 1970, p. 176; Khouri, 1968, p. 147).

But time had run out. Because of general mobilization, the Israeli economy was at a standstill (Maoz, 1990, p. 129). With the appointment of Moshe Dayan as Israeli defense minister on June 1, the outcome of the crisis was sealed. Stunned by the defense pact and fearful that joint Arab military actions could be devastating (Stein and Tanter, 1980, p. 218), Israel initiated its own devastating strike on June 4. By Nasser's own later estimate, the probability of war had reached 80% when he initiated his peace offensive. This is consistent with the antagonists being in a class III game; Nasser, it turned out, could not beat those odds.

Following Mor (1993), I have tried to show how perceptions of the strategic situation changed over the course of the 1967 crisis, making war ever more likely as the perceived game shifted from class I to class II to class III. When it became a class III game, Nasser was no longer able to extricate himself from the crisis he had incited and escalated to higher and higher levels.

Perhaps Nasser was overly bold in escalating to the level he did, but there was uncertainty surrounding the consequences of all his moves, making precise prediction impossible. Although the flurry of diplomatic activity set off just before the war was too little and too late, both it and the reasonably controlled escalation that preceded it was not the mark of a reckless leader but, rather, one very much in the throes of a catch-22.

6. King-of-the-Mountain Games

The four games Brams and Jones (1997) call *king-of-the-mountain games* are given in Figure 4a.[26] Observe that in each game there is a (3,4) state that C can induce with

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Figures 4a and 4b about here

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moving power and a (4,3) state that R can induce with moving power. While the outcome predicted by standard game theory is the unique Nash equilibrium of (3,4)—associated

[26]The appellation "king of the hill" is also used for these games, which are defined to be games "in which each person attempts to climb to the top of some point, as a mound of earth, and to prevent all others from pushing or pulling him off the top" (*Random House Dictionary of the English Language*, 1979).

with the dominant strategy of R and the best response of C—TOM predicts (4,3) as the outcome if R has moving power.

Instead of giving a new example of a king-of-the-mountain game, and the exercise of moving power in it, consider the class of mobilization situations that these games seem best to model. As depicted in the generic game in Figure 4b, C can choose to mobilize or not, and R can choose to concede or not. Not conceding is assumed to be not just escalating a crisis— as when R might countermobilize—but a strategy that, whatever C does, is destructive for both players (rank 1 or 2).

On the other hand, if R concedes, the outcomes are good for both players (rank 3 or 4). Following standard game theory, this game is easy to solve: R will choose its dominant strategy of cooperation; anticipating this choice, C will hold out for its preferred state, resulting in the Nash equilibrium of (3,4).

But if R has moving power, according to TOM, it can force C to stop at (4,3), just as C can force R to stop at (3,4) if it has moving power. In other words, which of the Pareto-optimal outcomes will occur depends on which, if either, player can continue the move-countermove process when the other player is forced to "throw in the towel." The latter player, it has been argued in game 37, was North Vietnam after repeated bombing campaigns by the United States in the Vietnam war (Brams, 1994, ch. 4), and Saddam Hussein after the air and ground attacks by the United States and its allies in the 1990-91 Persian Gulf war (Massoud, 1998).

These conflicts were rife with misperception and vulnerable to threats as well.[27] But, as indicated in section 4, a simple lack of information as to which player has moving power may well lead to cycling, as each player strives to demonstrate—by continuing the move-countermove process—that it, in the end, can prevail (i.e., be the "king").

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[27]In particular, R can threaten C's two worst outcomes, assuming it has "threat power" (Brams, 1994, ch. 5), to try to induce its preferred (4,3) outcome instead of the Nash equilibrium of (3,4).

There are some subtle differences in the four games. Call a move an *impediment* if it involves a player's moving from a better to a worse state, as is the case in all the king-of-the-mountain games when R moves from the upper right-hand cell to the lower right-hand cell (i.e., from 3 to either 2 or 1). In games 36 and 37, this is the only impediment, making these games *moderately cyclic*. In games 33 and 34, by comparison, there is a second impediment when C moves from the lower right-hand cell to the lower left-hand cell (i.e., from 2 to 1), making these games *weakly cyclic*.[28]

Notice in the king-of-the-mountain games that the players must move through *two* states in which the players suffer their worst (1) or next-worst (2) outcomes, which is never the case in catch-22 games. These games, in fact, might better model the 1960 Rotem crisis and stage I of the 1967 crisis than do the class I catch-22 games. In particular, the fact that Egypt returned to the status quo ante in the 1960 crisis indicates that it was probably satisfied (rank 3), not dissatisfied (rank 2), by this outcome.

7. Conclusions

Several empirical instances of both catch-22 and king-of-the-mountain games, which represent 28% of the 57 2 x 2 conflict games, have previously been studied.[29]

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[28]Of the 12 catch-22 games, six are moderately cyclic (38 - 41, 48, and 56) and none is weakly cyclic; the remaining six games (42 - 47) are *strongly cyclic*—there are no impediments—making these games "frictionless." It would seem that players would have the most incentive to cycle in the latter games (all in class III), because a move always brings a player to an immediately better state.

[29]While the theoretical percentage says nothing about the empirical relative frequency of these games, it is worth noting that different catch-22 games have been used to model conflicts in Brams (1994), including two Bible stories and one theological conundrum. Moving power is explicitly applied to the analysis of the latter situation, which involves a putative superior being (with moving power) playing against an ordinary being. In international relations, moving power has been used to explain a series of sanctions—continually imposed, lifted, and reimposed by the United States on Haiti in the 1980s and early 1990s (Simon, 1996)—and refugee repatriation (Zeager and Bascom, 1996). Analyses, based on TOM, that make nonmyopic equilibria their building blocks include Brams (1997) on surprise and Maoz and Mor (1996) on enduring international rivalries.

Although not as well-known as 2 x 2 symmetric games like Prisoners' Dilemma, Chicken, or Stag Hunt, these 16 games nevertheless pose trying choices for the players, especially when viewed from a theory-of-moves (TOM) perspective.

The specific TOM perspective I offered in this paper is that of cyclic games (36 in all), in which moves in either a clockwise or a counterclockwise direction never require that a player move from its best state. But more than being cyclic, what the 12 catch-22 and 4 king-of-the-mountain games share is that moving power in them, and only in them, is effective. That is, a player does better if it possesses moving power than if its opponent possesses it in 44% of the cyclic games (moving power is irrelevant or ineffective in the remainder), so there is good reason for each player to try to outlast its opponent in these games as the players alternately move and countermove around the matrix.

Such cycling can lead to endless frustration on the part of the players,[30] but occasionally they may recognize the futility of cycling and resolve their differences. This occurred in the Egyptian-Israeli conflict, but not without major outside help: After fighting five wars in 25 years (1948, 1956, 1967, 1969-70, and 1973) at great cost to both sides, Egypt and Israel still required considerable pressure from the United States to be induced to sign the Camp David accords in 1978, which then paved the way for the signing of a peace treaty between Egypt and Israel in 1979.

The two crises (1960 and 1967) analyzed here in this long-running historical conflict smack of being catch-22s. While the 1960 Rotem crisis did not escalate beyond a class I Mobilization Game, the 1967 crisis moved in three stages from a class I catch-22 game that mimicked Rotem to a class III game that ended in war.

In 1960, the peaceful resolution occurred when Israel refrained from undertaking a full-scale countermobilization and Egypt withdrew its forces from the Sinai, as the Mobilization Game model predicts. But such a resolution evaded the decision makers in

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[30]For an alternative analysis of frustration, based on the concepts of nonmyopic equilibrium and threat power in TOM, see Brams (1997).

the 1967 crisis as perceptions of the game moved it from a class I to a class II to a class III catch-22. Its inexorable moves up the escalatory ladder made countermobilization by Israel, culminating in a war that nobody wanted—at least in the beginning—inescapable. Nevertheless, I suggested that decision makers were rational in 1967, given the informational and other constraints they faced as they tried to escape increasingly more intractable catch-22s.

The usual explanation for such a conflict spiral, rooted in a static Prisoners' Dilemma that is intended to model the security dilemma, is unconvincing. The *dynamics* of conflict spirals seem better explained by the rules of TOM, especially those for cyclic games in which moving power is effective (16 games). In the 12 catch-22 games, dissatisfied states have a strong incentive to attempt to implement preferred outcomes.

There is less dissatisfaction, starting at the Nash equilibrium outcome, in king-of-the-mountain games. But like catch-22 games, it is unlikely that the situation will simply "settle down" at this equilibrium as long as C believes it might be able to upset it. In the 1960 Rotem crisis, which might well be modeled by such a game, Egypt's attempt through its mobilization to extract concessions from Israel failed—after a quiet show of strength by Israel—in large part because Egypt realized that it did not have the wherewithal to confront Israel at that time.

When a conflict drags on interminably because neither side has moving power, other parties may intervene to try to bring about a resolution. Thus, for example, outside pressure was exerted successfully in the South African conflict, but it has been less successful so far in other conflicts, including that in Northern Ireland.[31] On the other hand, the intervention of a major UN military force was decisive in inducing the warring sides in the former Yugoslavia to sign a peace treaty in November 1995, but only after four years of bitter conflict that cost some 250,000 lives.

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[31]A TOM analysis of this conflict, based on incomplete information and threat power, is given in Brams and Togman (1998).

Like the 1914 crisis, this conflict may well have been fueled by a series of catch-22s. To avoid conflict spirals that commence with mobilization decisions, it is important to recognize that there are different classes of the Mobilization Game. Mobilizing intellectual resources to try to head off escalation from a class I to a class II or a class III game is a critical task for political leaders.

Figure l

Cyclicity of Two Games

Noncyclic (Game 22)

(4,2)	←	(2,l)
↓		↓
(3,3)	|←	(l,4)

Cyclic (Game 35)

(4,2)	← →	(2,l)
↓↑		↓
(3,4)	←	(l,3)

Key: (*x*,*y*) = (payoff to R, payoff to C)
4 = best; 3 = next best; 2 = next worst; l = worst
Nash equilibria underscored
Unblocked arrows indicate direction of cycling

Figure 2

Moving Power in Two Cyclic Games

2a. Moving Power Is Effective in Game 56

R has moving power

(2,4)	←	(4,2)^r
⇓		⇑
(1,1)	→	(3,3)

C has moving power

(2,4)	⇐	(4,2)
↓		↑
(1,1)	⇒	(3,3)^c

2b. Moving Power Is Irrelevant in Game 49

R has moving power

(2,4)	←	(4,1)
⇓		⇑
(1,2)^r	→	(3,3)

C has moving power

(2,4)	⇐	(4,1)
↓		↑
(1,2)	⇒	(3,3)^c

Key: (x,y) = (payoff to R, payoff to C)
4 = best; 3 = next best; 2 = next worst; l = worst
Double arrows indicate moves of player with moving power
Single arrows indicate moves of player without moving power
r = state that R can induce with moving power
c = state that C can induce with moving power

Figure 3

Generic Mobilization Game and 12 Specific Games It Subsumes

Generic Mobilization Game

		C: Don't Mobilize		C: Mobilize
R	Don't Mobilize	(x_{11}, y_{11}) Status quo (SQ) —C dissatisfied	→	(x_{12}, y_{12}) Mobilization by C—crisis
		↑		↓
R	Mobilize	(x_{21}, y_{21}) Possible new SQ	←	(x_{22}, y_{22}) Countermobilization by R—war

Class I: R and C ***satisfied*** *(3 or 4) after C's mobilization—either no movement (stay at c state) or backtracking (return to r state).*

38 (51)		**39 (52)**		**40 (53)**		**41 (54)**	
(4,2)^r	$\underline{(3,4)}^c$	(4,2)^r	$\underline{(3,4)}^c$	(4,2)^r	$\underline{(3,3)}^c$	(4,2)^r	$\underline{(3,3)}^c$
(1,3)	(2,1)	(2,3)	(1,1)	(1,4)	(2,1)	(2,4)	(1,1)

Class II: R ***dissatisfied*** *(2) after C's mobilization—likely movement to c or r states*

48 (57)		**56 (56)**	
(4,2)^r	$\underline{(2,3)}$	(4,2)^r	$\underline{(2,3)}$
(3,4)^c	(1,1)	(3,3)^c	(1,1)

Class III: R ***very dissatisfied*** *(1) after C's mobilization—very likely movement to c or r states*

42 (73)		**43 (74)**		**44 (75)**		**45 (76)**		**46(70)**		**47(71)**	
(3,2)^r	(1,3)	(4,2)^r	(1,3)	(3,2)^r	(1,4)	(4,2)^r	(1,4)	(4,2)^r	(1,3)	(4,2)^r	(1,4)
(2,4)^c	(4,1)	(2,4)^c	(3,1)	(2,3)^c	(4,1)	(2,3)^c	(3,1)	(3,4)^c	(2,1)	(3,3)^c	(2,1)

Key: (x,y) = (payoff to R, payoff to C)
4 = best; 3 = next best; 2 = next worst; l = worst
Nash equilibria underscored
Arrows indicate direction of the cycling

r = state that R can induce with moving power
c = state that C can induce with moving power

Figure 4

4a. 4 King-of-the-Mountain Games

33 (19)		**34 (20)**		**36 (49)**		**37 (50)**	
$(4,3)^r$	<u>(3,4)</u>^{c}	$(4,3)^r$	<u>(3,4)</u>^{c}	$(4,3)^r$	<u>(3,4)</u>^{c}	$(4,3)^r$	<u>(3,4)</u>^{c}
(2,1)	(1,2)	(1,1)	(2,2)	(1,2)	(2,1)	(2,2)	(1,1)

4b. Generic King-of-the-Mountain Game

		C		
		Do not mobilize		*Mobilize*
R	*Concede*	I. R prevails $(4,3)^r$ ↑	→	II. C prevails <u>(3,4)</u>^{c} ↓
	Do not concede	III. Bad for both (1 or 2,1 or 2)	←	IV. Bad for both (1 or 2,1 or 2)

Key: (*x*,*y*) = (payoff to R, payoff to C)
4 = best; 3 = next best; 2 = next worst; l = worst
Nash equilibria underscored
Arrows indicate direction of the cycling
r = state that R can induce with moving power
c = state that C can induce with moving power

References

Bar-Zohar, Michael (1970). *Embassies in Crisis: Diplomats and Demagogues Behind the Six-Day War*. Englewood Cliffs, NJ: Prentice-Hall.

Brams, Steven J. (1994). *Theory of Moves*. Cambridge, UK: Cambridge University Press.

Brams, Steven J. (1997). "Game Theory and Emotions." *Rationality and Society* 9, no. 1 (February): 91-124.

Brams, Steven J., and Christopher B. Jones (1997). "Catch-22 and King-of-the-Mountain Games: Cycling, Frustration, and Power." Preprint, New York University.

Brams, Steven J., and Jeffrey M. Togman (1998). "Cooperation Through Threats: The Northern Ireland Case." *PS: Political Science and Politics* 31, no. 1 (March): 32-39.

Brecher, Michael (1972). *The Foreign Policy System of Israel: Setting, Images, Process*. London: Oxford University Press.

Brecher, Michael (1980). *Decisions in Crisis: Israel, 1967 and 1973*. Berkeley, CA: University of California Press.

Brecher, Michael (1975). *Decisions in Israel's Foreign Policy*. New Haven, CT: Yale University Press.

Dawn, Ernest C. (1968). "The Egyptian Remilitarization of Sinai, May 1967." *Journal of Contemporary History* 3, no. 3: 201-224.

Eban, Abba (1977). *An Autobiography*. New York: Random House.

Heller, Joseph (1961). *Catch-22*. New York: Simon and Schuster.

Holsti, Ole R. (1965). "The 1914 Case." *American Political Science Review* 59, no. 2 (June): 365-378.

Jervis, Robert (1976). *Perception and Misperception in International Politics*. Princeton, NJ: Princeton University Press.

Jervis, Robert (1978). "Cooperation under the Security Dilemma." *World Politics* 30 (January): 167-213.

Khouri, Fred J. (1968). *The Arab-Israeli Dilemma*. Syracuse, NY: Syracuse University Press.

Laqueur, Walter (1968). *The Road to Jerusalem*. New York: Macmillan.

Levy, Jack S. (1990/91). "Preferences, Constraints, and Choices in July 1914." *International Security* 15, no. 3 (Winter): 151-186.

Levy, Jack S. Thomas J. Christensen, and Marc Trachtenberg (1991). "Correspondence: Mobilization and Inadvertence in the July Crisis." *International Security* 26, no. 1 (Summer): 189-203.

Mailath, George J., Larry Samuelson, and Jeroen Swinkels (1993). "Extensive Form Reasoning in Normal Form Games." *Econometrica* 62, no. 2 (March): 273-302.

Mailath, George J., Larry Samuelson, and Jeroen Swinkels (1994). "Normal Form Structures in Extensive Form Games." *Journal of Economic Theory* 64, no. 2 (December): 325-371.

Maoz, Zeev (1990). *Paradoxes of War: On the Art of National Self-Entrapment*. Boston: Unwin Hyman.

Maoz, Zeev, and Ben D. Mor (1996). "Enduring Rivalries: The Early Years." *International Political Science Review* 17, no. 2 (April): 141-160.

Massoud, Tansa George (1998). "Theory of Moves and the Persian Gulf War." In Murray Wolfson (ed.), *The Political Economy of War and Peace*. Amsterdam: Kluwer Academic, forthcoming.

Mor, Ben D. (1993). *Decision and Interaction in Crisis: A Model of International Crisis Behavior*. Westport, CT: Praeger.

Nutting, Anthony (1972). *Nasser*. New York: E. P. Dutton.

Prittie, Terrence (1969). *Eshkol: The Man and the Nation*. New York: Pitman.

Rapoport, Anatol, and Melvin Guyer (1966). "A Taxonomy of 2 x 2 Games." *General Systems: Yearbook of the Society for General Systems Research* 11: 203-214.

Safran, Anwar el- (1977). *From War to War*. Indianapolis: Bobbs-Merrill.

Simon, Marc V. (1996). "When Sanctions Can Work: Economic Sanctions and the Theory of Moves." *International Interactions* 21, no. 3: 203-228.

Slater, Robert (1977). *Rabin of Israel: A Biography*. London: Robson.

Stein, Janice Gross, and Raymond Tanter (1980). *Rational Decision-Making: Israel's Security Choices, 1967*. Columbus, OH: Ohio University Press.

Trachtenberg, Marc (1990/91). "The Meaning of Mobilization in 1914." *International Security* 15, no. 3 (Winter): 120-150.

Willson, Stephen J. (1998). "Long-Term Behavior in the Theory of Moves." *Theory and Decision*, forthcoming.

Yaniv, Avner (1987). *Deterrence without the Bomb: The Politics of Israeli Strategy*. Lexington, MA: D. C. Heath.

Yost, C. (1968). "The Arab-Israeli War: How It Began." *Foreign Affairs* 46, no. 2: 304-320.

Zagare, Frank C., and D. Marc Kilgour (1998). "Deterrence Theory and the Spiral Model Revisited." *Journal of Theoretical Politics* 10, no. 1 (January): 59-87.

Zeager, Lester A., and Jonathan B. Bascom (1996). "Strategic Behavior in Refugee Repatriation: A Game-Theoretic Analysis." *Journal of Conflict Resolution* 40, no. 3 (September): 460-485.