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INTERNATIONAL ESCALATION AND THE DOLLAR AUCTION

By

Barry O'Neill

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Department of Industrial Engineering
and Management Sciences
Northwestern University
Evanston, Illinois 60201

Abstract

Two players bid for a dollar on the condition that both the loser and the winner must pay their bids, although only the winner will receive the dollar. Collusion or threats are excluded, bids must be in units of nickels and a player does not bid in a situation where bidding and not bidding would lead to the same payoff. We derive a formula for the players' rational strategies, which implies for example that when both have \$2.50 available the first bidder should open by bidding 60 cents and the other should remain silent. The fact that rational players would not bid against each other shows that unlike the Prisoners' Dilemma, the dollar auction is not innately a trap, but exploits some irrationality in the bidders' behaviour.

The dollar auction resembles international escalation in that the governments in conflict commit resources that will not be returned. Some points of difference in the two situations are listed and discussed.

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1. Introduction

Some social situations seem to be traps by their very structure and induce the participants to waste their resources. Often cited as an example is the dollar auction in which two people bid for a dollar bill. The high bidder wins the dollar even if the bid was less than a dollar. In contrast to a normal auction the loser as well as the winner must pay the amount bid, in the sense that if the bidding stops at 25 cents and 40 cents the auctioneer collects both amounts and gives the dollar to the higher bidder. The rules state that any raise must be by at least a nickel and there must be no discussion between the bidders.

Often the bids rise far past a dollar and the players seem unable to escape from the upward spiral. When one player has bid $1.50 for example, and the other $1.60, the first is faced with a choice of dropping out and losing $1.50 or bidding $1.65. Paying $1.65 for a dollar bill is embarrassing but at least cuts the player's losses to $.65. The other player then applies this type of reasoning and the bids climb steadily upwards.

In this paper we calculate the rational strategies for the two players and show that there would be no escalation of bids if both acted rationally. For example with $2.50 available to each, the first player should offer a bid of $.60 and the other should drop out. If the first player opened with less than $.60 that player's commitment to winning would be insufficient -- the other player could then enter and rationally expect to gain. On the other hand bidding more than $.60 would be a waste since $.60 is enough to induce the other to drop out.

It turns out that to derive a rational strategy we have to make an explicit assumption about how much money each has available for bidding since the outcome depends critically and sometimes discontinuously on the exact amount of the bankrolls. For example with $2.55 available to each, the best starting bid is $.65 but when their bankrolls are $2.90 it drops back to $.05.

Some have suggested that the first player's best move is to bid 95 cents but they are making the implicit assumption that the second player has no foresight, i.e., is ready to drop out only if the loss from bidding is completely obvious. Player 1 might be able to do better given the knowledge that player 2 is calculating and informed, as the theory of games postulates. It is usually possible for the first player to bid less than 95 cents and expect the second player to refrain for fear of an ultimate loss.

Those who have participated in the dollar auction tend to say that the best strategy is not to bid at all, but this behaviour would not be an equilibrium. If one knows the other will not bid, clearly the best response is to enter after all by bidding a nickel, so there is an internal inconsistency in suggesting that rational players should not bid.

Other possible strategies are for the two players to make a binding agreement to bid low and split the money later, or else for one to commit himself to the threat that he will bid to the maximum unless the other stays out. These are excellent strategies when the situation allows them, but we will rule them out by stipulating that the players cannot make binding agreements or threats.

Shubik (1971) was the first to discuss the dollar auction in print and later Teger and his associates (1980) used it as the paradigm for a set of controlled experiments on the concept of gradual commitment due to past investment. Interest in it arises also from its parallels with the phenomenon of a war continuing long past the time where either government could make an overall gain. Each can increase its commitment to the conflict but if it eventually loses, it will not get its resources back.

Maynard-Smith has investigated a somewhat similar game in the context of animal behavior (Maynard-Smith 1982). Two animals stand by a watering hole and neither can drink until the other has left. Waiting longer exacts a non-returnable cost in energy and lost opportunities and corresponds to bidding up by a nickel in the dollar auction.

2. The rules of the auction

We must state a few more explicit rules to define the game properly. We assume that by some arbitrary mechanism one of the players acquires the ability to make the first bid. If that player does not wish to bid the move passes to the second player. If the second player then declines the game is over and neither player receives anything, but if the second player bids the turn then goes back and forth, each bidding up by at least one unit over the other's last bid. If a player declines to bid at some point the game is over and the stakes of s units are awarded to the opponent. Neither player can bid more than a maximum bankroll b, which is equal for the two players. (The case of unequal bankrolls will be treated later.) We assume $b > s$.

We assume that the players cannot make deals with each other (perhaps communication is impossible or they do not trust each other). Also they cannot commit themselves to threats if those threats involve future moves that would not be in their own interest at that later point.

We will assume also that each player obeys sequential rationality in the normal sense that it is used in games of perfect information. Roughly speaking each player has unlimited foresight and is known to act in his or her interest at any possible position of the game based on the knowledge that the other player obeys sequential rationality. Sequential rationality will be interpreted to mean that we can assign payoffs to the terminal nodes of the game tree, work backwards through the tree at each step choosing the branch that assigns maximal payoff to the mover (assuming a unique maximum branch exists) and eventually find the value of the game to the first player.

The difficulty in this procedure is that some positions in our game generate two branches with the same maximal value. For the backwards induction procedure to be well-defined, we need to specify a unique move at each position since otherwise a player at a previous node would not know what to expect should the game reach that position, and thus would be unable to assign a payoff to the earlier move.

A way to get around the problem of several maxima using current game theory procedure would be to use the concept of sequential equilibria (Kreps and Wilson, 1982). Here a set of moves and a set of beliefs about how the players will act at future points jointly form a solution to the game. We would then look for all possible sets of self-consistent beliefs about how players will act at such choice points, and try to find patterns of moves that are consistent with those beliefs.

However too many possible strategies would result from finding all sequential equilibrium approach, so we find a particular sequential equilibrium which we think is the most reasonable one. We state a simple rule about players' choice behavior and regard it as part of the concept of sequential rationality for a dollar auction: if more than one branch has maximal value, it is assumed that a rational player will choose the move that involves the smallest bid, including possibly the bid of zero, i.e., dropping out. A player will be risk-averse in the sense of not venturing money without some positive reason for doing so.

3. The Rational Strategy

Our first theorem gives the optimal bid for player 1. It will turn out that player 2 should foresee that entering the bidding would be a mistake in the long run and so should drop out.

For simplicity it is assumed that bids are in integral multiples of some unit. In the game described above, the units are nickels, the stakes s are 20 units and the bankrolls b are \$2.50, or 50 units.

Theorem 1. For stakes s and equal bankrolls b, the rational course of action is for player 1 to bid (b-1) mod (s-1) + 1 units, and for player 2 to drop out.

Proof. When the players have reached a given pair of bids, the past history of the bidding is irrelevant. The game can then be represented as a directed graph as shown in Figure 1.

FIGURE 1 HERE

The nodes in the graph represent positions in the game and include the information of whose move it is, and what the current levels of the bids are. The graph is constructed by laying out a (b+1) x (b+1) array of nodes with rows and columns labelled 0 to b. The coordinates of a point represent player 1 and 2's bids. In Figure 1 positions at which player 1 has the move are drawn as circles, those at which player 2 has the move as squares. Possible moves of player 1 are shown by solid lines and those of player 2 by dotted lines. To simplify the diagram we have adopted the convention of taking a number of lines coming from or going to several different nodes and fusing them into a common stem. The understanding is that any higher bid coming out of the stem may be reached by any lower bid

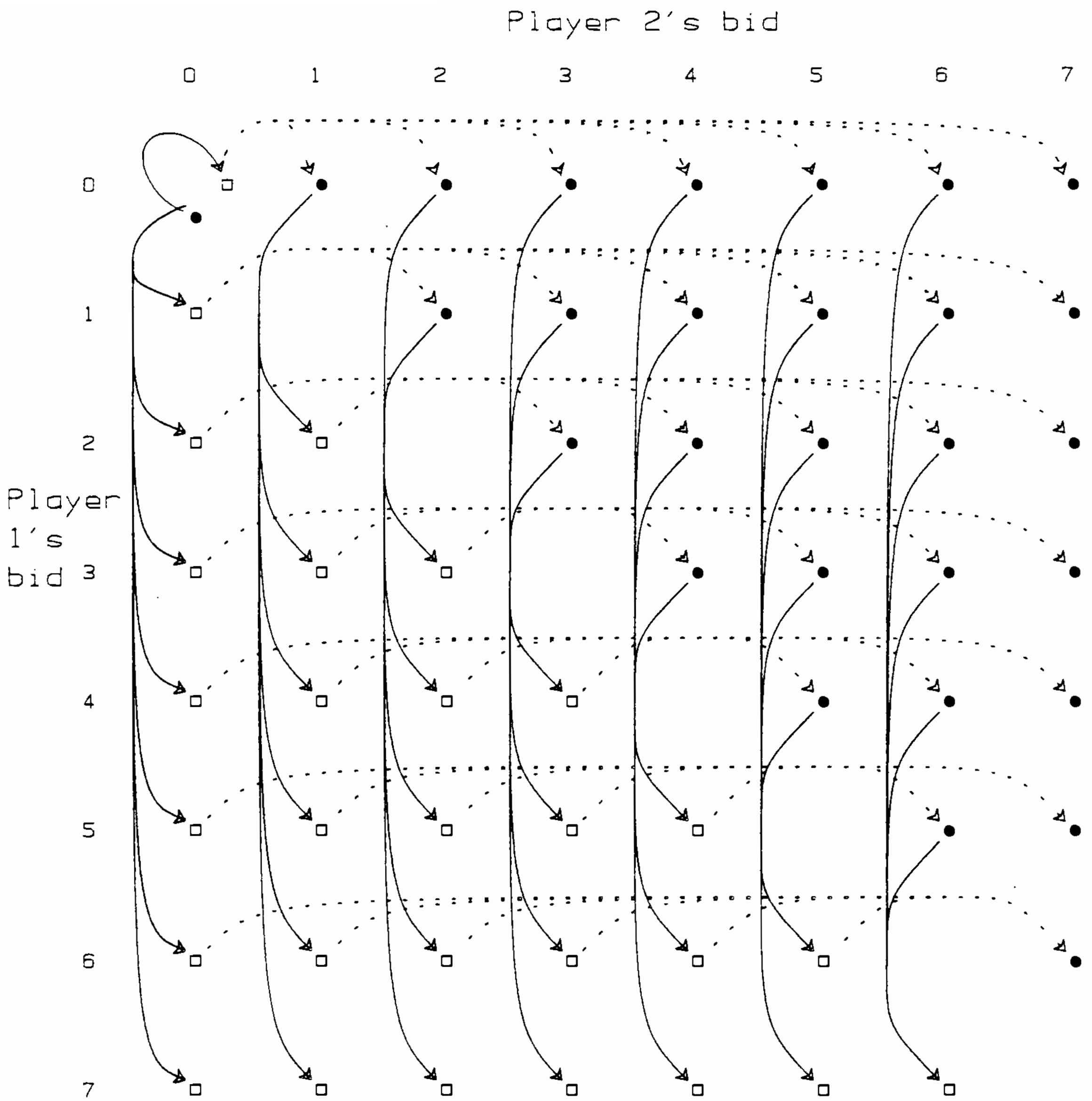

Figure 1. The graph of a dollar auction game with b=7. Positions giving player 1 the move are circles, those giving 2 the move are squares. The moves are represented by solid and dashed lines for players 1 and 2 respectively. Drop-out moves have been eliminated.

running into that stem.

Since there is no way for the players to make equal positive bids, all diagonal nodes are removed from the array, except for (0,0). The (0,0)-level is represented by two nodes, since player 1 may raise there or pass to player 2. For each node except player 1's move at (0,0), there is another terminal node, representing the player dropping out. For simplicity these moves are not shown in the diagram.

We define a win for player i as any node where player i would eventually receive the prize if play started at that node and proceeded rationally. It is not yet clear that the concept of win is well-defined -- perhaps two sequences of play satisfy rationality, but one leads to a prize for player 1 and the other a prize for player 2. However it will follow indirectly from the proof that at any node the winner is uniquely determined.

We can divide the graph into sections as shown in Figure 2.

FIGURE 2 HERE

The sections C_i are thus one node wide by b nodes long, while the B_i, D_i, and E_i sections are s-1 wide as shown.

Any node in C_i gives i the move but is clearly a win for the other player j since i cannot top j's bid of b and i's only choice is to drop out. Any node in E_i is a win for i since at the very least i can win s by raising to his maximum bid b. It would be better for i to make this raise than to drop out, since the raise is less than s. Any node in D_i will result in i dropping out since it would be better for i to fold there than to raise by s or more and any raise by less than s advances the play into E_j, which contains only wins for the other player. Thus the territory D_i represents a win for j. Likewise the area C_i contains only wins for j

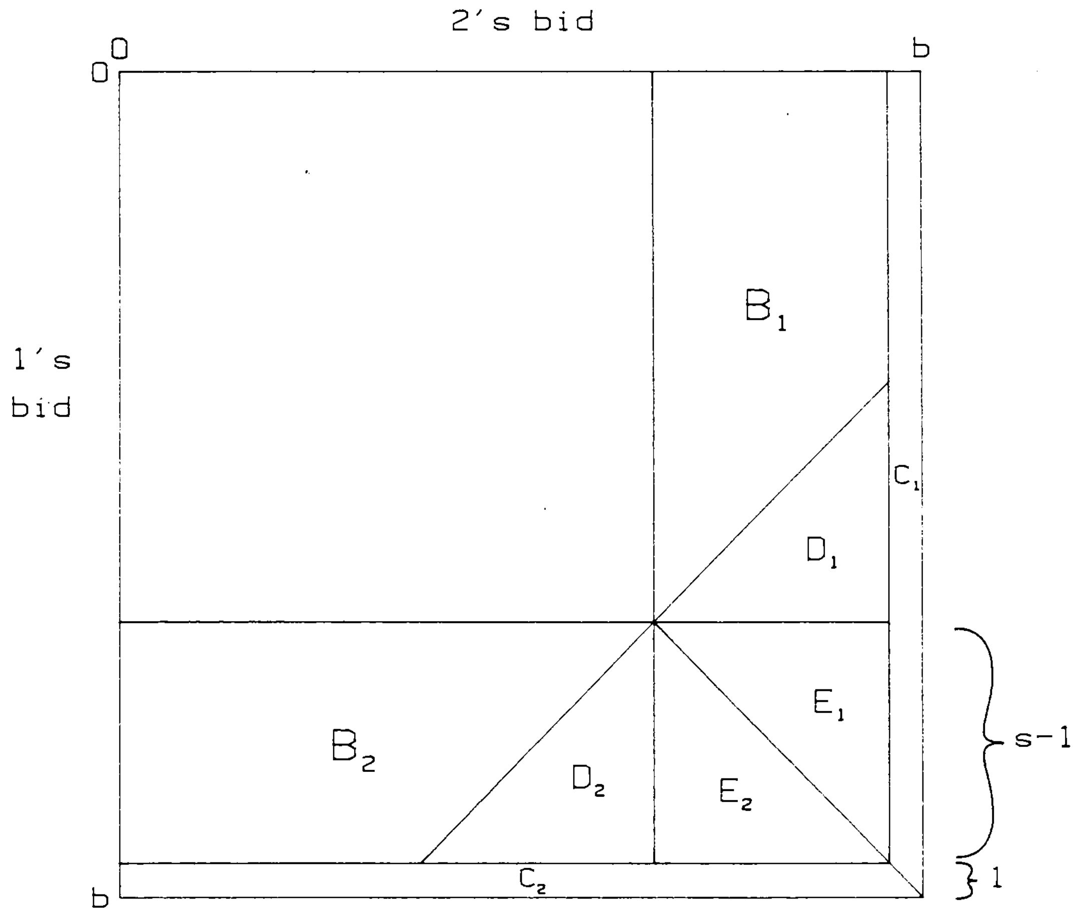

Figure 2.

since the only permissible raises for i are size s or greater.

Having labelled these areas as wins for one player or the other, we construct further sections of the graph as shown in Figure 3. The analysis of these areas is identical to the previous ones. The only difference in the strategic possibilities between corresponding sections is that players in the sections B', D', or E' can raise even higher than C', whereas in the previous case no bids higher than those into C were possible. But this difference is strategically irrelevant since moves past C' would be strictly dominated by bidding only into C'.

FIGURE 3 HERE

We repeat this sectioning and labelling procedure until we are left with an unlabelled square that is s-1 or less wide. Clearly we cannot analyze it in the same way if it is less than s-1 wide and neither will the method work if it is exactly s-1 wide, since there will be nodes in the diagonal (at the (0,0) level of bids), unlike previous sectionings.

The square will have dimension (b+1) - (s-1) - (s-1) ... - (s-1) = (b+1) mod (s-1) if this quantity is positive or s-1 if it is zero. It is straightforward to show that this conditional function is equal to simply (b-1) mod (s-1) + 1.

The choice confronting player 1 at (0,0) is as shown in Figure 4. By the above arguments C_1^* and C_2^* are wins for 2 and 1 respectively, therefore D_1^* and D_2^* are wins for 1 and 2 respectively. The best move for player 1 is to bid (b-1) mod (s-1) + 1 since this is the minimum bid that still represents a win. Player 2 will then drop out since the game has moved to a node that is a win for player 1. Q.E.D.

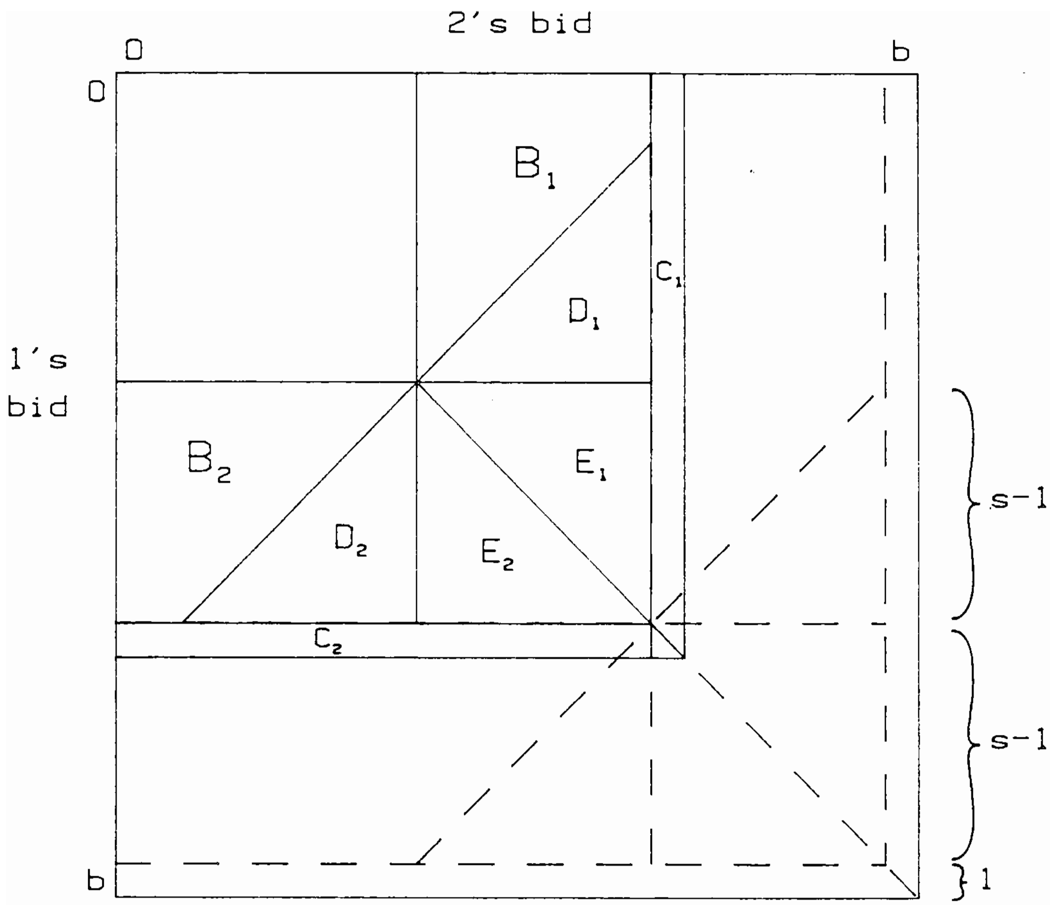

Figure 3.

FIGURE 4 HERE

If we modified our assumption concerning maximal equally valued alternatives to assume people bid up instead of drop out, that the edge of each square would increase from s-1 to s and the proper bid for the first player would then be (b-1) mod s + 1. In the example with b = \$2.50 and s = \$1.00, player 1 would open with \$.50 instead of \$.60.

The outcome of the auction is very sensitive to the sizes of bankrolls, a difference of a nickel in the players' pockets being enough to decide whether player 1 takes the prize for \$.05 or for \$.95. At first this result seems odd since rational players would never reach their bankrolls in the bidding. However, it is common in many types of games for the outcome to depend on paths not taken, and this phenomenon is well-known in bargaining models, where threats help a player even though they are never implemented. In fact, bidding up in the dollar auction is in effect gradually committing oneself like making a progressively stronger threat. It is a special type of threat involving greater and greater harm to oneself, rather than the other player, if one does not carry it out. Extreme discontinuities are also common in the normal English auction, where if the bankrolls are less than the stakes, the slightest difference in how much money a player has available for bidding can make the difference between winning and losing.

Still it would be more elegant to be able to eliminate the bankroll parameter b, and one tentative route is to let b grow to infinity and determine the best strategy in the limit. As b becomes larger, the proper opening bid follows sawtooth function that rises slowly and decreases sharply, and that increases from 1 unit up to s-1 units for each increase in

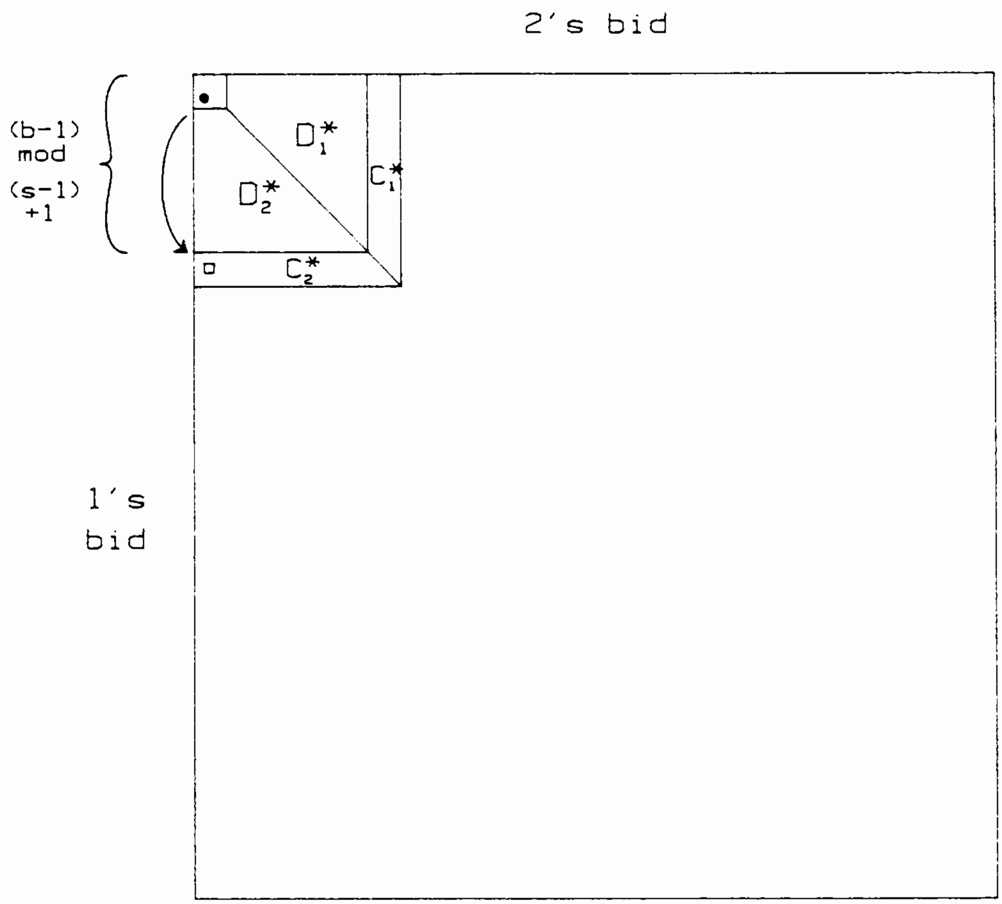

Figure 4.

the bankroll of s-1 units. The winner's payoff, which equals the stakes minus the bid, behaves as a sawtooth function that rises sharply and decreases slowly. In any case the proper opening bid does not approach a limit as b goes to infinity, so this method does not eliminate the influence of b.

More interesting results are obtained if the unit of money goes to zero. This assumption is equivalent to having the bankroll and stakes growing to infinity with their ratio fixed. The following corollary is derived from Theorem 1 by a simple manipulation of the modulo function.

<u>Corollary.</u> Let s and b approach infinity with b/s = a, a constant. Then the best bid for player 1 expressed as a fraction of s approaches the fractional part of a. If a is an integer, the best bid for player 1 in absolute terms equals exactly a, for all s > a.

Theorem 2 gives perfect equilibrium for the dollar auction, meaning that for every position in the game it prescribes a rational move, even if that position would never be reached by rational players.

<u>Theorem 2.</u> Suppose the current bids by players i and j are x_i and x_j. Then if player i has the move, i should bid $(b-x_{j-1}) \bmod (s-1) + x_j + 1$, if this quantity is less than $x_i - s$ and drop out otherwise.

<u>Proof.</u> The arguments given in the proof of Theorem 1 allow us to divide the graph of the game into sections and label each of these sections as a win for one player or the other.

It is clear that a player at a certain node of the graph should bid the least amount that moves the game to a winning position for him (at which point the opponent will drop out), if that raise is less than s, and drop out otherwise. The formula in the theorem follows directly from applying this rule. Q.E.D.

Some researchers have attached importance to the point of the game where the bids total more than one dollar, or to the point where a single bid first passes a dollar. In fact Teger found a tendency for players to cut off bidding after a dollar. Although these levels are psychologically important, they have no special meaning in the strategic analysis of the game -- according to Theorem 2 what matters is the distance measured in (s-1)-steps from the current levels to the bankroll, so that if each player's current bid were increased by s-1, the next move would remain the same.

4. Unequal bankrolls and values for the stakes.

In case the players possess different bankrolls, methods similar to those in Theorem 1 can be applied to prove the following theorem.

Theorem 3. Let the common stakes be s and let the players have unequal bankrolls b_1 and b_2. Then the first player should bid 1 if $b_1 > b_2$, and bid s-1 if $b_2 > b_1$. The second player should drop out.

So the player with the chance to open the bidding always wins the dollar, but the relative sizes of the bankrolls determine whether that player gains almost all the prize or almost none of it.

Allowing the prize to be more valuable to one player than the other seems to require a strategy that is a complicated function of the stakes s_1 and s_2 and the bankroll b. No simple formula could be derived, but the optimal moves were calculated for many sample games by constructing the graph corresponding to Figure 2, and writing a computer algorithm to work backwards and upwards from the lower righthand corner, as in dynamic programming. In some cases where s_1 is slightly less than s_2, it is worthwhile for player 1 to enter the bidding, but in most cases player 1 is advised to pass and let player 2 take the prize for a bid of 1 unit. It thus seems that different valuations of the prize are more crucial than different bankrolls, much like the lesson that is often drawn from the United States' experience in Viet Nam.

5. The Dollar Auction and the Escalation of International Conflict.

According to the above theory the dollar auction played rationally does not cause a waste of resources. International conflict and the dollar auction played by real people, however, often lead to disastrous outcomes. What elements of the three situations make the difference?

To take a specific example of international escalation, we now paraphrase a scenario described by Darilek *et al.* (1983) in their study of the psychological aspects of nuclear crises. It outlines a plausible string of events in which a local conflict in Central America escalates to nuclear war between the superpowers.

Scenario:

During the late 1980s tension in the Caribbean region is high. The United States has increased its military activity and there is widespread expectation of a US invasion.

The United States discovers that the USSR has deployed a new fighter-bomber in Cuba, capable of carrying nuclear and conventional weapons. Whether nuclear weapons are in fact in Cuba, the USSR will not say.

The United States declares that the threat is intolerable and establishes a naval blockade of Cuba demanding removal of the weapons in exchange for removal of the blockade.

The United States hopes the precedent of 1962 will convince the Soviet Union to accommodate. However the United States no longer dominates in strategic weapons. The Soviet decision-makers discussed the possibility of a blockade and as part of the decision to deploy the fighter-bombers planned not to accept this demand. Instead the Soviet Union blockades West Berlin demanding withdrawal of the Cuban blockade in exchange for removal of the Berlin blockade.

Some third parties urge the United States to accept removal of the two blockades as an even outcome, but this resolution is unacceptable from the American viewpoint since Soviet aircraft would remain in Cuba. The memory of 1962 has become double-edged: the American president would become extremely unpopular for accepting such a compromise after Kennedy's success.

Each superpower supplies its outpost by air. The United States announces that it will destroy the aircraft by conventional means at the end of two weeks. The Soviet Union replies that if this attack occurs, it will close off the United States' air route to West Berlin. The US replies that if the Soviet Union seals Berlin, it will invade Cuba to prevent its future military use by the Eastern bloc. The Soviet Union threatens to invade West Berlin if Cuba is attacked.

Both sides are confident they can limit the area of battle and prevent escalation to nuclear war and so carry out the sequence of threats. However developments prove that both were overly optimistic. Cuban defenses are strong and down many American planes. Likewise NATO attempts to keep the air corridor to Berlin open are more successful than the Soviet Union had expected.

Losing many aircraft in its attempt to close Berlin, the USSR launches strikes against the air bases from which the NATO fighters are operating.

Darilek *et al*. do not continue the scenario from then on -- their concern is with ways to halt the spiral at the early stages when diplomacy is still viable -- but they allow that a likely outcome is an exchange of nuclear weapons aimed at the superpowers' homelands.

The features that we think are most relevant to escalation are listed in Table 1. They are listed in such a way that possession of the feature should be expected to lead to entrapment in an escalatory spiral, and the table suggests that international escalation is the most dangerous. We will discuss each in turn now. (More details for some features in the international context are given by Schelling 1961, Smoke 1983 and Davis and Glaser 1983.)

	Ideal dollar auction	Real dollar auction	International escalation
Entrapment:	Non-entrapping	Often entrapping	Often entrapping
Limited ability to look ahead	-	X	X
Desire to win for the sake of winning	-	X	X
Investment made passively	-	-	X
Verbal self-commitment to future moves	-	-	X
Uncertainty about objective consequences	-	-	X
Crisis instability	-	X	X
Expectation of future interaction	-	-	X
Informational component in moves	-	X	X
Misperception of current state of escalation	-	-	X
No third-party intervention	X	X	-
No withdrawing resources once invested	X	X	-
No dropping out on equal terms	X	X	-

Table 1. Features promoting escalation in the dollar auction played by rational, real opponents and in international escalation.

Limited ability to look ahead.

In analysing the dollar auction we assumed that each bidder can look ahead to the other's reactions and reactions to reactions, etc. This assumption is clearly too strong. For the game where both hold $2.50, the the first bidder would have to look ahead 51 steps and countersteps to reach the end of the game and predict the ultimate winner to evaluate the first move.

It seems more reasonable that players look ahead a few steps in the game to some "horizon position", evaluate that position in some rough way and choose a present move on that basis. The evaluation is "rough" in the sense that they cannot play the game through to the end in their minds and thus can make only an estimate of who would win from that future vantage point. Just how far in the game tree people can look ahead is unclear, although the DeGroot (1965) estimated that chess grand masters and experts look ahead about seven moves. Of course, international escalation differs importantly from chess in that its participants have little experience and the rules are not well-defined.

Limiting the players' lookahead does not lead per se to either entrapment or to the contrary effect, a decision not to play. Which of these two tendencies would result from limited lookahead would depend on where the future moves disappear over the horizon. If the player's foresight stops at a position when the opponent has just moved, prospects for the player would seem bad and the latter would be tempted not to continue to play, but if the player's lookahead stopped after the latter had just moved, the player then would be optimistic about the results of making a bid. (A mathematical investigation of the interaction of length of lookahead and accuracy of assessment for some simple games is given by Pearl, 1984.)

One would expect then that half of the time a player would not bid. However this is more restraint than Teger's subjects displayed. In all of his experimental conditions the overwhelming majority entered the bidding so his real subjects were overly optimistic.

We suggest two explanations for this. First, real players have a tendency to end their lookahead at positions when they themselves have just moved. Seeing the situation from one's own viewpoint involves less mental work than seeing it from the opponent's, as there is an extra cognitive load involved in putting oneself in the other's shoes before predicting the other's response. The unpleasantness of facing a losing situation is another disincentive to looking past a future move that is one's own. Players' tendency to stop at their own move in one-move situations has been termed the "fallacy of the last move".

When lookahead is limited there is a further impetus to play a losing game. If one has several choices of moves from the present position, and evaluates each in a fallible way, it would be expected by chance that one of the moves would receive a higher estimated eventual payoff than it is really worth, and perhaps higher than the decision to drop out, whose value can always be determined without error. Since that the highest-rated move is the one that will be chosen, the decision to bid or not depends entirely on its evaluation, and the bidder forgets that its value is probably inflated by the process of unwanted error in its evaluation, combined with its position as it is the maximum of several estimates. (This phenomenon is related to existence of a "Winner's Curse" in auctions.) This provides a tendency to bid onward.

Desire to win for the sake of winning.

As the game progressed Teger's subjects reported experiencing an autonomous desire to win, apart from any money they might win or lose. The money invested in each successive bid would then become relatively less important making continuing the game an easier choice.

Such a special utility was not part of the rational auction, but it has many manifestations in international escalation such as the attitude that "Our dead shall not have died in vain."

Passive investment.

To bid up in the dollar auction requires a positive action by the participants whereas investment in a war often continues by itself. The mechanism of supporting the war is set up and parties must do something active to stop its continuation. A number of psychological experiments have illustrated the phenomenon of people feeling less responsibility for bad consequences due to failure to take action, than for those due to positive actions (Kahnemann and Tversky, 1982.)

Self-commitment to future moves.

In the real world crisis participants can communicate, and while one can imagine situations in which communication would help, in the above scenario it allowed both sides to commit themselves to an action that they later undertook. A single large step in the escalation was divided into two smaller steps. Communication permitted the making of threats, and the event of the threats having been made eased their carrying out.

Uncertainty about objective consequences of one's actions.

Bidding 50 cents over 40 cents means a win with certainty in the dollar auction but in international conflict the effects of one's actions are unsure. The success of the American and Russian attempts to maintain their respective blockades was influenced by chance events outside their control.

Uncertainty in the situation admits the possibility of excessive optimism. In international conflict the success of a country often depends on how well it handles some challenging task, and a number of psychological experiments have concluded that subjects tend to optimism in uncertain situations when their own skill rather than some external source generates the uncertainty (Howell 1972).

Crisis Instability

Uncertainty in the consequencs of the governments' actions opens up another impetus to escalation: crisis instability. Frequently the government that rises to a certain level of violence first has greater success at that level than the government that follows. It may be able to preemptively attack the other's resources, move into territory that is easier to defend than regain, or may have greater time at a heightened level of effort. This situation of an offensive advantage gives a incentive to increase the conflict. It does not hold in the dollar auction but often arises in international conflict.

Informational component of moves.

In international escalation each side may be uncertain about the other's goals. Just how important to the Soviet Union are the fighter-bombers in Cuba, and how important to the United States is their removal? Each must judge the other's values, and each may try to influence the other's judgement. Escalating has the performative function of winning the conflict, of course, but it may also acquire the informational aim of convincing the other side of one's resoluteness. In the rational dollar auction only the performative motive is operating since each player has no doubt about the other's goals, but this informational motive may arise in the international setting.

Expectation of future interaction among the participants

Many decisions in international conflict are taken not only for present success but to convince the other side that one will be resolute in future conflicts. Talk of the need to fulfill commitments, maintain credibility and so on, reflects a future penalty attached to bowing out of the escalation and promotes escalation.

Misperception of current level of escalation

To limit the escalation to a certain level both sides should perceive that they are operating on the same rung of the ladder. In the dollar auction the levels of bids are clear, but shared perception is more difficult when the player's environments or moves are assymetrical. A next step in Darelik *et al.*'s scenario might have been the use of conventional weapons to attack the other's tactical nuclear stockpile. Is the war now nuclear because nuclear weapons are targets, or is it conventional because only conventional weapons are exploding? If the attack is on Russian territory could Russia expect to attack American territory without being perceived as having escalated? The new upper limit of force bounding each goverment's response is a matter of perception and the two sides may disagree.

No third party intervention/No withdrawing resources once invested/No dropping out on equal terms.

These differences promote restraint in the international context compared to the dollar auction. Third parties not involved in the international conflict may take part in its resolution.

Darilek *et al.* provided an alternative ending to their scenario. In the two weeks during between the United States' threat to destroy the Russian fighters and the execution of the threat, the United Nations Secretary-General requested a meeting with the two superpower leaders and proposed that each side withdraw its forces from the hostage territories. The Soviet Union was to withdraw its fighters from Cuba and the United States was to withdraw its troops from West Berlin, each side guaranteeing the other a non-military presence. The two superpowers accepted this proposal and the crisis subsided.

Each government had backed down from a solemn commitment and yet this solution seemed realistic and attractive. In the dollar auction the players bid nickels but in the international context each committed "face". By a mutual withdrawal each side is saving face, as if in the dollar auction a third party appeared and said, "If you both give me half the amount you have bid, I'll let you off the hook." However bids cannot be rescinded in the dollar auction, and by the perverse rules of the game the players cannot bid up to equal levels and then quit. But equal withdrawal is an excellent solution in the international context. Insofar as each goverment's motive was largely reactive, one of image protection, jointly rescinding their bids is possible.

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