THE EFFECTS OF TAXATION ON MODERATING THE CONFLICT ESCALATION PROCESS: AN EXPERIMENT USING THE DOLLAR AUCTION GAME[1]

Robert COSTANZA, *Louisiana State University*

Wesley SHRUM, *Louisiana State University*

The dollar auction game was used to examine the escalation process, varying the amount and timing of a bidding tax. Expected utility theory predicts that the *amount*, while social trap theory predicts that the *timing*, of the tax should be most effective in reducing escalation. Results indicate that timing was important, while amount had little effect. External signals in escalating situations may be valuable primarily to make players reconsider their situation, rather than as modifiers of expected utility at the margin.

Situations in which a gradual or incremental pattern of behavior leads to dysfunctional consequences occur frequently at all levels of analysis (Brockner and Rubin, 1985). Anyone who has ever visited a county fair or Las Vegas has observed this kind of behavior pattern at its most blatant. Consider one particularly simple example: slot machines. In the long run, playing slot machines is irrational because they are simply programmed to pay off, say, $0.80 on the dollar in the long run. But in the short run the possibility of large payoffs at small short-run costs induces players to continue.

These entrapment situations are examples of a particular type of decision-making under uncertainty: uncertainty both as to the consequences of the behavior and the likelihood of its occurrence. The analysis of decision making under uncertainty has concentrated on situations where specific outcomes are uncertain, but alternative results have well-defined probabilities (Wilson and Crouch, 1987; Machina, 1987). What has received much less attention are those situations where alternative outcomes do not have well-defined probabilities. These situations make up the majority of our everyday life decisions, and also represent the kinds of decisions that structured the evolution of the human brain.

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There are two broad alternative models for decision making under uncertainty. The dominant paradigm is "expected utility theory" (Ells, 1982). This theory assumes that people are rational, that they have a set of well-defined preferences, and that they make decisions that maximize their expected utility, which is a function of the alternative physical outcomes and their preferences for those outcomes. Certain well-studied anomalies to this theory exist, however, mainly in situations that involve preferences for probabilistic (but well-defined) outcomes. It has even been shown that restating a probabilistically identical situation in different language can alter the results (Machina, 1987).

One alternative paradigm is the theory of "social traps" (Platt, 1973; Cross and Guyer, 1980; Teger, 1980; Costanza, 1987). A social trap is any situation in which the short-run, local reinforcements guiding individual behavior are inconsistent with the long-run, global best interest of the individual and society. This theory is based on behaviorist tenets, and assumes that people are only "rational" in the short run and locally, and give little weight to outcomes that are distant in time, space, or probability. We go through life making decisions about which path to take based largely on the "road signs," the short-run reinforcements that we perceive *most directly*. These short-run reinforcements can include monetary incentives, social acceptance or admonishment, and physical pleasure or pain. In general, this strategy is quite effective unless the road signs are inaccurate or misleading. In these cases we can be trapped into following a path that is ultimately detrimental because of our reliance on the road signs. For example, cigarette smoking is a social trap because by following the short-run social and physical road signs of pleasure associated with smoking we embark on the road to an earlier death from smoking-induced cancer. Persistent investment in unprofitable enterprises is another social trap because the desire to be proven right in the initial decision leads to unwarranted expenditures. Once a road has been taken it is very difficult to change to another.

There are several well-known experimental games designed to study behavior in traps. For example, the "prisoner's dilemma" game is an externality trap that has been used recently to study the conditions necessary for the evolution of cooperation (Axelrod, 1984). The "tragedy of the commons" is a well-known collective trap used to study overexploitation of natural resources (Hardin, 1968). This article examines factors influ-

TABLE 1

Some Causes and Examples of Social Traps (from Cross and Guyer, 1980)

Cause of Trap	Examples
1. Time delay	Discounting; smoking; drug addiction in general
2. Ignorance	Slot machines; gambler's fallacy
3. Sliding reinforcer	Pesticide overuse
4. Externality	Pollution; prisoner's dilemma
5. Collective	Tragedy of the commons
6. Hybrid	

encing escape from a type of conflict escalation trap. This trap involves a decision-making process wherein social actors continue to increase their commitment to a course of action that becomes less and less rational as the process escalates, all in pursuit of an uncertain goal.

Social traps can result from several causes. Table 1 is a taxonomy of these causes (from Cross and Guyer, 1980) along with some representative traps associated with each. Cigarette smoking is mainly a "time delay trap" resulting from the fact that the positive and negative reinforcements are separated in time. Traps can arise out of simple ignorance of the relevant reinforcements, from the change of reinforcements with time (sliding reinforcer traps), from the externalization of some important reinforcements from the accounting system (externality traps), from the actions of some individuals affecting the group in adverse ways (collective traps), or from a combination of these causes (hybrid traps).

Escaping from Social Traps

Cross and Guyer (1980) provided a list of four broad methods (not mutually exclusive) by which traps can be avoided: (1) education about the long-term, distributed impacts; (2) insurance; (3) superordinate authority (e.g., legal systems, government, religion); and (4) converting the trap to a trade-off. Education, for instance, can be used to warn people of the long-term impacts—destinations that are not generally marked and cannot be seen from a given vantage point. Warnings are often ignored, however, particularly if the path seems otherwise enticing. Governments can forbid or regulate certain actions that have been deemed inappropriate. The problem with this approach is that it must be rigidly monitored and enforced, and there is a strong incentive to ignore or avoid the regulations. But superordinate authority can simply be the means for the application of trade-offs. Most trap theorists believe that changing the trap to a trade-off by imposing compensatory fees is the most effective method to avoid and escape from social traps. This is because it does not run counter

to our normal tendency to follow the road signs—it merely corrects the inaccuracies by adding compensatory positive or negative reinforcements.

These methods involve either a change in the *information* processed by social actors or the *incentives* which shape their behavior. These two types of "escape variables" receive different emphasis in expected utility theory and social trap theory. The value of the incentives is particularly important for expected utility theory, which assumes a rational calculation of the marginal costs and benefits of each anticipated action. Social trap theory has paid greater attention to the informational function, as short-term "signposts" for longer-term contingencies. Decision making depends on both an awareness of the negative consequences of an activity and the magnitude of those consequences (Brockner and Rubin, 1985). Behaviors which lead to entrapment may be avoided because they are quickly perceived as having negative consequences, or because their consequences are perceived as extremely negative. Using the road sign metaphor, one might avoid a certain path because one becomes aware of unpleasant destinations relatively sooner (or later). Alternatively one might avoid the path because destinations are relatively more (or less) unpleasant. What would be desirable would be a method for separating and assessing these two effects.

The Dollar Auction Game

The "dollar auction" game is a social trap particularly well-suited for the simulation of conflict escalation (Shubik, 1971) and the assessment of escape techniques. It is an "investment trap," distinct from such either/or choices as the prisoner's dilemma. Major elements include (1) at least two actors engaged in goal-directed behavior; (2) initial failure, involving potentially greater investments if the goal is to be attained; (3) choice whether or not to escalate; and (4) uncertainty regarding goal attainment (Brockner and Rubin, 1985). Choice is crucial to the entrapment process: punishing conditions are characteristic of many social structures but they are often imposed from without. Uncertainty is important for the simulation of real-life situations, producing the internal conflict which accompanies entrapment.

The dollar auction is just like a normal auction except that *both* the highest and the second highest bidder have to pay the auctioneer their bid at the end of the game, but only the highest bidder gets the prize. The fact that the second highest bidder has an investment in the process that will be lost if she/he drops out leads to some unexpected behavior that is a useful model of the escalation process. Players in the dollar auction game frequently bid much more than $1 for a $1 prize—an irrational result that is the product of a series of "rational" decisions by the bidders. If

player A had bid $1 and player B had the second highest bid at $0.95, player B reasons that if he drops out he loses $0.95 while if he raises to $1.05 he only loses $0.05 (assuming he wins the $1 prize). So he usually raises, and this pattern of "rational" escalation (beyond the point where the overall outcome is rational) continues quite often to well beyond the $1 point.

A one-step rational decision rule for player B in the dollar auction game would be:

$$\text{Raise if} \quad pV - B_t \geq -B_{t-1}$$

or rearranged algebraically

$$\text{Raise if} \quad p > \frac{B_t - B_{t-1}}{V}$$

where:

B_t = bid of player B at time t, which must be larger than player A's bid, which in turn must be larger than B's bid at time $t - 1$;

V = value of the prize ($1 in all cases in our experiments);

p = perceived probability of winning the prize.

This simply says that if the expected net benefits (the expected winnings from raising, pV, minus the cost of the raised bid, B_t) are greater than the net costs (the negative of the current bid, $-B_{t-1}$) then raise. For example, at the dollar turning point, B_{t-1} = $0.95, B_t = $1.05, and V = $1.00. The perceived probability of winning (p) need be only slightly larger than 0.1 to make raising an apparently rational decision. An important point about this game is that the probability of winning (p) is unknown to the players.

Individual and group behavior in the dollar auction game has been extensively studied by Teger (1980) and associates. This series of experiments was designed to examine the escalation process, as indicated by the appearance of distinct "stages" in the bidding process, physiological and motivational correlates of the transition between stages, and "stopping" behavior, as indicated by the amount of the final bid. This quantity, measured in points or dollars, can be readily and precisely compared with the amount of expected reward, an experimental feature which does not generally hold for real-life situations but offers an advantage for an understanding of the escalation process. Bids over $1 are clearly in excess of the expected return and represent, even for a winning bid, a case of having "too much invested to quit."

The principal findings of Teger's research on the dollar auction may be summarized briefly. First, the distribution of highest bids is filled with gaps. Bids tend to be clustered around particular decision points: the point at which the bid exceeds the value of the prize to be gained ($1), the point at which half of the subject's resources are spent ($2.50), and the final depletion point ($5.00). A large percentage of subjects who bid more than $1 continue bidding until all of the resources they have been allocated are gone. Second, this distribution varies depending on whether the subject believes she/he is playing against humans (nonexistent confederates) or nonhumans (a deck of cards generating bids). In the latter condition, subjects are less likely to bid away all resources, though few in either condition quit between the value of the prize and the limit of their resources. Third, when the subjects are not told how much money they will have to bid with, the end point of the distribution is not consistent. Fourth, males tend to bid higher than females. Finally, there is some evidence that bidding stages are associated with shifting motivational patterns. Bids under $1 are made primarily for economic (rational) gain; bids over this amount are made in order to regain losses; bids in excess of one half of the subject's resources are made primarily for interpersonal, competitive (irrational) reasons.

While the usefulness of the dollar auction as a model of conflict escalation has been established, few attempts have been made to examine the conditions which impede escalation. Brockner and Rubin (1985) have considered "cognitive" and "motivational" deterrents to escalation using a different experimental paradigm. Increasing the salience of entrapment by providing information was shown to decrease the likelihood of *starting*, but not persistence after an initial commitment was made. However, in another series of studies by the same investigators, it was shown that the effects of manipulations depend to a large extent on their timing (*when*, during the escalation process, they are introduced).

Teger mentions one face-saving strategy which sometimes terminates the escalation process. If, for example, player B bids $2 after A has bid $1, this offers both players the option to exit the competition while losing equal amounts. Player A may decline to bid further at this point, but this method depends on a conscious "cooperative" bid by B at a particular point in the game.

What this strategy suggests is that both the timing and amount of increments may be important to the escape process. We may utilize this feature of the dollar auction paradigm to separate the two escape variables described above through the use of a "bidding tax" imposed by the experimenter on the participants (Costanza, 1984). Such a tax allows us to manipulate both the information and incentive structure of the game, making "escape" the rational choice. By varying the amount of the tax, the disincentives of a particular bid can be increased in a precise fashion. By varying the timing of the tax, information on the consequences of the course of bidding can be provided at specific points in the game. For example, if player B is at $0.50 and he is told that it will now cost $1.50 to

enter a bid of $0.60 because a $0.90 bidding tax has been imposed, he is in a new situation. Whether he drops out or remains he loses $0.50 and the bid of $0.60 will only be this effective if A does not raise. We would expect B to drop out at this point. But what if the tax is only $0.30, imposed when B is considering a bid of $0.25? Will B persist in bidding escalation, or will he be deterred by the prospect of this new information?

Thus, the introduction of experimental taxation allows us to vary both the information and incentive structure of the auction and provides a partial test of arguments based on expected utility and social trap theories. If taxes function mainly as a negative incentive, as expected utility theory would suggest, then the value of the tax should be inversely related to the high bid, because the costs incurred by the behavior of bidding increase in direct proportion to the size of the compensatory fee.

However, if the informational function of the tax is paramount, as social trap theory suggests, we would expect the timing of the tax to be positively related to the high bid. As a "signpost" which induces reflection on a potentially damaging course of behavior, early taxes should be more effective than late taxes in producing escape. In essence, this is a version of the hypothesis of "waning vigilance" (Janis and Mann, 1977). Over time participants become less vigilant in their decision making, such that at later stages of escalation they become less sensitive to information which might cast doubt on their course of action. Information is processed differently at different levels of commitment. In the case of the dollar auction, the early introduction of a tax should be important simply because as the game advances subjects are less responsive to the cues which increase cost salience.

Methods

We examined these hypotheses using a programmed version of the dollar auction game which pitted subjects against a computer confederate. Students in an introductory sociology course for nonmajors were asked to volunteer for a "bargaining" experiment that would take about half an hour. They signed up for specific time slots and were told they would receive three extra credit points in the course if they signed up and came to the experiment, and would lose one point if they signed up and failed to show up for the experiment. In addition, they were told they would be given $5 and that they could leave with more or less than this amount depending on how they played the game. There were only nine no-shows out of 101 students who signed up for the experiment.

When the students arrived, they were led to a waiting area and given some preliminary instructions to read. The preliminary instructions explained some details about using the computers and stressed the fact

that they would be using their own money to bid. We gave them $5, but any amount they bid over that was to be collected from them as well. Half the students (in the morning) were given $5 worth of tokens to be exchanged for real money at the end of the experiment, while the other half (in the afternoon) were actually given $5 bills. At the designated time the students were led as a group to five microcomputers which they believed to be connected on a network. The computers were arranged on a large seminar table but were partitioned from each other so that the students could not see each other during the experiment. After reading the rules they could decide not to play and walk away with their $5, or they could bid on the $1 prize. All but 5 of the 92 students decided to take the bait and bid. This is consistent with previous findings and probably reflects a felt obligation to make at least one bid (Teger, 1980).

All students were in fact playing against a program in the computer and not against other students. We note two differences between the procedure described here and that used previously. The use of computers offers advantages in the study of escalation because they require little maintenance during the experiment. Responses entered by the subject are recorded and constitute the data for analysis. Students plunged in with no further intervention from the experimenter.

Second, in Teger's experiments, even when the confederate's bids were randomly generated, the subjects believed that they were playing against other humans. Because interpersonal, competitive effects were not as strong when the subjects played a version of the game using a deck of cards, it was felt necessary to convince them that an (unknown) human opponent was involved. But the process of entrapment, as described by Teger (1980), Brockner and Rubin (1985), and others in its most general terms, is not limited to situations involving interpersonal competition. The subjects in the present experiment were simply told that they would be playing against "one or more other persons or a computer." Although we did not systematically collect information on the matter, the large majority of the subjects were quite surprised to learn that they were not, in fact, playing against other people. We surmise that—at least for this experimental paradigm—it is less important that subjects be *convinced* they are competing against a human than it is to be *uncertain* about whether they are playing against one.

Finally, subjects in previous experiments quit the auction when all resources were exhausted (with the exception discussed above). The rationale is that in a voluntary experiment subjects are unlikely to believe that they will be made to use their own resources. Yet if the subject does not consider the money his or her own, it is difficult to interpret results in terms of personal investments. By offering "extra credit" (1.8 percent of the points which could be accumulated over the course of the semester),

"payment" for the experiment had been made before beginning. Tokens (in the morning) and $5 bills (in the afternoon) were distributed in advance to encourage the participants to consider these resources their own. Further, the instructions emphasized that at the end of play they would be required to pay the experimenter the amount of their bid, whether or not this exceeded $5. Several subjects attempted to pay (overbids were not collected), but more importantly, all subjects said they had "lost" money (rather than saying they had "won" amounts less than $5).

The program, like the unseen confederate, continued to outbid the subject in a fashion which simulated the play of a human opponent. The computer's bids were larger than the subject's previous bids by $0.10 plus a random percentage (from 0 to 50 percent) of the subject's previous bid. This averaged out to about a 30 percent increase in the computer's bid over the subject's last bid.

The computer imposed the bidding tax at a random point between $0 and $2. The amount of the tax also varied randomly between $0 and $2. When the bidding tax became operational, the player read the following message on the screen:

> The AUCTIONEER has decided to impose a $ [tax amount]* bidding tax from this point forward. The tax is added on to the cost of making your next and all subsequent bids, but does not increase the value of the bids in terms of winning the auction. In other words, if the tax is $1 and you want to bid $2 it will cost you $3, but your bid will still only be worth $2. All players are being taxed at the same rate.
>
> Hit the RETURN key when you are ready to continue.
>
> *"Tax amount" is the randomly selected tax value.

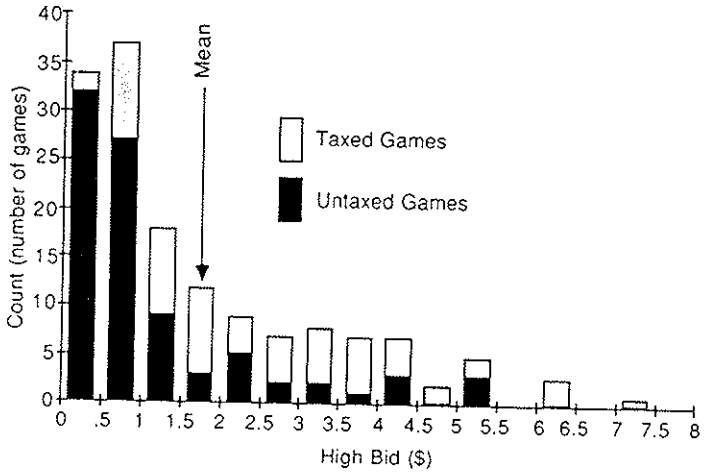
The principal dependent variable in the analysis is the amount of each player's highest bid, with each game considered a distinct case. Tests of the taxation hypotheses employ the amount of the tax and the tax start value (i.e., the bid at which the tax becomes operative). Prior research indicates that gender and learning effects are important to escalation, so we included control variables for gender and for game number (subjects were allowed to play the game more than once). Although developmental effects have not been systematically investigated, we felt it was prudent to include controls for age and number of years in college. Finally, start time and class grade were added to eliminate other potentially confounding influences.

Results

The average age of the student subjects was 19.8 years, and their mean number of years in college was 2.16. Ninety-two students played the game a total of 151 times for an average of 1.64 games per player.

FIGURE 1

Frequency Distribution of High Bids for All Games (n = 151)



Note: Fifty-three percent of the games involved bids of greater than $1 for a $1 prize. The highest bid was $7.10. Untaxed games with large bids sometimes occur because the tax amount was set to $0 rather than because the tax start value was not surpassed.

Their mean high bid before dropping out on a $1 prize was $1.70. Figure 1 shows the frequency distribution on the student's bids. Fifty-three percent of the games had an ending bid larger than the $1 prize. The highest bid was $7.10.[2]

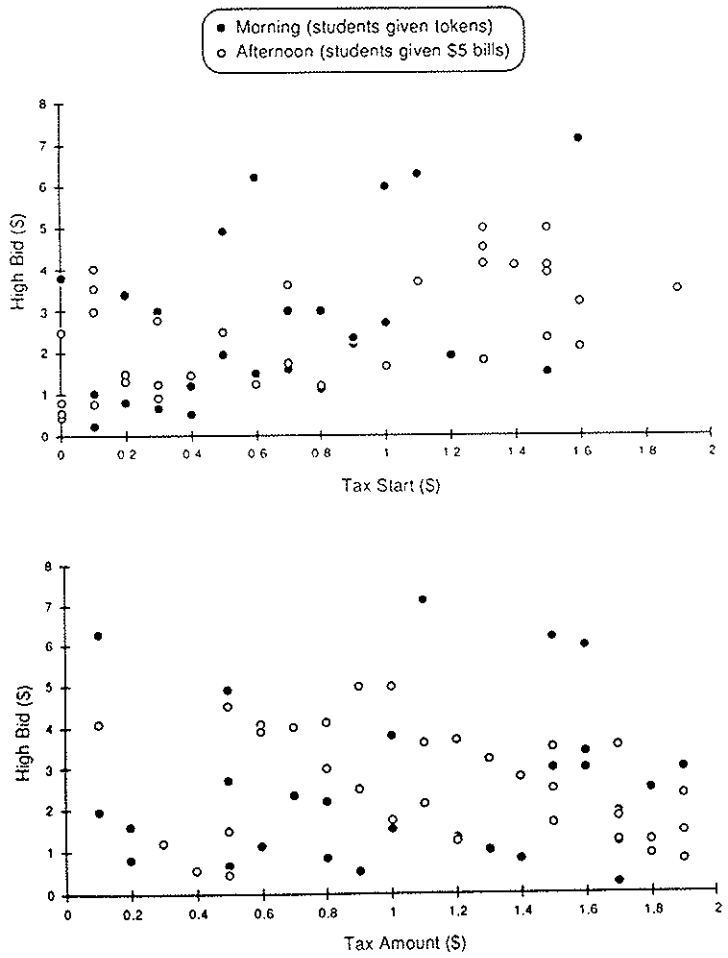
Of the 151 games played, 63 (or 42 percent) involved bids high enough to activate the tax. Figure 1 also shows the distribution of taxed versus untaxed high bids. The mean high bid for the taxed group ($2.51) was higher than the mean for the whole group ($1.70) and for the untaxed group ($1.10). This was due to the fact that the tax was not activated until some randomly selected point in the bidding between $0 and $2. Low bidders would therefore not be as likely to activate the tax, and the mean for games that did not activate the tax was therefore lower.

It is noteworthy that this distribution does not display the gaps which were prominent in Teger's study (without the bidding tax), but rather a relatively smooth decline in the frequency of successively higher bids. The distribution provides no support for the hypothesis that bids cluster at

[2]Actually, one student bid $180,000 and one bid $475, but we eliminated these games from the study because the students were obviously not taking the game seriously. Both of these games were played in the morning (when tokens were used) and both were second games for the students after they had already bid slightly more than their original $5 budget in the first game.

FIGURE 2

Tax Start and Tax Amount Plotted versus High Bid for Games with Bidding High Enough to Activate the Tax



certain critical points, either at the halfway mark or at $5.00. In fact, only two of the taxed games and none of the nontaxed games ended with a bid in the interval from $4.50 to $5.00. We attribute this to the fact that subjects were not given a fixed amount to bid with, a state of affairs which more closely approximates real escalation situations where preestablished limits are not involved. Our results here appear quite similar to Teger's condition in which subjects were not told how much they had to bid with.

Figure 2 plots high bid against tax start and tax amount for the 63 games which activated the tax. A positive relationship between tax start and high bid may be detected in the top part of the figure ($r = .502$), indicating that the earlier the tax was activated, the lower the player's ending bid. The negative relationship between tax amount and high bid ($r = -.107$) indicates that larger tax values were associated with lower bidding levels. The plots also reveal that the relationships are stronger for the group given $5 bills (open circles) than for the group given tokens (dots).

The results of a multiple regression analysis testing the taxation hypotheses are presented in Table 2. The value of the high bid in each game was regressed on tax start, tax amount, and six control variables. Nine separate regressions were run, seven of which explained significant proportions of the variance in the measure of escalation. The sample was partitioned into the group using tokens (rows 1–3), the group using $5 bills (rows 4–6), and then combined (rows 7–9). For each group, the first equation estimated included all control variables (grade in the course, age in years, gender, time of day at start of game, years in college, and game number), the second equation included only those controls which were significant in at least one case (years in college and game number). The third equation excluded all the control variables and included only tax start and tax amount.

From 25 to 65 percent of the variance in high bids is explained by the models estimated. As intimated in Figure 2, the models for the subjects who played with $5 bills display a much better fit, explaining 15–30 percent more of the variance than the same models estimated on the subjects who played with tokens.

The principal finding from Table 2 is the striking importance of tax start and the relative unimportance of tax value. For all equations, the point at which the tax is implemented is the best predictor of the amount of the high bid. While we expected larger taxes to be more effective at terminating the escalation process, even the net effect of tax value is in the expected (negative) direction in only four of the nine models estimated. Controlling for tax start, game number, and years in college, small taxes are almost as effective as large ones. Tax amount is only marginally significant ($p < .09$) when the explanatory variables are limited to tax start and tax amount, and the afternoon ($5 bill) subsample is used. Earlier taxes discouraged bidding regardless of the amount the subject is taxed, at least for the range of tax values employed. For the entire sample, each delay of one dollar in the onset of the tax is associated with an increase of $1.55 in the terminal bid.

In no case were the effects of start time, age, or class grade significant.

TABLE 2

Regression results for morning and afternoon subsamples and for the entire sample. Numbers are regression coefficients ± standard error. Three equations are shown for each, one with eight independent variables and reduced forms with four and two independent variables.

	Independent Variables					
	Tax Start	Tax Amount	Game Number	Years in College		
Morning (tokens)	2.205* ± 0.904	0.340 ± 0.761	−0.634 ± 0.667	−0.389	± 0.711	
	2.248** ± 0.768	0.449 ± 0.598	−0.633 ± 0.490	−0.086	± 0.333	
	2.161** ± 0.753	0.385 ± 0.590				
Afternoon ($5 bills)	1.030** ± 0.314	−0.201 ± 0.407	−0.151 ± 0.314	−0.610**	± 0.194	
	1.027** ± 0.272	−0.218 ± 0.323	−0.187 ± 0.278	−0.559**	± 0.155	
	1.230** ± 0.318	−0.644 ± 0.363				
All	1.549** ± 0.363	0.031 ± 0.361	−0.323 ± 0.301	−0.398*	± 0.207	
	1.438** ± 0.328	0.033 ± 0.336	−0.411 ± 0.282	−0.329*	± 0.170	
	1.507** ± 0.340	−0.163 ± 0.338				

*$p < .05$.

**$p < .01$.

The absence of a gender effect was contrary to expectations. Males did not in general bid higher than females as Teger's (1980) results indicated. Game number was negatively associated with high bid for the token and aggregated conditions. At least in some cases there was a learning effect, with subjects tending not to escalate as much on second or third plays. Years of college was negatively associated with high bid for the cash money and aggregated conditions. That is, more experienced college students terminated play earlier. This effect may be due to prior experience with (and scepticism toward) experimental procedures rather than worldliness or maturity, given the absence of an age effect. The effect does not appear for the token condition.

Comparison with Previous Studies

In addition to the findings on taxation, two differences between these results and those reported by Teger are worth emphasis. First, although his findings showed clear differences by gender, our data reveal no such pattern for taxed or nontaxed subsamples. Nontaxed games display relatively low ending bids (as a function of the design) while taxed games

TABLE 2—continued

Independent Variables				Equation	
Start Time	Gender	Age	Class Grade	R^2	Residual Degrees of Freedom
−0.0010 ± 0.003	0.179 ± 1.013	0.313 ± 0.725	0.011 ± 0.042	0.313	20
				0.296	24
				0.245*	26
−0.0003 ± 0.001	−0.116 ± 0.373	−0.003 ± 0.036	0.009 ± 0.012	0.650**	23
				0.609**	29
				0.401**	31
−0.0005 ± 0.001	−0.395 ± 0.415	−0.014 ± 0.052	0.013 ± 0.014	0.359**	52
				0.335**	58
				0.255**	60

involve a new contingency which Teger did not examine, so these findings are not necessarily incompatible. What they suggest, however, is that differences in gender-based competitiveness disappear with shifts in the information and incentive structure induced by taxation. If the imposition of taxation constitutes a reminder of the "rules of rationality," then the similarity of men and women in high bids is to be expected. The rational consideration of long-run costs is consistent with a diminished sense that "too much has been invested to quit" and a willingness to terminate the game quickly. Men and women are equally responsive to this kind of incentive.

Second, Teger's (1980: study III, pp. 33–35) conclusion that it makes no difference whether dollar auction bidding uses points or real money is worth reconsidering in the light of the differences we observed between subsamples. In Teger's study III auctions contrasting points and money, the maximum bid was fixed at $2, a decision we have criticized in light of both our own and his (study IV) results. A principal finding in Teger's study IV is that most subjects who bid above the value of the prize continue bidding until their resources are gone regardless of whether they are bidding with real money or points (where no specific value is attached

to the points). But subjects did quit bidding earlier when real money was used rather than points, leading one to suspect, again, that arbitrary termination points change the character of the bidding.

In the present study subjects were either given tokens, the value of which was specified, or $5 bills to begin the game. Although the average final bid was identical for the two groups for the taxed subsample ($2.51), the variance was larger among subjects playing with tokens (3.715) than for those playing with $5 bills (1.889). Differently put, subjects did not bid less on average when playing with real money, but they were seemingly more thoughtful with their bidding and less likely to bid wildly. Together with the fact that the models display a better fit to the data for the group which was given real money, this result suggests that escalation processes are sensitive to the actor's belief that the resources which are invested are indeed meaningful.

Conclusions

Current discussions of decision making in entrapment situations suggest that changes in reward structure should be effective in decreasing the likelihood of escalation. Applying this to the simulation of conflict escalation in the dollar auction game, we distinguished information and incentive components of taxation. We expected that both earlier and larger taxes would be associated with termination of bidding, drawing in arguments from expected utility theory and studies of information processing in traplike situations.

We found that the timing of the tax was much more important than the amount of the tax in determining the degree of observed escalation in the bidding process. Oddly, it seems to make little difference whether the subjects are heavily taxed or only lightly taxed—the extent to which taxation discourages subsequent bids is mainly a function of when the tax is implemented. Of course, this conclusion is limited to the range of tax values adopted in the present design. It would undoubtedly be possible to impose a tax value such that no further bids would be made irrespective of tax timing.

That small taxes are almost as effective as large ones when they are imposed early in the game strongly suggests that the information function of taxation is dominant in controlling the conflict escalation process, and that expected utility arguments are less powerful in explaining escape. Taxation, as these results demonstrate, is effective in modifying the behavior of subjects as they respond to random bidding increments in attempting to attain a specified goal. If the *amount* of the tax governs the speed with which they decide not to compete in the auction, a strictly economic rationale could be given for their behavior. That is, large taxes

(added to the subject's own bid) quickly reduce expected winnings to zero and the rational decision is to escape. But this interpretation is not well supported by the data. Instead, subjects confronted with an early tax, exiguous or not, are the ones most likely to escape the auction. Such a decision does not necessarily imply economic rationality if the combined value of tax and bid does not exceed one dollar. (At least, it implies no less economic rationality than entering the auction in the first place.)

An early tax is a disruptive signal. It provides a break in the game, a "time out" from the escalation of conflict, giving the bidder a moment to consider strategy and reevaluate his/her objectives. A pertinent comparison from Teger's study V shows subjects initially given $5 were less likely to bid away all of their resources when questionnaires were administered at points during the bidding. Like a tax, a questionnaire is a disruption resulting in reduced escalation at least under some conditions. More than a questionnaire, the mere existence of a tax makes clear to the bidder that adverse consequences attend further escalation. The very next bid will cost more than the intended bid (by some amount). It is this intrusive awareness which, in our view, alters the character of the auction. In effect, the trap becomes *visible* to the participants. From this perspective, it makes little difference whether the consequences of the next bid are extremely adverse or only mildly adverse, for the trap has been seen for what it is and can be escaped from.

The general conclusion from our study is that escaping from escalating situations seems to require intrusive information that can shock participants out of complacent continuation and into a fresh look at their situation. A breakdown of an old car may be necessary to terminate the cycle of escalating minor repairs. An accident may be necessary to cause a rethinking of the efficacy of nuclear power. Our results also indicate why it is so difficult to terminate chronic gambling. Even major losses have little effect on the escalation process if they occur late. However, even a relatively minor external stimulus may be effective if applied early in the process. The stimulus required to cause a rethinking of escalating situations can be externally applied in a controlled, nondamaging way. This strategy may offer the potential for more effective control of the ubiquitous escalation process. SSQ

REFERENCES

Axelrod, Robert. 1984. *The Evolution of Cooperation*. New York: Basic Books.

Brockner, J., and J. Z. Rubin. 1985. *Entrapment in Escalating Conflicts: A Social Psychological Analysis*. New York: Springer-Verlag.

Costanza, Robert. 1984. "The Nuclear Arms Race and the Theory of Social Traps." *Journal of Peace Research* 21: 79–86.

———. 1987. "Social Traps and Environmental Policy." *BioScience* 37:407–12.

Cross, John G., and Melvin J. Guyer. 1980. *Social Traps*. Ann Arbor: University of Michigan Press.

Ellis, Ellery T. 1982. *Rational Decision and Causality*. Cambridge: Cambridge University Press.

Hardin, Garrett. 1968. "The Tragedy of the Commons." *Science* 162:1243–48.

Janis, Irving L., and Leon Mann. 1977. *Decision-Making: A Psychological Analysis of Conflict, Choice and Commitment*. New York: Free Press.

Machina, M. J. 1987. "Decision Making in the Presence of Risk." *Science* 236:537–42.

Platt, John. 1973. "Social Traps." *American Psychologist* 28:641–51.

Shubik, Martin. 1971. "The Dollar Auction Game: A Paradox in Noncooperative Behavior and Escalation." *Journal of Conflict Resolution* 15:109–11.

Teger, Alan I. 1980. *Too Much Invested to Quit*. New York: Pergamon.

Wilson, Richard, and E. A. C. Crouch. 1987. "Risk Assessment and Comparisons: An Introduction." *Science* 236:267–70.