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Coping with Conflict: A Dynamic Decision Making Perspective

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Introduction

Why do some conflicts succeed in reaching a conclusion, while others linger on without any resolution? When the risks associated with surrender or a compromise is deemed to be higher than preserving the status quo then of course the high costs of preserving the conflict are rational. This is the explanation for maintaining a deadlock in the case of the prisoners' dilemma game (Grieco, 1988). However, as will be explained below, due to the dynamic nature of social interactions, no status quo, including a conflict, can be maintained for long unless the actors involved make an effort to preserve it.

In the case of intractable conflicts, researchers distinguish between two sets of factors perpetuating violent status quos. The first is the shared beliefs and attitudes of the people involved in the conflict. According to this perspective, feelings of hate, victimization and mistrust are so intense that there is a resistance to compromise because these beliefs justify the high costs associated with the conflict (Volkan, et. al. 1994; Kaplowitz, 1990; Rouhana & Bar-Tal, 1998; Bar-Tal, 2007). The second approach focuses on the social structure of the conflictive system. This interpretation perceives the conflict as a complex dynamic system. While the conflict goes through cycles of escalation and de-escalation, it seems that there are structural mechanisms that mitigate any attempt to reach a resolution or even deescalate the conflict (Starr, 2000; Coleman, 2006; Roopers, 2008).

The research presented in this article is associated with the second approach. The major question that was explored was how do people cope with systemic complexities of conflicts? In order to address this question an interactive microworld simulator was designed on the basis of principles developed in order to study how

people engage with complex systems, as well as additional features of complexity that characterize conflictive situations. The decision-making patterns of subjects operating the simulator were analyzed in an attempt to detect heuristics practiced by decision makers engaged with dynamic and complex environments (Brehmer, 1992; Funke & Frensch, 2007). While these heuristics are not necessarily responsible for the structure of the conflictive system, this research demonstrates that they impede the ability of decision makers to adapt to the complexities of the conflict.

Dynamic Complexities of Conflictive Interactions

Feedback

A system is defined as a set of components that interact with each other. These interactions are expressed by relationships between variables associated with each of the components of the system. When the value of a variable of a particular component changes it affects the values of variables of other components that comprise the system. In the case of political systems it is assumed that each component is an actor that is pursuing its own interests. However, the most significant contribution of complex system interpretations of political interactions is in the structure of the relationships between the actors.

The simplest type of system structure is the case where interactions between components are arranged as a series of successive events, where each change in the value of a variable is coupled with a proportional change in the value of another variable. In comparison, in a complex system a change in the values of variables of specific components does not seem to affect the values of variables of other components in a linear manner due to feedback loops that perpetuate or attenuate the

progression of disturbances throughout the system (Bertalanffy, 1950, Simon, 1962; Richardson et al., 2001). Under such conditions it is usually impossible to identify a clear beginning and end of a chain of events.

An example of a simple complex system interpretation of political interactions is a model of the Middle East conflict developed by Azar et al. (1978). This model assumes two opposing feedback loops that are responsible for maintaining the conflict in an intractable state. On the one hand it is argued that whenever the conflict escalates the superior actor is repressed because one of the superpowers intervenes in an attempt to aid its ally. On the other hand, whenever there are attempts to reach a settlement and end to conflict, these efforts are frustrated by extremist groups that launch violent and provocative actions. This is known as the spoiler effect (Stedman, 1997).

In recent years there have been a number of attempts to analyze conflicts on the basis of the principles of complex systems described above (Jervis, 1997; Coleman et al., 2007). However, the complexities of conflicts include more than just feedback loops between multiple actors. There are additional complex feature that are expected in social interactions, which are especially relevant for conflictive situations. These additional elements of conflictive systems can be divided into two types: dynamic and structural characteristics.

Dynamics

The actors engaged in the conflict and the interactions between them are continually evolving and changing. Therefore, it is a mistake to conceive interactions as a sequence of repeated games. This is because the decisions made by

the actors can change the structure of the system. This might be reflected by a change in the relationships between components of the system or changes in the attributes of other of actors as well as the actor making the decision. As a consequence the payoff functions may change and new policy choices might emerge, while previous policies become defunct (XXX, 2006).

Not every action has an impact. But even when policies are effective, it is temporary. Thus for example Blechman (1972) observed that Israeli reprisals were usually followed by a short term decline in the rate of Arab attacks against Israel. Likewise, XXX (2005) illustrated that UN Security Council resolutions against Israel were associated with a short term decline in the probability of attacks against Arab countries.

Although actions can have longer term effects, unlike the two examples above, systemic changes are not always reversible. There are many historical examples of attempts to obliterate political and social developments, such as signing a peace treaty after a war or replacing a regime with a previous regime that never succeeded in replicating the old system. While there is considerable debate why it is so difficult to resist and undo economic and social developments, the common denominator of all explanations is that once new knowledge has been produced it is very difficult to erase it (Giddens, 1984; Sztompka, 1993).

Another dynamic feature of conflicts is that the actors can initiate an action at any time. In the case of conflicts there is a tendency to initiate actions before the adversary is prepared to respond. Thus the perception that conflictive interactions represent a series of actions and counteractions (Holsti et al., 1964) is possible only if all parties agree to these rules.

Multiplicity

Non-linearity is not expressed only in dynamics, but also its structure. Conflicts are multifaceted and their effects require observing a combination of many different qualities at different levels of analysis (Richardson et al., 2001). Hence, payoffs cannot be estimated on the basis of a single scale, but instead are represented by various types of variables that include both quantitative and qualitative phenomena that cannot be trivially integrated into a simple utility function.

Policies also have multifaceted characteristics. While decisions are commonly presented as choices that are being made between alternative options, actors operating in complex social systems can choose any combination of policies at any given time, including choosing to do nothing. Hence, members of the system can cooperate with each other and behave in a very aggressive manner simultaneously (Jervis, 1997). This, for example, has characterized Israeli-Palestinian relations and might explain one of the reasons why peace negotiations tend to fail (Pundak, 2001; Seliktar, 2009). Likewise, there is also a possibility of not cooperating and not behaving in an aggressive manner. This situation has been referred to as a "cold peace" and to a great extent represents the shift in the policies of some Arab states towards Israel (Kacowicz, 2000).

Dynamic Decision Making

If conflicts represent complex systems then the study of strategic interactions requires taking into account how people make decisions in such environments. The major focus of research within this perspective, known as Dynamic Decision

Making (DDM), is the question how decision-makers attempt to optimize their policies over time.

It is assumed that improving higher utilities requires an ability to estimate the outcomes of alternative policies or combinations of policies. However, studies of DDM indicate that people suffer from considerable difficulties understanding casual relationships within complex systems (Sengupta & Abdel-Hamid, 1993; Gibson et al., 1997; Gonzalez, 2005). Due to the complexities described above decision makers frequently fail to analyze previous experiences in a consistent manner because it is difficult to account for the effects of all factors involved. If the decision-makers are trying to gain profits or they strive to avoid human casualties and serious damage then there will be a tendency to avoid policies that are deemed to be too costly and risky (Brehmer, 1992; Orasanu & Connolly, 1993; Lipshitz et al., 2001). Another limitation, in the case of conflicts, is the urge to take a preemptive action before the opponent acts. This reduces the time required in order to thoroughly analyze the consequences of all alternative policies.

Still, even if the decision makers manage to conceive a reasonable model of their environment, because complex systems are unstable, it is always possible that the structure of the system (the relationships between various objects and variables) might also be changing and the model will lose its relevance (Kuperman, 2006). Thus for example, while the Israeli forces that invaded Lebanon in 1982 were welcomed by many Lebanese citizens, the Lebanese public gradually shifted its attitude towards Israel and started supporting groups that opposed the Israeli presence (Mowles, 1986). The same can probably be said of many occupations and interventions, which in the short term seemed to be successful, but failed in the long

term. Also the American campaigns against Afghanistan in 2001 and Iraq in 2003 started successfully, but new unanticipated threats emerged in the aftermath of these operations (Slevin and Priest, 2003). Therefore, decision makers must continually reanalyze the environment and update their policies. Under such circumstances, instead of striving to maximize utilities decision makers settle for suboptimal compromises (Brehmer, 1992).

Suboptimal Decision Making Practices Relevant to Conflicts

Despite the difficulties associated with DDM, a decision maker could strive to make a decision that is analogous to the analytic decision making model, which is assumed to provide highest expected utilities. According to this model the decision maker would first have to collect information regarding the system and then chose a policy that is expected to produce the expected utility (Steinbruner, 1974; Maoz, 1990). However, one of the central hypotheses of DDM is that decision makers tend to adopt simple heuristics instead of attempting to gain a better understanding of the consequences associated with their actions. These heuristics are frequently perceived as being responsible for misperceived policies (Stein, 1988; Kanwisher, 1989). In the case of this research, the effects of three types of decision-making practices that can produce suboptimal outcomes (less than the maximum expected utilities) were studied. These practices can be observed in many social settings and are not limited exclusively to international conflict, although the consequences of applying them in conflicts can be very costly.

Satisficing

One of the major challenges of DDM is the sequential manner in which events occur. Simon (1955) suggested that this prevents decision makers from being able to compare alternatives because each alternative can be chosen at a different point in time rather than simultaneously. The example he gave was a person selling a home. Because the seller cannot choose among a number of alternative buyers, but must instead decide to accept or reject the offer of one buyer at a particular time, the seller must estimate what are the chances of a better offer in the future. The solution to this dilemma according to Simon was the principle of satisificing. This requires determining a minimal threshold of attributes that must be fulfilled. Thus, as long as the outcome of a policy passes the minimum satisfactory utility, the policy will be maintained. Only if the policy fails to meet the minimal criteria should an alternative be sought.

Simon's original explanation describes satisficing as a solution for overcoming objective constraints on the decision process. Therefore even in a dynamic system decision makers may have some ability to make a choice among a number of options within a limited time frame. For example, in the case of selling a house or a person seeking a job, the seller or the job seeker do not have to provide an immediate answer to an offer. They can create time frame within which they can accumulate a number of offers.

Still, even when a decision maker can choose among a number of options, satisficing is frequently assumed to be a consequence of subjective limitations as well. According to Holsti and George (1975), and Janis and Mann (1977), the principle of satisficing is preferred when the risks associated with a poor decision are low, and therefore rather than making an effort to seek the best possible policy,

the satisficing principle is considered sufficient, even when it is possible to compare other alternatives. However, as the risks associated with the decision increase there will be a stronger incentive to choose the best possible policy and therefore the satisficing principle will be abandoned. This process was observed by XXX (2005) in the case of Israeli use of force. During long stretches of time limited use of force was subject to simple decision rules that were applied by a small group of Israeli decision makers. But when tensions escalated, the Minister of Defense would propose a new policy which would be discussed by the Israeli government or a committee of ministers.

Normative biases

There are other reasons why decision makers might chose suboptimal policies. Discussions following an experiment where subjects engaged in a dynamic simulation of an intractable fishing dispute (see below) revealed that the many subjects were quite aware that they were choosing policies that were not effective. However there was a discomfort in maintaining the situation in a state of perpetual conflict, and a desire to reach some resolution, and for this reason some subjects continually pursued policies that failed. The major argument justifying this behavior was that this was the right thing to do under the existing circumstances. XXX (2010) proposed this indicated that these subjects were biased by normative principles. The norms were so strong that the subjects refused to abandon them despite the temptation to violate them for the purpose of increasing utilities. This is because

policies can also serve as signals for expressing concerns and intentions rather than just actions for manipulating the system (Wendt, 1992).

A good example of such decisions has been observed with the aid of the ultimate bargaining game, which is a game over how to divide a sum of money under conditions where the actor receiving the offer cannot make a counter offer, but must either accept or reject it. However, if the offer is rejected then both actors receive nothing. Experiments with this game reveal that contrary to the expected Nash equilibrium outcome, which predicts that the actor making the proposal should propose as little as possible to the second actor[1], it appears that there is a strong tendency of proposers to offer a 50:50 split (Güth et. al., 1982).

A number of researchers, who have modified the rules of the simple ultimate bargaining game or modified the experimental setting, have succeeded in creating conditions that increase the probability that proposers demand larger portions for themselves. However, even under circumstances that encourage self interest, there usually remain many proposers who continue to split the pie equally or allocate slightly larger portions for themselves (Binmore et. al., 1985; Forsythe et. al., 1994; Hoffman et. al., 1996).

While the example of fairness illustrates that many people are not self interested utility maximizing units, fairness serves a social purpose and therefore it is a functional norm. However, sometimes norms become social conventions, or what Elster (1989) termed as social norms. In this case the behavioral principle is applied in a Kantian manner, simply because this is proper conduct (Kant, 1785).

[1] This is because the actor receiving the proposal will benefit more from a small portion of the pie rather than receiving nothing.

Although “proper conduct” might serve an ideological or moral cause, such behavior indicates that the decision maker does not reflect on the utility of the preferred policy, and it is routinely applied regardless of the consequences. For example, in many ultimate bargaining experiments, even when the anonymity of the players was maintained so that their conduct was not subject to social judgment (they did not even see against whom they were playing), most proposers still divided the money equally or took only a slightly larger portion.

The possibility that decision makers might prefer to abide by social norms has not received sufficient attention among researchers of DDM. This is probably because DDM research has failed to focus on social interactions and therefore norms are irrelevant. However, if the environment is perceived as a conflictive complex system, the reliance on social conventions might actually be higher. When a social interaction has no clear rules of conduct and the game cannot reach a final conclusion, making a utilitarian choice might be so difficult, that the social convention becomes a more attractive choice because it will be perceived to be a “standard” policy that most people choose. Thus, for example, Shalom (1996) notes that in the 1950s there was a serious debate within the Israeli government regarding the deterrent effect of reprisal attacks against Arab states. Prime Minister Ben Gurion argued in favor of this policy by making an analogy with the punishment of criminals, claiming that no state has ever eliminated its justice system just because crime continues to prevail.

Information processing reduction

Decision makers engaged in conflicts must monitor data that indicate the state of the system. Therefore, it is very common to write reports describing the events that occur. In addition, it is common to produce periodic bulletins reporting statistical summaries of events. However, these reports require investing a cognitive effort and spending time to analyze the data.

While this issue has not yet been studied by researchers of DDM, other decision making experiments seem to indicate possible alternative ways people reduce their information processing efforts. The first is the tendency to round data. A second simplification of the data is to compare relative gains or losses rather than absolute quantities (Kahneman and Tversky, 1979). This tendency seems to make sense in the case of DDM because such decisions require comparing results over time. It should however be noted that these two methods of reducing information processing were observed in experiments where the subjects who participated had no choice but to rely on one source of data. But when decision makers are exposed to alternative types of data, they may prefer information that is easier to analyze rather than spending time deciphering complex data, even if it is more accurate and reliable (Beach and Mitchell, 1978; Payne, 1982).

Although heuristics that reduce information processing are not unique to situations of DDM, it is argued that there is possibly a higher incentive to adopt such heuristics in the case of conflicts. This is especially the case if there are no rules allowing each actor to take a turn. Because each actor has an incentive to preempt there is an urge to respond quickly and this can be achieved by reducing the time that is required to analyze the events.

Hypotheses

On the basis of the discussion regarding decision making practices in conflicts a number of hypotheses can be derived that are associated with each of the decision-making practices described above.

Although it is assumed that satisficing would be a suitable decision making practice for DDM, as explained above this does not prevent decision makers from striving to behave in an analytic fashion. Hence assuming that no cognitive heuristics are applied, an analytically oriented decision maker would abide by the following conditions

A1: Analyze the information related to each possible policy

A2: Chose the policy that produces the highest utility.

In contrast to the analytic decision making hypothesis in the case of satisficing, the decision makers will settle for a policy that produces sufficient utilities. Thus the satisficing hypotheses is proposed

S1: Analyze information related to a single policy

S2: The policy that produces the highest utilities will not necessarily be chosen

S3: If the policy is satisfactory, continue pursuing the policy

S4: If the policy is unsatisfactory, start the process again for a new policy

The second type of suboptimal decision making practice associated with conflicts is the adherence to social conventions. Unlike the analytic approach or satisificing, normative biases are concerned with the appropriateness of policies. Although this should not prevent a decision maker from collecting information about the consequences of alternative policies, rather than evaluating utilities, the major concern is behavioral conduct. Therefore, verbal information will usually be more relevant than statistical data. Thus the following hypothesis portrays this type of decision making:

N1: Observing verbal information is more likely than quantitative information

N2: The policy that produces the highest utilities will not necessarily be chosen

N3: If a policy serves as an appropriate response it should be pursued.

N4: If a policy is an inappropriate response it should be avoided

As noted above, there is a possibility that subjects will attempt to reduce information by avoiding complex analyses of data. Therefore the following hypothesis can be assumed regardless of other decision-making practices:

IPR1: Observing verbal information will be more likely than quantitative information

IPR2: The policy that produces the highest utilities will not necessarily be chosen

As can be observed in many cases it might not be possible to distinguish between decision makers motivated by normative biases and decision makers who are merely reducing information processing.

Research Design

Theoretical models of DDM were proposed over fifty years ago by researchers of public administration (Simon, 1955; Lindblom, 1959). Although the possible relevance of these decision-making theories to the study of international conflict has been acknowledged, only a few researchers have attempted to adopt these models in order to analyze foreign policy (Allison, 1971; Marra, 1985; Majeski, 1989; XXX, 2005; Sylvan & Majesky, 2007). To a great extent also within the field of public administration research DDM research has not been very common either. This is because the DDM perspective poses researchers with serious empirical obstacles. The DDM approach demands from the researcher to gather a detailed account about a series of events that occurred over time. Collecting such information with minimum missing data in most cases is not feasible. Although it is possible to sometimes collect a relatively complete series of actions international actors apply against each other (events data), the researcher does not necessarily know whether the decision makers actually analyzed and considered these events.

There is therefore a possibility that the actions observed by the researcher are not necessarily the same events that the decision-makers were contemplating (XXX, 2005).

During the last three decades, with the development of interactive computer simulators of complex and dynamic environments a new medium for studying DDM has emerged. These simulators, known as microworlds, provide researches with detailed records of the actions carried out by the subjects who operate them, thereby revealing decision making practices in environments that behave as complex systems (Sterman 1989; Rouwette, Größler and Vennix, 2004; Gonzalez, Vanyukov & Martin, 2005).

It is frequently argued that because simulations do not reflect real life situations then the "external validity" of the findings of such experiments are compromised at the expense of increasing their "internal validity" (McDermott, 2004). This popular argument is misleading. In the "real" world we expect people to behave differently in alternative settings. For example the manager of a bank behaves differently in a business meeting than in a party, at a doctor's appointment, or at home with the family. In fact, the decisions of the manager vary between each business meeting, simply because the circumstances differed. Thus, we should not be surprised that the manager will also behave differently in a simulation.

So what is unique about a simulation in comparison to any other setting? The simulation represents the participating subjects with a set of circumstances created by a researcher. Unlike natural incidences, the researcher can manipulate specific environmental factors in order to discover if those specific factors affect the subject's behavior. Such an analysis is possible because the simulation eliminates

"background noise," which includes other factors that also affect behavior. Because the background noise is absent, the change in behavior can be attributed only to the factors that were manipulated within the laboratory (Kinder and Palfrey).

Because the effects of many other factors that influence behavior are not accounted for in a simulation, then we should expect that the same subject will behave differently outside the laboratory. However, the simulation at least reveals how one specific factor among many affects behavior. The simulation will therefore allow us to recognize the impact of this factor in natural settings, even though it is not an exclusive factor.

The Fishing Dispute Microworld

Recently XXX (2010) developed a microworld of an international fishing dispute that also operates according to principles of complex systems, including the following characteristics:

1) Policy options available to the subjects are not alternatives. Choosing one option does not disqualify choosing another.

2) Subjects operating the simulator do not know in advance what are the payoffs and consequences of the policy choices, and must learn this from experience.

3) Information about the system can be learned from two sources. The first is textual messages that are sent to a mailbox. The second source of information is statistical data that is updated every simulated day.

4) Unlike a game of chess where each actor takes a turn this simulator operates in real time. Both the subject operating the simulator and the opponent, operated by the simulator's program, can initiate an action regardless of the other.

5) Policies have short term and long term effects on payoffs.

6) Some policy choices can change the available options.

7) Some policies choices can result in payoffs changes.

While the scenario of the conflict developed in this simulator is relatively simple (see below), the seven characteristics stated above are usually disregarded by researchers of decision making in conflicts and most people who have actually participated in a conflict are likely to recognize their relevance, This is the major advantage of this microworld simulator.

Another important feature of the simulator is that it records all actions taken by the subjects and the computer program. This includes the policies that are chosen and the type of data that is being read by each subject. In this manner it is possible to observe the policy preferences of each subject over time and characterize decision-making patterns of subjects who chose policies that increased payoffs in comparison to subjects who preferred suboptimal policies.

Procedure

Prior to running each simulation, the subjects attended a short training session on how to operate the simulator. It was explained to them that they would be simulating a leader of a small country that relies on fishing as its only source of income, and that they would be confronting another country of similar size and power that believes it has the right to fish in their territorial waters. Their goal as decision-makers was to try and earn as much national income as possible, while keeping human casualties to a minimum in the event of a conflict.

All subjects ran the simulation for 40 minutes. However, they were not told when the simulation would end. In a few cases the simulator crashed before the 40 minutes were completed. Simulations that crashed after less than 35 minutes were not included in the sample.

Simulator setup

Table I shows three columns: 1) The policy choices available to the subject operating the simulator, 2) the response of the computer player to each policy choice (including making no choice), 3) the effect of each policy on the payoff function. With the exception of casualties, which are reported as a text message, all other payoffs are displayed in the statistics table. As can be observed, the response of the opponent is a pure tit-for-tat. Every action that is chosen produces an identical response. However, contrary to most simulations that apply tit-for-tat, the payoffs do not correspond with the prisoner's dilemma. Instead the responses of the computer actor affect the values of the parameters of the utility function shown in the right column. While in other simulations tit-for-tat is applied in a series of repeated rounds and the payoffs are a function of the combination of choices made during each round, this simulator works in real time and therefore the action of the opponent creates an event that endures over time. The payoffs are then calculated on the basis of the accumulation of events within a specified time period.

All aggressive actions (threatening, dispatching patrol boats, or opening fire) chosen by the human subject had a short-term deterrent effect on the computer opponent, producing a short delay in sending the next message reporting illegal fishing and thereby slightly increasing fishing yields. In contrast to the aggressive

actions, the impact of signing an agreement to share the disputed waters decreased fishing yields by 50%. Only canceling the agreement eliminates this effect.

Because the computer program reacts to the policies of the subjects, as the simulation progresses the actor operating the computer program changes its policies. However, because the decision making rules of the computer program are identical in all simulations, the variations in the development of the conflict are completely dependent on variations in the behavior of the individual operating the simulation and therefore any outside factors that might influence the behavior of the subject operating the simulator is eliminated.

Although the payoffs change over time because decisions made by the individuals operating the simulator can alter the utility function, there still is an optimal strategy (providing highest payoffs), and this is to consistently threaten the computer opponent. This type of action produces a short-term deterrent effect. Although there are other policies that can produce a short term deterrent effect, all other policies incur extra costs.

Variables

Analyticity: The purpose of this variable is assessing the degree that subjects explore alternative policies. This was measured by counting the number of different options a subject explored during the first 10 minutes of the simulation. This measure ranged between 1 and 5.

Adaptation: In order to observe how preferences changed, the entire period of the simulation was subdivided into four parts of 10 days. For each policy the average number of days the policy was applied within each timeframe was counted.

Absolute initial preference: For each policy a dummy variable was created indicating if this was the initial preference.

Relative initial preference (RIP): For each policy the amount of time between the beginning of the simulation and the first time it was applied was measured in seconds. If the policy was never applied this was a missing value.

Long term preference (LTP): This is the average number of days a policy is chosen during the entire simulation. In the case of patrol boats, the maximum number of dispatched boats was also measured.

Quantitative Analysis (QA): This was measured by counting the number of times subjects observed the statistics table.

A variable for observing verbal messages was not used because all subjects consistently observed these messages.

Population

Data was collected from 92 political science students from the University of XXX who ran the simulation as part of a class assignment and agreed that the data collected in the simulation would be anonymously analyzed. Based on a sample of 81 students who provided full personal information, the average age of subjects was 26, 45% were graduate students and 42% were women.

Results

On the basis of the adaptation measures, for each policy the subjects were grouped into four alternative categories. 1) The policy was completely avoided. 2)

The policy was applied but later completely discarded. 3) The policy was administered, but its application rate declined after reaching a maximum. 4) The policy was applied and its rate was never reduced. This data is presented in table II. The cells in the table marked in yellow indicate the expected choices, assuming subjects maximized utilities.

As can be observed, the majority of subjects failed to choose the optimal strategies. Still, in the case of two of the five policies most subjects increased their utilities to some extent. 71% lowered the rate of maintaining agreements and 69% reduced the use of force. In contrast to these two policies, a majority of 77%, of the subjects refused to demobilize their forces at all. This indicates a strong bias in favor of this policy. In the case of doing nothing, 47% rejected this policy after trying it for more than one simulated day. However, 39% never chose this alternative for more than a simulated day. Therefore it seems there was a strong bias against this policy. Finally, in the case of threats, although nearly every subject administered this policy at least once, 71% of the subjects either completely or partially lost their inclination to apply this policy.

In order to explain the suboptimal choices made by the majority of subjects, the first question that was explored was if analyticity levels are associated with long term preferences (LTPs). An analysis of variance of LTPs as a function of analyticity scores are summarized in table II. As can be observed, more than half of the subjects chose less than five options, and with the exception of using force and doing nothing, there seems to be no significant relationship between the analyticity scores and the average LTPs even if the 3 subjects who chose only two policies are excluded. Yet in both cases the relationship is not negatively linear. Therefore it

seems that analyticity poorly estimates the capability of subjects to improve their utilities.

The next question was if biases in favor of suboptimal policies could be attributed to satisficing. This hypothesis was rejected on the basis of two observations.

First, it appears that after a policy is chosen and dismissed it will usually be applied at least once again. The only policy that was completely abandoned and rarely retried was "doing nothing." This explains the poor association between analyticity and LTPs. Even after subjects became aware of the negative consequences of certain policies they would retry them again. Many of these subjects were still applying previously rejected policies for short periods of time even during the last 10 minutes of the simulation.

A second very telling observation is the analysis of demobilizing forces. According to the satisficing principle the major variable dictating the choice between dispatching patrol boats and calling them back would be the number of patrol boats that were being sent to the disputed region. The larger the number of dispatched boats, the higher the likelihood that subjects would eventually reach the conclusion that the costs are too high and start seeking an alternative strategy. However, as can be observed in figure 1 and table III, this is usually not what happened.

Figure 1 displays box plots of the distributions of the maximum number of patrol boats each subject dispatched as a function of three criteria from table II. The first group includes all the subjects who returned all their patrol boats. The second group consists of subjects who returned at least one patrol boat, but not all of their

patrol boats, and the third group consists of subjects who refused to return any patrol boats that they dispatched. The two subjects who never dispatched any patrol boats are excluded from this analysis.

Table IV provides the results of a general ordered logistic regression predicting the logits of a partial or complete retraction of patrol boats as a function of the maximum number of boats each subject dispatched to the disputed region. As can be observed in this table as well as figure 1, contrary to what might have been expected from the satisficing principle, the subjects who were most likely to call back their patrol boats were actually those who sent very few boats, while subjects who did not return patrol boats included many subjects who dispatched large amounts of patrol boats, despite the high price.

This observation is consistent with previous analyses of Militarized International Disputes (MID) data from 1816-1992. According to Jones et al, (1996) states that display a high level of initial aggression are more likely to escalate than states that restrict the initial level of aggression. However, unlike the observations of the MID data, which do not provide any indication regarding the utility of escalation or avoiding escalation, in this simulation escalation was irrational because it was costlier than de-escalation. This seems to correspond with a normatively biased decision making pattern. Therefore the preference to dispatch patrol boats rather than threats might be because this is a more appropriate reaction to the violation of sovereignty.

If a policy is normatively biased, then it is expected that it would be one of the first policies chosen by a subject. As can be observed in table V, 72% of the subjects mobilized a patrol boat as one of their first two choices, while 58% tried

doing nothing for a single simulated day, 34% threatened the opponent, 22% engaged in an agreement, and only 2% resorted to violence. Although there are no significant correlations between absolute initial preferences and LTPs (data not shown), as illustrated in table VI, which presents correlations between the LTP of each policy and the relative initial preference (RIP) of each policy,[2] it appears that the correlations between the LTP of a policy and its RIP were negative and stronger than correlations with the RIPs of other policies. This indicates that LTPs were established quite early.

Table VI reveals three other significant types of negative correlations. The first two are between the use of force and the mobilization of force. These two correlations occur because use of force required mobilization first. Still, while these correlations are significant, they are relatively weak. The third negative correlation is between the RIP of mobilizing forces and the LTP of signing agreements. While there is no theoretical explanation for this observation, it should be noted that in comparison to the other three policies, there was a relatively weak correlation between the RIP of signing agreements and the LTP of signing agreements. This is because in comparison to the other policies, the portion of subjects who completely abandoned this policy during the last quarter of the simulation was relatively high (meaning the LTP of this policy for this group of subjects was less than 0.75).

The four major policies that subjects could choose from can be ranked according to their degree of cooperative and conflictive behavior. The most amicable action is to sign an agreement. The next least aggressive action is to

[2] Doing nothing was not analyzed because of too many missing values

threaten. A bit more antagonistic action is to mobilize forces, and the highest level of belligerence is to use force. If the RIP serves as a measure of the relative strength of a normative tendency, then this would be reflected in the strength of the correlations between these four RIPs. The further away the normative values of two policies the weaker their correlation. The validity of this assumption is displayed in table VII, which shows in the first three rows correlations between all four RIPs. All correlations that are not of neighboring normative rankings are less than 0.30.

The N for each correlation also serves as an indication of the normative distances between these policies. If N is smaller than 92 (the total sample size) then at least one of the RIPs is missing because this policy was never chosen. It is therefore expected that the wider the normative gap between two policies, the higher the likelihood that one of these policies will be avoided because it was assumed to be too aggressive or too appeasing, and this can be observed in the table. The lowest N is between the two extreme opposites: signing agreements and using force.

The bottom row of table VII is concerned with the proposition that normative biases might be associated with a lower tendency to refer to quantitative data because it is a poor source of normative information (N1). However, the data presented in this row reveals that the only RIP that was positively and significantly associated with the frequency quantitative analyses (QA) of the statistics table was the use of force. Interestingly, this was the only policy that QA was insufficient to evaluate its utility because casualties were not reported in the statistics table.

The lack of an association between normative biases and QA should not necessarily be surprising. While a subject may have a particular bias in favor or against a particular policy, there would still be a need to analyze data related to other

policies that are not normatively biased. Therefore possibly a better indicator of proposition N1 would be to observe if analyticity scores are related to QA. However, there was no significant correlation between the total number of policies that were applied and the tendency to observe the statistics table (data not shown).

While the inclusion of the QA proposition within the normative bias hypothesis remains questionable, lower rates of QA might represent information processing reduction (IPR) and this will be related to suboptimal choices. The relevance of this hypothesis was studied by conducting two types of analyses.

The first is shown in figures 2-5. In each figure box plots representing each of the four adaptation patterns are displayed for one of the four major policies. As can be observed, both the medians and the maximum values of the QA are positively associated with the retraction of agreements, mobilizing forces and use of force, while abandoning threats seems to be negatively associated with the medians and maximum values of the QAs. However, it appears that the distributions around the medians are very large and the minimum values of QAs are very low for all groups. This may explain the results of the second analysis presented in table VIII, which shows that LTPs of signing agreements and mobilizing force are negatively correlated with QA (controlling for RIPs), but not in the cases of threats and using force.

Discussion

This research analyzes decision-making practices in conflicts from a DDM perspective. Although DDM seems to be a relevant theoretical framework for conceiving international interactions, and especially conflicts, it has received very

little attention within the field of international relations and foreign policy analysis. This is most probably because it is very difficult to observe complex dynamic processes with the aid of historical documents, and therefore monitoring people who operate microworld simulators representing international arenas is the only available source of high quality and replicable data.

Still, even if the advantages of relying on data produced in a simulation are accepted, analyzing strategic interactions between conflicting parties requires taking into account certain aspects that have not been addressed in previous DDM research. This is because most of the simulators that have been developed in order to study DDM have been oriented towards managerial problems. However, rather than a dynamic environment representing a mechanistic system such as a market or physical environment, in conflicts decision makers are confronting intelligent actors. Thus, instead of attempting to understand the various components and how they influence each other, decision makers in conflicts attempt to evaluate the policies of their opponent as well as how their opponent judges their own policies. Although this type of analysis is perceived by game theoretic analysts as an exercise in calculating utilities of the contesting actors (Morrow, 1997), DDM requires taking into consideration additional factors that are ignored in most of standard game theoretic interpretations of strategic interaction.

The first issue, which is very central in DDM, is how decision makers learn about the structure of the system that they are confronting and deduce the consequences of their policy choices. In the case of strategic interactions decision makers explore the system by communicating with other actors and observing how they react to their own actions. This issue has been addressed by a number of game

theorists who have proposed an evolutionary model that includes a process of learning based on trial and error. Although subjects might never reach the desired state of equilibrium, at least it should be possible to observe some degree of increasing utilities over time (Farkas, 1996, Mailath, 1998 Erev and Roth, 1998). However, because the DDM perspective perceives systems as dynamic and complex, learning from experience is a bit more complicated.

First, rules of the game are voluntary. Even when the actors agree to adopt a set of rules, any actor can break the rules at any time. In addition many issues remain open and are vaguely defined. In many cases the actors are free to choose when to make a decision and how many different options they can combine together (even if these options seem contradictory), as well as choosing not to make a decision at all.

Another factor that is frequently not accounted for in studies focusing on strategic interactions is that the events occurring in complex systems cannot be equated to a sequence of repeated games. In a complex system, once a decision is made and a policy is launched there might be various time lags until the consequences of the decision unfold (Sterman, 1989). Likewise the effect of policies can vary. Some may have short-term effects while in other instances the system never returns to its previous state. Under such circumstances the decision makers must decide when new developments render the need to make a new decision. In most instances the circumstances of the new decision will not be identical to previous decisions, although there might be considerable resemblance to previous situations (XXX, 2006).

Despite the issues mentioned above, at first glance the results of this experiment partially correspond with the evolutionary model. Over time it is possible to observe that the majority of the subjects who participated in this experiment avoid doing nothing, signing agreements and using force. The only anomaly is the preference of mobilizing forces rather than applying threats. Still, the data collected in this experiment reveal that most subjects do not adequately explore all options, and even among those who do explore all options, this does not necessarily indicate that they perform any better than those who do not. This incongruity could be explained with the aid of the satisficing principle. Signing agreements and using force were relatively costly policies and therefore they were usually unsatisfactory. In comparison, the costs of sending patrol boats were very low. The price of dispatching a patrol boat was in fact lower than the increase in fishing income and therefore the net outcome of this policy was positive.

However, the satisficing hypothesis was rejected on the basis of two observations. First, contrary to what might have been expected, increasing the number of patrol boats is inversely related to the tendency to recall the boats, despite the rising security costs. Hence, it seems that those subjects who were dissatisfied with this policy were from the very beginning reluctant to dispatch patrol boats. The second finding that does not correspond with satisficing is that after rejecting a policy most subjects tend retry and discard it again at least once.

The two observations above are consistent with the hypothesis that normative biases impede utilitarian adjustments during conflicts. This hypothesis is supported by another significant observation, and this is that subjects are usually reluctant to abandon policies that are chosen very early during the simulation. Thus, even after

subjects realized the high costs of policies they normatively favored, they would usually retry the policy again. On the other hand, when a policy was normatively disfavored they were usually very sensitive to the costs associated with this policy and discarded it very quickly.

The possibility that normative biases play a role in the escalation of violence and the perpetuation of conflicts is well known. Possibly the most conspicuous conflictive social convention is the reciprocation of violence with counter violence, and there are many historical examples where the desire to retaliate has been quite destructive (XXX, 2005). The major problem, however, with the study of normative biases is that it is not always obvious if they are functional or dysfunctional, and this is a major advantage of this experiment. Because the subjects were running a preprogrammed simulator, it was possible to demonstrate that despite the negative consequences associated with the mobilization of forces the majority of subjects continued to reducing their utilities in order to abide by this convention, and possibly other conventions can be discovered in the future in a similar manner.

The final type of decision making practice observed in this study that can explain the failure of decision makers to learn from experience and continue pursuing suboptimal policies that fuel conflicts is the tendency to disregard complicated formats of information that require making a mental effort to analyze the data. This proposition was studied by counting the number of times subjects observed their statistic tables. Subjects who rarely observed the statistics tables evaluated their policies mainly on the basis of the opponent's behavior reported in text messages, while subjects who frequently observed the statistics table could discover additional costs and benefits. However, although some subjects observed

their statistics tables quite frequently, it seems that this in itself was not sufficient. Apparently there were many subjects who did not properly analyze their statistics and therefore the relationship between the frequency of statistics observations and optimizing policies was weak.

The weak relationship between the number of statistical observations and the capability to correctly analyze the effectiveness of alternative policies is consistent with the information processing reduction hypothesis. In the case of this simulation, observing the effects of agreements or using force required less of an effort than calculating the costs and benefits associated with mobilizing forces and sending threats. This is because using force did not necessarily require observing the statistics table and the impact of signing an agreement was easily visible because the loss of fishing revenues associated with this policy was very dramatic. However, estimating the costs and benefits of dispatching patrol boats and threatening the opponent demanded a more careful analysis of the data, and therefore a higher percentage of subjects failed to adequately recognize the effects of these two policies.

The question of reducing information processing has not been adequately studied in the case of international conflicts, and so this finding suggests this heuristic deserves more attention. Usually misperceptions are attributed to other types of cognitive failures (for examples see Stein, 1988; Kanwisher, 1989). This issue was raised a few years ago in Borum et al. (2004) who suggested that over-reliance on simple psychological assumptions rather than analyzing patterns of behavior have led to misleading conclusions regarding terrorism. To a great extent, even though many government agencies create databases with vast amounts of data,

they are never adequately analyzed. In the case of environments that are continually changing and the relationships between the components are highly complex, reliance on advanced methods of data analysis are a necessity. In this respect, due to the refusal of many governmental organizations involved in security and foreign affairs to adequately analyze data, it should not be surprising that decision makers fail to recognize indications of rising threats or to learn from their previous experiences.

It should be emphasized that the decision-making practices discovered in this research project tell us only part of the story. Most probably more decision making procedures and heuristics can be found. Yet, in addition to discovering how decisions are made in conflicts, an effort should be made in order to reveal when certain procedures and heuristics are more influential than others. In addition, not all people adopt each decision-making procedure, and therefore these experiments indicate what to look for when observing people engaged in conflicts in order to explain suboptimal choices.

Besides revealing common decision-making practices, the microworld simulator used in this research can be applied for conducting more advanced forms of research. With the aid of this simulator it is possible to manipulate various features of complexity and discover their precise effects on decision makers. Thus for example Sterman (1989) illustrated the effect of time delays between executing a policy observing its consequences. Another aspect of DDM is the informational media that is used by decision makers. Kleinmuntz and Schkade (1993) have attempted to evaluate alternative formats for displaying data in order to observe how this affects policy choices.

Finally, simulators of this type can also be used for evaluating the effectiveness of various techniques for making strategic decisions or mediation in conflicts. Hence rather than merely studying how decision makers cope with the complexity of conflicts, it is possible to improve decision makers' capabilities to disentangle the conflicts' complexities by devising new decision making practices and evaluating their effectiveness with the aid of the simulator.

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Table I: Subject's policy options, computer responses and payoffs

Subject's policy	Computer response	Costs and benefits
Do nothing	Do nothing	None
Propose an agreement	Agree to sign agreement	50% loss of fishing yields per day
Cancel agreement	Agreement canceled	Yields return to pre-agreement level
Threat	Threat	+10% on same day
Dispatch patrol boat	Dispatch patrol boat	-$1000 per day + 10% on same day
Return patrol boat	Return patrol boat	+$1000 every day + $8333 on same day
Open fire (if patrol boat dispatched)	Open fire	50% probability of casualties on same day + 10% on same day

Table II: Distribution of subject's adaptation patterns over time

	Threats	Agree-ments	Patrol Boats	Attacks	Do Nothing
Never applied	2.2%	5.4%	2.2%	8.7%	39.1%
Complete retraction	22.8%	42.4%	5.4%	31.5%	46.7%
Partial retraction	47.8%	22.8%	15.2%	30.4%	3.3%
Never retracted	27.2%	29.3%	77.2%	29.3%	10.9%

Table III: Subject's long term policy preferences as a function of analyticity levels (number of different policies that were tried)

Long Term Preference (dependent)	Analyticity (independent)	N	Mean	Standard Deviation	F-test All Preferences	F-test At Least 3 Preferences
Threats	2	3	0.01	0.02	2.9* (one way)	1.0 (one way)
	3	10	0.23	0.23		
	4	38	0.32	0.20		1.5 (linear)
	5	41	0.34	0.19	6.0* (linear)	
Agreements	2	3	0.40	0.50	0.6 (one way)	1.0 (one way)
	3	10	0.34	0.38		
	4	38	0.49	0.29		0.1 (linear)
	5	41	0.44	0.29	0.1 (linear)	
Patrol Boats	2	3	0.41	0.46	4.6** (one way)	1.6 (one way)
	3	10	0.79	0.36		
	4	38	0.90	0.16		0.2 (linear)
	5	41	0.83	0.23	2.0 (linear)	
Attacks	2	3	0.00	0.00	4.8** (one way)	4.7** (one way)
	3	10	0.10	0.12		
	4	38	0.31	0.22		
	5	41	0.24	0.20	3.2 (linear)	0.6 (linear)
Do Nothing	2	3	0.35	0.52	4.2** (one way)	3.3* (one way)
	3	10	0.13	0.29		
	4	38	0.03	0.06		
	5	41	0.10	0.16	1.1 (linear)	0.2 (linear)

*$p < 0.05$ **$p < 0.01$

Table IV: Relationship between returning patrol boats and maximum number of patrol boats dispatched (General Ordinal Logistic Regression)

Degree of retraction	Parameters	β	Std. Error	Wald
Partial	Intercept	1.117	0.418	7.130**
	Max Boats	-0.077	0.033	5.580*
Complete	Intercept	1.139	0.779	2.139
	Max Boats	-0.463	0.173	7.146**

*$p < 0.05$ **$p < 0.01$

Table V: Distribution of subjects' first two policy choices

Choice #1	Choice #2
Do Nothing 56.5% (n =52)	Agree to share fishing area 19.6% (n=18)
	Issue a threat 2.2% (n=2)
	Dispatch patrol boat 34.8% (n=32)
Agree to share fishing area 6.5% (n=6)	Dispatch patrol boat 6.5% (n=6)
Issue a threat 5.4% (n=3)	Dispatch patrol boat 5.4% (n=3)
Dispatch patrol boat 34.7% (n=31)	Do nothing 1.1% (n=1)
	Sign an agreement 2.2% (n=2)
	Issue a threat 28.3% (n=26)
	Attack foreign patrol boat 2.2% (n=2)

Table VI: Bivariate correlations between relative initial preferences and long term preferences of the four major policies.

	Long Term Agreements	Long Term Threats	Long Term Patrol Boats	Long Term Attacks	N
Rel. Initial Agreement	-0.23* (	-0.16	0.07	.019	8
Rel. Initial Threat	-0.21	-0.35**	-0.19	-0.16	9
Rel. Initial Mobilization of Force	-0.21*	-0.14	-0.60**	-0.27**	9
Rel. Initial Use of Force	-0.08	-0.12	-0.29**	-0.47**	8

*p < 0.05 **p < 0.01

Table VII: Bivariate correlations between the relative initial preferences of the four major policy options and quantitative analysis

	Agree-ments	Threats	Mobilizing Force	Use of Force
Threats	.35** (85)			
Mobilizing Forces	0.02 (85)	0.30** (89)		
Use of Force	-0.08 (79)	0.24* (84)	0.44** (84)	
Quant. Analysis	-0.16 (87)	0.08 (90)	0.16 (90)	0.42** (84)

*p < 0.05 **p < 0.01
N within parentheses

Table VIII: Partial Correlations between long term preferences and statistics observations (controlled for its relative initial preference times)

	Long Term Agreements	Long Term Threats	Long Term Patrol Boats	Long Term Attacks
Rel. Initial action	-0.44**	-0.35**	-0.57**	-0.49**
Statistics	-0.30**	-0.07	-0.21*	-0.03
F	13.4**	6.5**	30.1**	11.9**
N	87	90	90	84

*p < 0.05 **p < 0.01

Figure 1: Box plots illustrating the relationship between the maximum number of patrol boats that were dispatched and patterns of mobilizing forces

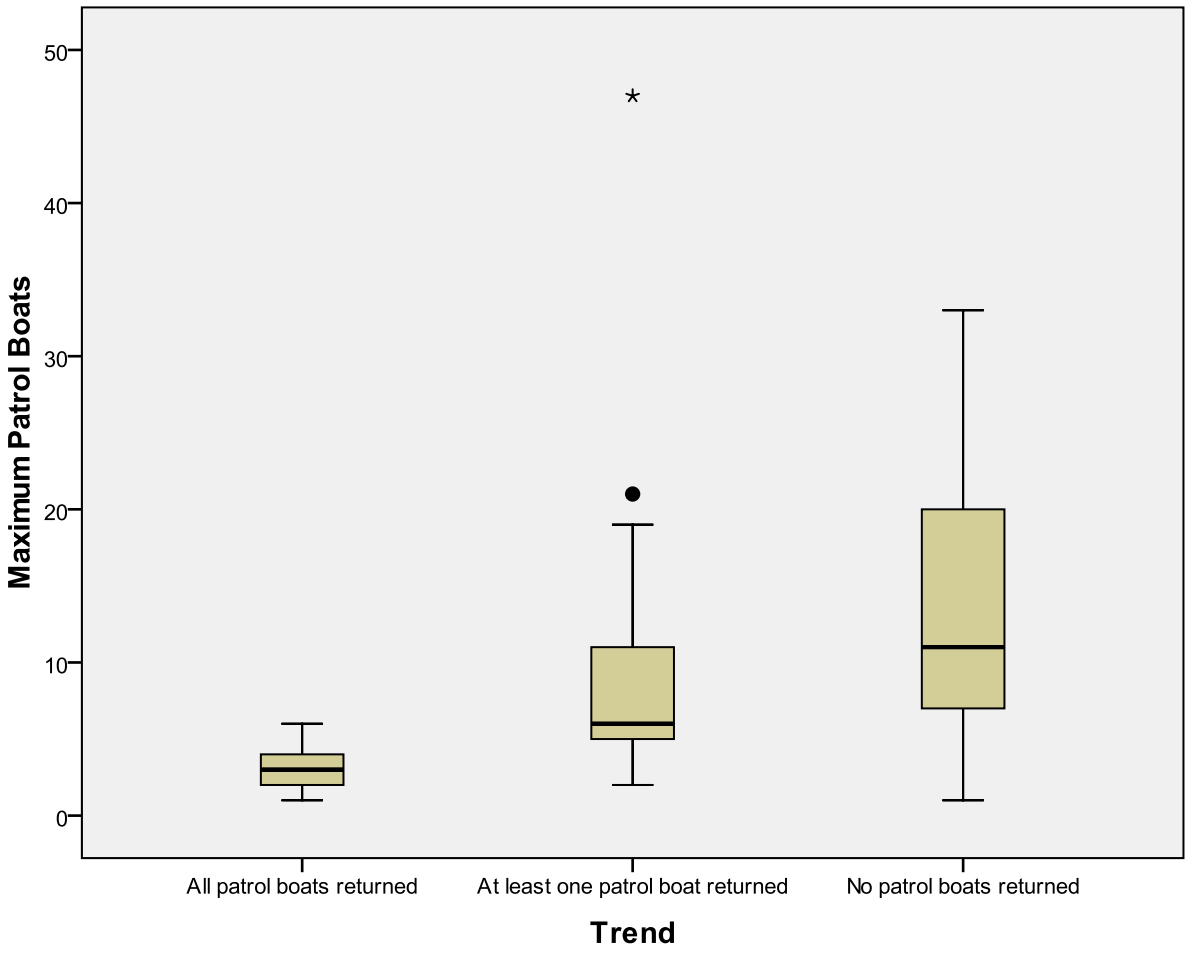

Figure 2: Box plots illustrating the relationship adaptation patterns of engaging in agreements and subjects' quantitative analysis levels

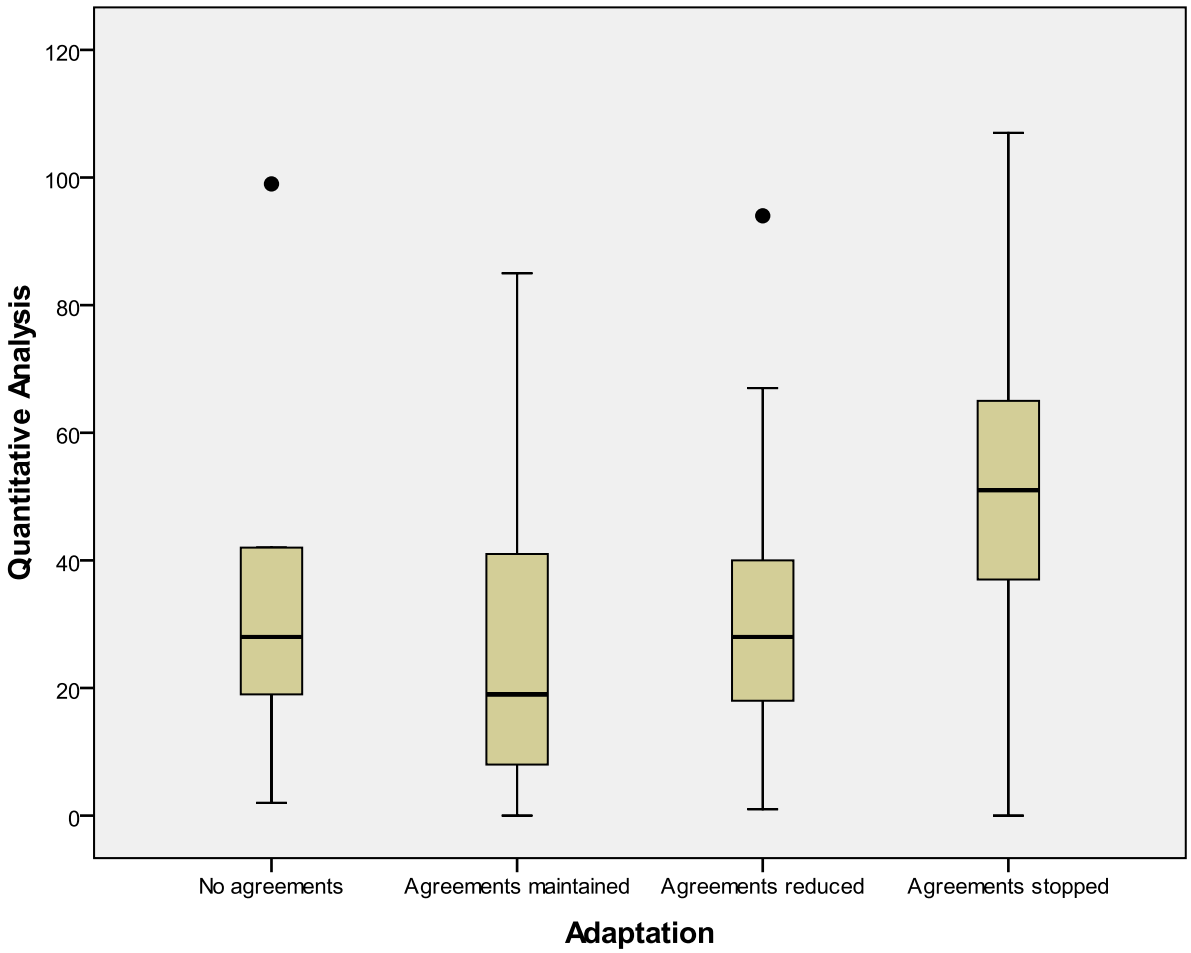

Figure 3: Box plots illustrating the relationship adaptation patterns of issuing threats and subjects' quantitative analysis levels

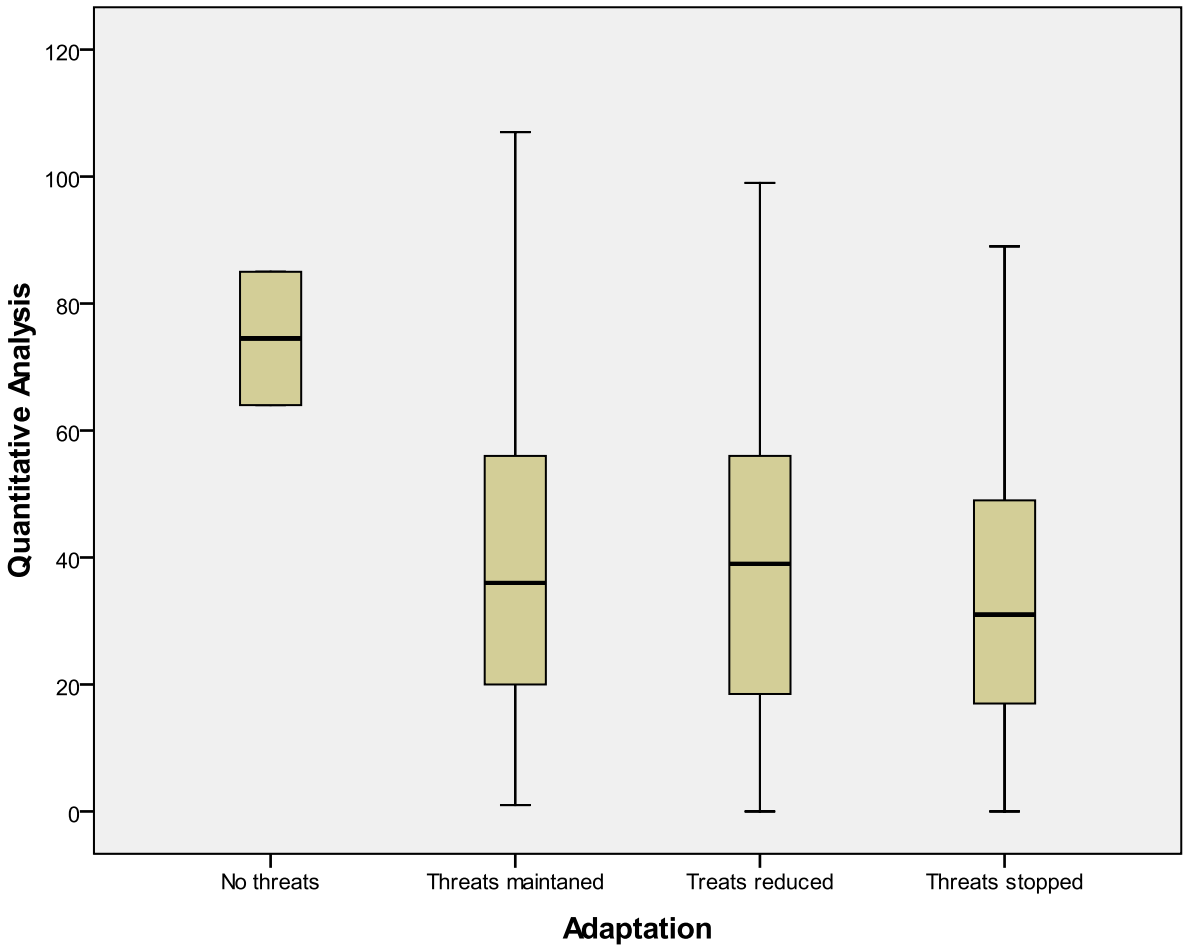

Figure 4: Box plots illustrating the relationship adaptation patterns of mobilizing forces and subjects' quantitative analysis levels

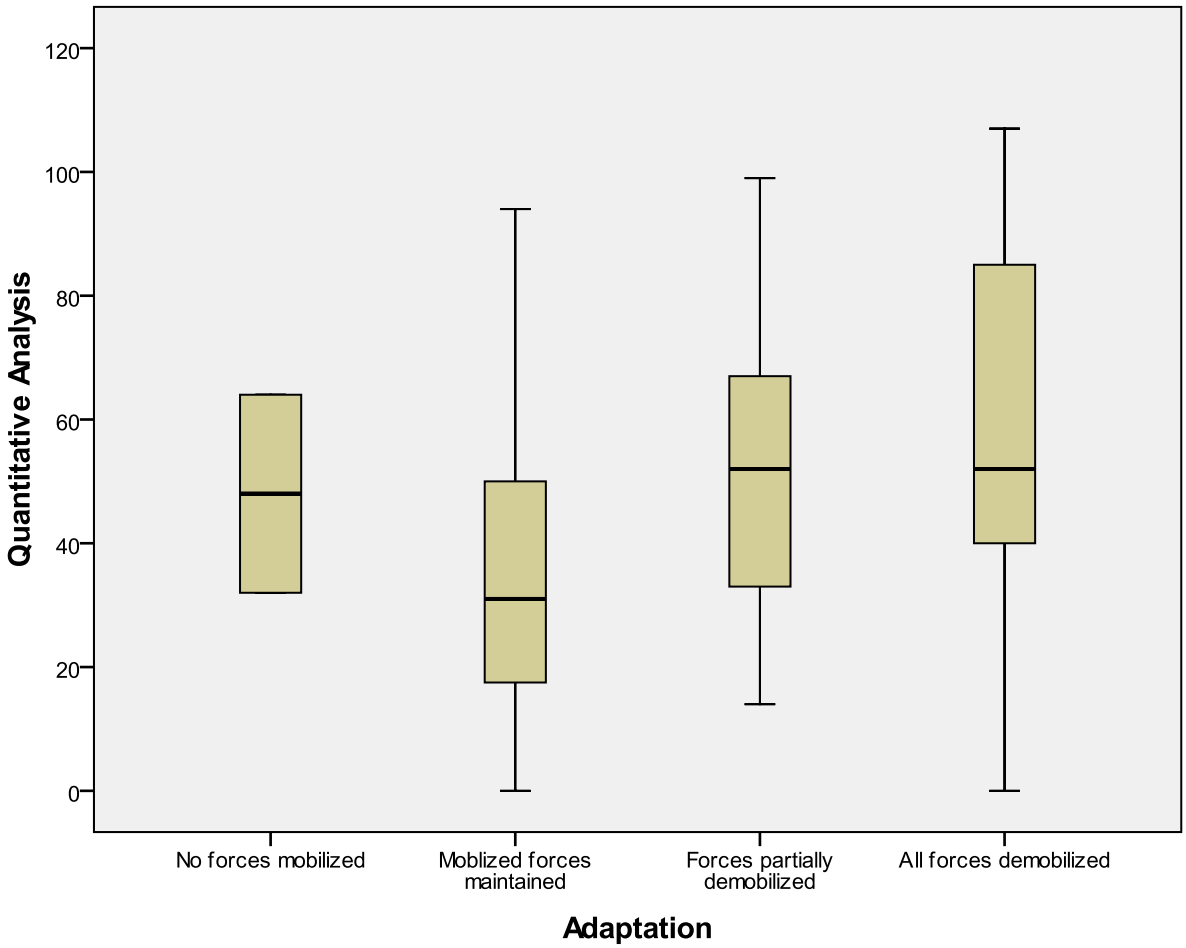

Figure 5: Box plots illustrating the relationship adaptation patterns of using force and subject's quantitative analysis levels