Threats to Peace: Threat Perception and the Persistence or Desistence of Violent Conflict

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Abstract. In international security, there are many cases of inter-group conflict where violence persists and conflict-oriented policies dominate at the expense of a more mutually beneficial allocation of societal goods. What are the barriers to successful negotiation in such scenarios, and why are conflict management policies difficult to achieve? Most studies of conflict focus on high-level political, economic, or sociological causes; however, psychological influences on decision-making, such as threat and personal motivation, play a large role in impeding conflict resolution or negotiation. In this paper, we analyze the psychological dynamics of threat perception and vested interests on the persistence or desistence of conflict. Threat perception can cause sudden and dramatic shifts in opinion and political choices, an effect which can be further amplified by media reporting. Leaders with a vested personal interest in continued conflict---"spoilers"---can manipulate this phenomenon to derail a peace process. We present a dynamic game theoretic framework of parallel inter-group negotiation and conflict models that incorporates this feedback between threat perception, motivations, leadership decisions, and the success of negotiations, explicitly representing the psychological components of conflict. A prototype implementation is used in empirical simulations to identify cases of conflict persistence and desistence.

1 Introduction

Persistent inter-group conflict poses a major international security challenge. An enduring issue is how to facilitate negotiation in sustained conflict; what are the forces working against conflict resolution, especially when such a solution would produce long-term, mutually beneficial outcomes? In this paper, we explore the impact of threat perception and vested interests on possible negotiation. Through dynamic game theoretic modeling, we develop a better understanding how inter-group perceptions of threat impact the persistence or desistence of conflict.

An extensive empirical literature exists examining the political, structural, and economic factors associated with inter-group conflict---some of which also use game theoretic models---

providing insight into potential causes (see [1-3]). However, uncertainty remains regarding barriers to the $desistence$ of conflict. To address this issue, we focus on the psychological dynamics of conflict, rather than high-level explanations. Unlike high-level factors, psychological dynamics can change abruptly, leading to knee-jerk political decisions. In such cases, $perceived\ threat$ can be a dominant factor potentially impeding progress towards peace. Threat has been acknowledged as influential in decision making[4-6]. While research indicates that political attitudes remain stable over time[7-9], there are circumstances where segments of the public will abruptly alter their opinions, such as when experiencing feelings of disgust or fear[10] or a heightened sense of mortality due to threats from outside groups[11-13]. Through media framing of events, this sense of threat can be further amplified in a population[15]. The psychological volatility induced by threat perception may increase popular support for military action or increased surveillance[6] and lead to greater intolerance, xenophobia, or prejudice[14,6]. The ability of threat perception to rapidly shift public attitudes toward conflict can constrain leaders from engaging in negotiations[15]. The internal motivations of leaders also impact the likelihood of peace. There are some leaders with a vested interest in the conflict status quo. Due to the potential impact of threat perception, such leaders may manipulate these psychological responses to derail a peace process. According to Stedman, the greatest risk to ending civil war comes from ``spoilers"---``leaders and parties who believe that peace...threatens their power, worldview, and interests, and use violence to undermine attempts to achieve it"[16] (see also [17]). Actual or perceived threats may be used not only by fringe groups or terrorists, but also by mainstream leaders[16] with a commitment to continued conflict.

We present a new model to investigate threat perception and leadership motivation, extending models of conflict persistence[18,19] to include negotiation events that may lead to desistence. Much of the prior work on conflict resolution has looked at higher-level sociological factors, such as intra-group cohesion[20], third-party intervention[21], and culture[22]. Several studies in autonomous agents have developed heuristics for the psychological and bargaining aspects of negotiation[23-25]. We explicitly model the psychological effects of threat on the public and leadership, assuming that many higher-level factors are captured as exogenous influences to threat perception and commitment to conflict.

In the remainder of this paper, we present a game theoretic model for negotiation dynamics in inter-group conflict (Section 2). We describe an implementation of this model in Section 3,and Section 4 concludes and discusses future work.

2 Modeling Negotiation Events in Persistent Conflict

To model negotiation in situations of sustained inter-group conflict, we present a discrete dynamical game theoretic system that incorporates the psychological dynamics of decision making under threat, encoded within a set of utility functions. These factors are represented along three dimensions: (1) threat perception, (2) vested interest, and (3) perceived success. Threat perception captures the reaction of the public and leadership to external shock, such as conflict or negotiation, and has an immediate impact on decisions. Vested interest is a leader's internal motivation to continue a conflict. Finally, perception of the success of prior policies and access to resources impact the decision to negotiate.

This framework approximates a two-level game, representing both leadership and public behaviors[26]. The public acts implicitly through reactions to perceived threats and support of negotiation- or conflict-oriented leaders. Public threat perception can be amplified through media reports, social media, etc. This effect is modeled as an endogenous factor A called the $amplification\ constant$.

The primary actors are the leaders of groups involved in the conflict. Let $\mathcal{G}$ be the set of groups. Leaders can be divided into two categories: (1) mainline and (2) fringe. Mainline leaders control the dominant portion of a group with greater access to resources. These subgroups often act as a coalition, but also compete for resources and public support. $\mathcal{L} = \bigcup_{G_i \in \mathcal{G}} G_i$ is the set of all leaders.

The model tracks events over time, where $\tau = \{t_1, ..., t_{max}\}$ is the set of discrete time points s.t. t_{max} represents a user-defined ending time point.

Definition 1 (Event). An $event$ is a tuple $E = (O, I, S, t_s, t_e)$ where $O, I, S \in [0, 1]$ and $t_s, t_e \in \tau$. $O, I, and\ S$ denote the probability of occurrence, intensity, and success, respectively, t_s is the start time, and t_e is the end time of the event.

Events contain probabilities of $occurence$ (will it be initiated), $intensity$ (the severity), and $success$ (will it be perceived as successful). For negotiations, we assume a global weight W on the probability of perceived success s.t. $S = W * S$; this captures exogenous factors that may reduce the success of negotiations. Events also have a duration $[t_s, t_e]$. For negotiations, t_s is the time the event was initiated, and t_e the time it occurred. This reflects the coordination required for negotiation; leaders may react differently to the impending date. Conflict events are taken unilaterally at a discrete time point (i.e., $t_s = t_e$).

Using events, we can define the conflict level, a measure of the intensity of the conflict over time. The goal of this model is to identify conditions for the desistence of conflict, i.e., that produce a low overall conflict level.

Definition 2 (Conflict Level). For a set $\mathcal{L}$ of leaders, the $conflict\ level\ C$ at time $t \in \tau$ is defined as

$$C = \sum_{L_j \in \mathcal{L}} \sum_{t-d}^{t} e(L_j, t) * I_t \tag{1}$$

such that $0 \leq d \leq t$, I_t is the intensity of event E_t that occurs at time t, and $e(L_j, t) : \mathcal{L} \times \mathbb{Z} \rightarrow \{0, 1\}$ is an indicator function

$$\mathrm{e(L}_j, t) = \begin{cases} 1 & L_j \in \mathcal{L}\ initiated\ a\ conflict\ event\ at\ time\ t \\ 0 & otherwise \end{cases}$$

The discount factor d allows users to more heavily weight recent events, ignoring those events that occurred in the distant past.

2.1 Psychological Dynamics and the Utility of Negotiation

At each time t a utility over perceived threat, vested interest, and perceived success is assigned to each participant and determines the probability of initiating a negotiation or conflict event. The following definitions formalize these concepts.

Definition 3 (Perceived Threat of an Event). Given a set of groups $\mathcal{G}$ and a negotiation event and conflict event $n = (O, I, S, t_s, t_e)$ and $c = (O', I', S', t'_s, t'_e)$, respectively, the *perceived threat of the event* at time t is defined as

$$TN(t, t_e, I) = \begin{cases} (I - C)e^{(t-t_e)} & t_s \leq t \leq t_e, \text{ and } 0 < C \text{ is a constant} \\ 0 & otherwise \end{cases} \tag{2}$$

$$TC_i(t, t'_e, I') = (t - t'_e) * e^{(I-C_i)*(t-t_e)} \quad \forall G_i \in \text{ s.t. } 0 < C_i \text{ is a constant} \tag{3}$$

Perceived threat is an exponential function, where some shock---a negotiation or attack---produces a jolt that can impact decisions. For negotiation, the influence of an event increases date t_e grows closer. When conflict occurs, there is an immediate spike in perceived threat which dissipates over time. Conflict has the same effect within a group; negotiation has the same effect across groups. Total perceived threat for a group G_i is a summation over all TC_i up to time t.

Definition 4 (Public Threat Perception) For groups $\mathcal{G} = \{G_1, ..., G_k\}$, perceived threats TN and $\{TC_1, ..., TC_k\}$ w.r.t. negotiation and conflict events $n = (O, I, S, t_s, t_e)$ and $c = (O', I', S', t'_s, t'_e)$, respectively, and the amplification constant A, *public threat perception* is defined as

$$Q(t) = A * TN(t, t_e, I) \tag{4}$$

$$\mathrm{P}_i(t) = A * TC_i(t, t'_e, I') \quad \forall G_i \in \mathcal{G} \tag{5}$$

Threat may also indirectly be used by leaders to manipulate the public; likewise, public support for peace or conflict can influence the behavior of political leaders. The perceived threat of an event can be amplified by media according to the amplification constant A when transmitted to the broader public.

The decision of whether to engage in a peace process or not is also influenced by a leader's internal motivations and previous commitment to conflict strategies.

Definition 5 (Vested Interest). Let $\mathcal{G} = \{G_1, ..., G_k\}$ be a set of groups, $\{P_1(t), ..., P_k(t)\}$ and $Q(t)$ be the public threat perception, and $0 < C$ be a constant. The $vested\ interest$ of leader $L_j \in G_i$ at time t is given by

$$V_{i,j}(0) \in [-1, 1] \tag{6}$$

$$V_{i,j}(t) = \frac{2}{1 + e^{-C * \chi_{i,j}(t)}} - 1 \qquad \text{where} \tag{7}$$

$$\chi_{i,j}(t) = \chi_{i,j}(t-1) + (P_i(t) - P_i(t-1)) + \delta(V_{i,j}(t-1))(Q(t) - Q(t-1)) + V_{i,j}(t-1) + e(L_{i,j}, t) - F$$

such that F is a constant and $\delta : [-1, 1] \to \{-1, 1\}$ is an indicator function

$$\delta(V(t)) = \begin{cases} -1 & V(t) < 0 \\ 1 & V(t) \geq 0 \end{cases}$$

and $e(L_{i,j}, t)$ is the same function given in Definition 2.

Vested interest in conflict is a sigmoid function from -1 to 1, where 1 is complete commitment to conflict and -1 is complete commitment to no conflict. Leaders with a $V_{i,j}$ near 0 are prone to drastic changes in their preferences and are very sensitive to both negotiation and conflict. Vested interest increases when a leader perpetrates conflict events, but slowly declines over time.

The δ function in Definition 5 accounts for different responses to the peace process. Leaders who favor negotiation exhibit a decrease in vested interest as the event approaches. Leaders with high vested interest, perceive the same event as an increased threat, further cementing their commitment to conflict.

The success of negotiation events is captured as a sudden impact to a leader's vested interest. This $negotiation\ effect$ depends on perceived threats throughout the event's duration and its perceived success. If a negotiation is successful, the drop in the conflict level can lead to an overall decrease in vested interest.

Definition 6 (Negotiation Effect). Given a set of groups $\mathcal{G} = \{G_1, ..., G_k\}$, public perceived threats $\{P_1(t), ..., P_k(t)\}$, a negotiation event $n = (O, I, S, t_s, t_e)$, and a negotiation weight W, the $negotiation\ effect$ on vested interest $V_{i,j}$ for each leader $L_j \in G_i$ at time t is given by

$$V_{i,j}(t) = \begin{cases} V_{i,j}(t) - W * S & if\ t = t_e \\ V_{i,j}(t) & otherwise \end{cases} \tag{8}$$

where $S = \dfrac{1}{1 + \sum_{i=1}^{k} P_i(t)}$

The last dimension, perceived success, captures a group's historical strategic success and capacity (i.e., resources) for conflict. We denote perceived success at time t as $S_i(t)$ for group $G_i \in \mathcal{G}$ using the same definition as[19]. Combining all of these psychological factors over time, we can model the utility of negotiation and conflict for each leader.

Definition 7 (Conflict Utility Function). Given a set of groups $\mathcal{G}$, a $utility\ function$ $U_{i,j}(P_i(t), V_{i,j}(t), S_i(t))$ for a leader $L_j \in G_i \in \mathcal{G}$ is a mapping

$$U_{i,j} : \mathbb{R} \times \mathbb{R} \times \mathbb{R} \rightarrow [0, 1]$$

This utility function provides a probability of choosing conflict over negotiation; a *strategy* for each leader is this probability over events.

3 Implementation and Experimentation

Using this dynamic modeling framework, we have implemented a prototype simulation system consisting of about 1,500 lines of MATLAB code. An empirical simulation was run using two groups, each with a single mainline and fringe leader. For each simulation run $t_{max} = 10,000$, indicating 10,000 days. On each day, the psychological behavioral factors were computed to determine each leader's strategy. from a 3-dimensional utility matrix indicating the probability of an attack. Negotiation events were generated from a probability distribution s.t. if the total conflict was below 0.02, there was a 0.25 probability of negotiation. We varied (i) the amplification $A = \{0.1, 1, 10\}$ to indicate low, medium, and high levels, (ii) the weight of negotiation success probability $W = \{0.08, 0.1, 0.12\}$, and (iii) the initial vested interest of all leaders $V_{i,j}(0) = [-0.9, 0.9]$. These simulations were run on 5 nodes of a Linux cluster with a combined 56 cores and 240 GB RAM. At least 10 runs were completed for each parameter setting.

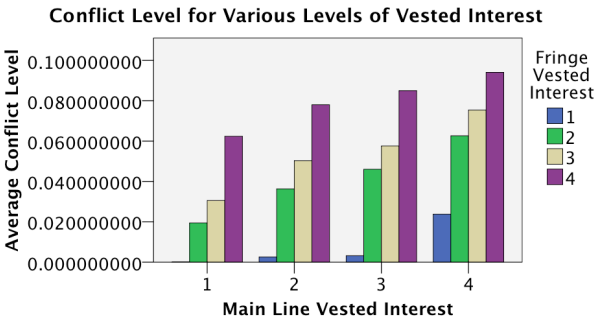

Fig. 1. Conflict level with spoiler effect.

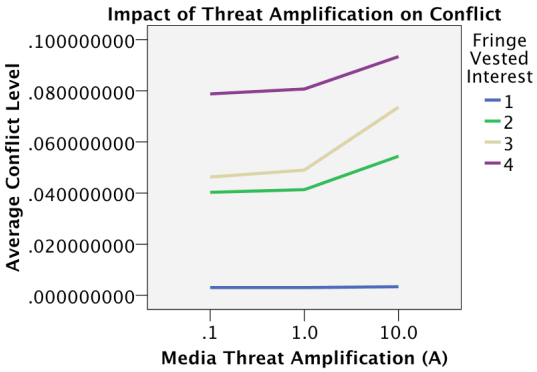

Fig. 2. Conflict level with increasing threat amplification.

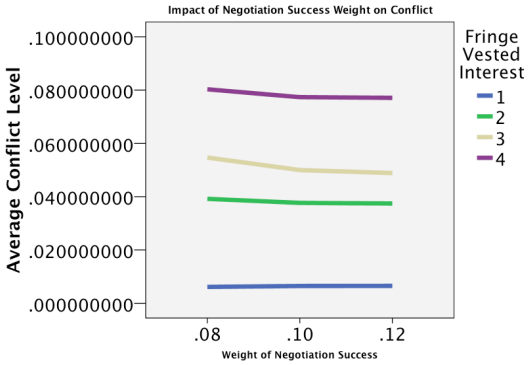

Fig. 3. Conflict level with increasing negotiation success.

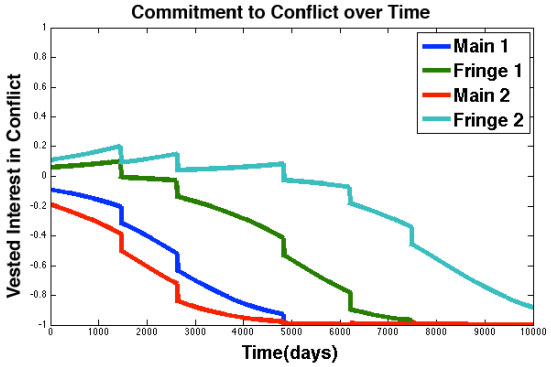

Fig. 4. Desistence of conflict.

Across all values of media amplification and negotiation success, we can observe a very clear spoiler effect, where fringe groups with commitment to conflict above 0 are able to cause high levels of sustained conflict, regardless of the vested interest of mainline leaders. This result is shown in Figure 1, where \$1\$, \$2\$, \$3\$, and \$4\$ are used to categorize vested interest where both groups are committed to no conflict, only one leans toward conflict, one is neutral and the other prefers conflict, and both groups are committed to conflict. Because fringe leaders are driving the conflict level, we examine the impact of threat amplification (Figure 2) and negotiation success (Figure 3) on the conflict level seen for these combinations of fringe vested interest where mainline commitment is category 3. In both cases, the effect is strongest when one group is committed to conflict while the other is neutral; increasing threat amplification is able to push these leaders into more violent conflict, while greater negotiation success is able to mitigate the conflict. Figure 4 illustrates the desistence of conflict over time as vested interest declines due to negotiation success (i.e., $W = 0.12$) when amplification is low ($A = 0.1$); however, at higher amplification levels, increased threat perception prevents negotiation and leads to conflict persistence.

4 Conclusions

We have presented a game theoretic framework of parallel inter-group negotiation and conflict models that incorporates the feedback between threat perception---as amplified by media---leadership decisions, and conflict. This novel approach explicitly represents the psychological dynamics of conflict, rather than the traditional focus on high-level structural factors. Through empirical model simulations, we identified cases that lead to either persistence or desistence of conflict. This model can provide an analytical tool for identifying potential policy interventions to prevent situations of high threat from tipping over into violent conflict, such as mitigating threat perception or incentivizing possible spoilers.

However, much work is still required to adequately understand the dynamics, including development of a more robust model of perceived success that considers individual leader's reactions to negotiation events and subsequent shifts in available resources; empirically calibrating the parameters (i.e., the amplification and negotiation impact, which were estimated by domain experts), from real-world data regarding conflicts; and expanding the model to investigate long-term policy implications of the persistence or desistence of conflict and the allocation of societal goods by utilizing government budget and macro-economic data.

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