

## Abstract

Do conflict events lead to distinct network patterns or motifs? Can we identify conflict constellations before they become conflict supernovae? Conflict early warning research has rarely, if ever, integrated social network theory and events-data analysis to study interaction patterns between more than two adversarial agents. This research draws on recent developments in network science to analyze network interaction and reciprocity patterns between multiple agents in Afghanistan prior to high levels of conflict and cooperation.

These agents, e.g., government, civil society, military, armed civilian groups, ethnic groups, religious groups, political opposition groups, paramilitary groups, peacekeeping forces, insurgents, and police form the vertices of the network while acts of conflict or cooperation performed by one group and directed at another form the directed edges in this network. Furthermore, since the data is not a snapshot of the network in time, but in-fact contains data regarding the specific day events (edges) between groups (nodes) occurred during the years 1990 to 2004, we analyze the dynamics of this network over time. This requires going beyond the simple tools often used in the study of networks such as reciprocity-a very simple measure when looking at a static network, but complicated with the introduction of different types of edges (conflict versus cooperation) and the dynamics of time. We therefore extend on previous work on the interaction of adversarial groups, such as Tit for Tat, to account for an adversarial multi-agent dynamic network

**Patrick Meier and Elizabeth Leicht (c) 2006 // Please do \*not\* circulate without permission. Abstract/plots embargoed through September 1, 2006. Contact: [patrick.meier@tufts.edu](mailto:patrick.meier@tufts.edu) at The Fletcher School, Tufts University.**

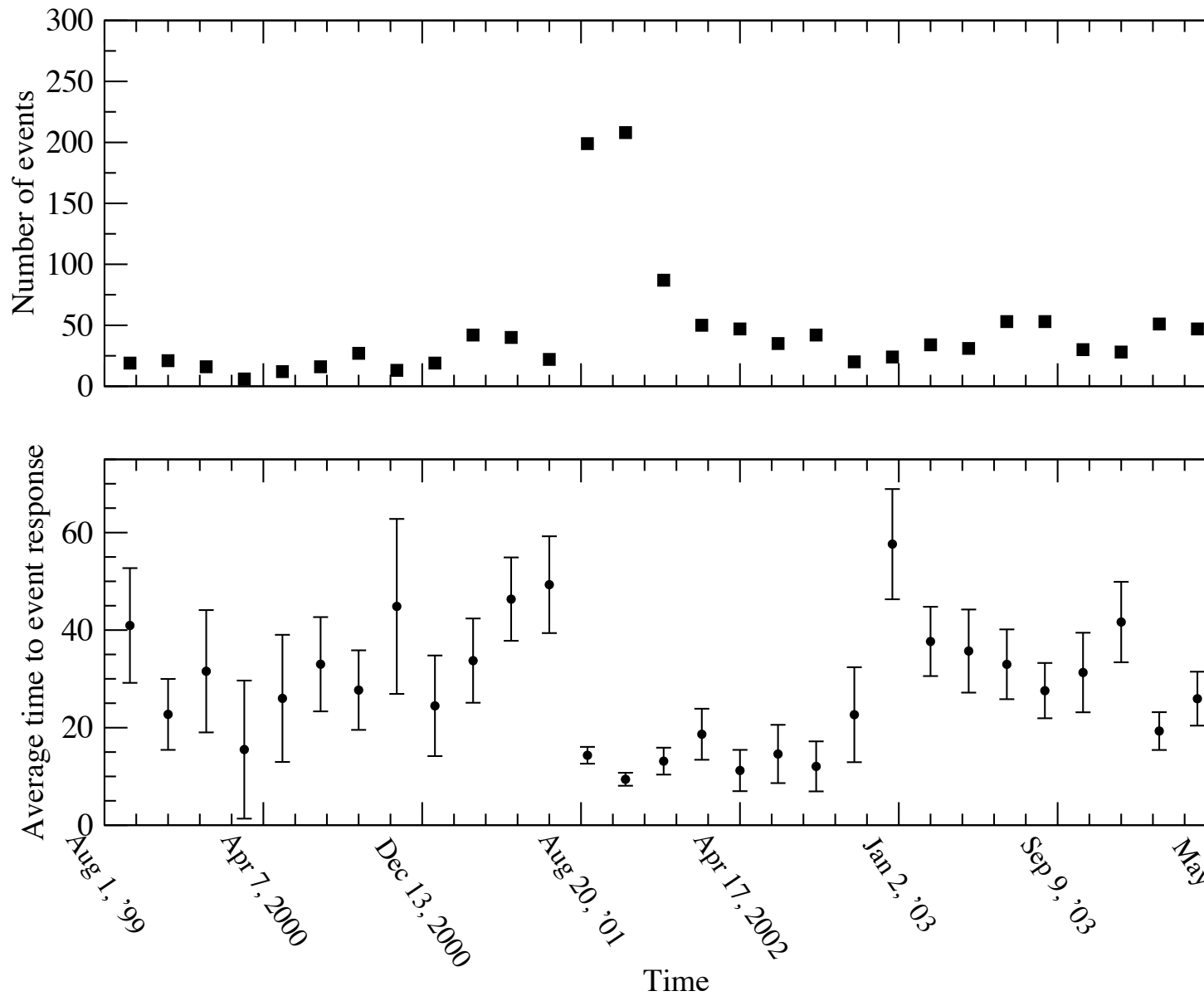


FIG. 1: The average time between reciprocal conflict events appears to be inversely related to the frequency of conflict events. After September 11th, the response time between conflict events shortens dramatically. Fluctuations in the standard deviation may be an early warning indicator of conflict escalation.

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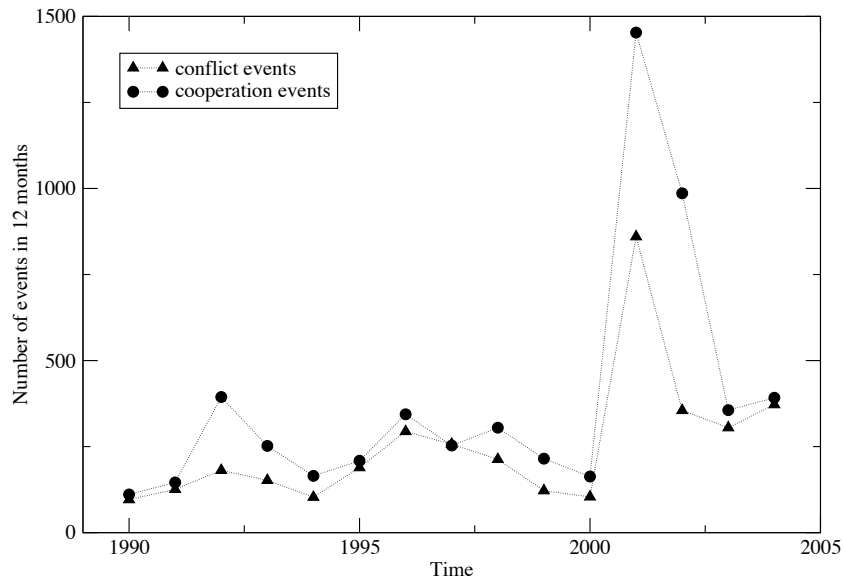


FIG. 2: Conflict and cooperation events appear to be directly related. The fierce battle over Kabul between warring factions in 1992 explains the corresponding spike in conflict events. The spike in 1996 reflects the Taliban’s consolidation of power in Afghanistan. Conflict and cooperation events decrease steadily between 1998 and 2001. The trough in conflict and cooperation events in 2000 is likely due to a series of natural disasters. Indeed, the year 2000 saw major droughts, locusts devastating crops, famine, outbreaks of disease and a 5.6 magnitude earthquake.

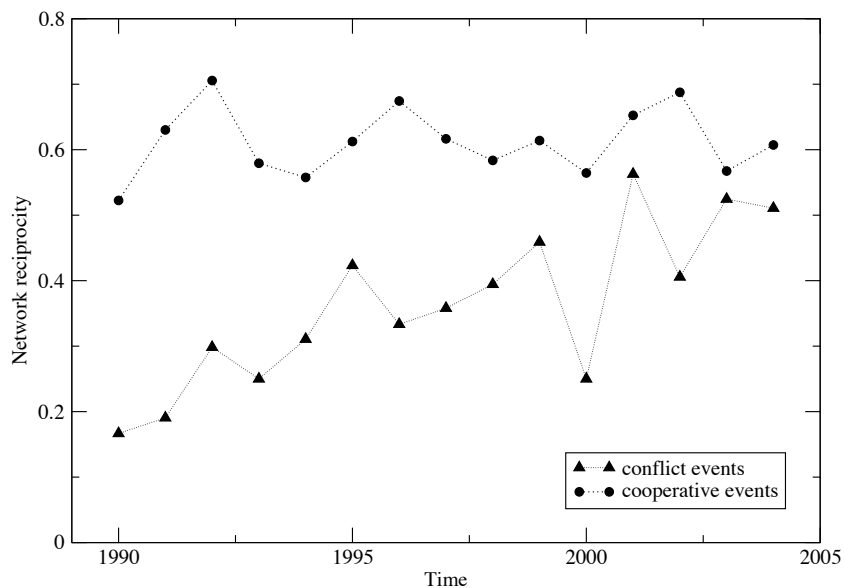


FIG. 3: Conflict reciprocity tends to increase through 1999. The fall in 2000 may be due to the series of natural disasters listed in Fig 1. The peaks in 1995 and 1999 may be explained by the Taliban’s mobilization across Afghanistan and an offensive to crush Masood’s forces, the last hurdle between the Islamic militia and control over the whole of Afghanistan.

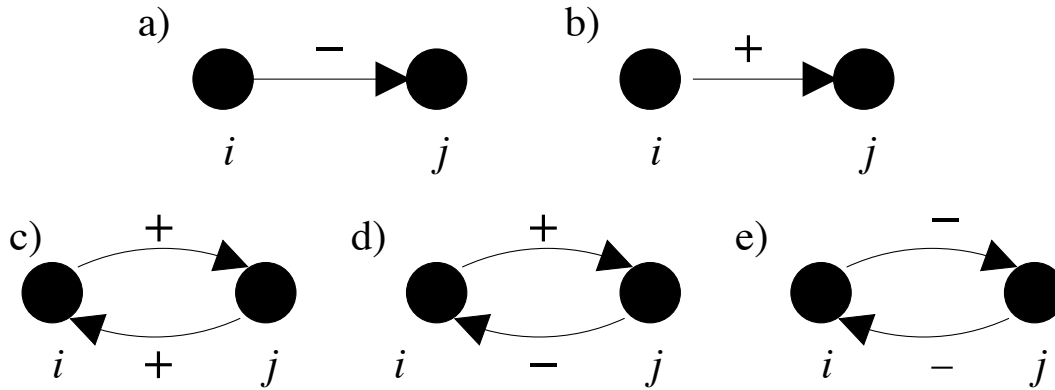


FIG. 4: a) The figure shows a cooperation event between vertex  $i$  and vertex  $j$  that is not reciprocated. Since the event is not reciprocated, it is also unbalanced. b) The figure shows a conflict event between vertex  $i$  and vertex  $j$  that is not reciprocated. Since the event is not reciprocated, it is also unbalanced. c) The figure shows two cooperation events between vertices  $i$  and  $j$ , each event is reciprocated making the interaction is balanced. d) The figure shows two conflict events between vertices  $i$  and  $j$ , each event is reciprocated making the interaction balanced. e) The figure shows a conflict and a cooperation event between vertices  $i$  and  $j$ . The events are reciprocated by the interaction is not balanced.

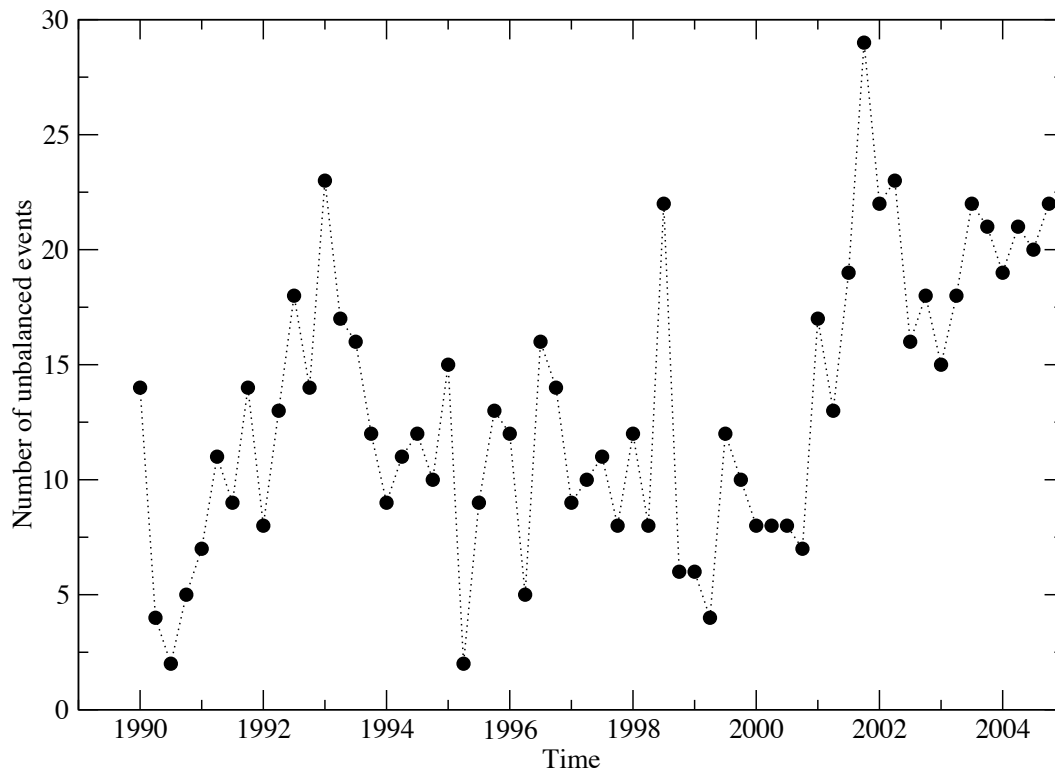


FIG. 5: This plot looks at the number of unbalanced events, either unbalanced and not reciprocated conflict events or reciprocated events that are unbalanced.