

Stochastic Opponent Modeling Agents: A Case Study with Hezbollah

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Abstract Stochastic Opponent Modeling Agents (SOMA) have been proposed as a paradigm for reasoning about cultural groups, terror groups, and other socio-economic-political-military organizations worldwide. In this paper, we describe a case study that shows how SOMA was used to model the behavior of the terrorist organization, Hezbollah. Our team, consisting of a mix of computer scientists, policy experts, and political scientists, were able to understand new facts about Hezbollah of which even seasoned Hezbollah experts may not have been aware. This paper briefly overviews SOMA rules, explains how more than 14,000 SOMA rules for Hezbollah were automatically derived, and then describes a few key findings about Hezbollah, enabled by this framework.

1 Introduction

Stochastic Opponent Modeling Agents introduced in [1,2,3] were introduced as a paradigm for reasoning about any group G in the world, irrespective of whether the group is a terror group, a social organization, a political party, a religious group, a militia, or an economic organization. SOMA-rules have been used to encode the behavior of players in the Afghan drug economy [4] as well as various tribes along the Pakistan-Afghanistan border [5].

In contrast with the above groups, Hezbollah is a well-known terrorist organization based in Lebanon. In September 2002, testifying to Congress, Deputy Secretary of State Richard Armitage stated, “Hezbollah may be the A team of terrorists, and maybe al-Qaeda is actually the B team.” [6] Prior to 9/11 Hezbollah was the terrorist organization that had killed the most Americans, carrying out the massive suicide bombings of the U.S. Marine Barracks and U.S. Embassy in Beirut in the early 1980s. Hezbollah also orchestrated a campaign kidnapping Westerners in Lebanon that triggered political crises in the United States and France.

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Hezbollah terror attacks have, however, extended far beyond the Middle East, to Europe and Latin America.

Ideologically, Hezbollah expounds a radical version of Shia Islam that seeks violent confrontation with enemies of Islam such as the United States and Israel. Rooted in Lebanon's long oppressed Shia community and closely allied with Iran and Syria, Hezbollah views itself as the spearhead in Islam's struggle with the West. At the same time, Hezbollah relies on the support of Lebanon's Shia community and its Iranian and Syrian sponsors and consequently its actions are shaped by these factors.

Hezbollah is also a multi-faceted organization that engages in a range of activities to further its cause. It participates in Lebanese elections and runs businesses and social services. It maintains a guerilla force that fought a multi-year insurgency against Israel in South Lebanon and conducted platoon and company level operations against Israel during the summer of 2006. Internationally, it provides training to Islamist terrorists including al-Qaeda and Palestinian terrorist groups. Because of its perceived success against Israel it has been lionized throughout the Arab world. To burnish its image it runs a satellite television station, radio stations, and even produces a video game. Hezbollah also has links to the Lebanese Shia diaspora, which has a presence on every continent. [7]

Hezbollah's combination of formidable capabilities, radical ideology, and international reach makes developing systems to better understand Hezbollah's operations and, if possible, predict them an important priority.

In this paper, we present an overview of a few of the more than 14,000 rules about Hezbollah's behavior that our SOMA system has extracted *automatically*. Of course, presenting all these rules is impossible in the context of a short paper – hence, we briefly describe our rule derivation methodology and then describe core SOMA results about Hezbollah.

2 SOMA Rule Derivation Methodology

We derived SOMA rules from the *Minorities at Risk Organizational Behavior (MAROB)* dataset [8], which is an extension of the Minorities at Risk (MAR) dataset [9]. MAR tracks the repression, discrimination and political behaviors, such as rebellion and protest, for 284 ethnic groups worldwide. In an effort to better understand the nature of political violence, MAROB was created at the University of Maryland in 2005 to track behaviors and characteristics of ethnonationalist organizations, those claiming to represent MAR ethnic groups. As nine of the 14 most deadly terrorist organizations from 1998 to 2005 were ethnonationalist, MAROB reflects the importance of studying ethnonationalist organizations.

From a computational point of view, MAROB associates a relational database table with each group. The rows of the table reflect different years. The columns of the table denote different properties about the behavior of that group or about

the environment within which the group functioned. For instance, a column such as KIDNAP specifies if the group used kidnapping as a strategy in a given year. Likewise, a column named FORSTFINSUP specifies if the organization got financial support from a foreign state during a given year. The columns of any relational database table associated with a MAROB group fall into three categories: columns about *actions* that the group took (such as KIDNAP above), columns about the *environment* in which the group functioned (such as FORSTFINSUP above), and other *administrative* columns. Note that the *environment* can include information about actions that *other* groups took that contributed to the climate in which the group being modeled exists.

Our SOMA rule extraction method used MAROB data from 1982 to 2004 in order to extract rules about Hezbollah. A SOMA rule about a group G has the form

$$\langle \text{Action} \rangle : [L, U] \text{ if } \langle \text{Env-Condition} \rangle$$

Where:

- $\langle \text{Action} \rangle$ is an action that the group took (such as KIDNAP)
- $\langle \text{Env-Condition} \rangle$ is a logical conjunction of elementary conditions on the environmental attributes. An elementary condition associated with the environmental attribute A is an expression of the form $A \text{ op value}$ where op is in the set $\{ =, <=, >= \}$.
- $[L, U]$ is a closed sub-interval of the $[0, 1]$ interval.

The above rule says that in any year when the $\langle \text{Env-Condition} \rangle$ is true, there is a probability between L and U that the group took the action stated in the rule. The rule below is an example of a rule that we extracted about Hezbollah.

KIDNAP: $[0.51, 0.55]$ if solicits-external-support & does not advocate democracy.

This rule says that in years when Hezbollah both solicited external support and did not promote democratic institutions, there was a 51 to 55% probability that they engaged in kidnapping as a strategy.

The SOMA rule extraction method consists of three steps:

1. Select a value for $\langle \text{Action} \rangle$,
2. Fix one environmental attributes as part of $\langle \text{Env-Condition} \rangle$,
3. Add varying combinations of up to three of the remaining environmental attributes to $\langle \text{Env-Condition} \rangle$ to determine if significant correlations exist between $\langle \text{Env-Condition} \rangle$ and $\langle \text{Action} \rangle$.

Using the standard definition of confidence from the literature, the rule extraction method calculates the difference between the confidence value produced by $\langle \text{Env-Condition} \rangle$ and its negation. If this difference exceeds a given threshold, then a SOMA rule is extracted. To obtain the probability range for the extracted rule, we

use the confidence value plus/minus ϵ . This process is repeated for all combinations of environmental attributes and actions.

By analyzing the MAROB data for a period of 23 years, we identified more than 14,000 rules for Hezbollah's behaviors.

3 Some Results about Hezbollah's Behavior

SOMA provided probabilities for four different Hezbollah actions: armed attacks, targeting domestic security forces, kidnappings, and transnational attacks. Due to space constraints, we focus on the rules on kidnappings and transnational attacks. In general, the rules are in accord with understood patterns of Hezbollah activities – while revealing some new insights about the triggers for these activities.

The central condition for the probabilities of kidnapping and for committing transnational attacks (including Katyusha rocket strikes against Israel and external terror attacks such as the 1994 bombing of the Jewish community center in Buenos Aires) is Hezbollah's relationship to Lebanese politics. From 1974 until 1992 Lebanon did not hold elections because of an on-going civil war. Prior to 1992 Hezbollah could not participate in Lebanese elections and did not attempt to represent its interests to Lebanese officials. In 1992 Hezbollah had a strategic shift in its relationship with the traditional Lebanese power structures and began to represent its interests to Lebanese officials by participating in elections. Hezbollah's leadership shifted from seeking to transform Lebanon into an Islamic state to working within the system to pursue its goals. Hezbollah's goals, particularly regarding confronting Israel, and its willingness to turn to violence against enemies both within Lebanon and without did not change. But the tactics did. Prior to Hezbollah's strategic shift, kidnapping was a primary tactic used by Hezbollah to gain stature. With the end of the Lebanese Civil War and Hezbollah's entry into Lebanese politics, the likelihood of kidnapping dropped substantially and the likelihood of committing trans-national attacks increased dramatically.

3.1 Hezbollah's Kidnapping Campaign

Table 1. Conditions and Probabilities for Kidnapping.

Conditions	Probability
Does not advocate democracy & solicits external support	.53
No foreign state political support & major inter-organizational conflict	.53
Solicits external support & does not advocate democracy & no foreign state political support	.66
Major inter-organizational conflict & no foreign political support & (foreign state provided non-violent military support OR standing military wing)	.66
Soliciting external support is a minor strategy & (electoral politics is not a strategy or does not advocate democracy)	.83

The conditions relating to increased probabilities of kidnapping reflect Hezbollah's capabilities and opportunities. Receiving military support or possessing a standing military wing would increase capabilities. Inter-organizational conflict represents an opportunity. Hezbollah and its rival Amal both conducted kidnappings as part of their struggle for primacy among the Lebanese Shia community.

The strongest condition linked to a Hezbollah kidnapping campaign is soliciting external support. When soliciting external support, Hezbollah leaders are meeting with other leaders and the organization is opening offices in other countries. In the Middle East kidnapping campaigns against the West and Israel are useful for raising an organization's profile – thereby making it a more attractive candidate for support. Kidnapping creates bargaining chips. When holding hostages, Hezbollah can either attempt to extract support from the hostages' nation of origin or give potential supporters the opportunity to act as an interlocutor between Hezbollah and the hostages' nation of origin. During the Lebanese Civil War, when Hezbollah efforts to obtain external support were greater, it appears that they were more likely to curtail their kidnapping activity – possibly in response to pressures from potential supporters.

3.2 Hezbollah's Transnational Attacks

Once in Lebanese politics, transnational attacks became the more attractive strategy. Terrorist attacks outside Lebanon could be denied and did not have a substantial impact on Lebanon itself. Since Lebanon does not have relations with Israel and many Lebanese resented Israel's long-standing security zone in the south

of Lebanon, Hezbollah's rocket attacks against Israel did not detract from Hezbollah's domestic political standing, and in some cases may have increased it.

Table 1. Conditions and Probabilities for Transnational Attacks

Conditions	Probability
Pro-democracy ideology	.52
Electoral politics is a minor strategy & no foreign political support	.55
Medium inter-organizational conflict	.58
Electoral politics is a minor strategy & no non-military support from the diaspora	.6
Electoral politics is a minor strategy & (medium rioting OR no foreign state political support)	.6
Electoral politics is a minor strategy	.635
Electoral politics is a minor strategy & medium inter-organizational conflict & no foreign state political support	.67
Electoral politics is a minor strategy & medium inter-organizational rioting	.67
Electoral politics is a minor strategy & medium inter-organizational conflict	.74

Two factors appear to have substantial impact on whether or not Hezbollah engages in transnational attacks. One factor is whether or not there are medium inter-organizational conflicts involving Hezbollah. The most substantial factor is whether or not Hezbollah is engaged in electoral politics as a minor strategy (that is, they have candidates holding elected office but it is not an election year – that would be major strategy). The positive relationship between medium inter-organizational conflict and transnational attacks could reflect a “rally round the flag” phenomenon in which Hezbollah tries to best its local rivals by focusing on the common enemy. But this phenomenon does not appear to apply to major inter-organizational conflicts, possibly because these conflicts cannot be defused as easily and require more attention from the leadership and more resources. This would also explain why medium inter-organizational rioting has a smaller positive effect on the probability of transnational attacks. Rioting requires substantial manpower, leaving fewer resources for the transnational attacks.

The correlation between minor involvement in electoral politics and transnational attacks highlights the tension between Hezbollah's ideology and practical need for public support. The decision to enter Lebanese politics was a contentious one, with the most strident Hezbollah militants opposed because they feared it would corrupt the organization and distract it from its primary role of confronting Islam's enemies. [10] To placate this faction it is essential that Hezbollah maintain its aggressive stance against Israel, not only by fighting Israeli forces in Lebanon but also by launching attacks into Israel itself. However, Hezbollah usually re-

frains from these attacks during election years. The exception was 1996, when a Hezbollah rocket campaign provoked a particularly harsh Israeli bombardment in which more than a hundred Lebanese were killed and many more were left homeless. In the elections later that year, Hezbollah lost two seats in Lebanon's parliament. This reflects the tension between Hezbollah's core ideology of confronting Israel and their need not to agitate the many Lebanese who are frustrated at their country's being used as a leading front for the Arab-Israeli conflict.

4 Conclusions

The SOMA system generated rules on Hezbollah's behavior that reveal Hezbollah as a complicated organization that responds to multiple constituencies. Internal conflicts with other Lebanese groups, lack of foreign state political support or support from the diaspora, and efforts to garner this support all impact Hezbollah's operations. Particularly intriguing is the strong positive relationship between participating in electoral politics and attacking transnational targets. This indicates that Hezbollah, despite its participating in an electoral process, remains committed to using violence to further its ends. However, the fact that Hezbollah refrains from these attacks during election years shows that the organization is sensitive to its domestic constituency. It is possible that driving wedges between Hezbollah and its state sponsors, while supporting political parties that vigorously oppose Hezbollah could force the organization to choose between satisfying its Lebanese constituency or its own ideology. Ending this balancing act could marginalize the organization and reduce its capacity for violence.

Since the summer 2006 war, the region has been on tenterhooks awaiting a resumption of hostilities. Examining the SOMA rules reveals some possible reasons why this war has not come. Early in 2007 domestic tensions between different Lebanese parties boiled over into large-scale protests and riots. Hezbollah has a low likelihood of engaging in transnational violence when there are major inter-organizational conflicts. There was also a Presidential election in November 2007. The Lebanese Presidency is reserved for a Maronite Christian, so Hezbollah does not have a candidate; however, it engaged in the process and has a substantial stake in the outcome. With a delicate balance of power in Lebanon, Hezbollah may not wish to inflame its opposition and tilt the political scales at such a sensitive time.

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