

Adversarial Behavior in Complex Adaptive Systems: An Overview of ICST's Research on Competitive Adaptation in Militant Networks*

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Abstract. There is widespread agreement among scholars and practitioners that terrorism scholarship suffers from a lack of primary-source field research [1]. The absence of solid ethnographic research has yielded studies that suffer from a lack of rigorous analysis and often result in opinion masquerading as analysis. This dearth of field work stems in part from a failure to integrate ethnographic research into computational modeling efforts. The project outlined in this paper seeks to redress this deficiency by combining the strengths of ethnographic field research with sophisticated computational models of individual and group behavior. Specifically, we analyze data from interview transcripts, news reports, and other open sources concerning the militant activist group Al-Muhajiroun and the terrorist groups Provisional Irish Republican Army (PIRA) and Revolutionary Armed Forces of Colombia (FARC). Using *competitive adaptation* as a comparative organizational framework, this project focuses on the process by which adversaries learn from each other in complex adaptive systems and tailor their activities to achieve their organizational goals in light of their opponents' action.

Keywords: Al-Muhajiroun, competitive adaptation, network analysis.

1 Introduction

A growing number of scholars and practitioners recognize the value of mixed-methods and interdisciplinary approaches to studying non-state actors that engage in political violence themselves or support the use of political violence by like-minded groups.

* This research is supported by a grant from the Office of Naval Research (ONR), U.S. Department of the Navy, No. N00014-09-1-0667. Any opinions, findings, or recommendations expressed in this material are those of the authors and do not necessarily reflect the views of the Office of Naval Research. We thank Devan Zeger for extensive help in the preparation of this manuscript.

Furthermore, there is a growing consensus that the terrorism and counterterrorism literatures suffer from a lack of primary-source field research. The vast majority of terrorism scholarship is based on secondary sources, contributing to a systematic bias based in data availability. Naïve and impractical policy prescriptions are often the result. This paper addresses these issues and provides an interdisciplinary framework from which to study the behavior of non-state militant groups that either carry out acts of political violence themselves or support the use of political violence by others. Building on the concept of competitive adaptation, we investigate how these actors learn and adapt when interacting with governments, civilians and other militant groups, as well as how they alter their subsequent behavior. Some guiding questions behind our work include:

- How do militant and government networks learn from and adapt to one another over time?
- How do major events (terrorist attacks, counterterrorism operations, death of a group leader, government policy shifts) affect the structure of militant networks?
- Does the structure of militant networks differ in models based on open-source information (news account, court transcripts, official statements) versus private information (interviews with de-radicalized or disengaged militants)?

Our approach combines the analytical richness of ethnographic research with computational modeling to provide a meso-level model of militant networks that function in complex-adaptive systems. Specifically, we use data from original interviews with group members together with news reports, public statements and other open source documents to study the competitive adaptation of three groups across four countries. The cases studied – Al-Muhajiroun, the Provisional IRA and FARC – are non-random, selected on the basis of convenience of access, team expertise and dissimilarity to one another, for the purpose of developing a generalizable, multi-disciplinary approach to the study of such opaque organizations. Preliminary analysis presented below involves Al-Muhajiroun, a former militant activist group based in the United Kingdom, banned by British authorities in 2010. Next, we present the theoretical framework of competitive adaptation and its usefulness in the investigation of our research questions. The subsequent discussion of Al-Muhajiroun details methods of data collection and analysis.

1.1 Organizational Learning and Competitive Adaptation in Militant Groups

There are few studies that specifically examine learning in nonconventional, covert, illegal or violent groups such as militant or terrorist organizations. Nevertheless, some recent work offers useful insights into how militant and terrorist organizations learn and adapt within the adversarial environments in which they operate. A team of RAND researchers, led by Jackson [2], examined organizational learning in several violent militant groups, including the Provisional Irish Republican Army, Aum Shinrikyo, Jemaah Islamiyah, Hezbollah, and the radical environmentalist Animal Liberation Front and Earth Liberation Front. A separate study by Hamm [3] [4] draws on court documents contained in the *American Terrorism Study* database and the criminological literature on social learning to explore how some violent political extremists acquire the skills to perform their tradecraft. While these studies offer

insights into how numerous militant groups train their members and develop certain technological innovations, they do not systematically examine the *internal* processes of group learning and interpretation, as experienced by militants themselves. Moreover, these studies do not take into account the broader competitive environments in which militant groups operate.

Drawing on organizational and complexity theory, Kenney [5] describes how organizational knowledge is leveraged by competing networks that interact in complex adaptive environments. Kenney dubs this process *competitive adaptation*, which explains how organizational learning occurs within an environment that is typically (though not always) characterized by hostility and multiple actors pursuing opposing goals. A network-based theoretical approach to the study of militant groups allows both effective modeling of the internal organizational dynamics of militant groups, in addition to broader strategic interactions between militant groups and governments. Competitive adaptation is thus the framework from which we approach our study of militant groups, and we employ ethnographically-based network analysis as our primary tool when modeling this framework. This approach, along with findings in the organization theory literature, provides us with guidance in developing our research and expectations.

1.2 Comparing the Social and Organizational Qualities of Militant Networks

Research on Al-Muhajiroun [6], the FARC [5] and Provisional IRA [7] provide qualitative descriptions of these groups' structures and how those structures may account for group behavior. We seek to expand on these findings using ethnographic data to compare and contrast these groups from both a qualitative perspective and using quantitative metrics of social network analysis. Measures of closeness, for example, allow for quantitative comparison of the distances between actors within networks, whereas measures of centrality enable us to compare the density of militant social networks [8]. Other metrics permit us to compare additional network attributes such as hierarchies and emerging leadership, thus enabling us to study the evolution of organizational attributes over time based on the analysis of primary and secondary ethnographic data. In the competitive adaptation framework, we expect that:

H1: Social and organizational network properties, such as centralization, hierarchy, and density of network ties, vary across different militant movements, and within movements across time in response to changes in their complex-adaptive environments.

Social network metrics calculated from the ethnographic data described above will allow us to arrive at substantive conclusions when comparing the structures, decision-making, learning and adaptation of militant and terrorist groups.

1.3 Examining Networks of Locations, Events, Knowledge, Resources and Tasks

When studying organizational learning and competitive adaptation in militant and terrorist networks, we seek to examine militant networks in their entirety, beyond the social context. Specifically, we recognize that in order to understand group dynamics, learning, evolution, decision-making and emergent behavior, it is necessary not only

to examine the roles and relationships of individual agents and groups within organizations, but also how those agents relate to locations in space, as well as the knowledge and resources leveraged by agents within organizations, in order to fulfill group tasks. Carley [9] writes that an organization can be described as an “ecology of networks” that continually evolves as agents within the organization learn, move and interact. A network of social roles within an organization might appear very different from a network of knowledge and expertise, which in turn might be very different from the network of resources or geographic proximity. Kenney’s [5] work on competitive adaptation similarly emphasizes the importance of organizational properties beyond those associated with individual human agents, arguing that the flow of knowledge, routines and artifacts within organizations is as important as the flow of personnel. We conceptualize militant networks consistently with these arguments and expect that:

H2: Militant networks ‘learn’ when their participants receive information about their activities, process this information through knowledge-based artifacts, and apply the information to their practices and activities.

The case study presented below does not definitively answer the project’s two broad hypotheses, but offers an example of the detailed, preliminary analysis needed in preparation for meaningful hypothesis testing.

2 Case Study: The Evolution of Al-Muhajiroun

Following the development of our interdisciplinary framework, the research team began to collect primary and secondary data related to the first militant group we chose to study: Al-Muhajiroun (henceforth referred to as AM). While AM is not a terrorist group, the group did support the use of political violence overseas (outside of Britain) in what it maintained was a defensive response to the aggressive foreign policies of Western states, including Britain and the United States, before being formally banned by British authorities in 2010. Moreover, in recent years numerous militants that were affiliated, in varying degrees, with AM or one of its splinter groups have been convicted of what Simcox et. al. describe as “Islamism related offenses” involving political violence [11].

Founded in 1996 by Omar Bakri Mohammed and officially disbanded for several years in 2004, former AM members continue to operate in the United Kingdom under several splinter groups included in our study. Work by Wiktorowicz [6] indicates that AM not only exhibits adaptive behavior as it interacts with British authorities, but that the relatively liberal political and social environments of the United Kingdom often condition these interactions, providing both advantages and disadvantages to each side. As an example, Wiktorowicz shows how freedom of the press in the United Kingdom has been a double-edged sword for AM, both assisting the group in publicizing its ideas to potential recruits, but also resulting in broad ostracism of the group that has had direct negative ramifications on its operations. These negative ramifications have included the groups’ banning from the use of public venues and increased police scrutiny of group activities, resulting in arrests and the costly loss of charitable organization status in the United Kingdom (p. 126).

In response to the negative ramifications of publicity, AM has adapted a strategy of organizational proliferation, diversification and obfuscation in order to continue spreading the group's ideology and connect with potential recruits without suffering the costs that are now associated with the AM label, and without risking organizational death in the event of a police crackdown (p. 124). Indeed, research by Raymond [12] shows that despite such a crackdown in 2004 which resulted in the organization's abolishment, AM members continue to operate in the United Kingdom and abroad under a variety of alternative platforms, fronts and splinter groups. Recent work by Kenney [13] discusses this adaptive dynamic between the British government and AM in depth. Following the disbanding of AM in 2004, the group's leadership established two new groups called Al Ghurabaa (The Strangers) and the Saved (or Saviour) Sect, both of which attracted many of the same members as AM. Furthermore, when these splinter groups faced the threat of disbandment, former AM leadership created the 'Ahlus Sunnah wal Jamaah,' an invitation-only Internet discussion forum (p. 124). More recently, former AM members and affiliates have created several new platforms or groups to facilitate their ongoing activism, including Muslims against Crusades and Supporters of Sunnah.

Whereas AM's organizational expansion is a clear example of adaptive behavior within the competitive environment in which it operates, it is also equally interesting that militant organizations such as AM often fail to adapt, or learn the wrong lessons, despite their experiences. Kenney [14] explains that militant groups might fail to adapt within their environments not only due to simple mistakes and human error, but potentially due to the underlying structures, ideologies or rules guiding an organization's behavior. The religious underpinnings of AM clearly condition the incentive structure of individual AM members and leaders, influencing how they adapt and fail to do so [6]. Kenney [14] notes that AM's religiosity has led its leadership to occasionally leave important tactical decisions, such as behavior that may result in imprisonment, to "God's predetermined fate for them." Thus from these examples of both adaptive and non-adaptive behaviors, AM is an interesting and relevant case study of how a militant group evolves and adapts (or has failed to evolve and adapt) in a Western democracy.

2.1 Collection of Primary and Secondary Source Data for Network Analysis

When collecting data for our analysis of AM, we have diversified among a broad range of primary and secondary sources. These sources included newspaper articles, interview and court transcripts, press releases and other group statements, as well as original interviews conducted with current and former AM members, members of front, successor and splinter groups, and British authorities.

From these primary and secondary sources, we constructed a thesaurus of known AM members (agents). In addition, we created thesauri of AM front and splinter groups (of which there were many), events, locations, resources, tasks and knowledge. These data are then processed using the text analysis program AutoMap, and semantic and network analyses are conducted using the dynamic network analysis (DNA) program Organizational Risk Analyzer (ORA) [15].

The preliminary findings presented below are based on 1,079 newspaper articles published from 1996 to 2009 that deal with AM primarily. The articles were collected

using Lexis Nexis. Duplicate articles and those not primarily concerned with AM were excluded. The data are presented dynamically, divided into three time periods segmented by major events in the history of AM, its members and associated organizations. The first time period (Network A) runs from the group's founding in 1996 through October 4, 2004 when AM officially disbands. The second period (Network B) begins with the July 7, 2005 attacks on the London metro (an event which sparked Omar Bakri's flight to Lebanon, where he still resides) to July 16, 2006, the day before the UK government officially banned AM's successor organizations, Al Ghurabaa and the Saved Sect. The final period (Network C) runs from this July 17, 2006 ban through the end of 2009. This analysis is limited to AM members and associated Islamists (i.e., the 'red team') – a total of 364 individuals spanning the 14-year period in view.

2.2 Preliminary Findings for Al-Muhajiroun

Table 1 summarizes the changing relationship of Omar Bakri, AM's founder, to others in the AM network. The numbers in each column indicate cumulative totals (i.e., two degrees of separation gives the cumulative total of rows 1 and 2, and so forth). The totals given in the bottom row indicate the total number of 'red team' agents detected in the network during the period in view.

Several characteristics of Bakri's connectedness to the network merit discussion. First, during any time period, if an agent is not connected to Bakri, that agent is not connected to *anyone* in the network; that is, that node is an 'isolate.' The data used do not support a relationship between these individuals and the AM network, though ethnographic data may augment this conclusion. Second, at any point in time, every agent in the network who is connected to Bakri is connected by no more than four degrees of separation. Third, Network A is a superset of Networks B and C. In other words, no new agents connect to Bakri subsequent to the first time period. However, consistent with *H1*, Bakri's connectedness to other agents in the AM network changes dramatically across the three time periods in view.

Table 1. Omar Bakri: Sphere of Influence

Degree of Separation	Network A	Network B	Network C
1	19	13	7
2	65	32	14
3	83	41	18
4	84	42	23
Total	186	80	91

Figure 1 depicts this changing relationship. As might be expected, Bakri's direct connections to other agents in the network declines significantly following his exile to Lebanon, shortly after the 7/7 attacks on the London metro. In Network A, Bakri is connected to 83 of 84 red team agents by no more than three degrees of separation (only Adel Abdel Bary, indicted in the United States in connection to the 1998 U.S. embassy bombings, is separated from Bakri by four degrees). From Network A to

Network B, where the July 7, 2005 cutoff approximates Bakri's removal to Lebanon, his total connections within the network drops by exactly half, from 84 to 42.

Also, while everyone remains connected to Bakri within four degrees, the proximity of these connections declines following Bakri's move to Lebanon and the ban on AM's successor groups. In Network A, 77 percent of agents (65 individuals) are connected to Bakri by no more than two degrees of separation; in Network C this number drops to 60 percent (14 individuals). The ability to influence other agents does not normally extend beyond the second degree, suggesting that Bakri's influence over AM members in Network C is only one-fourth of his influence in Network A.

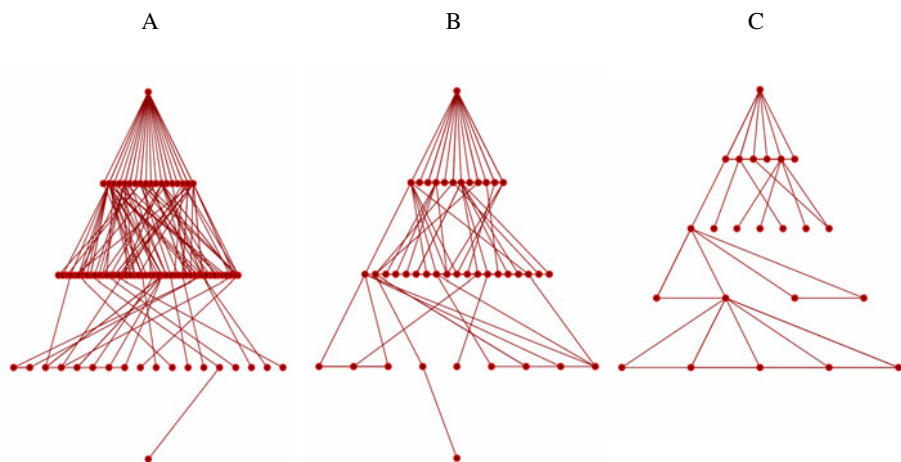


Fig. 1. Omar Bakri's changing sphere of influence

Further, in Network C, Bakri's connectedness beyond two degrees is tenuous: Only Osama bin Laden connects Bakri to the third degree, and only Mohammed Omran connects Bakri to the fourth degree. The bin Laden connection is based on circumstantial evidence at best. This shift suggests a gradual distancing between Bakri and the network, which is consistent with ethnographic evidence regarding the emergence of new leaders in the network, the proliferation of front and splinter groups in the network, and Bakri's apparent shift of roles into a position of symbolic leadership of the group from a distance. Future analysis of Bakri's changing role should examine changes over time in his access to resources for group mobilization. The extent to which Bakri's access to such resources improves or diminishes, combined with the access of his associates within two degrees, will provide significant information about the extent to which the AM network has been disrupted by 'blue team' efforts or has become a 'leaner, meaner' organizational machine (H2).

Other measures of leadership allow a comparison of Bakri's role in the network to the roles of other network elites. Agents in the network may score high along one or more dimension of leadership without ever holding a position of formal leadership in the organization. For example, Table 2 rank orders AM agents in terms of *betweenness centrality* across the three time periods, and Bakri ranks behind five to nine other agents in the network during any given period. Betweenness centrality

measures the extent to which a given node (i.e., an agent) constitutes the most efficient path between other nodes in the network. In other words, this metric assesses which agents reside in the most ‘best paths’ between other agents, suggesting that individuals ranking high in this metric are likely to serve as brokers or gatekeepers between different subgroups within the network. While ethnographic research suggests that the presence of Osama bin Laden high in these rankings is likely an artifact of the data, the high betweenness centrality of other, lower profile agents merits discussion.

Abu Hamza al-Masri, for example, was a close associate of Bakri and leader of the Supporters of Shariah group, which frequently collaborated with AM in its UK activities. Anjem Choudary, Abu Izzadeen, Abu Uzair, and Abdul Rahman Saleem were all long-standing students of Bakri’s that played different roles in AM and its splinter groups over the years. For example, Abdul Rahman Saleem served as AM’s spokesman in Pakistan, and organized the movement of British Muslims into Pakistan and from there into the insurgency in Afghanistan. Once back in the UK, Saleem acknowledged that he received military training in Afghanistan and Pakistan, and sought to recruit other young Muslims to do the same.

Table 2. Betweenness Centrality

Rank	Network A		Network B		Network C	
1	Abdul Saleem	.042	Abdul Saleem	.078	Abu Izzadeen	.013
2	Osama bin Laden	.037	Abu Hamza	.060	Osama bin Laden	.012
3	Abu Hamza	.035	Abu Izzadeen	.051	Anjem Choudary	.011
4	Hassan Butt	.020	Osama bin Laden	.039	Abu Hamza	.009
5	Saladhuddin Amin	.013	Saladhuddin Amin	.027	Mohammed Omran	.009
6	Abu Qatada	.011	Omar Bakri	.020	Omar Khyam	.008
7	Omar Sharif	.011	Omar Sharif	.018	Abdul Saleem	.007
8	Waheed Mahmood	.010	Abu Uzair	.018	Abu Qatada	.007
9	Mohammed Omran	.010	Hassan Butt	.016	Omar Bakri	.005
10	Omar Bakri	.009	Anjem Choudary	.011	Mohammed Babar	.005

Eigenvector centrality offers a very different measure of agents’ elite status within a network. This measure calculates the network’s principal eigenvector, meaning that a given node is considered central to the network to the extent that its neighbors are central. Well-connected agents connected to other well-connected agents score high on this metric, while the formula discounts nodes possessing many connections, as well as accounting for the fact that most nodes will have some connections. Notably, Omar Bakri’s eigenvector centrality ranking actually improves in Networks B and C, subsequent to his flight to Lebanon. While Bakri’s direct connections to the network suffers while in exile, his continued association with the AM leadership (i.e., other well-connected nodes) elevates his centrality to the network in this measure.

Others, such as Abdul Kahar Kalam, Omar Sharif and Richard Reid, appear to score high along this measure as a function of their involvement in specific, high-profile terrorist plots. Such agents may be part of tight cliques, meaning they are highly connected to others in the clique while they do not encounter discounts for connections to many nodes in the network, which they do not possess. This is

certainly the case with Ezzit Raad, arrested for his role in a terrorist plot in Australia, and Younis al Hayyari, an al-Qaeda affiliate shot dead in Saudi Arabia, both in 2005.

Table 3. Eigenvector Centrality

Rank	Network A		Network B		Network C	
1	Abdul Kahar Kalam	1	Abdul Kahar Kalam	1	Anjem Choudary	1
2	Omar Sharif	1	Omar Bakri	1	Abdul Saleem	1
3	Abdul Karim	1	Richard Reid	1	Willie Brigitte	1
4	Younis al Hayyari	1	Abdul Karim	1	Omar Bakri	.960
5	Abu Obeida	1	Younis al Hayyari	1	Saladhuddin Amin	.918
6	Ramadan Shallah	1	Ezzit Raad	1	Jawad Akbar	.787
7	Ezzit Raad	1	Fadal Sayadi	1	Omar Khyam	.704
8	Abdul Koyair	1	Abdul Koyair	1	Waheed Mahmood	.407
9	Abdul Qassim	1	Anjem Choudary	.626	Abu Izzadeen	.390
10	Mohammed Salim	1	Abu Izzadeen	.562	Abu Hamza	.343

Other preliminary findings suggest meaningful differences in a network may emerge based on data *type*. For example, differences appear to exist between the content of public and private statements made by organization leaders. Preliminary analysis of private statements by AM leaders suggests the importance of the conflict in Kashmir that is not apparent in public statements. Findings such as this reinforces our notion that collecting additional primary source material from former members of groups like AM will produce valuable insights.

The results of these analyses are highly predicated on the quality of thesauri and data used. By constructing our thesauri to exclude general terms (e.g., ‘children’) and historic figures and events (e.g., the Prophet Mohammed), we improve our ability to focus on evolving authority structures and other characteristics of the network. As the project moves forward, we will compare network structures based on different data types – beyond the use of ethnographic data to verify computational analysis described here – with the ultimate goal of triangulating data types as a means of cross-validating a comprehensive model of competitive adaptation.

3 Next Steps

As our computational modeling team continues to analyze the data we have provided to them on Al-Muhajiroun, our field researchers are collecting primary source data from former members of AM as well as from other groups. One field researcher recently completed two months of field work in Britain during which he conducted 39 interviews with former AM and splinter group affiliates. Interviewing such individuals can be done safely, ethically and does produce valid, policy-relevant data [1]. Using the theoretical framework of competitive adaptation, our research team will analyze these data with the objective of understanding how many of the internal processes affecting militant organizations affect their behavior, their use of terrorism (or lack thereof) and how they learn and adapt within their complex-adaptive environments. The resulting model of competitive adaptation will contribute an evidence-base to inform decision-making and

law enforcement training, in addition to evaluating and forecasting the impact of specific policy interventions.

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