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Complexity theory and Al Qaeda: Examining complex leadership

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[Osama bin Laden is] a product of a new social structure. A new social feeling in the Muslim world. Where you have strong hostility not only against America, but also against many Arab and Muslim regimes who are allying to America ... And that's why if bin Laden was not there, you would have another bin Laden. You would have another name, with the same character, with the same role, of bin Laden now. That's why we call it a phenomena not a person.

Interview with Saad Al-Fagih, PBS online, 2001

Recent events in the world are forcing us to restructure our understanding of leadership and organization. The al-Qaeda organization and its pervasive presence in the world demonstrated first-hand the power of a flexible, moderately coupled network of individuals brought together by a common need and aligned behind an informal and emergent leader. Its structure, which resulted from bottom-up coordination of individuals who voluntarily came together based on common need rather than from top-down hierarchical control, clearly demonstrates the power of a networked system based on relationships and shared vision and mission. To understand this and other types of network organizations, traditional models of leadership and organizational theory may no longer be sufficient, and may perhaps even limit our ability to realize the capabilities and resilience of such organizational forms.

To address such limitations, leadership theorists are exhibiting interest in new perspectives on organizing such as complexity theory (Boal *et al.*, in press; Hunt & Ropo, in press; Marion & Uhl-Bien, 2001; McKelvey, in press; Streatfield, 2001). Complexity theory proposes that organizations are complex systems composed of a diversity of agents who interact with and mutually affect one another, leading to spontaneous "bottom-up" emergence of novel behavior (Marion & Uhl-Bien, 2001; Regine & Lewin, 2000). Because of this, leadership in complex systems requires a shift in thinking from traditional "command-and-control" models that focus on control and stifle emergence (McKelvey, in press) to "complex leadership" models (Marion & Uhl-Bien, 2001) that enable interconnectivity and foster dynamic systems behavior and innovation. In this way, complexity theory helps explain organizational behavior relative to the "dynamic swirl" of social and organizational events that influence complex systems and their agents.

The purpose of this article is to derive propositions regarding complexity and complex leadership (Marion & Uhl-Bien, 2001) and to illustrate them using the case of al-Qaeda. We will argue that the conditions that led to the emergence of al-Qaeda were conducive to complex leadership, and that complex leadership helps explain the success of this terrorist movement. Although detailed data of the sort needed for rigorous qualitative analysis are obviously unavailable, we believe that the al-Qaeda example is such a powerful illustration of complexity concepts that it merits a nontraditional format for presentation.

Complex leadership

Complex leadership has been recently introduced into organizational leadership (Marion & Uhl-Bien, 2001), and differs from traditional models of leadership on several key issues. First, complex leadership argues that organizations and their leaders are products of interactive dynamics. That is, leaders do not create the system but rather are created by it, through a process of aggregation and emergence.

Second, complex systems are better led by indirect than direct leadership behaviors. Complex leadership moves away from traditional assumptions regarding hierarchical bureaucracy and top-down leadership control (McKelvey, in press). Complex leaders need to temper control preferences and instead foster and enable bottom-up behaviors and stimulate systems toward emergent surprises.

Third, complex leadership is not necessarily embedded in a formal position, but more properly permeates the complex organization. That is,

the differences between "leader" and "follower" are blurred. We coin the term complex adaptive agent (CAA) to capture this idea and to distance complex leadership from traditional notions of leadership as a formal position of control. The term is a deliberative derivation of the common complexity term complex adaptive systems (Marion, 1999).

Fourth, complex leaders can more effectively affect the fitness of a system by enabling what McKelvey (in press) calls distributed intelligence (DI). That is, complex leaders foster (as opposed to determine) connectivity among diverse agents and enable effective coupling of structures, ideas, and innovations to ensure that they are neither too loose nor too tightly interdependent.

To describe how this works, we turn next to an overview of complex leadership and an explanation of why we believe it applies to the case of al-Qaeda.

COMPLEX LEADERSHIP AND THE CASE OF AL-QAEDA

Complexity theory is, primarily, about the dynamics of networks (Marion, 1999). It is the study of self-reinforcing interdependent interaction and how such interaction creates evolution, fitness, and surprise. It proposes that knowledge—the source of innovation, emergence, and structure—is not the property of individuals or groups but rather emerges out of interactions (Fonseca, 2002).

Viewing organizations from a complexity perspective fundamentally changes considerations about leadership. In contrast to traditional top-down, leadership-controlled perspectives, complex adaptive agents view organizing as a bottom-up dynamic that is generated through interactive bonding among interdependent, need-seeking individuals, each of whom is driven by local (bounded) assessments of social and organizational events. This interactive dynamic can be described in terms of process theory in that it represents a series of causally linked events. Unlike most views of process theory (Bryman, 1996), however, complex dynamics are recursive; they exhibit interdependent, multiway chains of causality, non-linear behaviors, and multiple, often conflicting, feedback loops. The recursive aggregation process is too complex to be effectively controlled or determined by leaders. It may be influenced, however, by leaders who foster or enable the emergence of complex networks (Marion & Uhl-Bien, 2001).

We argue that Islamic terrorism is amenable to complex leadership because of the context in which it must function. First, the very nature of

the Islamic radical movement, its demand for operational secrecy juxtaposed against a highly visible organizational persona, the intricate nature of resource gathering and allocation, its size, and the incorporation of many diverse, subautonomous groups inevitably spawned complex leadership patterns, complex adaptive agents, and a complexly structured organization. The organization is simply too complex with too many unique and diverse functions to be tightly led or structured. Second, we suggest that complex leadership was not deliberately chosen by bin Laden and his cohorts, but rather was forced on them by conditions—and that it explains in large measure the success of this organization.

Specifically, we argue that the nature of Islamic militancy spawned a complexly structured al-Qaeda led according to complex leadership principles. This proposition is a unifying theme throughout this article, and the events surrounding the emergence and behavior of al-Qaeda will be interpreted relative to it. Al-Qaeda's structure is attributable in part to its guerrilla terrorism strategy, which is much less formalized than is the case in more traditional military systems. Its structure is also attributable to a business necessity to sell goods and raise funds (al-Qaeda owns a number of commercial enterprises), and these businesses are run as formalized bureaucracies. Al-Qaeda has extensive banking relationships, but its banking structure is much more informal than western systems (there is little centralized record keeping, for example). Al-Qaeda's main business, terrorism, is fogged in secrecy, and the secrecy, along with the demands associated with resource acquisition by terrorist cells, intelligence gathering, and general coordination, requires tightly controlled cells that are loosely to moderately linked with outside resources.

Al-Qaeda, then, is influenced by broadly diverse systems (distributed intelligence), some of which are tightly structured, some very loosely coordinated, but most moderately coupled—particularly with one another. It is characterized by multiply redundant chains of interaction, particularly in its banking and money-exchange systems. It possesses numerous loci of leadership (complex adaptive agents) bound by common purpose and catalyzed by bin Laden and others. It is structured in ways that allow it to adapt and learn. That is, al-Qaeda represents a complex system.

To illustrate this complex network notion relative to complex leadership and complex adaptive agents, we next propose a set of complexity/complex leadership propositions and relate them to the emergence and leadership of al-Qaeda.

Organizations arise (and leaders emerge) through aggregation

Complexity theory proposes that organizations arise, and leaders (acting as complex adaptive agents) emerge, through a process of aggregation (Holland, 1995; Kauffman, 1993). Aggregation is the structuring of actors and activities into forms and ideas; it is the result of recursive interaction, autocatalysis, and correlation.

The micro dynamic by which aggregation occurs is called correlation. Correlation describes an emergent dynamic in which interacting and interdependent units compromise a measure (but not all) of their individualistic need preferences to the needs of others and to the needs of an emergent alliance (this should not to be confused with statistical correlation: Poincaré, 1992; see also Marion, 1999; Marion & Uhl-Bien, 2001; Prigogine, 1997). Correlation is a bottom-up process in that it is a function of interaction among the basic units of a system, although the milieu in which it occurs is typically influenced (for better or worse) by leadership decisions.

The primary alliances that emerge from the correlational process are called "aggregates" (Holland, 1995; Marion, 1999), defined as sets of directly interacting, correlated units. Aggregates are linked interdependently to other aggregates to form meta-aggregates, such as manufacturing/raw material provider relationships. The aggregates in a meta-aggregate exhibit less direct interactions than do units in an aggregate, but are nonetheless rather closely interdependent. Alliances of meta-aggregates are labeled field aggregates, defined as inter-influence (as opposed to direct) relationships. Automobile producers, road construction industries, and auto insurance companies are part of a field aggregate because of their mutual, albeit indirect, interdependencies.

The process of aggregation creates opportunities for leadership. Leadership operates in two ways in the aggregation process: first on the micro level (as we address here), and second on the macro level (as argued in the next section). On the micro level, units need representatives to conduct negotiations with other units during aggregation. Micro-level complex leadership behavior may help resolve internal and external conflicting constraints, defined as need incompatibilities that are often expressed as task-related conflict (Jehn, 1997). Conflicting constraints are an inevitable, and important, product of moderately coupled (e.g., complex) systems. They pressure a system to seek solutions that accommodate diverse needs (Kauffman, 1993), thus fostering innovation and

growth. The dynamics by which this occurs also underlie and promote the correlational process (Marion & Uhl-Bien, 2001).

Direct leadership behavior (broadly defined as deliberate effort to influence) can serve to enhance the resolution of conflicting constraints. Such direct leadership, however, is localized in nature, thus primarily affecting immediate conflicting constraints. These local events (constraints plus local response) become part of a broader web of interactive dynamics that defy direct leadership because of their overwhelming complexities.

From this discussion, we can derive the following propositions:

Proposition 1a: Adaptive, interactive social units coalesce into aggregated units; these units are bonded by correlational forces that are driven by conflicting constraints.

Proposition 1b: Direct leadership behaviors demonstrated by unit members help negotiate the interactions that generate correlation. Correlation and aggregation in turn allow for the emergence of direct leadership behaviors.

FINDINGS FOR PROPOSITION 1

Aggregation of the militant Islam movement should be understood in several dimensions. First, this aggregation process has obviously involved the coming together of diverse terrorist groups for common purpose. Second, it should be understood in terms of its accretion of support structures such as radical Islam groups in the West, banking and money-changer structures, and resource providers. Finally, this aggregation dynamic required the emergence of leaders that helped consolidate its structure and identity.

Islamic militancy began as nationalistic movements (aggregates) bent on establishing Islamic governments in their home states. The earliest modern group, the Muslim Brotherhood, appeared in the 1920s in Egypt (Emerson, 2002). It was followed in the middle of the twentieth century by other groups in Egypt, Lebanon, the West Bank and Gaza Strip, Libya, Yemen, and other Middle Eastern nations (Bergen, 2001). These groups differed largely on the degree of militancy they advocated and in their nationalistic foci. Cooperative efforts evolved during the war in Afghanistan in the 1980s, which catalyzed the emergence of an umbrella organization, MaK, that loosely united a large number of diverse groups in a common cause (Bergen, 2001). This confederacy was expanded in the 1990s under al-Qaeda, culminating in the 1998 establishment of a

confederation of terrorist groups called the World Islamic Front (Bergen, 2001; US Department of State, 2001). What started, then, as aggregates in the middle of the twentieth century evolved into meta-aggregates opposed to Israel in the 1970s, and matured as meta-aggregates in the 1980s and 1990s.

Our definition of field aggregates hypothesizes the accumulation of structures with diverse functions linked by a common focus; thus the alliance of terrorist groups in the 1990s does not constitute a field aggregate. Field aggregates emerged when these aggregates and meta-aggregates became interdependently linked with businesses (bin Laden invested millions in African companies in particular), governmental agencies, nongovernmental relief organizations (NGOs), Islam training schools, radical Islam groups in the West, banking structures, wealthy supporters, communication outlets, and mosques (see Figure 1 later). These collateral structures were aligned to lesser or greater extent with the core terrorist movement in the same sense that auto repair stations and the plastics industry are allied to lesser or greater extent with the auto industry. The emergence of these structures alongside the more specific terrorist groups began under MaK during the Afghan/Soviet war (Bergen, 2001). It was crucial to the subsequent success of al-Qaeda, which succeeded MaK after the war, and to its fitness. Without the broader structure, al-Qaeda would have lacked the money and the ability to move and hide money, the recruiting capability, the public relations support, or the expertise to pull off a project as large as the airline attack on the World Trade Center.

Various correlational dynamics enabled the aggregation of Islamic groups and ideologies. Militant groups interacted within a number of contexts, including their common anger over events involving Israel and Palestine, the Afghan war, and secular Muslim governments such as that in Egypt (Bergen, 2001). Groups (and their constituents) had common experiences in al-Qaeda training camps (centers of indoctrination and military preparation that trained people from numerous militant groups) and in the Afghan war. Before the Afghan war, Islamic militancy was fractured by nationalistic goals and different opinions about what *jihad* entailed (some, for example, saw it as internal struggle, others as external militancy; Bergen, 2001). Interactions (correlations) in training camps, in the Afghan war, and over the Palestinian issue helped the various movements resolve their nationalistic differences and identify commonalities.

Together, these events virtually define what is meant by aggregation, suggesting support for Proposition 1a.

The aggregation of al-Qaeda required the emergence of leaders who directly helped consolidate its structure and identity. We delineate the function of leadership into direct (Proposition 1b) and indirect (Proposition 2) activities.

There are numerous, highly celebrated examples of direct leadership activity in the Islamic militancy movement in the twentieth century. The behaviors predicted by Proposition 1b were illustrated when bin Laden negotiated the formal merger of radical movements in 1998 (Bergen, 2001). Another example occurred when Al-Zawahiri and Sheik Rahman (now imprisoned in the US for his role in the first WTC bombing) negotiated the unification of the Jihad and Brotherhood movements in Egypt in the early 1970s (Bergen, 2001). In addition Abdullah Azzam, who led MaK in the 1980s, was an important broker for the confederation of Islamic movements in the Afghanistan war (Bergen, 2001). Finally, cell leaders brokered the accumulation of resources and kept cell members with suicide roles focused (Bergen, 2001). These leadership behaviors directly influenced correlation and the resolution of pertinent conflicting constraints: Al-Zawahiri and Rahman negotiated differences in violence levels between the two Egyptian groups; Azzam and bin Laden negotiated nationalistic differences and promoted a Pan-Islamic attitude (i.e., correlation); cell leaders negotiated conflicts between survival drives and martyrdom. We find evidence, then, to support Proposition 1b.

THE AGGREGATION PROCESS IS SPED UP BY CATALYSTS

A premise of complexity theory and complex leadership is that selection forces (Hannan & Freeman, 1977; Kieser, 1989; Singh & Lumsden, 1990), traditionally thought to be the source of evolution and elaboration, are not sufficiently powerful to produce the diversity and dynamic vibrancy observed in social and organizational behavior. Selection is hampered by its dependence on random or accidental change (Kauffman, 1993); it is more useful for nudging a system in profitable directions as it emerges than for creation and elaboration.

Instead, complexity overlays another dynamic on top of the selection process, one that is internal to the emergent system and requires little external motivating energy (as Kauffman, 1993, put it, "order is free"). This dynamic is called "autocatalysis," and refers to a tendency of recursive systems to self-generate catalysts that speed up or enable the emergence and evolution of forms (Kauffman, 1986, 1993).

Correlation and aggregation create initial, rudimentary structures, but simple interaction alone (as with accident and natural selection) elaborates slowly and unexceptionally. However, the interactive process also "auto-generates" catalysts that enhance or speed up an emergent dynamic. Catalysts, for example, can manifest as behavior that is copy-catted (as occurs in mob activity); it may be structures that create their own building blocks (e.g., organized labor in the early twentieth century); or it may be external events that precipitate internal reaction (as happened after the initial court ruling in the Rodney King affair in Los Angeles in 1992). Catalysts bring constituent agents into proximity and enhance or stimulate the correlational process. Catalysts do quickly what selection, with its random trials and errors, can only do slowly.

John Holland (1995) describes this phenomenon from a different (but overlapping) perspective, one that is more amenable to our discussion of leadership. He observed the emergence of specialized catalytic forms in his neural network simulations and coined the term "tag" to describe what he observed. Generally, tags are catalytic "things" (as opposed to events; a terrorist bombing is a catalyst but a bomber is a tag catalyst) that lend overt, even deliberate, symbolic meaning to an emergent event.

Tags perform two specific catalytic functions. First, by providing unifying symbolic meaning, they delineate their systems from their environments, give them identity, and help bond constituent parts. Thus a tag can be (among other things) an idea, a physical symbol of a system such as a flag, a common enemy, or a belief. Second, tags can perform leadership functions. As such, they serve to spark bottom-up activity rather than to implant top-down expectations. Leadership tags function as unifying symbols of a movement, they articulate its goals, and they embody its meaning. Tags (including leaders) emerge out of, and owe their existence to, interactive dynamics. They rarely (we suspect, never) initiate an interactive dynamic themselves; rather, they are produced by the broader dynamic.

Earlier we argued that leaders could influence local dynamics with direct leadership strategies (Proposition 1b). Tags influence aggregation with indirect strategies; that is, they catalytically spark bottom-up activity. Direct leadership acts largely for selfish (locally focused) reasons and its self-interest results in conflicting constraints at a higher level of interaction (leading to a mesh of conflicting constraints). Such a complex of conflicting constraints can be resolved for the good of the whole system, but the process is too convoluted for effective intelligent resolution (Kauffman, 1993). To influence the process, leaders/complex adaptive agents must exhibit indirect leadership behaviors.

Indirect leadership behaviors do not directly resolve conflicting constraints; rather, they stimulate conditions that both create conflicting constraints and foster conditions that permit their resolution. That is, they foster network structures that present complexly interactive challenges, create atmospheres that "empower" workers to deal with constraints, enable network relationships that can work through constraints and use them as springboards for creativity, and focus or speed up the process of constraint resolution.

Proposition 2: Catalysts are events or things that stimulate interactive behaviors and speed up aggregation processes. An important form of social catalyst is the tag, or "things" (including leaders) that symbolize and help rally interacting agents, thus speeding and focusing aggregation (indirect leadership).

FINDINGS FOR PROPOSITION 2

There were several key events that served as catalysts to speed up the emergence of organized terrorism in the Middle East. A particularly important catalyst emerged out of the Second World War: the creation of the Jewish state of Israel in 1948. This, perhaps more than any single event, aroused Islamic anger and fed anti-Jewish attitudes (Emerson, 2002). Other catalyzing events include the Camp David Accord in 1979, the Soviet invasion of Afghanistan in the 1980s, the US presence on what is considered sacred Arabian soil following the Iraqi war (even moderate Arabs chaff at this), and the US cruise missile retaliations for the bombing of its embassies in Kenya and Tanzania in 1998 (PBS Online, 2001).

In each case, the catalyst enhanced Islamic resentment, stimulated recruitment for militant groups, and helped different groups understand their common objectives (that is, it sped up the correlational process; PBS Online, 2001). The 1998 retaliations, for example, significantly enhanced bin Laden's reputation in the Middle East and lent urgency and credibility to the emergence of the mature field aggregate called the World Islamic Front (PBS Online, 2001).

As we defined them earlier, tags are specialized forms of catalysts; specifically, they are "things" (as opposed to events) that symbolize, articulate, or help unify a movement. Tags include leaders. There are numerous examples of leadership tag behavior in the Islamic militancy movement. Qutb, the 1950s leader of the Egyptian movement, articulated the movement's violence by calling it *jihad* (defined by moderates as soul struggle; Bergen, 2001); similarly, al-Zawahiri articulated

emerging pan-Islamic sentiments in the 1980s (Bergen, 2001). Bin Laden became a rallying focus for anti-American anger following America's cruise missile bombing of a pharmaceutical plant in Sudan and training camps in Afghanistan (PBS Online, 2001).

Tags serve to embody the attitudes, hopes, angers, fears, and actions of a people, thus focusing their common purpose and identity. The rallying capacity of such tags is far more important than their capacity for action. Leaders like bin Laden and al-Zawahiri are more important as symbols and articulators than as managers; indeed, the movement is far too complex to be managed effectively. Al-Qaeda is sufficiently organic to take care of itself. It needs tags, as proposed in Proposition 2, more than managers.

COUPLING PATTERNS DETERMINE THE FITNESS OF THE SYSTEM

A third critical aspect of complex systems relates to coupling patterns and the fitness of the system. Specifically, interdependencies among agents and aggregations are described in terms of coupling strength. Weak coupling permits units to innovate and to adapt to the demands of their environment, but provides only rudimentary structure for the dissemination of innovation or the consolidation of fitness (Weick, 1976). Tightly coupled, or highly interdependent, systems offer ample structure for dissemination, but discourage innovation because of the demands of too many conflicting constraints. When change does successfully intrude on a tightly coupled system, it can spread rapidly through the multiple chains of interdependency, often resulting in the collapse of the system.

Complexity theory suggests that fit structures are primarily moderately coupled but possess a diversity of weak and tightly coupled systems as well (Kauffman, 1993; Marion, 1999). The predominant moderately coupled structure is sufficiently loose to permit localized experiments and adaptations, and sufficiently tight to challenge the structure with conflicting constraints without freezing it into inaction (Kauffman, 1993; Marion, 1999). A moderate number of conflicting constraints stimulate the system to seek accommodations to the various need preferences.

Some loose and tight structures within a moderately coupled system are useful, however. Tightness can help a system resist change when dealing with moderately changing environments (Kauffman, 1993). Tightly coupled nodes within the system facilitate communication and coordination. They are also profitable targets for disruption, however. Carley and

Ren (2001), for example, found that maximum damage can be inflicted on a system by removing its tightly coupled communication centers. Loose structures, by contrast, are sufficiently divorced from the mainstream system to persist when the system is damaged, thus they can bridge different emergent events.

Complex adaptive agents (CAAs; e.g., complex leaders) affect coupling patterns in several important ways. First, they can stimulate interdependency and interaction among units, thus enhancing the aggregation process. Second, CAAs (particularly those in formal or recognized positions) typically seek to extend their control over organizational behavior and to the degree they are successful they tighten the system's dependency on the leader (Pfeffer, 1997). This is particularly evident with charismatic leadership, which serves to enhance the fitness of an organization but accomplishes this by restricting organizational behaviors to a highly centralized vision (McKelvey, in press). Third, CAAs' relationships to the system often (but not necessarily) enable them to serve as centralized communication nodes within that system. A CAA who is intimately interactive with the public, administrators, and workers may be an important communication hub, for example.

In general, complex leaders, or complex adaptive agents, are in a position to enable (or inhibit) conditions that stimulate the effective coupling of structures, ideas, and innovations. CAAs do not *control* effective coupling, for control would deprive the emergent system of the creativity implicit in distributed networks of interacting, intelligent nodes. Rather, they create the ambience necessary for effective coupling. They do this, for example, in the way they structure formal subsystems, by "planting seeds of innovation" (proposing ideas, providing resources or slack time), by enabling decentralized decision making, by stimulating interactions among different aggregates, and by stimulating interdependency and conflicting constraints (e.g., organizing a system so that changes in one aggregate affect the functioning of one or more other aggregates).

Proposition 3: Fit aggregates, meta-aggregates, and field aggregates are moderately coupled in a network of interdependencies, but possess a diversity of tight and loosely coupled subsystems. Complex leaders, acting as complex adaptive agents, catalyze coupling, encourage tightness, and may serve as tightly linked communication nodes.

FINDINGS FOR PROPOSITION 3

Details regarding the level of coupling within the al-Qaeda network are difficult to ascertain because of the level of secrecy that characterizes this organization, but there is sufficient secondary information to make general statements. Coupling patterns will be explored from two perspectives: the operational level of terrorist cells, and the broad, overall structure of the organization.

Operationally, one can describe coupling in terrorist cells using a fairly well-documented incident: the bombing of the *USS Cole* in 2000. There were two onsite cells in Yemen working on this effort (Bergen, 2001). One cell performed the logistical work of collecting resources, arranging to obtain boats to deliver explosives, obtaining safe houses, conducting surveillance, and hiring low-level help. The second cell was responsible for loading explosives into the boat, conducting the actual bombing attempt, and seeing that it was filmed for recruiting uses. These cells were tightly coordinated by facilitators who were responsible for coordinating activities within and between the operational cells, keeping the suicide bomber committed, coordinating resources and training preparation, general logistics, and communicating with outside contacts (Bergen, 2001; see also Associated Press, 2001; Engel, 2001). Terrorist cells, then, are tightly coupled internally.

Externally, the cells appear to be moderately coupled to a fairly large network of support (although the evidence regarding coupling was at times contradictory: Associated Press, 2001; Emerson, 2002). The facilitators were communication nodes within the cell (Bergen, 2001). They had access to sophisticated communication tools, including satellite telephones, fax machines, and email. Cell facilitators and members traveled frequently to meet with resource providers and to smuggle money and explosives (*Newsweek*, 2001). If the *Cole* bombers used the same *modus operandi* as the 9/11 bombers, their resource providers included banks in Dubai, rich Saudi and Kuwaiti businessmen, and cells operating within the Middle East and Europe that obtained explosives and solicited and laundered money (Hosenball, 2002). There is also evidence that terrorist cells communicated with members of other terrorist groups. Steven Emerson (2002), for example, traced phone calls of the 1993 WTC bombing suspects and found that they had been in contact with, among others, the spiritual leader of the Palestinian Islamic Jihad.

We are uncertain about the level of coordination exerted over cells by the leadership core in Afghanistan. There is evidence that various al-

Qaeda leadership operatives were involved in planning and supporting terrorist activities (Eggen & Dobbs, 2002; Hirschkorn, 2001), but on balance cells appear to have had significant freedom to interact with other terrorist group leaders and with resource providers, and were given latitude to exploit their environments (Isikoff *et al.*, 2001; Klaidman & Isikoff, 2002). Terrorist plots were sophisticated, requiring (among other things) detailed planning, access to resources, access to training, to forged passports, and to laundered money (Struck *et al.*, 2001). Networks of support had to be rather extensive and terrorists required a certain amount of flexibility to accomplish their sophisticated objectives (Struck *et al.*, 2001). Tightly controlled external couplings would not likely have provided sufficient flexibility to launch major activities such as the *Cole* or the 9/11 bombings.

The terrorist cells that conducted the *Cole* and the 2001 WTC bombings, then, appear to have been moderately coupled to a fairly broad network of support, but tightly coupled internally. This is consistent with our definition of coupling fitness in Proposition 3.

The broader network of al-Qaeda is represented by Figure 1. It is composed of a leadership core, bankers and money exchangers, training camps, mosques and radical *imans*, businesses, nongovernmental (charity) organizations (NGOs), allied terrorist groups, operational cells, support organizations in America and Europe, and Islamic conferences (Emerson, 2002). Interestingly, bin Laden's leadership core is not intimately connected in this network; that is, its direct influence over elements of the network is limited. This suggests that the network would survive the loss of this leadership core. However, the linkages in Figure 1 are physical linkages representing channels of direct influence. Were we to overlay linkages representing symbolic influence, the leadership core would be highly connected within the broader network. Bin Laden's symbolic, unifying importance in the emergence and cohesiveness of this network is significant. His most important role is that of tag, as defined for this article.

Physically, the broad terrorist network appears to be moderately interdependent (Eggen & Dobbs, 2002; Hosenball, 2002; Isikoff *et al.*, 2001; Klaidman & Isikoff, 2002; *Newsweek*, 2001; Struck *et al.*, 2001). Terrorist groups communicate and cooperate with one another—radical Islamic conferences in the US, for example, draw participants from a number of terrorist organizations (Emerson, 2002)—but they do not control one another's activities. NGOs and other fund-raising agents use third world banks to conceal how their money is distributed, but they are not controlled by those banks (Hosenball, 2002). Leaders within cells serve
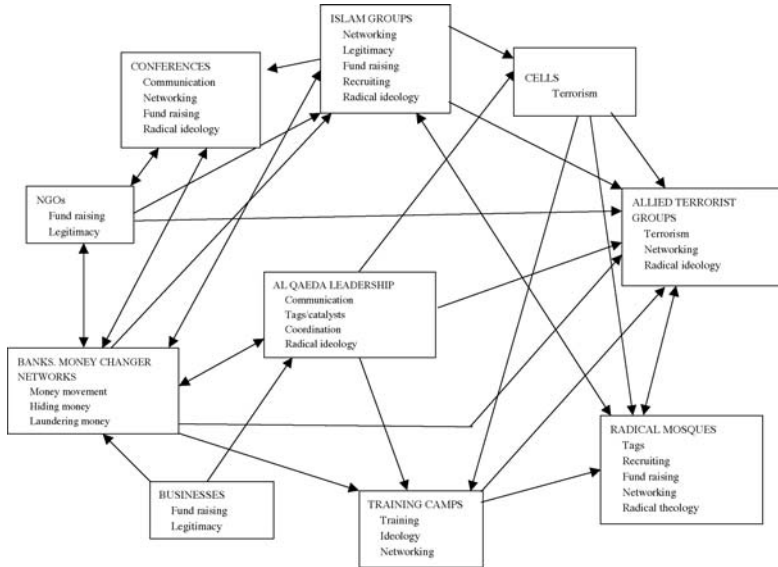
Figure 1 Simplified representation of the al-Qaeda network. Subcategories identify the given component's functions; arrows indicate direction of moderately to tightly coupled dependency. Al-Qaeda refers to bin Laden's leadership core. Each component is itself comprised of numerous aggregates linked in loose to tightly coupled networks of interdependency.

as local communication hubs and are in some ways tightly controlled by central leadership, although in other ways they have significant discretion. Higher-level leaders in al-Qaeda coordinate to some extent the flow of money within the organization, and they provide some level of coordination for terrorist cell activity (Hosenball, 2002). There is little evidence that they control the activities of NGOs, Islamic support groups in the West, or conferences (Emerson, 2002).

The training camps are important communication nodes in this network; these camps enable terrorists to develop a sense of common purpose with other terrorists and a sense of identity with the broader militant movement. Consequently, they are useful targets for interdiction. The banking, business, and NGO constituents are highly decentralized and dispersed (loosely coupled), by contrast, thus seriously hampering post-9/11 efforts to interdict the flow of money.

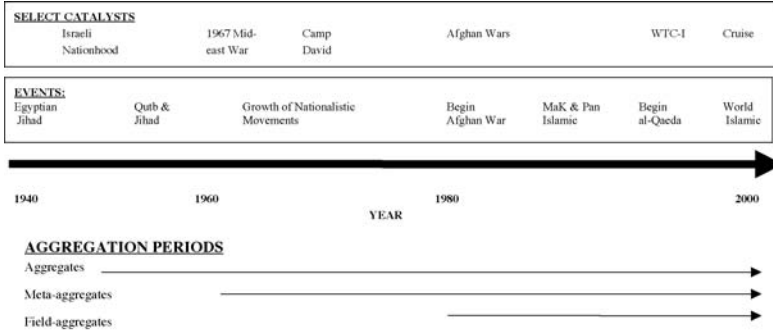We argue that the evidence supports Proposition 3.

Figure 2 *Timeline of key events, catalysts, and aggregation periods in the emergence of Islamic terrorism*

HUMAN CAPITAL IS MAXIMALLY ENABLED WITHIN MODERATELY COUPLED DISTRIBUTED INTELLIGENCE NETWORKS

Finally, complexity theory argues that human capital is maximally enabled when it is organized within distributed intelligence (DI) networks that are moderately coupled with one another (Marion, 1999; McKelvey, in press). According to complexity, each aggregate (a unit that can be as small as a single individual) in an organization possesses a level of intelligence; Becker (1975) refers to this as "human capital." It is tempting—but, according to complexity perspectives, incorrect—to assume that competent human capital alone is a sufficient foundation for fit and productive organizational behavior. One might assume, for example, that leaders should focus on hiring competent people and working to assure that they function at peak efficiency. However, even genius may be minimally productive if isolated from other social actors (Marion, 1999; McKelvey, in press).

Theorists since 1980 have increasingly observed that an organization's fitness and creativity are a product not just of its human capital, but also of its social systems or social capital (Burt, 1992; see also Burt, 1997; Granovetter, 1985; Masterson, 2000; Settoon *et al.*, 1996; Uhl-Bien *et al.*, 2000). Following Fonseca (2002), we extend this a step further. Knowledge is not the exclusive property of individuals (human capital) or of groups (social capital); rather, it is derived from interaction (Drath, 2001) among people and among heterogeneous groups. That is, human

and social capital are maximally enabled when embedded within appropriate networks of interaction and interdependency. McKelvey (in press) adds that the nodes of a distributed intelligence network should optimally possess diverse skills and outlooks; that is, they should be heterogeneous. We propose the term "interaction capital" to capture all of this.

Interaction capital suggests that innovations by aggregates in properly interacting DI networks can influence innovations in other aggregates. Other aggregates within the network will likewise produce innovations of their own, and eventually innovations will start to link, thus creating larger or more sophisticated innovations. Occasionally the process will grow so large that it leads to major change or introduces major new innovation.

DI dynamics emerge bottom-up. Bottom-up activity produces far greater complex behavior that can be produced by (top-down) deliberate human planning or coordination (Kauffman, 1993; Marion, 1999; Marion & Uhl-Bien, 2001). Leadership that recognizes this and fosters conditions enabling bottom-up coordination and the development of moderately coupled structures in which ideas can emerge freely and find one another will be effective in maximizing interaction capital (Drath, 2001; Marion & Uhl-Bien, 2001).

Proposition 4: Moderately coupled, complex systems function as distributed intelligence (DI) networks. Leadership in al-Qaeda was conducive to the emergence of moderately coupled DI networks, thus maximally enabling its interaction capital.

Findings for Proposition 4

Moderately coupled, distributed intelligence networks of heterogeneous nodes, when stimulated by conflicting constraints to experiment and innovate, tend to foster meta- (more sophisticated) ideas and field ideas. From this perspective, they are networks of self-aggregating analytical units in much the same way that the brain is a self-aggregating (i.e., learning) network of interacting neurons.

We have already argued that al-Qaeda is a moderately coupled network of heterogeneous agents, thus it is a DI system. The question implicit in Proposition 4, then, is: What did al-Qaeda leadership do to enable a moderately coupled DI network?

Bin Laden and his colleagues enabled moderate coupling by failing, either intentionally or (more likely) by necessity, to consolidate power over the system. The leadership instead served the important complex

leadership role of tag, in that it articulated and symbolized Islamic militancy. As tag, it encouraged innovative behavior and initiatives across the world and lent a sense of unity and identity to Islamic militancy.

Al-Qaeda catalyzed the emergence and growth of militant movements, western Muslim advocacy groups, NGO support groups, radical mosques, banking and money-exchange networks, and media outlets (Emerson, 2002). Often they merely reaped the benefit of structures that appeared unbidden (the social support organizations in the US, for example). Indeed, we could find little evidence that the emergence and expansion of many of the systems supporting al-Qaeda, particularly those at the field level, were centrally planned. Rather, the cumulative evidence suggests that they emerged bottom-up and found niches in the broader network (e.g., see Emerson's 2002 discussion). Al-Qaeda leadership provided models of creativity, dropped seeds of innovation, encouraged innovative initiatives, stimulated the growth of supporting resources, and largely stayed out of the way of spontaneous growth and innovation. We submit that this evidence supports Proposition 4.

DISCUSSION

Examining complex leadership, using al-Qaeda to illustrate its dynamics, offers important new perspectives of effective leadership. Leadership models have traditionally placed strong emphasis on "the leader" and control (Fayol, 1916), and our implicit leadership theories are heavily grounded in this model (Jermier, 1998). Complex leadership changes our paradigms regarding both leaders and leadership by viewing leaders more broadly, beyond formal roles, and by identifying direct and indirect (e.g., complex adaptive agent) leadership behaviors. Individuals who engage in adaptive behaviors—not just those in formal leadership roles— act as leaders, blurring the lines between leaders and followers and emphasizing the importance of emergence in complex adaptive systems (Marion, 1999).

Rather than directing and controlling, complex leaders help negotiate conflicting constraints to create correlational bonds that produce aggregation (direct leadership). Creation of these bonds helps them to emerge as leaders in the system (e.g., leaders "bubble up" and are held up by the system; when one falls, another can rise up as a replacement). Complex leaders, acting as complex adaptive agents, also capitalize on situations that create conflicting constraints and foster conditions that permit the interaction of a complex of constraints (i.e., indirect leadership), thus

enabling aggregation, innovation, and fitness. That is, they foster network structures that present complexly interactive challenges, create atmospheres that "empower" others to deal with constraints, and enable network relationships that can work through constraints and use them as springboards for creativity.

The case of al-Qaeda provides an illustration of complex leadership enacted. Our analysis provides evidence indicating that al-Qaeda exemplifies a complex organization with complex leadership. It appears to be the product of bottom-up aggregation enabled by direct and indirect leadership processes. Rather than starting with a leader and with specific goals, al-Qaeda and its leaders emerged from a wave of strong sentiment in the Middle East into a powerful field aggregate, with a vast network of resources and capability. Al-Qaeda leaders did not create this movement, but rather were created by it. Through direct leadership behaviors, they forged alliances that helped increase the power of the network. Through indirect leadership behaviors they capitalized on opportunities (e.g., catalysts) that emerged out of network dynamics, and helped serve as tags to catalyze al-Qaeda's structure and activities.

Al-Qaeda leadership, through choice or necessity, appeared to have maintained and fostered a moderately coupled network, but one possessing internal structures that were loosely and tightly organized as appropriate. This feature of al-Qaeda is critically important because it helps ensure survival of the network in the face of direct threat. Tight coupling occurs when leaders implement rigid controls in a system in order to direct activities and to be informed of decision making. Loose coupling refers to functional independence; it allows systems to survive dramatic system-wide perturbations. Moderate coupling allows the network to engage in independent decision making as needed, but also to withstand threats to the system. Moderate coupling is not so loose that it sacrifices the united effort toward the common cause, but it is sufficiently loose to maintain flexibility. Finally, al-Qaeda leadership acted in ways that linked diverse agents in a distributed intelligence network. This enabled creativity and innovation on a large scale (such as that needed to pull off the 9/11 events), and helped assure the broadly based viability of the system.

Organizing according to complex leadership principles would mean that the leadership of the network gives up certain things: insistence that the "top" of the organization is kept fully informed of the actions of the members; control over the linkages formed by network members (rather, members form their own network linkages); and authority over actions of

the members (rather, members act on their own within the overall mission of "wreak havoc on the enemy"). The role of the "top" would be to continue to catalyze the mission, recruit new members (e.g., create correlational bonds), promote activities within the context of the mission (e.g., *fatwas*), and provide resources and network contacts. The role of the network members would be to foster interconnectivity and create linkages that further advance the power of the network to meet the mission of the organization.

As a result, al-Qaeda represents a highly adaptive learning organization that, in many ways, keeps one step ahead of the more sophisticated and developed western nations that it opposes. In a sense, it is like bacteria that manage to work around the best efforts to eradicate them. This is important to understand, because the use of traditional leadership paradigms to view al-Qaeda may result in inappropriate reactions and responses. Complexity perspectives tell us that going after al-Qaeda's top leadership would not be enough to take care of the problem, and might even create a catalyst to further energize the system. While bin Laden is a charismatic leader (Eggen & Dobbs, 2002), he did not make himself so central to the al-Qaeda network that innovation is restricted to his vision or the movement would die with his demise.

Instead, the present analysis shows that al-Qaeda is the product of interaction capital and is not the brainchild of an individual. Its strength does not reside in its leaders, although its leader tags were important to its development and fitness. Its strength resides in its complexity. This is highlighted by the quote at the beginning of this article (from al-Qaeda apologist Saad Al-Fagih):

> If bin Laden was not there, you would have another bin Laden. You would have another name, with the same character, with the same role, of bin Laden now. That's why we call it a phenomena [sic] not a person. (PBS Online, 2001)

Magnus Ranstorp, deputy director of the Centre for the Study of Terrorism and Political Violence at the University of St. Andrews in Scotland, adds:

> [Al-Qaeda] is directed from the bottom up as much as the top down. The typical pattern before September 11th was of local al Qaeda cells initiating reconnaissance of potential targets, planning and then going back to the al Qaeda leadership for approval and possible funding. The foot

soldiers are self-initiating and self-sustaining. (Quoted in Eggen & Dobbs, 2002)

In other words, contrary to many conceptualizations that leadership is the predominant force in the creation and survival of organizations, complex leadership and the case of al-Qaeda show that leadership is not necessarily a person (or a formal role) but a phenomenon created by, and residing in, a complex adaptive system.

The implications of this are powerful. Al-Qaeda is composed of a diversity of individuals and groups who join based on common need and shared vision (e.g., they internalize the goals and values), are provided with resources and contacts with whom they can develop plans for attack, and then are told to "go wreak havoc on the enemy" (e.g., the mission) without requirements for bureaucratic oversight or micro-managing from above. Such a system represents an incredibly forceful and resilient organizational form.

While there is obviously much that we don't know about this organization, or the leadership of complex networks in general, it does seem that by examining organizations through a new lens of complex leadership we may be able to generate insight for organizational leadership far beyond traditional views (which may be limiting us currently). One might argue that the examples of complex leadership examined in this article may be so different from the experiences of business organizations that their generalizability is subject to question, particularly regarding the issue of control and accountability. However, others argue that our current views of control may be as extreme in the opposite direction (i.e., too much control), and that current organizational structures inhibit the creativity and flexibility needed to survive in a rapidly expanding information age (Stacey *et al.*, 2000).

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