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# Malevolent Creativity in Terrorist Organizations

## ABSTRACT

Terrorist organizations are both imitative and innovative in character. While the drivers of imitation have been extensively modeled using concepts such as contagion and diffusion, creativity and innovation remain relatively underdeveloped ideas in the context of terrorist behavior. This article seeks to redress this deficiency by presenting a conceptual framework with which we can understand the complex nature and multiple drivers of creativity and innovation within terrorist organizations. The overriding questions we address are: what factors spark creativity and innovation within terrorist organizations, and are there particular organizational traits that increase an organization's propensity to be creative and innovative? Using insights from industrial and organizational psychology and aided by illustrative examples and case studies from the history of terrorism, we aim to show that the multiple drivers of creativity and innovation are identifiable. By providing a conceptual framework that explores these key issues, we suggest that a much clearer research agenda for these issues may emerge. We conclude with a discussion concerning how our framework can help inform counter-terrorism practices.

*Keywords:* creativity, malevolent, terrorism, innovation.

Terrorist organizations are both imitative and innovative in character. Organizations espousing vastly different ideologies and goals frequently replicate a perceived successful tactical or technological innovation established by another organization. This process has been extensively modeled using concepts such as contagion (Bloom, 2005; Dugan, LaFree, & Piquero, 2005; Midlarsky, Crenshaw, & Yoshida, 1980; Moghadam, 2008) and diffusion (Bonneuil & Auriat, 2000; Braithwaite & Li, 2007; Horowitz, 2010). However, careful examination of creativity and innovation within the context of terrorism still remain underdeveloped with notable exceptions from Jackson et al. (2005), Dolnik (2007), and Rasmussen and Hafez (2010). This article seeks to redress this deficiency by presenting a conceptual framework to aid in understanding the complex nature and multiple drivers of creativity and innovation within terrorist organizations.

The overriding questions that guide our analysis are: what factors spark creativity and innovation within terrorist organizations and are there particular organizational traits that increase a terrorist organization's propensity to be creative and innovative? Using insights from social, cognitive, industrial/organizational, educational psychologies and the broader organizational behavior literature, applied to illustrative examples from the history of terrorism, we aim to show that although it is nearly impossible to predict the precise onset of specific innovations within terrorist organizations, given the correct information, it may be possible to predict a terrorist organization's capacity for creativity. Our focus therefore is concerned with the process, behaviors, and organizational capabilities that precede the onset of a terrorist innovation. This focus potentially offers greater insights into counter-terrorism strategy focused upon disrupting the abilities of terrorist organizations to operate in this way.

Put another way, we assert that it is possible to measure, in a terrorist organization, many of the key variables crucial to the creative process. By providing a conceptual framework that explores these key issues, a clearer research agenda for these issues will emerge. While Rapoport estimates that 90% of terrorist organizations die out or disappear within the first year of their existence (Cronin, 2009), perhaps a key explanation for the survival of the remaining terrorist organizations is their ability to adapt, innovate and be creative against the more substantial state powers against which they fight.

This article largely focuses on tactical innovation as opposed to strategic, or organizational innovation more broadly. Tactical innovation encompasses a terrorist organization's adoption of an entirely new method, mode or means of violence rather than a terrorist organization's capacity to copy or the forms of learning it engages in. We first offer a succinct literature review of the organizational dynamics of terrorism. Creativity is then distinguished from innovation—two concepts that are often incorrectly used interchangeably within terrorism studies. Our approach is consistent with the view of creativity as both process and product. Characterizing creativity and innovation as processes requires us to understand the dynamic interactions (and the properties that govern those interactions) by multiple actors. The ability to first generate ideas for a new tactic (including who to target and how to deliver the attack) or how to adapt certain technologies and then use them in combat entails understanding how the creative process works. It also entails understanding how organizational structures and management systems facilitate this process. In turn, this involves understanding the drivers of creativity from both a bottom-up (creativity in individuals and small groups) and a top-down (leadership and intra-organizational structural effects) perspective while also accounting for the competitive environment in which terrorist organizations operate against a much stronger foe. The multi-dimensional, multi-causal, and dynamic nature of the creativity process is outlined. Characterizing the result of this process as product requires outlining the factors that underpin an assessment of a product's creativity and likelihood of diffusion. Finally, this article concludes by applying the theoretical model to two case studies of terrorist plots and summarizes the model's implications for counter-terrorism policy.

## ORGANIZATIONAL DYNAMICS OF TERRORIST ORGANIZATIONS

Studies that focus upon the organizational dynamics of terrorism generally fall into one of three categories, with each category being characterized by a distinct overriding research question;

1 Why do organizations use terrorism?

2 How do organizations learn and copy terrorist tactics?

3 How do organizations create and innovate with new terrorist tactics?

Arguably, the third question has as much, if not more, operational significance for counter-terrorism practitioners. How terrorist organizations innovate with new tactics represents a different concern from adopting a tactic from another terrorist organization's repertoire. A problem with the emphasis on learning from other terrorist organizations is that much of what we learn can only be observed after an attack. The implication being that there is little scope for understanding how and when to intervene in the development of a terrorist attack. By applying theory and frameworks from other literatures, our intent is to develop a predictive model of terrorist innovation from which we can gain predictive capacities to aid in the investigation and disruption of terrorist plots.

### WHY DO ORGANIZATIONS USE TERRORISM?

Rational-choice types of explanations seek to explain why organizations engage in violence. The wealth of studies on suicide bombing provides a useful illustration. Various analyses emphasized suicide bombing's strategic utility (Gupta & Mundra, 2005; Pape, 2005), its ability to balance power in an asymmetric war (Luft, 2002), its power to produce system collapse (Hafez, 2007), and its role as a signaling act (Hoffman & McCormack, 2004). Bloom (2005) emphasizes the relationship between suicide bombing, domestic political competition, and the search for public support. Ganor (2000) highlights other strategic motives such as the efficiency with which the bomber can still activate the charge when captured. Although these studies offer a great deal of insight into why terrorist organizations may choose to engage in this particular manifestation of terrorist violence, their intent is descriptive rather than proscriptive, and they often overlook micro-level decisions that are capable of being manipulated or disrupted by counter-terrorist agencies. Such micro-level decisions include questions such as the following: What structures facilitate certain manifestations of violence? What drives the decision to choose one tactic over another? What drives a terrorist organization to copy the tactics of others? What facilitates a terrorist organization to innovate in terms of technology or delivery methods used?

### HOW DO TERRORIST ORGANIZATIONS LEARN AND COPY TACTICS?

A growing number of studies on the organizational dimension of terrorism have begun to focus upon in-group antecedent behaviors and organizational traits that lead to terrorist violence. These studies focus upon how organizations engage in violence. At the forefront of these studies, researchers focus upon what types of

violence are likely to be replicated as well as organizational traits that make replication of another organization's tactics more likely. The majority of these studies follow in the manner of Midlarsky et al. (1980) who quantitatively illustrate the contagion effect that occurred transnationally during the rise of terrorist violence between 1968 and 1974. They also examined the types of violence most likely to be replicated elsewhere. Bombings, kidnappings, and hijackings diffused much more readily across borders than assassinations and raids according to the analysis.

More recently, suicide bombing experts such as Pape (2005), Bloom (2005), and Moghadam (2008) utilized process-tracing techniques to emphasize the key role success plays in facilitating a tactic's diffusion or contagion. Dugan et al. (2005) present a time-series analysis of 1,101 attempted aerial hijackings to illustrate that hijacking rates significantly increase due to copy-cat processes. In a highly sophisticated account, Horowitz (2010) demonstrates that external linkages and organizational capabilities facilitate a terrorist organization's ability to copy the innovation of others. For Horowitz, a terrorist organization willing to engage in suicide bombings yet missing the organizational capability or the necessary ties with others is unlikely to be able to sustain a campaign of suicide bombings.

While many studies on terrorism acknowledge that successful terrorist organizations must learn, very few show how they learn. According to Kenney (2007), it is unfortunate that "many government officials, policy analysts, and even researchers gloss over how…terrorists…actually *learn*, in the sense of acquiring, analyzing, and applying knowledge and experience…It is not enough simply to claim, as many do, that…terrorists learn" (p. 13). Kenney focuses upon training practices and outlines the various means by which al Qaeda has spread knowledge through its network. Examples include state sponsorship, training camps, knowledge-based artifacts such as training manuals, "informal apprenticeships, on-the-job training, communities of practice, and combat" (Kenney, 2007, p. 145). Kenney (2010a,b) has also undertaken excellent analyses of knowledge and tradecraft amongst Islamist militants in Britain, Spain and online.

## HOW DO TERRORIST ORGANIZATIONS CREATE AND INNOVATE WITH NEW TACTICS?

Other studies have emphasized a change in focus toward terrorist innovation. This recent trend is a critical move away from previous analyses that emphasized a lack of creativity and innovation within terrorist organizations. For example, Merari (1999) compared terrorism to conventional war and argued that terrorism "has not changed much in the course of a century, and virtually not at all during the last 25 years" (p. 54). Hoffman (1993) also noted the remarkable consistency and conservative nature of terrorist attacks. Dolnik (2007) concurs asserting, "What we have witnessed is that this scope [of terrorist attacks] is relatively limited and remarkably unchanging. In fact when one surveys the last 50 years of terrorist operations case by case, very few incidents strike the observer as creative *in any way*" (p. 56).

However, as the data-driven study of terrorism and political violence slowly becomes more fine grained and comparative in nature, the focus has shifted to how

(not just why) terrorism occurs. There is a creeping acknowledgment that innovation regularly occurs and can be categorized in a number of ways. Crenshaw (2010) offered a typology of terrorist innovation, delineating three kinds. First, adopting new technologies to achieve unchanged objectives constitutes tactical innovation. A well-known example is Hezbollah's adoption of suicide bombings in the early 1980s. The same is true when they largely abandoned suicide bombings to rely on more conventional bombings during the 1990s. Tactical innovation is not limited to attack types, but can also be extended to delivery systems, the adoption of new technologies, initiation types, IED types, and changing the profile of operatives. Second, adopting new objectives comprises strategic innovation. For example, the increasing politicization of the Provisional Irish Republican Army through the 1980s and 1990s, reflected in the growing power and status of its political wing Sinn Fein, largely reflects a strategic innovation at the elite level of the movement. Third, changes at the organizational level in terms of structure or recruiting processes represent organizational innovation. Again, the Provisional Irish Republican Army (hereafter PIRA) provides an excellent example. A large-scale re-organization of PIRA's structure to a tighter cellular-based network in which cells acted independently of one another occurred between 1977 and 1980 (Coogan, 2000). Previously, PIRA structured itself like a conventional army with various brigades, battalions, and companies responsible for specific geographical combat areas. This change placed far less emphasis on the quantity of recruits and far more emphasis on secrecy and discipline than the preceding phase. Almost instantly, the effects of the structural changes became noticeable with 465 fewer charges for paramilitary offences occurring within a year (Smith, 1997, p. 145).

The shift of emphasis within terrorism studies toward understanding issues surrounding innovation is perhaps best illustrated by a 2010 conference at the U.S. Naval Postgraduate School that brought together a number of terrorism experts to present on various case studies of terrorist attacks across a wide spectrum of actors and conflicts. Collectively, the analysts agreed on a number of issues. They agreed that more resources (financial and human) potentially lead to more prolific innovation. The participants also agreed that leadership plays a central role, but there was no agreement on what type of leadership facilitates innovation most. Finally, they agreed that innovation itself is often incremental and driven by the need to overcome security constraints. As such, the analysts argued that the ability to develop predictive indicators is next to impossible. One respondent, Gary Ackerman (2010), asserted that preconditions of innovation include feasibility and compatibility, hospitable environment, networks of actors, ample resource reserves and risk tolerance. Concurrently, drivers of innovation include problem solving, competition and status, invention and discovery.

These studies appear fixated with predicting the onset of specific innovations and regularly acknowledge exasperation in efforts made to reach this goal. The lack of inter-disciplinary work and intended operational relevance for counter-terrorism practitioners may explain these shortcomings. Our focus, however, informed by industrial and organizational psychology and other related disciplines, is more concerned with the process, behaviors, and organizational capabilities that precede the

onset of an innovation. Not only is an organization's capacity for creativity and innovation observable but also offers far more insights into a counter-terrorism policy focused upon interrupting the abilities of terrorist organizations to operate.

## CREATIVITY AND INNOVATION AS A PROCESS

Issues concerning innovation and creativity typically possess a romanticized persona. Researchers and organizations alike overly celebrate its benefits while neglecting creativity's negative consequences (McLaren, 1993). Creativity is assumed to be largely "benevolent"—directed toward what most would consider ethical, appropriate, and desirable goals (Cropley, Kaufman, & Cropley, 2008). More recently, researchers have begun to focus on the "dark side of creativity" (Cropley, Cropley, Kaufman, & Runco, 2010). The concept of malevolent creativity and its applicability to issues surrounding terrorism and crime have recently emerged. Malevolent creativity is depicted as a creative effort deemed necessary and right by some organization or individual working to fulfill self-interested goals, but also entails intended negative consequences for some other group. Malevolent creativity is conducted with the conscious intention to benefit the self or organization and an awareness of its negative consequences on others. It should not be confused with creative efforts that somehow unintentionally lead to harmful outcomes, such as the invention of the automobile which had other unintentional negative consequences for the environment. Of course, the extent to which creativity is truly benevolent or malevolent is subjective—it might be viewed by one person as necessary and beneficial, but directly hurts another individual or organization. Given the creative endeavor involved in secretly plotting terrorist attacks with limited resources and personnel against a stronger foe, acts of terrorism saliently exemplify contemporary malevolent creativity.

One of the key early theoretical findings within the emergent literature was the observation that creativity and innovation, although linked, represent two distinct entities that combine as a process in the formation of a product. While creativity refers to the generation of ideas and novel concepts, innovation involves implementing these ideas (Amabile, 1996). In other words, for an innovation to occur, it must first go through a creative process from idea generation through to full implementation (outlined below). The transition from a creative idea to an innovative product (in this case a terrorist attack) is the key process to understand. This theoretical insight has, to date, not diffused to the few existing studies of creativity and innovation in terrorist organizations, which typically use the terms creativity and innovation interchangeably and depict both as a static phenomenon (one major exception being the case of Cropley, Kaufman and Cropley, 2008). This is surprising considering its practical importance for counter-terrorism efforts. While terrorist organizations may devise an extremely creative act of violence, if they lack the organizational ability to carry it out, the creative act will never become an innovative one. Also, a terrorist organization with the resources for innovation but lacking the traits needed for creativity will become too repetitive and ultimately stagnate in terms of tactics employed. By depicting creativity and innovation as a process, phase-specific

intervention points may also be identifiable for counter-terrorism practitioners (Cropley, Kaufman and Cropley, 2008). This further demonstrates the practical importance of understanding the nature of the creative process within terrorist organizations. This article will demonstrate that although the ability to predict and anticipate the onset of creativity within a terrorist organization is almost impossible, the ability to predict capacity for innovation is relatively more realizable, given the right information or intelligence.

Contrary to common perception, innovation and creativity are not akin to a spontaneous flash of a light-bulb moment. Instead, they result from a well-aimed, intentional search for improvement (Anderson & Gasteiger, 2007). Often the process is meticulous and follows a general pattern of problem definition, idea generation and exploration, and idea implementation (Amabile, 1996; Finke, Ward, & Smith, 1992; Wallas, 1926). The classic model of creative process described creativity as a sequence of preparation, incubation, illumination, and verification stages of cognitive processing (Wallas, 1926). The preparation stage is characterized by a preliminary analysis of the problem drawing from existing knowledge and skills. The incubation stage occurs when the individual shifts his or her main focus to another task, but at the same time, analytical thinking regarding the problem and its related associations are still occurring at the backstage. When promising ideas appear to emerge suddenly, the illumination stage is said to have taken place. Once creative and innovative ideas are formed, the individual engages in a verification stage where conscious effort is taken to evaluate and refine the ideas for improvement.

Although the classic model of creative process received much empirical support, it is not without criticism. The classic model has been described as too abstract and as offering limited testable hypotheses. Subsequent models of creative problem solving instead focused on characterizing creativity as a dynamic, recursive process where individuals move back and forth from the sub-stages of cognitive thinking prior to the final formulation of the creative product (Mumford, Mobley, Uhlman, Reiter-Pamon, & Doares, 1991). Some even go so far as to discourage the examination of the creative process altogether and call for a focus on the information-processing steps occurring within each stage of the creative process (Lubart, 2001). Nevertheless, most process models of creativity follow a general pattern of problem definition, idea generation and exploration, and idea implementation (Amabile, 1996; Finke et al., 1992; Merrifield, Guilford, Christensen, & Frick, 1962; Osborn, 1953; Wallas, 1926).

Researchers have expanded and refined these classic models of creativity. Mumford et al.'s (1991) eight-stage model of creativity has become a widely known and used model. The stages include problem construction, information gathering, category search, selection of best-fitting categories, combining and reorganizing category information, idea evaluation, idea implementation, and monitoring. In other words, the creative process begins with defining or recognizing the existence of a problem, acquiring and retrieving relevant information to help with the problem, reorganizing and combining selected information in new ways to facilitate the creative process, implementing the solution, and finally, conducting regular monitoring and evaluation of the problem solution to ensure that the solution met initial goals. In

some cases, organizations engage in an additional stage of solution optimization to refine the product prior to its launch (Basadur & Gelade, 2006).

Finally, the creative process is distinct from noncreative processes in several ways. First, the creative process involves targeting an ill-defined problem whereby individuals typically engage in the creative process to identify novel and alternative solutions to the problem. In contrast, noncreative processes may consider using previously acquired solutions to solve the problem. The creative process is characterized by recursive and dynamic thought patterns of divergent and convergent thinking while the noncreative process typically occurs in a linear and additive fashion. When existing information is used in the creative process, it is usually combined with new information and reorganized to facilitate problem solution. On the other hand, in noncreative processes, information is recalled and reused in its original form without much recategorization (Mumford et al., 1991).

## CREATIVITY AND INNOVATION AS PRODUCT

In terms of products, psychologists assert that the core characteristics of creativity are concerned with novelty/originality, relevance, elegance, and generalizability. Creative products are novel and generate effective surprise in their beholder while remaining relevant and useful (Cropley et al., 2008). Essentially, the product must meet both consumer and target population needs. A creative product lacking relevance and effectiveness is merely aesthetic. Terrorist attacks can be measured along these lines. For a terrorist attack, the consumer is usually the community that the terrorist organization claims to represent (i.e., PIRA claimed to represent Irish Catholics). However, the terrorist organization's target audience is often an audience beyond the direct victims of the violence. Spontaneous novel acts of violence generate effective surprise within the target audience. The violence and its subsequent media coverage generate an image of the terrorist organization as strong, cohesive, and relevant.

Hezbollah's use of suicide truck and car bombers between November 1982 and October 1983 offers a useful illustration of a novel product that possessed relevance and effectiveness while causing the effective response amongst the target population and satiating consumer needs. In terms of novelty, this campaign is often credited as the first sustained use of suicide bombings. In essence, Hezbollah's suicide bombings generated effective surprise amongst the target population and Hezbollah achieved these goals while mobilizing support amongst their consumers. The first bombing targeted an Israeli Defence Force military HQ and killed over 60 personnel. The next suicide bombing killed further 60 and injured over 100 when the U.S. Embassy in Beirut was attacked. Furthermore, in October 1983, over 300 French and U.S. soldiers were killed in coordinated suicide bombing attacks on their respective barracks. The level of fatalities caused illustrates the effective surprise deployed against Israeli, French, and U.S. troops. Subsequently, U.S. and French troops evacuated Lebanon. The novelty, scale, and intensity of these suicide bombing attacks lead to its unprecedented success. Within 2 years of their opening suicide bombings, Hezbollah emerged from dozens of aspirant militant organizations active at the time in Lebanon to be the most preeminent amongst them. The novelty of suicide bombings and

the symbolic power and martyrdom narratives inherent in them played a key role here in ensuring their relevance to their consumer audience (e.g., the community they claim to represent).

Counter-terrorist forces aim to reduce novelty in terrorist attacks because novelty is a particularly dangerous element. Furthermore, media coverage of terrorist attacks can often reduce the novelty of subsequent attacks. For example, early PIRA letter-bombs in England were highly novel and caused much disruption. The longer this manifestation of violence continued, media warnings increased vigilance within the wider public and subsequently eroded novelty value (O'Doherty, 2008). In another example, passengers of United flight 93 were able to prevent terrorists from crashing the plane into their intended target because they had learned of the earlier terrorist attacks that morning and responded in anticipation of those specific events re-occurring (Cropley et al., 2008).

The timing of a bombing attack also affects the value of the novelty. PIRA bomber Shane Paul O'Doherty explains in his autobiography: "It was a bad idea to detonate a bomb on a Saturday evening. It was too late to be reported in most Sunday newspapers" (O'Doherty, 2008, p. 118). Once a set of skills is perfected, terrorists may tend to rely on this expertise. However, the problem with creative, but repeated, acts of terrorism is the element of diminishing returns. Truly creative acts of terrorism often contain novelty value. Over time, however, the novelty diminishes. To sidestep diminishing novelty, terrorist organizations regularly shift tactics in terms of who is targeted, the attack method, the components of the bomb, or the delivery method. This involves a return to the creative process depicted above.

Another element of creativity is the elegance of the solution. Elegance refers to whether the product is logical, sensible, and well-crafted. In other words, "good solutions look like good solutions" (Cropley et al., 2008, p. 108). For example, Dolnik and Bhattacharjee (2002) discuss the costs and benefits to Hamas in using suicide bombings, rockets, and chemical weapons. They conclude that suicide bombings provide "greater overall net benefits than any other option. The technological simplicity, cost-effectiveness, controllability of consequences, ease of avoiding defensive countermeasures, and the morale boosting nature of suicide bombings make it the ultimately favorable tactic for fulfilling Hamas' objectives" (Dolnik & Bhattacharjee, 2002, p. 121). So while chemical warfare may enhance organizational prestige and increase deterrence costs, the fact that suicide bombings are cheaper, less likely to alienate their constituency and more cost-effective means that this particular manifestation of violence is far more elegant than a chemical attack in the short-term at least.

Broadly speaking, organizational behavior researchers assert that creative solutions must also be generalizable. This refers to the degree of applicability of the product, not only in terms of satisfying target population needs, but also the extent to which it sparks new ideas and inventions, challenges the status quo, and generates new ways to resolve current problems (Cropley et al., 2008). For example, the benefits from the original invention of the wheel are obvious, but its long-lasting impact comes from its generalizability. The wheel sparked challenges amongst the status quo by creating the

need for smooth roads, sparked new ideas and inventions such as modern propellers, jet engines, and turbines, and generated new ways of resolving current problems such as the transportation of heavy materials over long distances. For terrorist organizations, suicide bombings are a highly generalizable tactic. Since the Hezbollah bombings outlined above, Shia organizations' suicide bombings were appropriated by Sunni Muslims, Christians, Sikhs, and secular terrorist organizations such as the Tamil Tigers who are mainly comprised of Hindus. It is a tactic used by vastly different terrorist organizations espousing vastly different religious, political, or ideological objectives. Also, minor changes to suicide bombings have occurred over the years such that its novelty and generalizability have been sustained. The Lebanese progenitors of suicide bombing primarily used car and truck bombings. The use of individuals within the vehicles to detonate the bombings was a new innovation to the more conventional car bombing campaigns developed by the anarchist group the Galleanists in the U.S. at the turn of the 20th century and later perfected by the likes of the PIRA. Many of the early Tamil Tigers suicide bombings resembled those of the Lebanese organizations. Use of car and truck bombings proliferated. They also improved upon earlier failed Lebanese attempts at using boats to attack naval vessels. The Tamil Tigers were the first militant organization to employ the suicide belt that individuals tie around their waist. Following the belt bomb innovation by the Tamil Tigers, the Palestinian organizations used them around 70% of the time. Males exclusively carried out 9 years of suicide bombings until January 2002 when Fatah's al-Aqsa Martyr's Brigade employed Wafa Idris. Hamas and Palestinian Islamic Jihad soon followed suit in employing women as suicide bombers. The more recent use of proxy bombers (in Northern Ireland, Iraq, Columbia) who are intentionally killed is also a form of adaptation of a suicide bombing (e.g., using a human body to conceal, deliver and ultimately detonate the explosive device).

Finally, there are two forms of product innovation—incremental and radical innovation. These variants differ in the degree to which they are revolutionary and novel. Radical innovation consists of fundamental changes that strike a clear departure from existing processes and products. Incremental innovation describes small adjustments to the current technology or product (Dewar & Dutton, 1986). Radical innovation represents the core of creating effective surprise and shock in consumers. Radically creative products possess the surprise factor of being rarely anticipated and thus provide a competitive advantage to the designers by making it extremely difficult for competitors to emulate the product's unique qualities. In this case, instead of the products being, for example, consumer goods, creative outcomes are successful subway gas attacks, effective improvised explosive devices, strategic recruitment of new extremists, and responsive counter-attacks against military officials. Of course, this advantage lasts only until the competitors in turn generate a more technologically advanced and desirable product. In the same way as businesses compete with one another, the war on terror is seen as a dynamic struggle between law enforcement officials and terrorists to out-perform one another by employing increasingly creative means to effectively strike at their targets and evade detection (Cropley, Kaufman and Cropley (2008), p. 107).

Incremental innovations in general do not provide the same instant impact that radical innovations possess.

It is self-evident that a business entering a market with a product that has never been seen will, at least initially, have no competition. A less creative product, for example, one that is simply an incremental improvement on an existing product, will not exhibit the same degree of revolutionary impact. Competitors will be quick to respond with their own incremental improvements. In simple terms, creative products (or, more generally, creative solutions) are harder to anticipate than routine (noncreative) solutions. For this reason, it is hard to compete against a truly creative revolutionary product. (Cropley et al., 2008, p. 107)

Incremental innovations in terrorist attacks, however, do not necessarily follow this same pattern. In the words of one senior British Explosives Ordnance Disposal officer; "No terrorist bomb is necessarily new. It's usually born of a bomb used in previous campaigns" (Styles, 1975, p. 160). For example, building on previous technology and knowledge, terrorist organizations creatively modify and adapt their bombs and explosive devices to confuse and undermine counter-insurgency measures taken by security and law enforcement officials. PIRA kept in their arsenal variations of a bomb type that they released one by one so that authorities had more difficulty keeping track and designing effective counter-strategies against them. For example, one version of the bomb would utilize a metal casing, which dictates the use of a metal detector by security officers to find them, but the proceeding one would be encased in plastic, rendering metal detectors useless in bomb investigation scenes. In other words, most IEDs are "the product of terrorist ingenuity and although, outwardly, a device may resemble a well-tried or proven model, internal changes such as anti-handling devices, collapsing circuits and other modifications may be encountered" (Ryder, 2005, p. xii). All of these additions represent malevolent incremental innovations that bomb disposal units struggle to keep on top of. Effective terrorist innovations can therefore be both radical and incremental. The drivers of both variants are elaborated upon in the next section.

## THE MULTI-LEVEL DRIVERS OF CREATIVITY IN TERRORIST ORGANIZATIONS

The beginning of a creative process is not random. Instead, multiple levels of interacting actors combine to initiate the creative process. Interplay of individuals, teams, leaders, organizations, and environments contributes to this process. Figure 1 depicts this process below. Innovation therefore is multiply determined and each level of analysis is expanded upon below with illustrative examples from the history of terrorism.

### TERRORISM, CREATIVITY, AND THE GREATER ENVIRONMENT

Environmental drivers of terrorist innovation can be both distal (often clumsily encompassed under presumed "root causes" of terrorism) and proximal (counter-terrorism policies). Mumford and Hunter (2005) suggest that dissatisfaction with
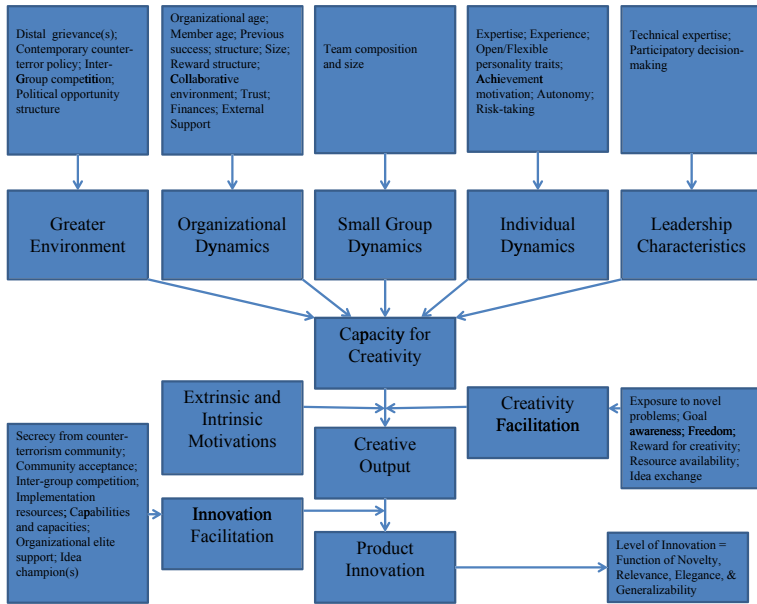
FIGURE 1. A conceptual framework for understanding innovation and creativity in terrorist organizations (adapted from Hunter, Cassidy, & Ligon, 2012; Hunter & Cushenbery, 2011; Hunter, Cushenbery, & Friedrich, 2012).

the current state of affairs within one's community or state can be a strong motivator for innovation. Terrorism's social, political, and systemic preconditions may therefore offer a fertile ground for creativity. By themselves, however, the underlying causes and preconditions of terrorism cannot explain creativity in terrorist organizations. All terrorist organizations stem from a sense of religious, political, social, national, or cultural grievance; yet, terrorist organizations also display a distinct heterogeneity in how creative they are at first glance. For example, PIRA is widely recognized as overseeing the greatest innovation and deepest expertise in the construction and deployment of IEDs by any non-state violent organization. PIRA-based IED technology and technical acumen later emerged in conflict zones across Colombia, Israel, Lebanon, Spain, Iraq, and Afghanistan. On the other hand, loyalist terrorist organizations in Northern Ireland often displayed a complete incapacity to innovate in IED-related technology (Styles, 1975).

Thus, a desire for change is not enough to encourage creativity in all terrorist organizations. To understand this disparity in creative output, we must look further into more proximal causes that individuals and terrorist organizations experience in their daily behavioral routines rather than abstract notions of distal grievances. One such proximal environmental driver is that of external agencies *imposing* the need for innovation on a terrorist organization. As Crenshaw (2010) notes, the social

movement literature embodied by Tarrow (1994) suggests something similar in "that government actions as well as new opportunities and constituencies stimulate innovation in social movements and their strategies of protest" (p. 43).

For terrorist organizations, three types of external agencies exist. First, effective counter-terrorism policies may force terrorist organizations to experiment with other creative acts of violence. At the same time, new counter-terrorism policies, while increasing the pressure to innovate, may also curtail a terrorist organization's capacity for creativity and innovation. Mass arrests of highly skilled and intelligent bomb-makers may leave a gap in the terrorist organization's structure that will take time to replenish through requisite training and experience. The decapitation of a terrorist organization's elite may also lead to a shift in emphasis within the terrorist organization away from innovation and toward more tried and tested violent repertoires.

Terrorist organizations espousing similar goals may attempt to outbid one another for community support and this represents a second form of external agency that may drive creativity and innovation for a terrorist organization. Community support for particular types of violence may also encourage terrorist organizations to innovate and fulfill these needs and this encapsulates the third form of external agency. Bloom's (2005) outbidding hypothesis caters to these two external agencies. Bloom hypothesizes that these dynamics account for why Fatah's al-Aqsa Martyr's Brigade ultimately adopted suicide bombings as a tactical innovation. Fatah's diminishing community support at the expense of organizations such as Hamas coupled with high community support for suicide bombings provides incentive for Fatah to create new tactics.

Furthermore, innovation is a process of change, which is inherently a temporal phenomenon (Lubart, 2001). Thus, planning is crucial for successfully releasing new products. Planning requires understanding market trends and development opportunities. However, without appropriate testing and evaluation, the product can fail. Thus, external pressure may place a greater emphasis on idea evaluation with innovative products (Mueller, Melwani, & Goncalo, 2011). These findings from the organizational psychology literature resemble much theorizing from the field of social movement studies. Grievances in and of themselves fail to account for the emergence of violent contentious actions. Instead, organizational elites utilize political opportunity structures to maximize their chances of mobilizing previously passive but potential recruits and supporters. The same is true for particular manifestations of violence once mobilization has begun (see Sarma, 2007).

## TERRORISM AND ORGANIZATIONAL-LEVEL CREATIVITY

Organizational-level variables that drive creativity can be placed into two categories: variables that organizational leaders can manipulate and variables that are outside the control of terrorist organizational leaders. The latter encompasses variables such as organizational age and success. Aging organizations contain larger contingents of aging workers who may hold expectations that the status quo will remain (Tushman & O'Reilly, 1996). Likewise, successful organizations are the most likely to become entrenched in their practices because of previous rewards. Often, the

external agencies elaborated upon above may force change before a successful or relatively old organization is prepared to embrace it.

Organizational-level variables of creativity that leaders can control are numerous but include organizational structure, organizational size, offering extrinsic/intrinsic rewards, ensuring a collaborative environment, building inter-team trust, engaging in participatory decision-making, encouraging a unified commitment to the project, appointing principled leadership, financial resources, obtaining external support and recognition, adopting a flexible approach to roles and behaviors that accommodate emergent ideas, provision of feedback and encouragement to "be creative" (Abetti, 2000; Carson & Carson, 1993; Grant & Berry, 2011; James, Clark, & Cropanzano, 1999; Shalley, 1991). Given the secretive nature of terrorist organizations, most of these variables cannot be applied to individual case studies short of interviews with disengaged militants. Arguably, only four of these specific variables can be measured from open sources; organizational structure, organizational size, financial resources and external support networks—the effects of each are elaborated upon below with reference to terrorism examples.

The creativity literature illustrates that a flexible, organic structure, as opposed to a bureaucratic structure, is more conducive to innovation in organizations (Drazin & Schoonhoven, 1996; Hunter, Friedrich, Bedell-Avers, & Mumford, 2007). For example, in Hellstrom and Hellstrom's (2002) qualitative study, most respondents perceive organizational rules as hindering creativity. While workers depend upon quick feedback because "ideas are perishable goods", informal networks possess the danger of ideas being stolen for the benefits of others. Thus, while too much structure suffocates creativity, too little structure deters idea generation, subsequent evaluation, and the processes needed for full implementation. Al-Qaeda's pursuit of chemical, biological, radiological, and nuclear (hereafter CBRN) materials acts as a perfect example of how a terrorist organization's structure affects the creative process. The total decentralization of al-Qaeda activities (depicted by Sageman, 2005) in the wake of 9/11 and the subsequent invasion of Afghanistan caused a major change in the scale, intensity, expertise, and maturity in al-Qaeda's search for CBRN. The pre-9/11 somewhat flexibly structured al-Qaeda typically sought either to obtain or develop sophisticated nuclear, radiological, and biological devices from South Africa in 1993, Russia and Chechnya in 1996, Sudan in 1998, Pakistan in 1999, and Afghanistan between 1999 and 2001 as well as attempts to deal with A.Q. Khan's nuclear network in Pakistan that supplied states like North Korea with nuclear technology. On the other hand, the post-9/11 decentralized network's efforts to date are marked by a discernable shift toward smaller, cruder biological and chemical devices. Typically, attacks using such devices were devised, planned, and plotted by cells and affiliates loosely connected (if at all) to al-Qaeda central and its leaders such as Zawahiri, Bin Laden, and al-Suri. They focus less on nuclear and radiological components and shift emphasis toward chemical components. They also tend to be cruder than the more elaborate plans devised in the Afghan training camps. The geographic spread of these plots is extensive, far greater than the targeted focus of pre-9/11 plots.

Furthermore, Tushman and O'Reilly (1996) illustrate that larger organizations possessing complicated interlinked structures may be dependent on a network of external ties and suppliers that provide raw materials for their products and can hesitate to innovate in order to leave the ties undisturbed. The cost and difficulty of implanting change incentivizes some organizations to remain rooted in terms of structures, systems, procedures, and processes. This fact may be even more compounded for terrorist organizations for whom downsizing the cadre against their will may lead to the formation of splinter groups, informants, and disillusionment amongst the remaining militants. Cognizant of these dangers, PIRA's shift from a traditional hierarchical structure to a cellular based one in the late 1970s also occurred according to internal PIRA documents because of a need to "return to secrecy and discipline" occurred alongside the development of an auxiliary unit who were charged with a "policing role" within Catholic communities (Coogan, 2000, p. 467). Rather than this structural change leading to a mass decommissioning of trained operatives, auxiliary units mainly became composed of individuals deemed unsuitable for PIRA activity against British rule in Northern Ireland. In effect, this unlikely structural change was managed through role migration within the violent movement.

Although a large organization's resources can be conducive to innovation, it may also lead to losing focus, which in turn leads to poor planning (Halbesleben, Novicevic, Harvey, & Buckley, 2003). This largely explains why PIRA decided to change their structure 7 years after its formation. Their now publicly available staff report, which documented these changes, addresses this problem up front:

> We are burdened with an inefficient infrastructure of commands, brigades, battalions, and companies. This old system with which the [British Army] and [Special] Branch are familiar has to be changed. We recommend reorganization and remotivation, the building of a new Irish Republican Army. (Coogan, 2000, p. 465)

External support for terrorist organizations may come in many forms. First, the terrorist organization's constituency of people it claims to represent may offer active or passive support. PIRA, for example, received active support from American-based supporters both in monetary terms (which allowed for the purchase of necessary equipment/materials) and in technical expertise (largely in the form of Richard Clark Johnson, a NASA-trained electrical engineer who helped PIRA develop radio and radar-controlled initiation systems; Oppenheimer, 2009). Passive support for PIRA activity in the independent Republic of Ireland aided much of the arms training and engineering experiments conducted by PIRA with little fear of informants from the wider community. Second, financial and operational support from state governments constitutes external support. The training, bases, arms, intelligence, and finances from governments and security agencies such as the Ministry of State Security (the Stasi) in the former German Democratic Republic, Syria, and Libya undoubtedly aided the transformation of Carlos the Jackal's international terrorist network into an innovative, elusive, and adaptive terrorist organization. Third, as demonstrated by Horowitz (2010), the more organizational ties and ideological simi-

larities, the more likely it is that one terrorist organization will innovate by replicating the tactics of the other terrorist organization in the dyad.

Despite innovation and creativity's obvious benefits, they are often met with varying degrees of resistance (Mueller et al., 2011). Individuals proposing new ideas challenging the current social and technical systems may face opposition (Anderson & Gasteiger, 2007). Sometimes, ideas themselves may not be the cause of tension. For example, when access to limited resources is required for the development of novel products, it may become contentious. Even upon acceptance of initial ideas, start up problems and intentional defiance by other employees may hinder a new product's successful implementation (Anderson & Gasteiger, 2007). This exact process occurred with early PIRA incendiary devices that utilized a condom as a fuse delay device. The device entailed filling a condom with sulfuric acid. The time the acid took to dissolve the rubber acted as the time delay mechanism. Upon dissolving, the acid reacted with the incendiary material and produced fire. Two reasons led to this device's demise. First, although it was highly novel, original, relevant, and elegant, it was highly dangerous to the operator (Oppenheimer, 2009, p. 202). The main resistance to this bomb, however, came from individuals who refused to store caches of condoms, previously proscribed by the Catholic Church, in their homes (O'Doherty, 2008, p. 59).

## TERRORISM, LEADERSHIP AND CREATIVITY

We must first distinguish what role leaders play in the creative process before distinguishing particular leadership behaviors that engender greater creativity and innovation. According to previous literature, leaders provide structure and vision, facilitate idea progression, champion and promote ideas to others, provide resources and feedback, model appropriate behaviors, motivate subordinates, model open-minded thinking, extend discussions to encourage more idea generation, define problems in new ways, and grant autonomy to subordinates (Damanpour, 1991; Halbesleben et al., 2003; Mumford, 2000; Mumford, Hunter, Eubanks, Bedell, & Murphy, 2007).

One of the clearest findings in creative leadership research is that technical expertise is critical for leader performance (Mumford et al., 2007). Expertise helps leaders appraise follower capabilities, creates awareness of professional expectations, and provides a basis for effective exercise of power (Gumusluoglu & Ilsev, 2009). There are many examples of this behavior within the history of terrorism. For example, between 1998 and 2001, members of the core al-Qaeda leadership actively sought materials that could be used as weapons. During this period, Ayman al-Zawahiri's Egyptian Islamic Jihad (EIJ) organization formally merged with al-Qaeda. Zawahiri was tasked with developing biological and nuclear options for the organization. Given his science background, Zawahiri was deemed a natural choice to lead the development of a CBRN program and to procure the necessary materials (Wright, 2002). "He personally oversaw and managed the biological weapons development, and he steered the group toward the idea that these weapons might be used to attack vulnerabilities in the US infrastructure and economy" (Mowatt-Larssen, 2010,

p. 12). As mentioned above, once al-Qaeda became far more decentralized, new recruits with far less technical expertise than Zawahiri took up the CBRN mantle, but still have yet to reach anything approaching the levels of sophistication in planning and development reached under Zawahiri's leadership.

A second pertinent example is that of Yahya Ayyash, who held the joint positions within Hamas of chief bombmaker and leader of the West Bank battalion. Nicknamed "The Engineer", Ayyash is often credited as being the mastermind behind Hamas' initial adoption and deployment of suicide bombings.

## TERRORISM AND CREATIVITY IN INDIVIDUALS

It is commonly perceived that newcomers to a domain may be more creative than experts because they are unhindered by locked modes of thinking. Although this may be true in some cases, research shows that to conceptualize creative solutions to problems, an individual needs expertise in the problem domain (Walczyk & Griffith-Ross, 2008). Experience and expertise provide individuals a framework for interpreting, gathering, and acting on information (Mumford et al., 2007; Taylor & Greve, 2006). Having a broader and richer frame of reference allows individuals a larger reservoir to draw from when solving problems. Specifically, expertise promotes (a) a more rapid acquisition of knowledge, (b) use of systematic solutions rather than trial and error, and (c) applications of the principles, relationships, and prototypic cases to novel problems (Mumford, 2000). The value of expertise is so great that some researchers argue most individuals take 10 years to make an important contribution in their domain (Kaufman, 2009). The Global Terrorism Database, compiled by the University of Maryland's research center Studying Terrorism and Response to Terrorism, currently comprises information on 87,710 incidents of terrorism. Of this dataset, 44.28% are bombings. Given the relative difficulty in understanding how to effectively create and deploy bombings, engineers and scientists are disproportionately represented amongst university graduates within terrorist organizations, especially so within Jihadist organizations according to Gambetta and Hertog (2007).

However, Mumford and Hunter (2005) identified several ways that information can be a hindrance to creativity. Too much information is dangerous because it can lead to information overload. This results in a loss of focus or focusing on the wrong aspects of a problem. People may gravitate toward the part of the problem they can understand quickly and easily while disregarding more technical aspects that may actually encompass key components. They may become over reliant on information used successfully in the past and fail to seek out new information. Finally, they may compartmentalize their thinking and focus solely on their immediate work role rather than taking the broader vision often necessary to make impactful solutions.

In addition to expertise, research has indicated that creative people tend to share certain personality traits. Creative people tend to be open and flexible, entertaining a wide array of possible solutions before concluding on a single answer (Shalley & Gilson, 2004). They show substantial autonomy and possess a high degree of achievement motivation, while remaining somewhat domineering and critical

(Barron & Harrington, 1981; Silvia, Kaufman, Reiter-Palmon, & Wigert, 2011). These traits can lead people to set high standards and thus become so dissatisfied with their environment that they are motivated to change it in new and unconventional ways.

In addition, creative people possess a firm sense of themselves as creative individuals and tend to take risks (Shalley & Gilson, 2004). These traits not only enhance creativity because they represent a personality that is not hampered by the status quo, but also aid ideas to be heard and provide the confidence necessary to carry them through. Furthermore, personality traits such as recklessness or unconventionality facilitate creative endeavors by encouraging individuals to push the boundaries of societal norms and challenge the status quo (Schuldberg, 2001). The types of traits necessary in some domains may be different than those that lead to success in others; for example, while conscientiousness is important for creativity in technical professions, rebelliousness is a key factor for creativity in the arts (Feist, 1998). In addition, creative people restructure their work environments to fit their needs, which can lead organizations and industries to become more creative over time (Mumford, 2000).

## TERRORISM AND CREATIVITY IN TEAMS

While individual traits are conducive to creative work, they may also hinder collaborative efforts, which themselves are often necessary to solve complex problems and require multiple areas of expertise. Indeed, the traits that allow innovative employees to break from social norms also leave them susceptible to interpersonal conflicts with co-workers (Anderson & Gasteiger, 2007). As suggested by Feist's (1998) meta-analysis of creative personality, innovative people tend to remove themselves from social interactions more readily. Despite a creative individual's need for autonomy, workgroup support strongly predicts innovation (Baer & Frese, 2003). Several reasons explain why teamwork benefits creative efforts. First, diverse expertise contributes to the pool of information available for idea generation. It also provides a greater need to articulate the problem at hand (West, 2002). Work groups provide ties and networks that promote innovation (Hellstrom & Hellstrom, 2002). In turn, these ties provide support in uncertain times and help lower stress. Team members serve as collaborators and provide feedback in an environment of trust (Mueller & Kamdar, 2011; Paulus, Dzindolet, & Kohn, in press; Pirola-Merlo & Mann, 2004). Finally, teammates serve as role models. In a study of research and development scientists, Amabile and Gryskiewcz (1987) found that 65% of surveyed scientists assert the presence of a role model facilitated creativity.

Cohesiveness has positive effects on innovation because it increases group process effectiveness, promotes awareness of team members' skills and team mental models, aids in more efficient decision-making, and builds trust and liking among group members (Ayres, Dahlstrom, & Skinner, 1997; Mumford & Hunter, 2005). However, organizational psychologists argue that a balance should be maintained between cooperation and conflict. Conflict can be beneficial if it is focused on the task. Cognitive conflict is based on disagreements arising from opposing perspectives, while personal-

ized conflict is directed at specific people and their performance (Amason & Sapienza, 1997). Cognitive conflict can induce new ideas by challenging the status quo and galvanizing team members to reexamine their solutions. In contrast, personalized conflict can impede collaboration and lead to a breakdown of communication.

Team composition can also impact innovation (Hülsheger, Anderson, & Salgado, 2009). OB researchers assert that the ideal size for creative teams tends to be between four and eleven members (West & Anderson, 1996). Teams larger than seven members are too large for effective collaboration between team members and tend to have a lower team climate. Teams smaller than four have fewer experienced people to draw from, as well as fewer people to evaluate ideas (West & Anderson, 1996).

Shane Paul O'Doherty's ascent to the role of explosives officer in PIRA's Derry Brigade in 1974 provides a clear illustration of creativity in terrorist teams. Looking to improve PIRA's quality in bombs while maintaining safety standards for operatives, O'Doherty sought to re-organize the explosives division. "I sought to get all of the individual explosives officers, whether from the companies or battalions, into a pool over which I could exercise control, producing better training and improved safety standards. Pooling them would make higher quality operatives available to any unit or area, whereas before, the unit would have to rely on its own somewhat isolated explosives officer". Through this pooling, "groups of Explosives Officers came together to discuss…and that's when the ingenuity came out. And you found that a lot of people had a lot of ingenuity" (O'Doherty, 2008, p. 123). O'Doherty's example shows that often by pooling individually talented Explosives Officers into a group, the group became more valuable than the sum of its parts.

## DISCUSSION

In effect, the literature surveyed throughout this article points toward a number of key variables that may aid the study of a terrorist organization's capacity for creativity and innovation. While each section discussed above utilized illustrative examples, this section presents two detailed case studies to illustrate the multi-causal framework in more depth with the aim of developing a predictive model of terrorist innovation from which we can gain predictive capacities to aid in the investigation and disruption of terrorist plots.

### THE 2006 TRANSATLANTIC LIQUID BOMB PLOT

The first case encompasses the 2006 transatlantic liquid bomb plot which intended to use 10 liquid-based explosive devices in-flight on planes traveling from the U.K. to North America. Discovered and interrupted before the attack was planned, the plot is perhaps best known for the security measures put in place post-event regarding liquid allowances in carry-on bags. The plot, although foiled, displayed many facets of malevolent creativity. A memory stick belonging to one of the plotters showed that the targeted flights each carried between 241 and 286 passengers and crew. Aspects of the greater environment, organizational dynamics and individual/leadership characteristics drove the offenders' collective capacity for creativity.

In terms of the greater environment, contemporary counter-terrorism policies highlighted the need for creative solutions. The airline security procedures, such as installation of bulletproof and locked cockpit doors, the restriction of certain items such knives with a blade less than four inches long, the introduction of air marshals, and improved security screening procedures immediately after 9/11 lessened the opportunity for a repeat attack and created the need for more creativity amongst jihadist cells. This specific plot was an incremental twist on the Bojinka airline plot that sought to conceal 12 IEDs inside the life jackets or under the seats of separate U.S.-bound aircraft. The most creative aspect of the 2006 plot involved the IED in terms of its construction and detonation. The explosive mixture was to be peroxide-based and allegedly consisted of acetone peroxide and hexamethylene triperoxide diamine (HMTD), both of which can be found in the form of hair bleach, are sensitive to heat and friction and can be initiated by electrical charge. A sugary drink powder called Tang would be mixed with the peroxide chemicals to produce the explosive mixture. This mixture would be injected via syringe into 500 ml plastic bottles of soft drinks and the resultant hole would be resealed. Through injection, it made the bottle look like it had been unopened since purchase. A second type of explosive was to be concealed within an AA battery and the whole device was to be charged and detonated through linking the bottle containing the explosives to a light bulb and a disposable camera. The camera's flash would be sufficient to detonate the device. To deliver these devices, the plot necessitated the use of suicide bombers who would board each of the ten planes, and construct the IED mid-flight and detonate them. The nature of the IED itself would allow the plotters to pass through security undetected. In a recent interview with CNN, a senior counter-terrorism official stated that the progression between the London underground bombings in July 2005 and this plot was "very unexpected and brilliant" (Robertson, Cruickshank, & Lister, 2012).

In terms of leadership and individual characteristics, technical expertise was key. Prosecutors described Abdulla Ahmed Ali (a qualified computer systems engineer) as the "engineer" responsible for manufacturing the storage containers for the home-made explosive mixture. Ali had also previously received terrorist training during regular trips to Pakistan and the Afghanistan border between 2000 and 2005. Other members such as Adman Osman Khatib and Assad Ali Sarwar had also received training in Pakistan. After returning from Pakistan in December 2005, Khatib used internet resources to research the explosive properties of hexamine and hydrogen peroxide at Ali's suggestion. Assad Ali Sarwar's and Tanvir Hussain's primary tasks involved buying the necessary equipment and prime ingredients and manufacturing the HMTD.

In terms of organizational dynamics, recently discovered documents in Germany revealed that much of the plot was facilitated and conceived by Rashid Rauf, a British Jihadist based in Pakistan (Robertson, Cruickshank & Lister, 2012). According to the seized documents authored by Rauf, he analyzed various security screening machines used at baggage checkpoints and found they were susceptible to overlooking liquid explosives. Rauf further notes that, "the discovery that hydrogen

peroxide could be colored without losing its explosive properties was a major break-through" and a good deal of time was further spent practicing "how to open a drinks bottle, empty it, and replace with Hydrogen Peroxide, to make it seem uno-pened". Such resources, exposure to novel problems, goal awareness, and processes not only drove the capacity for creativity but also facilitated the capacity for innovation. Ultimately, effective counter-terrorism techniques and surveillance prevented the plot becoming a successfully deployed innovation.

## THE BRIGHTON HOTEL BOMBING

The Provisional Irish Republican Army bombed a hotel in Brighton, England, at 2.54 a.m., October 12, 1984. The hotel, at that time, housed Margaret Thatcher and much of the U.K. government who were in town for the Conservative Party annual conference. The explosion collapsed five floors of the hotel, killing 5 and injuring 34. What marked this event as particularly innovative was the use of a home video recorder as long-delay timer which was set to initiate the explosive device 24 days, 6 hours and 36 minutes after it had been concealed behind the walls of a hotel bath-room. Although an incremental innovation from previous iterations that used mechanical clocks/watches, or memopark timers, the length of time afforded by this particular device enhanced PIRA's violent capabilities to a great extent. In this case, the dynamics driving the capacity for creativity and eventual innovation were also multiple.

Beginning with aspects concerning the greater environment, while PIRA's deep antipathy toward Margaret Thatcher initiated the idea of attempting to assassinate her, the security constraints PIRA faced developed the necessity for creative solutions. PIRA's grievance against Thatcher was largely a product of her intransigence toward PIRA hunger strikers who protested their status and conditions in Northern Ireland jails. In total, ten hunger strikers died and PIRA largely held Thatcher accountable. PIRA's newspaper *An Phoblacht,* in the aftermath of the attack stated the strategic decision behind targeting Thatcher: "We believe that [killing Thatcher]…would have…led to a major and radical rethink along the lines of with-drawal". Aware of the upcoming Conservative Party conference location ahead of time, PIRA needed a device capable of being planted and primed weeks in advance of security taking position within the hotel and therefore the need for a long-delay device arose.

The individual entrusted with the device generation and deployment was Patrick Magee, PIRA's chief explosives officer, who had allegedly played a key role in the development of timing initiation units since the late 1970s. Placing an experienced recruit like Magee as the primary operative also lessened the need for extra individuals to be deployed and hence maximized PIRA's ability to keep the plot quiet from counter-terrorism agencies. Further, Magee's individual expertise came from a training camp in Libya (Oppenheimer, 2009, p. 263, 282). Other facets of the plot relied upon external support also. This plot marked PIRA's first use of Libyan-imported Semtex, a commercial explosive with far greater power, security (for the operatives) and elusiveness from sniffer dogs (it is odorless). PIRA would have been

incapable of this attack if they used their stockpiles of homemade explosives because it was likely that security dogs would have detected the scent and perhaps more importantly, it would have been impossible to conceal given the fact that pound-for-pound, homemade explosives do not carry the same explosive power. For the same impact, PIRA would have needed hundreds of pounds of homemade explosives compared to the thirty pounds of malleable Semtex that was concealed behind a hardboard panel of the hotel room's bath.

The airline plot and the Brighton bombing share many similarities in terms of their creative drivers and innovation facilitators despite occurring 22 years apart by vastly different actors espousing vastly different goals and worldviews. For the trans-atlantic airline plot, exposure to novel problems created by the contemporary security infrastructure post-9/11 combined with technical expertise, resource availability, and foreign aid facilitated the plot until it was eventually interrupted in coordinated arrests. In the case of the Brighton bombing, grievances against Thatcher and the security that surrounded her exposed PIRA to novel problems in trying to assassinate her. Possessing technical expertise within their leadership ranks combined with the resources of foreign training and equipment made the plot viable.

What separates the two plots is the fact that one was successfully carried out (although the prime motive of killing Thatcher was not met) while one was interrupted. While PIRA entrusted a technical expert to conceive, develop, and deliver the IED, the airline plot's necessity for suicide bombers to develop and deploy the IED mid-flight increased the number of necessary actors, increased communication between the actors and increased the likelihood of the plot being identified and interrupted by counter-terrorism agencies. In this way, the PIRA assassination plot was more elegant because of its fewer components and necessary actors.

## CONCLUSION

Although the ability to accurately anticipate the timing of terrorist innovations may always be beyond counter-terrorism practitioners, the same is not true for understanding a terrorist organization's capacity for creativity and innovation. Academic theorizing on the nature of terrorist innovation often conflates both creativity and innovation as being the same static phenomenon. This paper distinguishes the two and demonstrates that organizational and industrial psychologists identified a number of recurring drivers of both creativity and innovation. It is possible to code and assess a terrorist organization's ability to creatively formulate new ideas and technologies that may later become a terrorist innovation. The transition from a creative idea into an innovation may take a long time if the necessary components (specific explosive mixtures or technology) or actors (lack of willingness of individuals to become suicide bombers) are not in place at the right time. The key therefore is to understand the multiple levels of dynamic actors and drivers that combine to form the creative process itself.

The theoretical framework has many implications for counter-terrorism perspectives. First, the framework provides insight into decisions concerning resource allocation in targeting specific parts of the terrorist organization that are more likely to

be creative and from which innovations diffuse through the rest of the network. For example, in the two case studies above, the main drivers at the individual actor level were those with technical expertise. Related to this, Asal, Gill, Rethemeyer and Horgan (in press) found that terrorist sub-units with a higher proportion of individuals with technical expertise are more likely to produce outcomes identical to the terrorist organizations stated goals (e.g., to be discriminate or indiscriminate in the killing of particular targets). Second, effective counter-terrorism policies produce novel problems for terrorist organizations that in turn may drive the need for creativity. Because of this, counter-terrorism practitioners may need to anticipate the second-order effects of employed counter-terrorism policies to better anticipate how terrorist organizations may respond in kind. Third, because creativity and innovation are a process, any threat assessment of a terrorist organization or group should aim to understand the stage in the process that a particular plot is at, to tailor an adequate response. Plots, such as the liquid bomb plot (above), that are nearing the end of the process may necessitate the need for immediate action and arrests. On the other hand, maintaining surveillance, embedding undercover agents, or interrupting the resources and available time that facilitate creativity and/or innovation may better manage plots at the earlier stages of the process. Fourth, interrupting the flow of communication across an organization may aid in reducing a terrorist organization's ability to share and communicate responses to novel problems. Finally, a terrorist group newly acquiring foreign aid (in the form of training or weaponry) may be an indication that a tactical innovation is in the process of being developed and may necessitate the need for increased surveillance or counter-measures.

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