

## Psychological Strategies for the Defence Against Terrorism

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### SUMMARY

*Various subdisciplines of psychology are relevant to the defence against terrorism, in terms of anti-terrorism, counter-terrorism, and terrorism consequence management. Anti-Terrorism: Psychological methods can be applied to reduce vulnerabilities to attack and to encourage the general public to identify infrastructure and other vulnerabilities. Counter-Terrorism: Psychological techniques are available to assess and improve terrorism awareness in the general population. The detection performance of counter-terrorism personnel can be improved: psychological methods can enhance situation awareness, situated cognition, detection capabilities, and decision-making; automated expert system tools employing fuzzy signal detection can assist personnel; other psychological techniques can enhance individual and team function, personnel selection and training. Psychological principles can also be applied to obstruct and impede terrorist functioning. Consequence Management: Psychological methods can be used to enhance capabilities of first responders, improve escape and evacuation procedures for civilians, promote resilience in the general population, and treat victims of terrorism more effectively. We propose possible configurations for psychological consulting teams who would help defence authorities use these strategies to address terrorist activity.*

### 1.0 INTRODUCTION

Defence against terrorism (DAT) is often discussed in terms of technological innovations and technical barriers to terrorist success. This includes considerations of surveillance and intelligence; naval, air, space, and land-based military sciences; information and communication technology; security engineering; radiation technology; sensors and telemetry; imaging technology; weapons science, and so forth. As valuable as these disciplines are for DAT, it is our opinion that the traditional social sciences have critical contributions to make in this area. In particular, we propose that psychology has much to offer in furthering DAT. As we hope to demonstrate, psychological comprehension is crucial for successful DAT in all its forms.

Much of what has been written about psychological approaches to terrorism has focused on understanding the internal psychology of the terrorist, the sociocultural roots of terrorism, the social psychology of terrorism's

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aftermath, and public policy about terrorism [1-11]. As valuable as these contributions are, our intent here is to embrace a much broader view of psychology's potential impact on DAT. In this limited space, we cannot deal with all of psychology; thus, we 'bracket,' or leave for other venues, the pressing questions of how terrorism begins and how its psychosocial origins can be addressed. Rather, we focus here on how psychology can help security and intelligence personnel prevent or respond to specific terrorist acts, and how psychology can help ameliorate the consequences of those acts.

Consider the stereotypical psychologist: a clinician who reclines in a padded armchair, analyzing societal problems in terms of difficulties with early toilet training, and reacting to every client statement with such canned responses as "How does that make you feel?" This stereotype not only seriously misrepresents even clinicians, it ignores the great number of experimental psychologists and related neuroscientists who do not engage in clinical work at all. Psychology is an extraordinarily wide umbrella covering many subdisciplines, such as human factors and ergonomics (i.e., the science of human performance and human-machine interaction), cognitive psychology, neuroscience, artificial intelligence, social and personality psychology, consumer psychology, counseling and psychotherapy, and cultural differences in behavior, to mention only a few subdisciplines. Psychologists design measures of attitudes and behavior, study the interaction of humans with machines, and design research to test programs to improve human performance in many kinds of environments. As we demonstrate below, many subdisciplines within psychology are applicable to DAT.

In this work, we outline contributions that the discipline of psychology can make within each of the three facets of DAT: Anti-Terrorism, Counter-Terrorism, and Consequence Management. Throughout our presentation, we identify psychological methods, specialty areas, and topics (*italicized below*) that are particularly pertinent to DAT. It is our hope that civil and military authorities will consider implementing psychological approaches and technologies, as these authorities grapple with the challenges of defending against terrorism.

A few words are necessary concerning our approach in this work. Being mindful that a paper such as this may find its way into the hands of many different kinds of DAT personnel, we have chosen to reference this work rather thoroughly, including not only basic reference works, but also specialized texts, and recent conference proceedings. Our intent in doing this is to enable the reader, who may need to develop a brief on potential psychological contributions for others in the chain of command, to self-educate in the areas we touch upon, should the need arise. In addition, we have defined as "psychological" much research and theory where psychology overlaps with other fields. (For example, although we describe artificial intelligence, or AI, as a psychological specialty area, AI obviously owes a great deal to the discipline of mathematics as well). In doing this, our intention is not to deemphasize the importance of other fields, but to be inclusive in demonstrating the contributions that psychology has to make to DAT.

### **2.0 PSYCHOLOGY AND ANTI-TERRORISM**

Since the founding of NATO, its member nations have been open societies, with relatively permeable borders, unsecured infrastructures, easily accessed information and communication systems, and populations who have enjoyed life without open warfare within their own borders for now more than five decades. The threat of terrorism exposes the vulnerability of open, peaceful societies in multiple ways. Unsecured infrastructures and easily accessed information and communication systems are each eminently vulnerable to attack. Easily traversed borders facilitate travel for friend and foe alike. Populations that are accustomed to years of domestic peace may be unfamiliar with, or insensitive to, signs of terrorist preparation.

Anti-terrorism involves defensive measures to reduce the vulnerability to attack presented by populations, territory, infrastructure, and information and communications systems. Psychological methods can be used to promote anti-terrorism by furthering two objectives: reducing and identifying vulnerabilities.

## **2.1 Apply Human Factors and Ergonomics Principles to Reduce Vulnerabilities**

Post-9/11, there has been much effort devoted to designing or renovating buildings to address security issues; such concerns are evident in recent design criteria for U.S. federal buildings [12]. The disciplines of psychology and engineering overlap in the subdiscipline of *human factors and ergonomics (HF/E)*. This specialty uses knowledge of human abilities and limitations for the design of systems, organizations, jobs, machines, and other physical objects for safe, efficient, and comfortable human use (adapted from [13], p. 4). One sub-specialty within this broad area involves the use of HF/E principles in architecture and interior design; these principles can be used to implement security and evacuation enhancements as part of a complete design strategy [14]. This can be seen as a variation of *environmental design research* in psychology, which focuses on the quality of fabricated environments [15]. Principles from HF/E and environmental design research should be implemented, both to design new structures and systems, and to retrofit older structures and systems, to reduce vulnerability to terrorism. For example, a wealth of suggestions have been made to increase aviation security through the implementation of HF/E principles [16].

One type of anti-terrorist activity involves the use of so-called “red teams.” These are teams of anti-terrorist personnel devoted to discovering and correcting a system’s areas of vulnerability, before terrorists find these liabilities. Although often applied against cyberterrorism, red teams can in principle be applied against any type of terrorist threat. HF/E researchers have studied anti-cyberterrorism red teams, an activity that has yielded suggestions for improved red team effectiveness [17]. Similar research studies would likely improve the function of red teams deployed against other types of terrorism, as well.

## **2.2 Enlist the Aid of the Populace in Identifying Vulnerabilities**

As the terrorists themselves have shown, it is possible for low-tech terrorism strategies to circumvent relatively sophisticated security procedures. It would be appropriate for security authorities to attempt to anticipate such attacks, by enlisting the combined intellectual power of their own populace through the use of *behavioral reinforcement techniques* [18, 19]. That is, through the use of mechanisms of reward and schedules of reinforcement, security authorities may encourage members of the public to report potential vulnerabilities in infrastructure, target-likely buildings, and so forth. (This idea bears a distant familial resemblance to various “Crimestoppers” and “Crime Tips” programs, in which members of the public may anonymously report information bearing on crimes, for monetary reward; such programs have resulted in many prosecutions. Our idea, however, involves the proactive detection of vulnerabilities, rather than the reactive reporting of criminal activities.) A variation on this idea would be to use reinforcement techniques to shape the behavior of volunteer security forces patrolling unsecured infrastructure. This is the idea behind the Airport Rangers, a volunteer force on horseback that patrols an international airport in Texas [20]. Another variation on this idea would be to encourage selected professionals (e.g., human factors professionals, structural engineers, computer professionals) to come forth with their observations of systemic or particular vulnerabilities [21]—volunteer professional red teams, as it were.

Some have written of the “impossibility of completeness” inherent in attempts to prevent terrorism at or along the way to potential targets ([10], p. 38). Although absolute completeness may be impossible, enlisting the assistance of a national or local population in identifying problem areas will surely yield valuable information about infrastructure vulnerabilities that we would not otherwise possess.

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### 3.0 PSYCHOLOGY AND COUNTER-TERRORISM

Each terrorist activity has a cyclical form, involving the stages of planning, preparation, execution, escape, and evaluation. (Of course, suicide attacks do not involve escape or evaluation by the terrorists most directly involved.) Successful completion of the cycle means that the terrorist can begin the cycle anew, perhaps spiraling to some larger scale of attack. However, each stage presents at least some opportunity for security authorities to interfere with the cycle. Interrupting this cycle comprises counter-terrorism.

More precisely, counter-terrorism involves offensive measures to track down, prevent, deter, and interdict terrorist activities. Psychological methods can be applied to counter-terrorism to meet three important objectives: increased population alertness to terrorist activity, improved detection performance of security and intelligence personnel, and increased obstruction of terrorist functioning.

#### 3.1 Make the Populace Alert to Signs of Incipient Terrorist Activity

Lightning rarely strikes from a clear sky. Similarly, terrorism rarely if ever occurs without preparation. Terrorists travel. Materials, transportation, lodging, training, and access to targets must be purchased. Targets must be researched and surveilled. Destructive materials must be appropriately placed. An alert populace may be able to detect and report preparations for terrorist activity before terrorist acts are executed. This may involve reporting specific patterns of activity (e.g., unusual purchases). In addition, an alert populace may be able to detect and report events that indicate that a terrorist activity is in the midst of execution. For example, this may involve reporting the presence of suspicious objects (e.g., abandoned packages). Several psychological methods and specialty areas are applicable to the task of making a population more alert to signs of terrorist preparations, through the assessment and improvement of terrorism awareness.

##### 3.1.1 Assess Terrorism Awareness

Before we can change behavior towards an ideal, we must have a sense of what the current state is, and how this state deviates from the ideal we have established. *Assessment techniques* can be devised to gauge levels of individual and group awareness regarding signs of potential terrorism. The psychological subdiscipline *psychometrics* possesses well-established techniques to develop assessment methods that are valid and reliable [22, 23]. The basic objectives of assessment research should be (1) to define what is meant by terrorism awareness, both in general and in terms of its components; (2) to develop valid and reliable assessment techniques for each of the components of terrorism awareness; (3) to gather valid data about the populace's terrorism awareness using these techniques; and, (4) to identify strengths and weaknesses in the populace's terrorism awareness. Once these basic objectives are met, a further worthy objective would be (5) to identify conditions that tend towards greater and lesser terrorism awareness.

##### 3.1.2 Improve Terrorism Awareness in the General Population

Once we have a sense of the level of terrorism awareness present in the populace, and a sense of what components of terrorism awareness show particular need for improvement, we are in a position to attempt to improve the social level of terrorism awareness. Three psychological specialty areas are relevant to this area: *educational psychology*, *methods of persuasion*, and *program evaluation*.

One approach to improving terrorism awareness involves overt instruction ([10], p. 39). Psychology has a long history of research into learning methods as an aspect of *educational psychology*. Much of this research addresses ways to enhance or optimize learning [24, 25], and this research should be applied to designing

instructional methods for increasing the terrorism awareness of the general public. Although much educational research deals with schoolchildren, a great deal of this research is applicable to adults as well. (For that matter, classroom instruction of children in terrorism awareness should not be overlooked.)

Another approach to improving the public's counter-terrorism behavior involves *methods of persuasion*, a topic of psychological research for a long time [26-31]. A subfield of *consumer psychology* that combines the psychology of instruction with that of persuasion is the area of "*social marketing*," which has the objective of changing personal and social behavior, typically to further some societal goal [32-36].

Of course, a program to improve terrorism awareness is only as good as the changes it actually creates in personal and social behavior. To assess these changes, *program evaluation* methodologies are crucial [37-39].

### **3.2 Improve Detection Performance of Counter-Terrorism Personnel**

Psychology has much to offer in terms of improving the performance of counter-terrorism personnel, who are in the front lines of terrorism prevention. This applies both to personnel in immediate security, such as airport baggage screeners, and to more meta-level professionals, such as intelligence agents. Psychology's potential contributions involve enhancing the psychological capacities of these personnel for detection, giving these personnel improved tools to use for detection, helping these personnel to perform better as parts of teams, helping administrators to select appropriate personnel for counter-terrorism, and training personnel more effectively following their screened selection.

#### **3.2.1 Enhance Detection Capabilities of Counter-Terrorism Personnel**

It is well-known that baggage screeners' detection of weapons carried by passengers at American airports was not optimal, even as late as 2003 [40]. It is also well-known that American intelligence agencies' detection of the threat posed by terrorists in 2001 was faulted in the 9/11 Commission's report [41]. These two portions of the counter-terrorism spectrum share some characteristics. At a high level of abstraction, all counter-terrorism personnel are engaged in the detection of relatively rare but potentially catastrophic events. For baggage screeners, the task is to detect the presence of small weapons of interpersonal violence or mass destruction; for intelligence agents, the task is to detect patterns of activity suggestive of preparations for terrorist activity. Ultimately, then, the task facing each type of personnel involves the use of two crucial psychological faculties involved in detection of a terrorist threat: attention (that is, the capacity to detect and attend to crucial stimuli) and decision-making. *HF/E* and *cognitive psychology* are subdisciplines that address these crucial psychological capacities.

HF/E has amassed considerable research-based insight that can be used to address several issues relevant to the attentional performance of counter-terrorism personnel. These issues include vigilance [1, 16, 42-44], focused attention [45], selective and divided attention [46], stress and fatigue [47, 48], and signal detection [49]. HF/E researchers have investigated very specific aspects of cognition and human performance relevant to counter-terrorism; for example, some researchers have investigated the function of mental rotation within a baggage screening task [50].

Some HF/E scientists are involved in research regarding *neuroergonomics*, the study of the brain and behavior when a person is working [51, 52]. This research is relevant to counter-terrorism. For example, some current neuroergonomic research involves the study of brain function during baggage screening tasks, as performance degrades with fatigue [53]. More generally, the study of continuous wakefulness and consequent fatigue, and the effect of these variables on performance of military personnel, is a long-standing area of concern in HF/E [54-56]. This research is applicable to the improvement of performance for counter-terrorism personnel.

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There are different ways in which HF/E researchers have addressed attention. One involves the concept of *situation awareness*:

The formal definition of situation awareness is ‘the perception of the elements in the environment within a volume of time and space, the comprehension of their meaning, and the projection of their status in the near future.’ The term *situation awareness* comes from the world of the military pilot, where achieving high levels of situation awareness was found to be both critical and challenging early in aviation history.... The importance of situation awareness as a foundation for decision making and performance applies to almost every field of endeavor. ([57], p. 13, citation and some italics omitted, abbreviation expanded)

A great deal of HF/E research and theory has focused on situation awareness ([57-64]; see also multiple papers in [65, 66]). It is likely that some of the research that has focused on situation awareness in military personnel [67-70] will prove useful in improving the situation awareness of counter-terrorism personnel.

Another way in which HF/E scientists have addressed attention recently is through the concept of *situated cognition* [71, 72]. At the risk of oversimplifying, we may say that if situation awareness is a still photograph, situated cognition is a motion picture. Situated cognition follows the way in which information about a given situation is processed, from “ground truth,” through several conceptual lenses, to a given decision maker’s projection or interpretation of the situation. It is likely that research involving situated awareness will be useful in improving the performance of a wide variety of counter-terrorism personnel.

HF/E researchers have also emphasized research on decision-making ([73, 74]; see also multiple papers in [65, 66]). In particular, human factors researchers have focused much attention on decision-making under stressful conditions, often in military contexts [75-79]. Much of this research is relevant to the decision-making challenges facing counter-terrorism personnel.

Some HF/E research has specifically focused on describing and improving the work of intelligence analysts through focusing on cognitive factors in intelligence analysis [80-86]. *Cognitive modeling* has been applied successfully to understanding and improving the function of, for example, aviation crews [87], and is beginning to be applied to intelligence analysts [88]. It is to be expected that cognitive modeling research will improve performance when applied to counter-terrorism teams and individual personnel.

As it happens, situation awareness and situated cognition may be considered as special cases of more general constructs, such as directed consciousness [89, 90]; this means that a great deal of cognitive research is relevant to the task of improving detection capacity in counter-terrorism. *Cognitive psychology* researchers have amassed an enormous literature of laboratory studies concerning attention [91-94], decision-making [95-98], and reasoning [99-104]. Application of this research to counter-terrorism may result in improved detection performance for security personnel and intelligence agents.

### 3.2.2 Equip Counter-Terrorist Personnel with Psychologically Sophisticated Automated Tools

As mentioned earlier, to speak highly abstractly, counter-terrorism personnel at all levels are involved in signal detection. However, especially for intelligence agents, the task involved departs significantly from the classical signal detection paradigm. It is not just that there is a great deal of noise obscuring the signals of preparation for terrorist activity. To make the situation much more complicated, the signals themselves are not necessarily signals, as it were. To use a simple example, sometimes a person purchasing a large amount of agricultural fertilizer simply has a large farm; sometimes such a person is using the fertilizer to produce

powerful explosives for terrorist activity. The purchase of large quantities of fertilizer, then, is not a straightforward signal of terrorist activity. Rather, such a purchase is what is technically referred to as a “fuzzy signal”: sometimes the signal denotes terrorism, but most often it does not.

To supplement classical signal detection approaches, HF/E researchers have been working to develop *fuzzy signal detection* theory and applications [105, 106]. This approach can be implemented on *artificial intelligence* platforms derived from *cognitive psychology* [107] to create *expert systems* for detection of fuzzy signals [108]. Thus, it would be possible to develop an automated expert system to analyze data (e.g., patterns of purchases, travel, Internet activity) with fuzzy signal detection techniques, and alert counter-terrorism authorities to the detection of patterns that suggest preparations for terrorist activities. (Elsewhere in this symposium, the first author describes the conceptual outlines of such a system; [109]). Use of expert systems implementing fuzzy signal detection also has been advocated for commercial aviation security [42].

### **3.2.3 Enhance Team Function of Counter-Terrorism Personnel**

Counter-terrorist personnel typically function as members of teams. Complicating the issue, members of a given team (e.g., intelligence analysts) may be scattered across several physical locations, and thus must function as distributed or virtual teams. In addition, some teams include “members” who are artificial intelligence constructs, or (*artificially*) *intelligent agents*. Despite these complications, effective team performance is essential to all counter-terrorism functions.

Researchers in *HF/E* and *industrial-organizational* (I/O) psychology have studied *team functioning* for some time, with an eye toward assessing and improving team function ([16, 110-115]; see also multiple papers in [64, 65]). Some research has focused specifically on distributed or virtual teams, and teams that include (artificially) intelligent agents [116-120]. A great deal of this research is applicable to the challenges faced by counter-terrorist teams.

As counter-terrorism teams increasingly become multicultural or multinational in composition, issues of cultural *worldview* and *acculturation* can be expected to affect team performance. Worldviews are sets of assumptions about physical and social reality that have important effects on behavior [121]. Research demonstrates that some dimensions of worldview affect team performance [122, 123]. It is expected that future research will show that team performance is affected by several more dimensions of worldview, and by differences within a team in terms of worldview and acculturation [124]. Use of psychological techniques to address worldview and acculturation may enhance counter-terrorism team performance.

### **3.2.4 Use Psychologically Sophisticated Methods to Select and Train Counter-Terrorism Personnel**

Present indications suggest that the need for all types of counter-terrorism personnel will continue to increase. counter-terrorism work includes some very stressful occupations; for all counter-terrorism work, the consequences of performing well as opposed to poorly may determine the difference between life and death, perhaps for thousands of individuals. It is thus worthwhile to put a great deal of thought and effort into appropriate personnel selection, training, and development, for all levels of counter-terrorism personnel.

*Personnel psychology* has amassed a large research base, and is an area of very active research with regard to recruitment and selection [1, 125, 126]; some of this research focuses on military contexts [127]. Recent years have seen a great deal of sophisticated research involving the application of *personality psychology* to personnel selection [128, 129], as well as continued research into the relationship of various personal characteristics to performance; much of this research has occurred in military contexts [130-133]. A great deal of this research is directly applicable to the matter of selecting new counter-terrorism personnel.

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*Training and development* also has long been a concern of psychological research, both for I/O psychologists generally [134], and for HF/E researchers seeking to improve military training [135]. Of course, the research mentioned above addressing ways to enhance learning and instruction [24, 25] should be applied to the instruction of counter-terrorism personnel. Lately, some research activity has focused on evaluating the effectiveness of training, specifically in military contexts [136]. Here, too, much accumulated research is directly applicable to training of counter-terrorist personnel.

*Simulations*, including virtual role playing, can be a useful component of a training program [137]. In recent years, HF/E researchers have used the *scaled worlds* approach to designing computerized simulations for training, often in military settings [138]. Scaled world simulations have also been developed specifically for first-responder functions within a terrorism context [139]. We expect that further use of this technology will be effective in training all levels of counter-terrorism personnel.

The use of *virtual reality* (VR) for training has been the subject of a great deal of research [140], including some research specifically focused on VR training for high-risk jobs [1], for work involving teams [141], and for national defence [142]. We expect that VR training will prove to be effective in training counter-terrorism personnel.

One aspect of training and development that would be useful for counter-terrorism personnel involves *cognitive enhancement*. This is our term for several lines of scientific research that focus on the nature or enhancement of personal intellect or intelligence [143-145], creativity [145-149], intuition [150], and even wisdom [145, 151-152]. Each of these cognitive capacities can be used to detect or even anticipate possible terrorist activities.

A creative, imaginative approach to anticipating potential terrorist activities is in order. As the 9/11 Commission Report noted, “Imagination is not a gift usually associated with bureaucracies. ... [However,] it is ... crucial to find a way of routinizing, even bureaucratizing, the exercise of imagination” [41, p. 344]. Such exercises could prove highly useful in anticipating potential terrorist activities. For example, occasionally it has been claimed that no one could have predicted that the 9/11 terrorists would use airplanes as missiles to attack the World Trade Center. In fact, however, the use of hijacked passenger jet airplanes as missiles in an attack on the World Trade Center was anticipated over six months before the 9/11 attacks—in a television drama. The creativity that the television writer and producer Chris Carter showed in the pilot episode of his short-lived television series, “The Lone Gunmen” [153], would be useful for counter-terrorism work.

### 3.3 Obstruct Terrorist Functioning

Broadly speaking, there are at least two ways in which psychological research and theory may be applied to the task of obstructing terrorist functioning. These may be called methods based on terrorist observation and general user obstruction, respectively.

#### 3.3.1 Apply Methods Based on Terrorist Observation

In any given terrorist activity, the terrorists involved use specific tactics and methods. Learning these specific tactics and methods may suggest ways to defend against them. For example, some researchers, through studying actual hackers with *qualitative research techniques*, have successfully identified specific tactics and methods that are relevant to cyberterrorism [154], a research strategy that may suggest methods of defence. More generally, it may be possible to use such research techniques with terrorists in custody, to identify specific terrorist approaches against which defences may be devised.

### 3.3.2 Apply Principles of Operator Obstruction

In some ways, terrorists are a distorted mirror image of intelligence and security personnel. Defence personnel function in teams; terrorists function in cells. Defence personnel gather intelligence; so do terrorists. Defence personnel engage in complex planning and decision-making; terrorists do the same. In short, terrorists face some of the same sort of challenges for effective cognitive and behavioral functioning that defence personnel do. In turn, this means that the same sorts of psychological research that is relevant to enhancing the functioning of defence personnel is relevant to impeding the functioning of terrorists. It is a matter of applying the same research—but in reverse. We may refer to this as applying principles of *operator obstruction*.

There are certain situations in which scientists may wish to prevent or impede personal functioning, rather than enhance that functioning [155]. For example, we accept the need to devise drug containers that are difficult to open—for children. Likewise, we exert much effort to make computer networks less accessible to hackers, at the same time that we try to make them more accessible to authorized users. Similarly, the many principles that HF/E scientists use to enhance performance can be inverted, as it were, to make terrorists and their cells less effective. Although specific examples are outside the scope of this document and its security classification, defence officials would be well advised to consult with specialists in HF/E and I/O psychology for help in devising programs to obstruct terrorist functioning.

## 4.0 PSYCHOLOGY AND CONSEQUENCE MANAGEMENT

At least into the foreseeable future, it seems likely that, despite our best efforts at prevention, some terrorist acts will occur. Consequence management involves measures to (1) limit the consequences of terrorist attacks, and (2) stabilize the situation in the aftermath of such attacks, in support of civilian authorities. Psychological methods can be applied to consequence management to enhance capabilities of first responders to terrorist incidents, to improve escape and evacuation procedures, to promote general resilience, and to treat victims effectively.

### 4.1 Enhance Capabilities of First Responders to Terrorist Incidents

We have already noted the relevance of research into *situation awareness (SA)* and *situated cognition (SC)* to the matter of improving the performance of counter-terrorism personnel. These same bodies of research are relevant to first responders to terrorist incidents (i.e., police, fire, and emergency medical personnel). Much like civil aviation and military personnel, for whom the concepts of SA and SC were first developed, the effectiveness of first responders depends upon their accurate awareness and understand of critical aspects of their environment, with life and death consequences. Improving the situation awareness and situated cognition of first responders should improve their effectiveness in responding to terrorist incidents. In addition, research into *decision-making* [73-79] is applicable to first responders, as it is to counter-terrorism personnel. HF/E scientists have amassed a large body of research relevant to improving the function of first responders.

First responders, of course, typically function as members of teams. We also noted earlier the relevance of research regarding *team function* to the matter of improving the performance of counter-terrorism personnel [110-120]. This same body of research is relevant to improving the performance of first responders.

Earlier we noted the need for counter-terrorism personnel to have sophisticated tools. The same need exists for first responders. HF/E researchers have participated in the creation of such software tools as the Enhanced Consequence Management Planning and Support System (ENCOMPASS), which supports the information needs of multiple distributed first responder agencies, and the Domestic Emergency Response Information System, which supports emergency responses among multiple organizations responding to a crisis [1].

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### 4.2 Improve Escape and Evacuation Procedures for Civilians

Post-9/11, there has been a renewal of research interest regarding how people react during fires and other occasions requiring building evacuations and emergency egress [1, 156]. *HF/E* researchers have long been concerned with the design of effective emergency signage and alarms for a civilian population [157, 158]. This research is highly relevant to the matter of designing escape and evacuation procedures for those present at the site of a terrorist attack. (Incidentally, researchers in these fields have also studied how to make alarms for first responders and military personnel more effective [159, 160].)

### 4.3 Promote Resilience in the General Population

One way to manage the consequences of terrorism is to take a proactive position: take steps to make the general population less vulnerable to some of the psychological effects of terrorism. This involves applying research regarding *resilience*, a topic focused upon by the subdiscipline of *positive psychology*. Resilience is a normal human process [161], but the capacity for resilience is not equally distributed across the population; resilience may vary with personal worldviews [121]. In recent years, researchers in positive psychology have made a good start at conducting research concerning human strengths [162-165], resistance to depression [166], inner “toughness” in the face of adversity [167, 168], and resilience [169-171], including specifically resilience in the face of terrorism [172-173]. Stress exposure training has been recommended for the military [177]; it may well be useful for the general population as well. This research is applicable to the construction of large-scale programs to promote the development of resilience among the general population. The effect of such an effort would be to make the population less vulnerable to some of the negative psychological effects of terrorist attack.

### 4.4 Treat Victims Effectively

We have come to understand much concerning the negative effects of a terrorist attack on mental and emotional health [178-181]. The American Psychological Association has provided information to the public to help people to cope with the aftermath of terrorism [182, 183]. Victims of terrorist attacks should be treated with appropriate *post-traumatic and crisis psychological treatment*. Psychology now has theoretical frameworks for understanding the psychological effects of terrorism (e.g., [184]). Although we yet have much to learn about appropriate treatment following 9/11-style catastrophes, we have some clinical advice for community-level intervention [185]; some effective and promising treatments for post-traumatic stress disorder in general have been identified [186, 187; cp. 188], including *virtual reality therapy* [189]. Research has also addressed treatment of military personnel following terrorist attack [190]. This entire research and clinical literature is applicable to the effective treatment of victims of terrorist attack.

Finally, some clinical advice is available to help practitioners cope with the challenges of working with victims of trauma other than terrorism [191]. It may be expected that many of these guidelines will apply to practitioners treating victims of terrorism.

## 5.0 CONCLUSION AND OUTLOOK

We have here indicated the multiple ways in which various psychological subdisciplines can and indeed should contribute to DAT. There are several ways in which readers can apply this knowledge.

On one level, it would be appropriate to implement psychological expertise within a specific program, department, or government ministry. For example, it would be appropriate to call in psychological consultants

to consider the functioning of a specific counter-terrorism program. On a wider scale, it would be appropriate to form a core of psychologists to consult on national or regional DAT as a whole. Our sense of the situation is that, the wider the scale of psychological intervention, the greater the benefit.

A comprehensive team of psychologists addressing DAT should be composed of representatives of several subdisciplines. Ideally, these would include specialists in *human factors and ergonomics* (useful in many areas, as noted above), *industrial/organizational psychology* (particularly specialists in team assessment and enhancement), *psychometrics* (to develop appropriate assessment instruments), *educational psychology* (to develop and assess instructional programs), *social and personality psychology* (specifically specialists on influence and persuasion), *cognitive psychology* (for cognitive enhancement), *clinical psychology* (for therapeutic intervention), and *counseling psychology* (specifically specialists in positive psychology and resilience). A team meant to address the issues we bracketed earlier (that is, the psychosocial origins of terror) should include specialists in *social and personality psychology* who are focused on those issues. In either case, the team leader should be someone with qualifications in *general psychology*; this possibly misleading designation refers to a special approach in psychology that is focused on unifying psychology, building bridges between and among the many specialties and subdisciplines within psychology [192].

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