# Training Strategies to Mitigate Expectancy-Induced Response Bias in Combat Identification: A Research Agenda

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**Abstract**

Historical assessments of combat fratricide reveal principal contributing factors in the effects of stress, continuous operations or sleep deprivation, poor situational awareness, emotions, and lack of training. This paper discusses what and how improvements in combat identification (CID) may be achieved through training. In addition to skill-based training, CID training must focus on countering the negative effects of expectancy in the face of heightened anxiety and stressors of continuous operations that lead to combat errors or fratricide. The paper examines possible approaches to training for overcoming erroneous expectancies and emotional factors that may distort or limit accurate "blue force" identification.

## INTRODUCTION

Combat Identification (CID) is the process of attaining an accurate characterization of detected objects (friendly, enemy or neutral) throughout the Joint battlespace (DoD, 2000). Combat Identification is a function of Situational Awareness (SA) and Target Identification (TI) capabilities; effective CID requires adherence to doctrine, unit tactics, techniques and procedures, and approved rules of engagement (ROE). The goal of CID is to improve unit combat effectiveness while preventing fratricide (friendly fire) and minimizing collateral damage. CID is the process that human shooters or sensors go through to identify entities on the battlefield prior to making shoot/don't shoot decisions. To perform CID, the warfighter uses all available means at his disposal to sort the entities on the battlefield prior to applying combat power. The focus of the present paper is on exploring ideas for training mitigations that address stress-induced emotional and cognitive factors that introduce biases and expectancies that undermine CID.

Fratricide, as defined by the U.S. Army's Training and Doctrine Command (TRADOC) Fratricide Action Plan, is "the employment of friendly weapons and munitions with the intent to kill the enemy or destroy his equipment or facilities, which results in unforeseen and unintentional death or injury to friendly personnel" (U.S. Department of the Army, 1993, p.1). Fratricide has been a concern since humans first engaged in combat operations, although it gained much emphasis in the Persian Gulf War (U.S. Department of Defense, 1992). The percentage of deaths attributed to fratricide has ranged from 21% during World War II (American War Library, 1996) to 17% in the Persian Gulf War (Garamone, 1999). During recent major combat operations in support of Operation Iraqi Freedom, fratricide studies have reported a 25-percent increase in platform-to-soldier incidents and an increase in soldier-to-soldier incidents of 10 percent. It is difficult to know with certainty what the actual fratricide rate is because of the fog of war and the negative stigma that fratricide brings.

Rates of fratricide are increasing in part due to the increased accuracy and lethality of weapons, and despite the introduction of advanced technologies designed to increase target identification performance. Indeed, as TI is only part of the equation underlying TID, it is clear that enhancing SA is a continuing and critical need. Reliance on technology alone is a flawed strategy because technology is not infallible; technology may fail or be unavailable, and it may be undermined by technology developed by an adversary. Human SA will always be part of the equation because, ultimately, the human gives the order and pulls the trigger. Because of the background of human error in the equation, there is a sense of inevitability associated with the fratricide problem. It has been argued that fratricide is one of the inescapable costs of war (Marine Corps University Command and Staff College [CSC], 1995). But just as causal analysis studies of human error have produced insights and effected design/organizational improvements to reduce accidents, studies of the human factors underlying CID errors can reduce friendly fire incidents. The challenge is to minimize this unwanted companion to war that has been shown to produce devastating effects on troops in addition to the tragic loss of life: Data collected through the U.S. Army's Center for Army Lessons Learned (CALL) suggest 10 potential effects of friendly fire incidents (U.S. Department of the Army, 1992), including disrupted operations, a loss of initiative, loss of team cohesion, and loss of confidence in the team leader.

## Reported Causes and Contributing Factors

A report produced by the U.S. Army's CALL center cites primary causes of fratricide (U.S. Department of the Army, 1992) as poor situational awareness, combat identification failures, and weapons errors; with contributing factors including anxiety, confusion, bad weather, and inadequate preparation, and leader fatigue. The report states that these contributing factors are a critical dimension of realistic training conditions. Inadequate training is often cited as a contributing factor by studies of fratricide; other factors that have been cited include poor leadership, inappropriate procedures, language barriers, lack of appreciation of own platform position and heading, an inability to communicate changing plans or situations, and disorientation, confusion, and carelessness of aircraft crews [BBC News, 2004a, 2004b; Marine Corps University Command and Staff College (CSC) 1995; Penny, 2002][1]. While these studies provide some insight into contributing factors, identifying these factors as contributing does not by itself illuminate diagnostic factors underlying these failures. Wilson, Salas, Priest, & Andrews (2007) examined human factors literature for underlying human factors causes of friendly fire incidents. As argued by Wilson et al. (2007), to accomplish tasks on the battlefield requires cognitive processes, performed as a collective effort that requires shared cognition. Using a human-centered approach, they concluded that in the absence of adequate shared cognition, warfighters can have problems interpreting cues, making decisions, and taking correct action. They concluded that when shared cognition "fails," the incidence of fratricide increases. They derived a taxonomy of behavioral markers that may help military leaders reduce the consequences of fratricide in war (see Table 1) and they identified factors (based on the individual, task, organization, technology, and environment) that influence shared cognition (see Figure 1). Addressing CID and fratricide requires mitigation strategies to reduce human errors and better prepare war fighters for factors that undermine SA.

The taxonomy presented in Table 1 has the potential to be a useful tool in diagnosing the contribution of shared cognition breakdowns in fratricide, and in identifying possible training strategies to prevent or overcome such breakdowns. Identifying portions of the taxonomy that are most influenced by combat stress, and more particularly, by stress-induced emotional and cognitive factors, can further define a training roadmap and strategies for reducing cognitive biases that undermine CID.

[1] Over reliance on technology should also be included in any list of factors contributing to fratricide.

Table 1. Behavioral markers of teamwork breakdowns (from Wilson et al., 2007)

| | |
|---|---|
| **Communication** | |
| Information exchange | ▪ Did team members seek information from all available resources?<br>▪ Did team members pass information within a timely manner before being asked?<br>▪ Did team members provide "big picture" situation updates? |
| Phraseology | ▪ Did team members use proper terminology and communication procedures?<br>▪ Did team members communicate concisely?<br>▪ Did team members pass complete information?<br>▪ Did team members communicate audibly and ungarbled? |
| Closed-loop communication | ▪ Did team members acknowledge requests from others?<br>▪ Did team members acknowledge receipt of information?<br>▪ Did team members verify information sent is interpreted as intended? |
| **Coordination** | |
| Shared mental models | ▪ Did team members have a common understanding of the mission, task, team and resources available to them?<br>▪ Did team members share common expectations of the task and team member roles and responsibilities?<br>▪ Did team members share a clear and common purpose?<br>▪ Did team members implicitly coordinate in an effective manner? |
| Mutual performance monitoring | ▪ Did team members observe the behaviors and actions of other team members?<br>▪ Did team members recognize mistakes made by others?<br>▪ Were team members aware of their own and others surroundings? |
| Back up behavior | ▪ Did team members correct other team member errors?<br>▪ Did team members provide and request assistance when needed?<br>▪ Did team members recognize each other when one performs exceptionally well? |
| Adaptability | ▪ Did team members reallocate workload dynamically?<br>▪ Did team members compensate for others?<br>▪ Did team members adjust strategies to situation demands? |
| **Cooperation** | |
| Team orientation | ▪ Did team members put group goals ahead of individual goals?<br>▪ Were team members collectively motivated and did they show an ability to coordinate?<br>▪ Did team members evaluate each other, while using inputs from other team members?<br>▪ Did team members exhibit 'give-and-take' behaviors? |
| Collective efficacy | ▪ Did team members exhibit confidence in fellow team members?<br>▪ Did team members exhibit trust in others and themselves to accomplish their goals?<br>▪ Did team members follow team objectives without opting for independence?<br>▪ Did team members show more and quicker adjustment of strategies across the team when under stress based on their belief in their collective abilities? |
| Mutual trust | ▪ Did team members confront each other in an effective manner?<br>▪ Did team members depend on others to complete their own tasks without 'checking up' on them?<br>▪ Did team members exchange information freely across team members? |
| Team cohesion | ▪ Did team members remain united in pursuit of mission goals?<br>▪ Did team members exhibit strong bonds and desires to want to remain a part of the team?<br>▪ Did team members resolve conflict effectively?<br>▪ Did team members exhibit less stress when performing team tasks? |

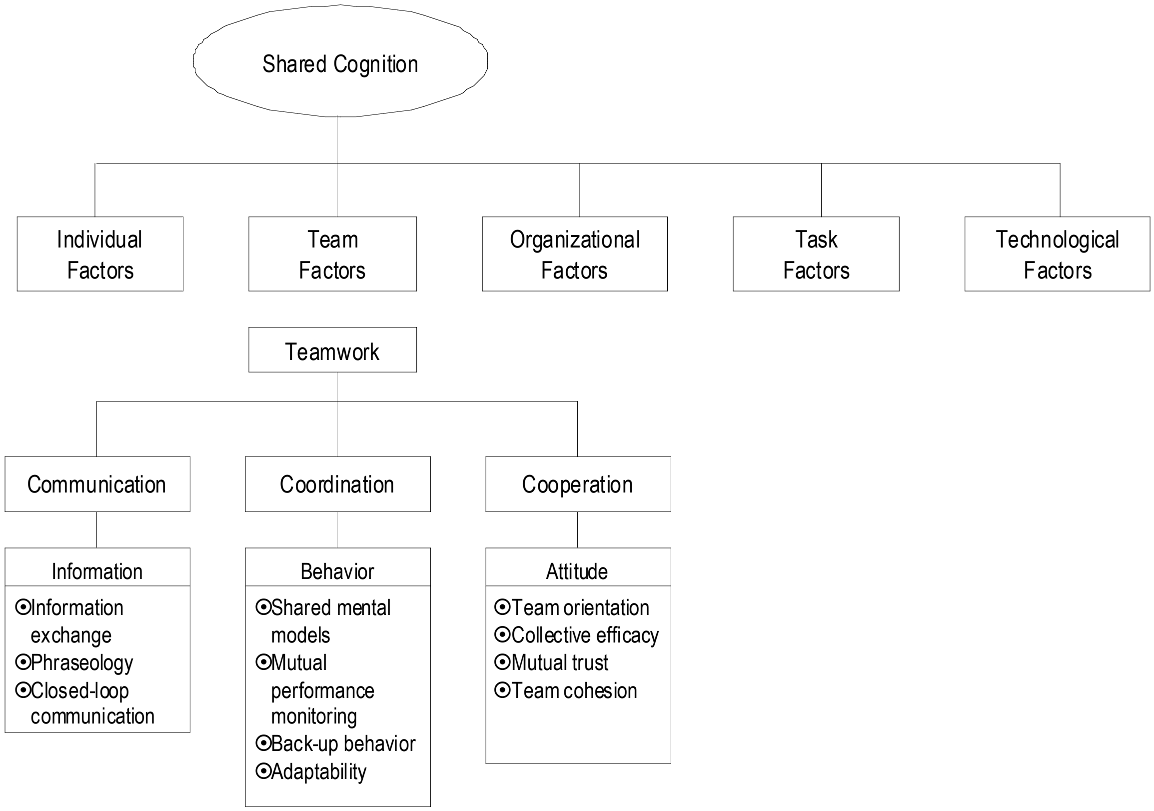


**Figure 0. Framework for classifying teamwork breakdowns (after Wilson et al., 2007).**

## The Role of Emotion, Stress, and Cognition

Emotions play a powerful role in everyday life and in military planning and operations, as well as military training. For a comprehensive examination of the psychology and performance effects of emotion and stress, the reader is referred to excellent reviews of the effects of stress (Staal, 2004; Kavanagh, 2005) and emotions (Blascovich and Hartel, 2007) on cognition. Emotions influence our perceptions and they bias our beliefs; they influence our decisions and in large measure guide how people adapt their behavior to the physical and social environment (Musch and Klauer, 2003; Judge and Larsen, 2001). Because emotions can impair decisions, military training developers are well advised to incorporate an emotional element into training to elicit the strong emotions soldiers will feel on the battlefield.

## Effects of Emotion and Affective State

Emotion has effects at all levels of cognitive processing; many of them are directly relevant to military contexts. Military situations are fraught with uncertainty, and understanding the role of emotion in arriving at accurate situational awareness may prove useful in optimizing decision processes.

A person's affective state is primarily influenced by a largely automatic process termed evaluation (Bargh and Ferguson 2000; Barrett, 2006a). Evaluation is a fast analysis, often unconscious (Moors and De Houwer, 2006), in which something is judged "good for me" or "bad for me" – in other words, an analysis of whether or not properties of a situation are important to one's survival, well-being, and goals (Ellsworth and Scherer, 2003). Thus affective states influence what people attend to and how they interpret what they see. MacLeod (1996) suggests that anxiety impairs cognitive performance by diverting mental resources toward task-irrelevant information that relates to the perceived threat. Emotions also influence what people remember about an event, or details just before or after an event that elicits strong emotions (such as intense fear). Research has also shown that emotions can bring about self-deception (e.g., Mele, 2000) or overwhelm reason (Shiv and Fedorikhin, 1999) in making decisions.

## Effects of Stress

Stress has strong effects on every aspect of cognition from attention to memory to judgment and decision making. A general framework describing performance effects of stress is shown in Figure 2 (from Kavanagh, 2005). In general, under stress, attention appears to channel or tunnel, reducing focus on peripheral information and centralizing focus on main tasks. Originally observed by Kohn (1954), this finding has been replicated often, first by seminal work of Easterbrook (1959) demonstrating a restriction in the range of cues attended to under stress conditions (tunneling) and many other studies (see Staal, 2004). Peripheral stimuli are likely to be the first to be screened out or ignored. Decision making models proposed by Janis and Mann (1977) support this hypothesis and suggest that under stress, individuals may make decisions based on incomplete information. Friedman and Mann (1993) suggest that when under conditions of stress, individuals may fail to consider the full range of alternatives available, ignore long-term consequences, and make decisions based on oversimplifying assumptions—often referred to as heuristics.[2] There is also a large literature on the effects of stress on vigilance and sustained attention, with a particular focus on stress caused by fatigue and sleep deprivation. A review by Davies and Tune (1970) concluded that vigilance tends to be enhanced by moderate levels of arousal (stress), but sustained attention appears to decrease with fatigue and loss of sleep. In the cognitive domain, a study by Wickens, Stokes, Barnett and Hyman (1991) found that under time pressure, noise, and financial risk, individuals performed more poorly on vigilance and attention tasks, but declarative knowledge tasks were not affected.

[2] While researchers who argue that perceptual narrowing reduces the quality of individual decisions, Klein (1996) observes that the use of heuristics may allow individuals to respond more quickly to external demands while under stress or when provided only partial information.

Several investigations have shown that tasks that are well-learned tend to be more resistant to the effects of stress than those that are less-well-learned. Extended practice leads to commitment of the knowledge to long term memory and easier retrieval, as well as automaticity and the proceduralization of tasks. These over-learned behaviors tend to require less attentional control and fewer mental resources (Leavitt, 1979; Smith & Chamberlin, 1992), which further results in enhanced performance and greater resistance to the negative effects of stress—i.e., they are less likely to be forgotten and more easily recalled under stress. Van Overschelde and Healy (2001) found that linking new facts learned under stress with preexisting knowledge sets helps to diminish the negative effect of stress. On the other hand, there is also a tendency for people under stress to "fall-back" to early-learned behavior (Allnut, 1982; Barthol & Ku, 1959; Zajonc, 1965)—even less efficient or more error prone behavior than more recently-learned strategies—possibly because the previously learned strategies or knowledge are more well-learned and more available than recently acquired knowledge.

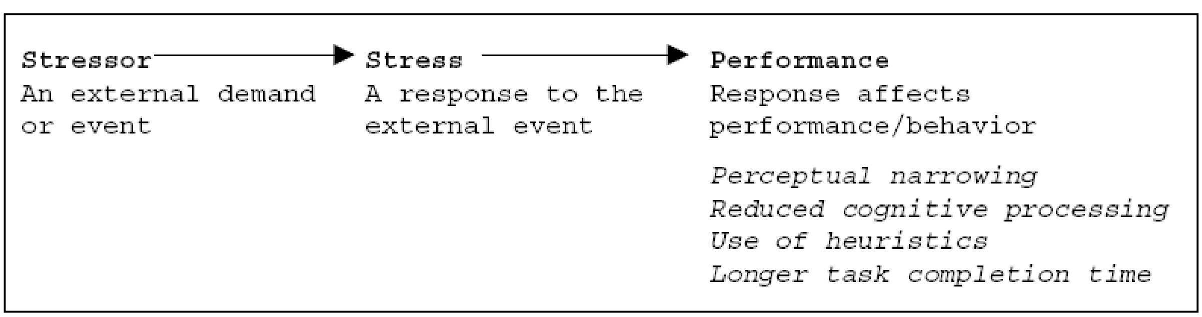


**Figure 0. Performance effects of stress. (from Kavanagh, 2005; p. 3)**

Research suggests that high stress during learning tends to degrade an individual's ability to learn—perhaps due to interference or disruption in the encoding and/or maintenance phases of working memory. An implication for instructional strategies is that a phased approach should be used, with an initial learning phase under minimum stress, followed by gradual increasing exposure to stress more consistent with real-world conditions. Stress inoculation training attempts to immunize an individual from reacting negatively to stress exposure. The method provides increasingly realistic pre-exposure to stress through training simulation; through successive approximations, the learner builds a sense of positive expectancy and outcome and a greater sense of mastery and confidence. This approach also helps to habituate the individual to anxiety-producing stimuli.

Finally, it is important to consider group processes in this context. Historically, research has focused on individuals, but there is a growing literature on team decision making. Effective teams are able to adapt and shift strategies under stress; therefore, team training procedures should teach teams to adapt to high stress conditions by improving their coordination strategies. Driskell, Salas, and Johnston (1999) observed the common finding of Easterbrook's attentional narrowing is a phenomenon also applicable to group processes. They demonstrated that stress can reduce group focus necessary to maintain proper coordination and situational awareness—i.e., team members were more likely to shift to individualistic focus than maintaining a team focus.

## *Cognitive Biases*

Gestalt psychology tells us that we tend to see what we expect to see. Expectancy effects can lead to such selective perception as well as biased decisions or responses to situations in the form of other cognitive biases like confirmation bias (the tendency to search for or interpret information in a way that confirms one's preconceptions) or irrational escalation (the tendency to make irrational decisions based upon rational decisions in the past). The impact of cognitive biases on decision performance—particularly response selection—is to foster decisions by individuals and teams that are based on prejudices or expectations that they have gained from information learned before they are in the response situation. For example, if a combat pilot is told that only the enemy is on the north side of a river, the pilot may be biased to fire prematurely at the first potential target seen on the north side of the river. The pilot has an expectancy that this action will lead to a successful first level outcome, namely the enemy will be destroyed or disrupted.

We believe that disruption of rational decision making processes by cognitive biases is only exacerbated by the stress experienced in life and death situations. High-stress, emotionally-charged combat situations thus provide a stimulus for the effects of cognitive biases that overcome the effects of prior training.

Following are two well publicized incidents of friendly fire where we believe that expectancy and response bias played a major role.

> Pennsylvania Guard pilots cleared in 'friendly fire' incident 10 Marines died, 4 hurt when A-10 jets and Iraqis struck U.S. force last year ("Sun National", 2004) "The Central Command placed sole blame on an unidentified Marine captain who called in the two Air Force A-10 attack jets without realizing that dozens of Marines were in the area. Because the Marines were attacked by both friendly and enemy fire, the

exact source of their wounds could not be determined, investigators said. The pilots, who used binoculars, said they could pinpoint only white pickup trucks and not the Marines' armored vehicles, two of which were attacked by the jets, according to the investigative report. Investigators said the Marine captain gave the pilots blanket approval to attack an area on the outskirts of Nasiriyah. The Marine captain faces possible disciplinary or administrative action. Col. Gregory Marston, vice commander of the 111th Fighter Wing, said the pilots were "miles" from the Marines when they began their bombing and strafing runs, and not as close and "low" as some Marines reported after the incident. The report said the pilots circled at 15,000 feet before descending and beginning their attack. "People on the ground were shooting" at the two pilots, Marston said. "They staged this at the prescribed altitude and the prescribed distance from the target." Marston said he doubted that the pilots had flown directly over the Marines, because "that's not how they train." Marston said he could not recall the last time the squadron trained with Marine units. The pilots could see the white pickup trucks near Nasiriyah because the vehicles stood out against the desert background, said Marston, unlike the Marines' green armored vehicles, which the pilots said they did not see."

**Friendly fire: a recent history – CBC news** On Sept. 4, 2006, two U.S. A–10 Thunderbolts mistakenly attacked Canadian troops in Afghanistan during Operation Medusa, a major operation aimed at retaking control of two dangerous districts west of the city of Kandahar. In April 2002, American fighter pilot Harry Schmidt killed four Canadian soldiers when he dropped a 225–kilogram bomb on a unit conducting military exercises near Kandahar. Schmidt saw gunfire on the ground, which he mistook for surface-to-air fire. Schmidt attacked, killing Sgt. Marc D. Leger, Cpl. Ainsworth Dyer, Pte. Richard Green and Pte. Nathan Smith. Eight other Canadians were wounded in the bloodiest friendly fire incident to hit this country since the Korean War.

## Implications for CID Training

Based on the foregoing discussion, we may summarize the challenges and needs for more effective CID training in general terms as well as more specifically addressing deficiencies in scenarios, addressing needs for incorporating stress and stress management techniques, and addressing challenges in preparing warfighters to overcome cognitive biases. In general terms, based on research described above, the following factors should be included in CID training:

- Training should provide extended practice, promoting more persistent memory and easier retrieval, and to encourage automaticity and the proceduralization of tasks to make them more resistant to the effects of stress.
- Team training should focus on strategies for maintaining group cohesion and coordination, mitigating the tendency for team members to revert to an individual perspective and lose shared situational awareness.
- Training should exercise the execution of cognitive tasks by both individuals and groups.

## *Deficiencies in Typical Combat Training Scenarios*

We train warfighters based on threat scenarios, but deficiencies in the characteristics of such scenarios may prevent the learning of strategies to overcome cognitive biases while under stress. CID training should provide sufficiently complex scenarios that induce stress by forcing warfighters into “uncomfortable territory.” We must inject complex or dynamic changes (threats) into scenarios that induce trainees to experience uncertainties of the real world, rather than simply exercising previously-learned skills and “recipes” learned to face typical or expected threats. In other words, we must ensure that the trainee is forced to operate without perfect information and in the face of “surprises” that challenge preconceptions or assumptions. Without such complex and dynamic threats, training can cause the warfighter (and battle planners) to overestimate their capabilities. As argued by Sawyer and Pfeifer (2006) in a homeland security training context, “… organizations must recognize that the threat is dynamic and is characterized by extensive uncertainty. To move beyond preparing for the last war, our training must challenge and test our assumptions about operating in complex environments, examine our operational and strategic constraints, and evaluate our capabilities to respond effectively to challenging, changing events.” [p.

250]. Thus, the following suggestions apply to scenario construction and management in CID training:

- CID training scenarios should include complex/dynamic threats that reflect the uncertainties of the real world—scenarios that force trainees to operate without perfect information and that incorporate surprises that challenge preconceptions or assumptions.
- CID training scenarios should be designed to encourage the habit of testing one's assumptions to produce more adaptive, resilient CID performance in the face of uncertainty.

## *Need for More Realistic Stress and Stress Management Training*

All training involves instruction and practice in exercising knowledge, skills, and abilities necessary to accomplish a task. Thus, in the context of CID, warfighters must be trained on how to accurately perceive stimuli that will inform the trainee's decision making process as to whether the stimulus of interest is friend, foe, or neutral, and how to recognize a failure in TI technology (see Cannon-Bowers & Salas, 1998). Additionally, because of the intense nature of the battlefield (also referred to as the "fog of war"), warfighters experience extreme pressures that they must overcome to apply the knowledge, skills, and abilities that they acquire during training, and to control intense emotions associated with battle. While they receive extensive training on strict rules of engagement, procedures and requirements to pursue the commander's intent, none of the training experiences can match the real battle where they must make life-or-death decisions quickly. Therefore, a major challenge for CID training—and one that is distinctly different from training on knowledge, skills, and abilities—is training to enhance awareness of the effects of stress on cognitive performance and to exercise the execution of cognitive tasks, individual and group decision making (maintaining shared situation awareness) under conditions of stress that are comparable to operational environments, with the ultimate aim of reducing human errors associated with CID.

We recognize that training (and development of effective combat ID training) becomes more complicated when we emphasize potential affective issues that might produce cognitive biases. However, we feel it is vital that warfighters be able to recognize and then be trained to overcome, if possible, those biases. It is not a case of the warfighters not knowing what cues they should be looking or listening for. Their initial skill-based training taught them those cues. Rather, it's a case of warfighters being taught to recognize their proclivity to bias their interpretation of the cues when they are emotionally charged. As was discussed previously, emotional stress can cause warfighters to narrow their attentional focus, start looking for reasons to fire instead of reasons not to fire. Can we teach war fighters to recognize and overcome these cognitive biases? A large part of the answer rests on whether we can teach warfighters to recognize their emotionally charged state and then to manage that state. It's not realistic to expect warfighters to overcome their emotions in a combat situation; however it should be possible to train them to recognize and undertake the management of those emotions in unfamiliar situations.

The following suggestion should be included in a prescription for improving CID training through the use of more realistic accommodation of stress factors:

- Training strategies should incorporate an emotional element into training to elicit the strong emotions soldiers will feel on the battlefield.

- Because high stress during training tends to impair learning, a phased approach should be used, beginning with minimum stress and building up to stress levels more consistent with real-world conditions.

## *Need to Address Cognitive Biases*

CID training must be designed to more effectively address cognitive biases. Cognitive biases such as the confirmation bias and irrational escalation can cause experienced warfighters to spend critical time searching for familiar cues or indicators associated with situations with which they have had experience or training, to the detriment of their ability to think outside the box and observe cues and stimuli that are most relevant to the novel situation that they face. Therefore, training on combat ID should attempt to teach warfighters to identify and assess the relevant indicators in a new environment, without automatically resorting to preconceived lists of indicators.

A training approach to address the effects of stress on cognitive biases, and management of such biases, may include detailed "after-action reviews" to raise trainee awareness about the ways they gathered information to help them recognize threats, identify problems, and make correct decisions (or incorrect ones). The focus of this type of training, which occurs after the traditional skill-based training, is to help the warfighters learn to keep their eyes and minds open to crucial elements in situations they have not experienced before. They must be able to weigh all information—even unexpected information—and keep an open mind to overcome cognitive biases that restrict their perception, attention, and decision making performance. The ability to imagine or anticipate unexpected outcomes is critical to effective decision making under stress.

Training requirements to better meet the objectives of addressing stress-induced cognitive biases in CID include:

- CID training should enhance awareness of the effects of stress on cognitive performance—such as tunneling and flawed decision making strategies that ignore information—and coping strategies to moderate these effects. The training should be designed to make as explicit as possible what might happen to skill and knowledge under stress on the battlefield.
- Train awareness of cognitive biases and practices for managing these biases
- Emphasize habits of testing assumptions and moving beyond traditional reactive behaviors to train techniques for more adaptive, resilient CID performance in the face of uncertainty.

## Conclusions: Summary of New CID Training Requirements and a Preliminary Research Agenda

In conclusion, we have attempted to survey relevant literature on warfighter affective conditions relevant to CID performance with an objective of describing new CID training requirements that address stress-induced cognitive limitations or biases. Our suggestions for enhancing traditional CID training emphasize the need to expose warfighter trainees to high-stress training in completely unfamiliar scenarios, and to provide meaningful cognitive feedback to help them cope with and manage their limitations and biases. Listed below is a summary of these requirements. Following this list, we discuss the need for a research agenda to further define CID training challenges.

## *Summary List of CID Training Effectiveness "Prescriptions"*

- CID training must move beyond core competency training by training warfighters to cope with increased stress and cognitive biases in unfamiliar situations
- Training strategies should incorporate an emotional element into training to elicit the strong emotions soldiers will feel on the battlefield.
- Training should provide extended practice, promoting more persistent memory and easier retrieval, and encourage automaticity and the proceduralization of tasks to make them more resistant to the effects of stress. Because high stress during training tends to impair learning, a phased approach should be used, beginning with minimum stress and building up to stress levels more consistent with real-world conditions.
- CID training should enhance awareness of cognitive biases and the effects of stress on cognitive performance—i.e., to train warfighters to recognize and avoid, or at least manage, their emotional state so that effects of cognitive biases are reduced.
- Team training should focus on strategies for maintaining group cohesion and coordination, mitigating the tendency for team members to revert to an individual perspective and lose shared situational awareness.
- Training should exercise the execution of cognitive tasks by both individuals and groups.
- CID training scenarios should include complex/dynamic threats that reflect the uncertainties of the real world—scenarios that force trainees to operate without perfect information and that incorporate surprises that challenge preconceptions or assumptions.
- CID training should emphasize habits of testing assumptions and moving beyond traditional reactive behaviors to train techniques for more adaptive, resilient CID performance in the face of uncertainty.

## *CID Training Research Challenges*

Clearly, performing research on warfigher affective conditions is very difficult. It is not clear that we can create simulated conditions that would adequately replicate battlefield conditions in such a way as to bring about the kind of expectancy and response bias we have described. In addition, there are ethical issues that would have to be considered. Nevertheless, we believe a research agenda is needed to properly explore this topic.

A necessary, first exercise is to extend the training taxonomy developed for the HF Journal article by Wilson et al. (2007). First, the taxonomy must be extended in the area of stress-induced response bias and deleterious effects on expectancies. Second, it would be useful to describe and speculate on the additions to the taxonomy for training individual warfighters to avoid response bias induced fratricides. Finally, a research agenda should be established and executed. Main elements of the research agenda, informed or motivated by the present discussion, are summarized below.

- Research is needed to examine possible effects on decision making performance while warfighters are expending limited cognitive resources trying to "manage" their emotions.
- Research is needed to assess whether systems like Blue Force Tracker can improve the warfighter's expectancy of the stimuli they are likely to see. How can Blue Force Tracker displays be improved to reduce cognitive biases?
- Research is needed to further understand the effects of cognitive bias in combat settings.
    - Define stress factors that exacerbate cognitive bias. There is substantial evidence that stress is a key factor. What roles are played by; fatigue, illness, fear of fratricide, past experience, lack of skill and/or knowledge of the weapon

system or environment, poor team communication, trust in intelligence, trust in superiors?

  - Define aspects of cognitive bias that most strongly apply to combat settings. It is not clear that every combat situation could be covered by the same biases. (Along these lines we think it is important to expand the taxonomic categories first defined in Wilson et al.'s (2007) Human Factors Journal article.)

- Determine whether it is possible to mitigate stress-related cognitive bias through better and/or more training.
  - Our assumption is that cognitive bias will be less of a problem if a warfighter is better trained, but is that assumption correct? The training community's general feeling is that the better trained the warfighter, the better they will be able to overcome the negative effects of stress. Is that assumption correct? Because of the difficulty of conducting empirical studies where valid stressors are introduced and measured, we believe this question will remain difficult to answer, but we believe it should receive more research attention than it has.
  - Continuing on the training theme, what training methods and technologies can best be used to mitigate cognitive bias? Do these methods and technologies need to be used differently for different warfighters?
- Determine whether anecdotal reports of friendly fire incidents should be trusted by researchers who are investigating cognitive bias in combat. First- and second-person reports of actual incidents are notoriously prone to bias. Are we taking the right lessons from actual incidents, and can these lessons be reliably relied upon to shape training programs to reduce cognitive bias?

These research challenges form a minimal set of requirements for a developing valid research agenda. Our review of present literature indicates that we have few valid answers for many of these research questions. In addition, we believe there would value in doing research to identify training approaches to help warfighters overcome the terrible effects of being involved in a friendly fire incident—undoubtedly related to training and psychological interventions aimed at alleviating the effects of post-traumatic stress syndrome. Without such intervention, warfighters suffering these effects bring great danger upon their unit and themselves if their emotional grief overwhelms their training and desire to continue the fight. It is possible that no training could help a warfighter overcome those situations and the warfighter might have to be quickly removed from the combat situation. There are, of course, many situations where such removal would not be possible.

The potential gains from the proposed training approaches that emphasize cognitive/affective management skills are evident. The use of dynamic threat scenarios to promote coping with uncertainties in unfamiliar situations will build warfighter abilities to think ahead rather than merely react, and to be better equipped to perform in the midst of the "fog of war." If, on the other hand, we continue to limit our CID training objectives to core competency/skill development issues, then it seems that we will continue to run "limited" exercises well, build false confidence in our abilities, and fail to meet our most critical challenges in protecting our forces from friendly fire incidents.

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