# Aiding Police in the Detection of Imminent Terrorist Attacks: Testing Different Approaches to Improving Situation Assessment Skills

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**ABSTRACT**
Since the 2001 terror attacks in the United States, counter-terrorism strategies have become a security priority for many nations. More recently, the upsurge of ‘home-grown’ extremists and those returning home from foreign conflicts represents a significant risk to public safety. Unfortunately, the pre-identification of would-be terrorists is an extremely difficult task for law enforcement, especially in the final stages of a planned attack. The authors detail two training approaches that could be used to improve law enforcement officers’ situation assessment skills. The paper details research in progress involving the development of virtual-reality training programs, which each simulate environments that are presumably vulnerable to terror attacks (e.g., public transport), but differ in their approach to improving situation assessment, and subsequent performance in the detection of terrorism risks (i.e., sensitizing trainees to diagnostic cues vs. unguided cue discovery in complex, ecologically valid environments).

**KEYWORDS**
*Learning and Training; Security; Decision Making; Expertise; Government and Law*

## INTRODUCTION

Since the 2001 terror attacks in the United States, counter-terrorism strategies have become a security priority in many nations. More recently, the upsurge of ‘home-grown’ terrorists and those returning home from foreign conflicts represents a significant risk to public safety. For instance, in a number of countries, the government-directed threat assessment level is currently at ‘high’; meaning that an attack is likely (National Terrorism Public Alert System, Australian Government; 2015).

A terrorist attack is often likened to a missile launch, in that once the missile has been launched and is approaching a target, it is extremely difficult to thwart. Indeed, without intelligence, identification of a would-be terrorist during the final stages is an ominous prospect for law enforcement. This challenge is of course compounded by the limited avenues for stopping the attack once an offender has been identified. Thus, research has focussed less on situational prevention and more on the ‘launch’ phase. That is, detection of terrorist activities at the preparatory stages of an attack (e.g., reconnaissance, resourcing, ‘dry runs’, etc.), using approaches such as *Social Network Analysis* modelling (Ressler, 2006), in an effort to improve intelligence-based procedures.

Despite this emphasis on the intelligence process, police undoubtedly remain the front line defence to terrorism. It is estimated that 90 per cent of information on potential terrorist threats comes from local law enforcement (U.S. Department of Homeland Security, 2003). The capacity for police to assess scenes rapidly and accurately, particularly those involving large volumes of people (e.g., public transport, major events etc.) is paramount to preventing an attack, or minimizing its impact. Currently, many police organisations can only provide officers limited specialised training in threat assessment and the initiation of countermeasures should detection occur.

When considering training program design for such a task, it would seem intuitive to target trainees’ *situational awareness* for development. Situational awareness can be defined as an individual’s perception of environmental elements, the comprehension of their significance, and the ability to predict their relative status in the system in the near future (Endsley, 1995). In lay terms, it constitutes ‘what is doing, why is it doing that, what will it do next ?’ (Endlsey, 1995, p. 38).

Situational assessment skills are differentiated by the capacity to target and engage relevant *cues* present in the environment (Wiggins, 2006; Klein, 2004). From a cognitive perspective, cues are presumed to represent relationships, held in memory, between environmental or situational features (bottom-up), and consequential events of interest stored in long-term memory (top-down) (Wiggins, Azar, Hawken, Loveday, & Newman, 2014). This initial stage of assessment is often characterised by an absence of conscious deliberation (Finkbeiner & Forster, 2007), and therefore allows a person to efficiently reduce the complexity of the operational environment, and instead places reliance on the identification of patterns of cues (Klein, 1993).

The use of cues has been shown to differ across expertise, to the point where highly experienced decision-makers may only require a limited number of cues to formulate a decision (Wiggins, 2014). Indeed, in numerous domains such as fire-fighting (Klein, Calderwood, & MacGregor, 1986), medical diagnoses (McCormack, Wiggins, Loveday, & Festa, 2014), and criminal investigations (Morrison, Wiggins, Bond, & Tyler, 2013), highly proficient operators have been shown to consistently engage a limited number of highly *diagnostic* cues across varying decision scenarios. In comparison, less experienced practitioners tend to engage more cues, less consistently, across decision scenarios (Boreham, 1995; Kirschenbaum, 1992; Morrison et al., 2013). Arguably, it is this distinction between expert' and novice' cue application that contributes to the less rapid and less accurate outcomes observed in novice decision-making.

From the accumulated evidence, it would seem that invariably, performance begins with situation assessment and the recognition of relevant cues (Endsley, 1995; Klein, 2008; Rasmussen, 1993). Cue diagnosticity (i.e., discriminatory power), will determine the efficiency with which an individual diagnoses the system state. Thus, the sensitization of trainees to diagnostic cues has been recently emphasised in numerous training programs.

An inventory of diagnostic (often termed critical) cues may be elicited from subject-matter experts using Cognitive Task Analysis and eye-tracking techniques, and may be validated and refined to a critical set using survey methods, and cue recognition tasks (Morrison et al., 2014). These cues can then be embedded in training representations which either *cue* trainees' attention by highlighting environmental features, or simplify the representation by 'filtering out' less relevant features. Here, the layers of complexity present within real-world environments can be gradually, and systematically, added to scenarios. A typical example of this cue-based approach to training was demonstrated by Wiggins and O'Hare (2003) who used cognitive interviews with general aviation pilots to identify a range of cues that were deemed critical. Training software was them developed, which highlighted the cues, and provided opportunities to incorporate them into weather-related decisions. This form of training was shown to improve trainees' performance. Similarly, within a sporting context (football referee decision-making), Plessner et al., (2009) demonstrated that referees' repeated exposure to cue-based associations, with immediate feedback, resulted in improvements in decision-making.

The authors postulate here that such cue-based training methods may augment current police training methods in the rapid assessment of scenes for threats to security. Indeed, expert knowledge regarding such threat detection has already been successfully extracted, but has been used by law enforcement largely in a 'checklist' manner. For instance, Israeli Police have conducted a significant number of interviews with witnesses of suicide bombers in order to identify suspect features that may indicate an impending attack (see Table 1).

**Table 1.**A list of indicators published by Israel Police in 'Terror: Let's Stop it Together', which was based on knowledge drawn from interviews with suicide bomb experts.

| | |
|---|---|
| **External appearance** | |
| - | Clothes unsuitable for the time of year (e.g., a coat in summer). |
| - | A youngster (usually) who is trying to blend, by dress and behavior, with the surrounding population (on public transport, at entertainment places, amongst soldiers, or religious/Orthodox groups), even though he or she doesn't belong to that group. |
| - | Anything protruding in an unusual way under the person's clothing. |
| **Suspicious behavior** | |
| - | Nervousness, tension, profuse perspiration. |
| - | Walking slowly while glancing right and left, or running in a suspicious manner. |
| - | Repeated attempts to steer clear of security forces. |
| - | Repeated nervous feeling for something under one's clothing. |
| - | Nervous, hesitant mumbling. |
| **Suspect equipment** | |
| - | A suitcase, shoulder/hand-bag, backpack. |
| - | Electrical wires, switches or electronic devices sticking out of the bag or pocket. |

These indicators, or what we may term as cues, could be embedded in high fidelity simulation programs now readily available to training system developers (e.g., Oculus Rift). Indeed, the cues mentioned here could be represented in simulations featuring a busy commuter train, or a crowded shopping centre. Cueing/filtering techniques could then sensitize trainees to diagnostic cues, as they navigate these immersive environments. These simulations may offer a convenient (e.g., infinitely re-playable scenarios; exposure to a range of conditions, including non-routine cases), cost-effective, and safe approach to simulating high stakes environments that are difficult to stage in the physical world. However, the authors must note that a strict cue-based approach to training is not without its limitations.

Issues in training may arise where the salience of the cues (i.e., conspicuousness or availability) may result in over processing, and a consequent loss of broader situational awareness. Further, the validation of the cues as 'critical' relies heavily on expert reports, which may be constrained by a lack of agreement on who constitutes an expert, agreement amongst said experts, or in cases of agreement, the selection of inappropriate, incomplete, or ecologically invalid cues.

The cue-based training approach appears to be based on the conventional view of situational awareness, as advocated by Endsley (1995), which postulates a global awareness and understanding of the system state now and in the near future. However, an alternative perspective suggests that this definition neglects a crucial element of situational awareness; the *situation*. For instance, Rasmussen (1993) suggests that situational awareness reflects an adaptive capacity to guide behavior in response to dynamic situations, and would seem to advocate an emphasis on ecologically valid simulations, built on exposure and repetition of accurate and varied representations of the operational context. For instance, when examining pilots' situational awareness ability, Caretta, Perry, and Ree (1996) found that the best predictor of performance was simply the number of hours flown. It could be argued that cue-based approaches may be 'watering down' the complexities involved in operational tasks, and depriving learners of a full appreciation of the goal-constraints associated with specific situations.

## RESEARCH QUESTION

From the above discussion, it is worthwhile to explore and directly contrast the two differing approaches to improving situation assessment. Specifically, the current work aims to test and compare the efficacy of two training approaches, within a terrorist-threat detection context. By building different conditions which emphasise either: 1) sensitivity to diagnostic cues (i.e., visual cueing and filtering techniques); or 2) unguided cue discovery in complex, ecologically valid environments, we can hope to improve our understanding of the role of factors such as situational awareness, ecological validity, and cognitive load, in the design of effective training systems.

## METHOD

### Materials and Procedure

3D Modelling, Rigging, and Animating software (UnityPro 4) is being used to create several virtual environments to be run on a Oculus Rift virtual reality headset (Figure 1), in conjunction with a Virtuix Omni Walker. Participants will be fully immersed in the experience of a patrolling a public scene for threats to public safety. In the cue-sensitivity condition, these simulations will use either animations to *cue* trainees to diagnostic cues, or will reduce the saliency of other less diagnostic information (i.e., filtering). In the unguided cue-discovery condition, trainees will be subject to the full complexity of the environments, and provided opportunities to establish cue-based associations via exposure, repetition, and feedback. See Figure 2 of a projected composite of the training experience. Assessment will comprise measures of situational awareness, cognitive load, and diagnostic performance in test scenarios.


**Figure 1. Occulus Rift Hardware**

**Figure 2. Composite of simulated scene**

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