# Performing Under Pressure: The Science Behind Stress Inoculation Training for Police and Military Personnel

## Introduction

Police officers and military personnel pay a well-documented price for their work. For this population, repeated exposure to critical incidents significantly increases the risk of PTSD and depression compared to civilian occupations (Wagner et al., 2020; Abrantes et al., 2024). Chronic occupational stress also carries elevated risks of cardiovascular disease, metabolic disorders, and sleep disruption (Abrantes et al., 2024). Beyond these health consequences, acute stress measurably impairs performance in the very situations this work demands (Cooper et al., 2024). Yet most operational training focuses on skill acquisition in controlled conditions, not on preparing for the stress under which those skills must be used (Delahaij & Soeters, 2006). This review examines the scientific basis for an approach designed to close that gap: stress inoculation training delivered through virtual reality, incorporating real-time heart rate variability monitoring, breathing-based regulation, and biofeedback. It covers the psychophysiology of operational stress, how physiological arousal is measured and regulated, inhibitory control as the cognitive function central to stress-related decision-making errors, and the evidence for VR, biofeedback, and breathing as components of an integrated training system.

## 1. Occupational Stress in Police and Military Personnel

Officers begin every shift in a state of anticipatory arousal, with stress peaking during the most demanding moments on duty and recovery rarely complete before the next shift begins (Anderson et al., 2002). Military personnel show a comparable pattern, with mental health

deterioration often continuing after return from deployment rather than resolving with distance from the threat (Adler et al., 2011).

The cognitive cost is also significant. In high-stress operational contexts, the stress response produces attentional tunnelling, time distortion, and deteriorating fine motor control (Andersen & Gustafsberg, 2016). Lieberman et al. (2005) found that cognitive impairment under combat-like stress exceeded deficits associated with alcohol intoxication. In police contexts, heightened physiological stress responses have been directly associated with decreased performance and increased errors in lethal force decisions (Baldwin et al., 2022). What differentiates those who perform well under these conditions is not the absence of a stress response but the capacity to regulate it. Mental preparedness, encompassing decision-making, situational awareness, and energy management, is what makes that possible (Andersen et al., 2015). Executive functioning also plays a small but significant role in PTSD vulnerability following trauma exposure in military personnel (Liu et al., 2023), suggesting that building these capacities matters not only for performance but for long-term resilience. Understanding the physiological stress response is therefore the starting point for addressing both the immediate performance costs and the longer-term consequences of operational stress.

## 2. The Psychophysiology of Acute Stress

### *2.1 The Autonomic Response*

Stress involves heightened arousal, an unpleasant subjective quality, and reduced perceived control. Controllability is one of the strongest moderators of how intense a stress response becomes (Fink, 2016). This matters for training because giving people effective tools for managing their physiological state may reduce not just performance decrements but the felt

intensity of stress itself. Physiologically, the acute stress response is coordinated by the autonomic nervous system. Sympathetic activation raises cardiovascular and respiratory activity. At the same time, parasympathetic activity decreases, which allows heart rate to rise more rapidly (Bustamante-Sánchez et al., 2020). These shifts are detectable through cardiac measurement (Fenici et al., 2011).

### *2.2 Heart Rate Variability as a Stress Marker*

Heart rate variability (HRV) refers to the natural fluctuation in time between successive heartbeats. A healthy heart does not beat like a metronome: it continuously adjusts in response to the dynamic interplay between sympathetic and parasympathetic inputs to the cardiac cycle (Shaffer & Ginsberg, 2017). Greater variability reflects greater flexibility in that regulation. Under acute stress, this autonomic balance shifts and variability falls, making HRV a sensitive and practically accessible real-time marker of physiological arousal (Shaffer & Ginsberg, 2017).

For real-time measurement in applied settings, the appropriate metric is RMSSD: the root mean square of successive differences between adjacent inter-beat intervals. Unlike some HRV measures, RMSSD specifically reflects parasympathetic activity and is reliable for recordings under five minutes (Shaffer & Ginsberg, 2017). Interpreting RMSSD meaningfully requires an individual pre-task baseline, collected before the task to avoid contamination by anticipatory stress (Marchisio, 2025). Tracking RMSSD during training therefore provides an objective indication of how much the stress response is affecting the individual at any given moment.

## 3. Inhibitory Control Under Stress

Inhibitory control is the capacity to suppress an automatic response when the situation calls for restraint (Diamond, 2013). In operational contexts it is central. An officer must withhold a shooting response when a target is misidentified, hold back when de-escalation is required, and maintain composure when instinct pushes toward panic. The go/no-go task is the standard laboratory measure of this function (McLaren & Verbruggen, 2016). Participants respond to frequent target stimuli while withholding responses to infrequent non-targets, and the high ratio of go to no-go trials creates a strong tendency to respond that requires active inhibitory effort to suppress (Wessel, 2018). Biggs (2022) and Biggs and Pettijohn (2022) establish a causal link between inhibitory control and shoot/no-shoot errors, making the paradigm a direct measure of a function that fails in the field.

Under stress, this capacity is selectively vulnerable. Horn et al. (2025) found that cognitive load specifically degraded the ability to withhold a response, even in officers who showed overall improvements in shooting under pressure. Importantly, inhibitory control is trainable, and training produces gains that transfer to operational settings (Spiegel & Sutter, 2025), making it a promising target for interventions aimed at maintaining performance under stress.

## 4. Breathing Regulation and Biofeedback

### *4.1 Breathing as a Regulatory Tool*

Of all the physiological changes that stress produces, breathing is the only one that can be deliberately controlled, making it a direct point of access to the autonomic stress response. Slow breathing at fewer than ten breaths per minute increases HRV and parasympathetic activity, countering the physiological effects of the stress response (Zaccaro et al., 2018).

With sustained practice, the capacity to voluntarily regulate the autonomic nervous system strengthens progressively over months (Bornemann et al., 2019).

The evidence that this translates to high-stress operational contexts is direct. Compared to normal breathing, slow breathing before a VR active shooter drill produced significantly lower salivary alpha amylase levels after the drill, indicating a reduced sympathetic stress response (Dillard et al., 2023). Ibrahim et al. (2024) showed that slow breathing improved first-shot accuracy in student officers, noting that the first shot is typically the most performance-critical measure in this context. Sætrevik et al. (2025) found that police trainees who used controlled breathing during a critical incident simulation outperformed those following standard procedures.

### *4.2 Biofeedback: Turning Regulation Into a Learnable Skill*

Breathing regulation without feedback has a practical limitation. A person cannot easily assess whether their effort is producing the intended physiological change. Biofeedback addresses this by providing real-time information about physiological state, allowing the person to adjust their breathing until the intended effect is achieved. A meta-analysis found that HRV biofeedback training produces large reductions in self-reported stress and anxiety (Goessl et al., 2017). Even a single short session produces a measurably reduced stress response during a subsequent cognitive task (Prinsloo et al., 2013). In a police cadet population, resonance frequency biofeedback training has been associated with improved HRV and cognitive performance, including during simulated operational scenarios (Napier, 2021).

The established limitation of biofeedback is that it is typically practised in quiet, low-demand settings, where attention can be fully directed inward. Operational contexts are neither quiet nor low-demand, and translating a skill learned under one set of conditions to a

fundamentally different one is not straightforward (Brammer et al., 2021). Michela et al. (2022) addressed this directly by embedding HRV biofeedback within a VR shoot/no-shoot task, finding improvements in breathing control, HRV, and task performance that carried over to sessions run without biofeedback.

## 5. Virtual Reality and Stress Inoculation

### *5.1 Virtual Reality and Stress Inoculation Training*

Research confirms that VR can reliably elicit measurable physiological stress responses (Van Dammen et al., 2022). In police-specific contexts, Martaindale et al. (2024) found that stress responses during a VR scenario were comparable to those during realistic in-person scenario training. McAllister et al. (2022) confirmed that a VR-based active shooter scenario significantly elevated both salivary stress biomarkers and subjective stress ratings. What makes a stressor feel real is not visual fidelity but whether the situation feels consequential and unavoidable (Finseth et al., 2024). Lower-fidelity simulations with well-designed feedback structures can therefore produce stress responses comparable to expensive photorealistic systems, making game-style VR a practically viable training environment (Weiß et al., 2021).

Stress inoculation training (SIT) works by exposing individuals to manageable stress while teaching coping strategies, with the aim of building tolerance that carries over to more demanding real-world situations. The framework proceeds through three overlapping phases: conceptualising the stress response and its effects, acquiring and practising coping skills, and then applying those skills in real situations (Meichenbaum & Deffenbacher, 1988). VR is well-suited to that final phase. It allows high-stress scenarios to be simulated safely and

practised repeatedly in conditions that would be difficult or dangerous to recreate in real life (Wiederhold, 2024).

### *5.2 Transfer to Operational Performance*

The test that ultimately matters is whether skills trained under stress hold in the real world. A meta-analysis of use-of-force training found that programmes introducing contextually realistic pressure early in training improved performance by 10.6% compared to standard approaches (Cooper et al., 2024). Nieuwenhuys and Oudejans (2011) showed that officers trained under anxiety maintained shooting accuracy under subsequent stress exposure four months later, while those trained without stress continued to deteriorate.

The evidence that VR-based biofeedback training transfers to real operational performance is growing. Chen et al. (2025) found that participants in a respiratory biofeedback game applied learned regulation skills to real-world situations after as little as one week of practice, with the effect sustained across ten weeks. Most directly, Michela et al. (2025) found that HRV and performance gains from VR biofeedback training carried over to a professional shooting assessment conducted outside the virtual environment.

## Conclusion

Stress degrades operational performance through mechanisms that can be measured, regulated, and trained. The evidence reviewed here supports each step in that chain, from real-time HRV monitoring to breathing-based regulation, biofeedback training, and VR-based stress inoculation. What the literature cannot yet answer is how these components perform when brought together in a single programme. Systematic evaluation of that integration is the logical next step.

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