POLICE EDUCATION AND TRAINING REVISITED: DRAWBACKS AND ADVANCES

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PUBLISHED IN: Frontiers in Psychology and Frontiers in Education

frontiers Research Topics

frontiers

ISSN 1664-8714
ISBN 978-2-83250-626-4
DOI 10.3389/978-2-83250-626-4

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POLICE EDUCATION AND TRAINING REVISITED: DRAWBACKS AND ADVANCES

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Citation: Staller, M. S., Bennell, C., Koerner, S., Suss, J., eds. (2022). Police Education and Training Revisited: Drawbacks and Advances. Lausanne: Frontiers Media SA. doi: 10.3389/978-2-83250-626-4

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frontiers | Frontiers in Psychology

TYPE Editorial
PUBLISHED 14 October 2022
DOI 10.3389/fpsyg.2022.1045924

OPEN ACCESS

EDITED AND REVIEWED BY
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SPECIALTY SECTION
This article was submitted to Educational Psychology, a section of the journal Frontiers in Psychology

RECEIVED 16 September 2022
ACCEPTED 03 October 2022
PUBLISHED 14 October 2022

CITATION
Staller MS, Koerner S, Bennell C and Suss J (2022) Editorial: Police education and training revisited: Drawbacks and advances. *Front. Psychol.* 13:1045924. doi: 10.3389/fpsyg.2022.1045924

Editorial: Police education and training revisited: Drawbacks and advances

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KEYWORDS

police learning, police–citizen interaction, reflexivity, scientific observation, professionalization and professional development

Editorial on the Research Topic
Police education and training revisited: Drawbacks and advances

The education and training of police officers plays a prominent role in equipping officers with the knowledge structure, competencies, attitudes, and values that are needed to professionally conduct their duties in alignment with the ideals of a democratic society. Police officers learn in formal learning settings such as classrooms and scenario-based training rooms, but learning extends to a variety of non-formal and informal learning settings that exist outside the explicit curriculum of police education and training institutions (see "(Non-)Learning to police"). The "police system," with all its structures and frameworks, as well as its individuals (e.g., police trainers, management, and supporting staff), shares the power—and the responsibility—for ensuring that what is learned is what is needed. However, current debates about police professionalization and reform, sparked in part by the death of George Floyd (Boxer et al., 2021), indicate that there is much to learn by focusing scientific scrutiny on police education and training. Observing and re-evaluating learning settings and goals through a scientific lens addresses one leverage point of the complex system that has repeatedly led to unfavorable outcomes in police–citizen encounters.

Although, organizationally, the "science system" is not necessarily part of the "police system," the two social systems have become aligned over the last two decades, as evidenced by the rise of the term "evidence-based policing" (Boulton et al., 2020). Also, current debates concerning police–citizen encounters can be interpreted as progress in the sense that there *is* amplified communication about policing (Nassehi, 2021) and a growing acceptance that a scientific approach might benefit our understanding of police–citizen encounters. Understanding the factors that influence these interactions includes examining the education and training officers receive.

As researchers, we are fully aware that our logic related to the system of science fundamentally differs from the logic of the policing system. As such, we must regularly reflect on our share of, and contribution to, the status quo of police training and education. This is evidenced by discussions we have between ourselves (Bennell et al., 2021; Koerner and Staller, 2022). Yet, as researchers, we have the tools available that allow for rigorous and alternative observations (and the observation of our observations) that might provide a reflexive lens through which we can better understand issues around police education and training.

With the limitations of our own perspectives in mind, it is with delight that we share our Research Topic "*Police education and training revisited: Drawbacks and advances*" with the scientific community and with those we want to help and encourage in their practice: police trainers and police managers. With 10 original research reports,one brief report, two conceptual analyses, and one review, we provide a Research Topic—comprising 14 articles from a total of 50 dedicated authors—that sheds light on issues of performance in police–citizen encounters as well as on issues of the corresponding education and training that officers receive. By providing this Research Topic, we hope to foster further research concerning the Research Topic of police education and training, and stimulate discussion between practitioners, practitioners and researchers, and among researchers.

Author contributions

MS and SK drafted the manuscript. CB and JS provided conceptual and Editorial contributions. All authors contributed to manuscript revision, read, and approved the submitted version.

Acknowledgments

We would like to thank Benjamin Zaiser for his help in putting this Research Topic together.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

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frontiers in Psychology

ORIGINAL RESEARCH
published: 11 August 2021
doi: 10.3389/fpsyg.2021.719046

Testing the Efficacy of a 1-Day Police Decision-Making and Autonomic Modulation Intervention: A Quasi-Random Pragmatic Controlled Trial

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Specialty section:
This article was submitted to Educational Psychology, a section of the journal Frontiers in Psychology

Received: 01 June 2021
Accepted: 23 July 2021
Published: 11 August 2021

Citation:
Di Nota PM, Arpaia J, Boychuk EC, Collins PI and Andersen JP (2021) Testing the Efficacy of a 1-Day Police Decision-Making and Autonomic Modulation Intervention: A Quasi-Random Pragmatic Controlled Trial. Front. Psychol. 12:719046. doi: 10.3389/fpsyg.2021.719046

Contemporary discourse has identified several urgent priorities concerning police training and education, including: (a) empirically testing and validating the effectiveness of current programming in reducing lethal force decision-making errors; (b) integrating evidence-based content and pedagogical approaches into police curriculum; and (c) understanding the breadth and length of programming necessary to ensure learning and transfer of skills to operational field settings. Widespread calls to identify effective and actionable training programs have been met with numerous research studies, systematic reviews, and policy recommendations that reveal the need to train officers' internal physiological awareness, which is foundational in shaping cognitive decision-making, emotion regulation, and behavior under stressful conditions. Several investigations have shown improvements to both lethal force errors and physiological recovery following a multi-day autonomic modulation (AM) intervention. Immediate and sustained training gains are observed following repeated practice with clinically validated protocols integrated into training scenarios. Despite evidence-based support for AM in addressing the aforementioned priorities, police organizations are faced with limited time and funding for training and education. The goal of the current quasi-random pragmatic controlled trial was to evaluate the effectiveness of a modified 1-day version of an established AM intervention. A sample of active-duty police officers were quasi-randomly assigned to an AM intervention (n = 82) or waitlist control group (n = 105). Lethal force errors and objective measures of autonomic arousal and recovery were measured during reality-based scenarios pre- and post-training and at 12-month follow-up. In contrast to previous investigations of longer AM intervention protocols, no significant training-related improvements to behavioral or physiological outcomes were found immediately post-intervention or at follow-up. The current results suggest that single-day training is insufficient to learn the physiological awareness and regulation

skills necessary to perform effectively during lethal force encounters, as demonstrated by a lack of immediate or sustained training effects. Practical considerations, such as resource allocation, that may undermine the effectiveness of implementing evidence-based police training are discussed.

Keywords: police education, use of force, police training, occupational stress, stress management, autonomic arousal, heart rate variability, biofeedback

INTRODUCTION

In response to numerous high-profile cases of police shootings and civilian deaths, there is mounting demand from both police and public stakeholders to identify effective occupational training programs that reduce lethal force errors (Iacobucci, 2014; Dubé, 2016; Huey, 2018; CCJ, 2021). An additional consequence of lethal force errors includes negative psychological and physical health outcomes among police, which are compounded by repeated and long-term exposure to other traumatic work-related exposures (Violanti et al., 2006; Carleton et al., 2018).

Trauma-exposed occupations including police and other emergency first responders are at heightened risk for developing post-traumatic stress injuries (PTSIs) as a result of their work, including heightened symptoms of depression, anxiety, stress, and burnout (Carleton et al., 2018). Many organizational interventions aim to build resilience, which is a broadly defined concept that refers to an individual's ability to psychologically recover and/or maintain stable mental health following a potentially traumatic event or prolonged period of chronic stress (Bonanno, 2005; APA, 2012). For the purpose of the current study, we operationalize resilience as the ability to modify autonomic nervous system (ANS) responses to stress and recover from the physiological responses induced by acute stressors, such as increased modulation of cardiorespiratory responses (i.e., heart and breathing rates) and release of corticosteroids (i.e., cortisol), which have been shown to degrade officers' cognitive and motor skills during high-threat encounters (Anderson et al., 2019; Di Nota and Huhta, 2019).

Numerous types of organizational training programs and interventions have been developed with the goal of reducing the impact of occupational stressors on operational performance and psychological functioning. However, empirical evaluations of these programs reveal limited effectiveness and significant practical challenges to implementing and evaluating training programs within organizational contexts (Beshai and Carleton, 2016; Di Nota and Huhta, 2019; Anderson et al., 2020; Di Nota et al., 2021). One effective approach that promotes both performance and health includes training police officers' awareness and adaptive management of internal physiological responses to stress (Bennell et al., 2021). In addition to psychoeducational modules that educate officers about stress physiology and adaptive regulation techniques (Arnetz et al., 2009, 2013), autonomic modulation (AM) using biofeedback during working hours or stressful critical incident scenarios have been particularly effective in improving lethal force errors as well as measures of physical and mental health (McCraty et al., 2009; McCraty and Atkinson, 2012; Andersen et al., 2015, 2018; Andersen and Gustafsberg, 2016; Ramey et al., 2016). In spite of these evidence-based findings, police organizations require significant resources to both deliver and empirically evaluate the long-term effectiveness of AM interventions. Building on the extant literature and balancing practical limitations with experimental rigor, the current study aims to investigate the effectiveness of an abbreviated 1-day version of a previously validated 4-day AM and performance intervention within an operating police agency. By utilizing a pragmatic approach, the current study provides insights into the minimum training duration required to observe significant improvements (both immediate and sustained) in lethal force decision-making and AM, both of which greatly impact the health and safety of the public and police.

Several researchers have capitalized on the scientifically established mechanisms underlying AM (see section "Physiological Mechanisms Underlying the AM Intervention" for details) for the purpose of improving resilience and performance among police officers. Visualizing objective physiological measures like heart rate (HR) and heart rate variability (HRV) in real time is known as biofeedback (HRVBF) and was first employed in organizational training by McCraty et al. (2009). Following a 2-day intervention, these researchers found significant improvements in physiological (i.e., cholesterol, blood pressure, HR), psychological (i.e., positive outlook, self-reported distress), and self-reported operational outcomes (i.e., productivity, motivation) among correctional officers. In a follow-up study, McCraty and Atkinson (2012) delivered a 12-h HRVBF intervention to police officers and found similar post-training improvements to self-reported work performance, coping, depression, family relationships, and interpersonal skills. A subset of officers participated in critical incident scenarios to evaluate the effectiveness of the HRVBF intervention on improving AM and performance during simulated high-threat operational contexts. Based on one post-training scenario, the training group (n = 12) showed marginally improved performance, significantly greater increases in HR, and no differences in recovery time (i.e., time to return to average resting HR) 7 weeks following the HRVBF intervention.

In order to maximize learning at a neurophysiological level that is robust to the interfering effects of stress, skills training needs to be delivered in the same manner in which it will be used in the field (Di Nota and Huhta, 2019). Accordingly, Ramey et al. (2016) delivered an extended training protocol that involved two 2-h educational HRVBF sessions to police followed by 3 months of recommended skills practice both in the field and at home before and after stressful events. Researchers found that younger participants showed greater post-training improvements

to psychological and physiological (C-reactive protein) measures of stress and cardiovascular disease risk. However, the study failed to report compliance to the 3-month recommended HRVBF practice and also suffered from significant loss of physiological data (68%). While these investigations reveal promising post-training improvements to police autonomic regulation and performance, their findings are highly dependent on adherence to, and duration and fidelity of, HRVBF training protocols.

Building on prior literature, Andersen et al. (2015) developed a 4-day immersive AM intervention called the International Performance and Efficiency Program (iPREP). By integrating HRVBF and metacognitive coping skills training directly into reality-based use of force (UOF) scenarios, iPREP is designed to maximize learning, retention, and application of relevant skills in operational contexts where officers are expected to perform effectively under acute stress. Based on pedagogical insights from police and military populations (Driskell and Johnston, 1998), Andersen et al. (2015) first present psychoeducational modules related to AM and resilience promotion. Next, adaptive metacognitive and breathing skills are conditioned by utilizing HRVBF during increasingly intense and stressful critical incident scenarios that are representative of what officers would experience in the field (Staller and Zaiser, 2015). Initial findings demonstrate that the AM intervention was effective among a sample of special forces tactical police officers (i.e., SWAT) and significantly modulated autonomic arousal post-training (Andersen et al., 2015). Subsequent investigations have established significant reductions in police lethal force errors and improved situational awareness and physiological indicators of health both immediately post-iPREP training and sustained for up to 18 months (Andersen and Gustafsberg, 2016; Andersen et al., 2018).

Despite the promising results of the AM studies summarized above, researchers and applied practitioners have highlighted significant practical barriers to consistently delivering and empirically evaluating the effectiveness of training interventions within an operating police agency (Scantlebury et al., 2017; Di Nota and Huhta, 2019; Andersen and Collins, 2020; Anderson et al., 2020). Finite agency resources including time, money, and available qualified personnel (i.e., trainers and participants) also limit the extent to which additional (i.e., non-mandatory) training such as AM and resilience promotion can be delivered to officers. Furthermore, significant resources, partnerships, and coordination with external research teams are needed to empirically validate AM interventions that balance experimental control (i.e., random assignment of participants, intervention and study duration, follow-up evaluations) with operational demands (i.e., shiftwork and staffing).

Addressing the above priorities motivated the goal of the current study: to test the effectiveness of an abbreviated 1-day (i.e., 10 h) version of an established 4-day AM intervention (Andersen et al., 2015, 2016, 2018). Utilizing a quasi-random pragmatic controlled trial design, the current investigation leveraged organizational challenges with scientific rigor to test the effectiveness of a more time- and cost-effective AM intervention protocol. Based on the reviewed multidisciplinary literature on stress physiology, learning, and organizational training interventions (see also section "1-Day AM Intervention Protocol"), we hypothesized that reductions in lethal force errors and improvements in autonomic functioning would be far less pronounced than those following longer intervention durations. The insights gleaned from the current study aim to provide important insights on the necessary training duration required to observe significant improvements in lethal force decision-making and stress modulation following an AM intervention tailored to the occupational demands of the police agency.

MATERIALS AND METHODS

Participants

A total of 187 (31 female) active-duty frontline police officers volunteered for the current study. Demographic information was voluntarily supplied by a sub-sample of officers and is summarized in **Table 1**. The total pool of active officers at the large urban police service in Ontario, Canada was approximately 750. Study inclusion criteria were any frontline officer who had completed all basic training, were not being supervised by a "coach" officer and were deemed as "fit for duty" according to the service's standards on the days that researchers attended the service to recruit study participants (see section "Procedure" below). Exclusion criteria were un-sworn police service workers (i.e., civilian staff), officers who were on medical leave or vacation at the time of study recruitment and evaluation, and officers deemed unfit for duty. The police service did not provide an estimate of the number of individuals that met exclusion criteria from the total pool.

Considering recommendations regarding pragmatic trials (Patsopoulos, 2011) and the operational demands of the current police agency, allocation of eligible participants to the experimental and control groups was quasi-random such that participation in the current study and AM intervention was secondary to reporting for occupational duties and scheduling. Officers that could return for a full day of AM intervention training within 2 weeks of the baseline evaluation were assigned to the experimental group (n = 82), and those officers that could not participate in an additional training day within the 2-week time frame (i.e., due to shift work requirements or vacation schedules) were assigned to the control group (n = 105). The control group in this study was an "intent to treat" group in which the intervention materials were provided to police administrators and promised to be delivered to control participants by the organization once the study was complete.

Of the original 187 participants, 65 (35%) returned for the follow-up evaluation completed 12-months following the last AM intervention session. No significant differences in age, years of service, or outcome variables (lethal force decision-making, physiology) were observed between participants who returned for follow-up and those lost to attrition (ps $>$ 0.10). Given that shift work schedules and planned absences are assigned months and sometimes even a year in advance, we were unable to forecast the level of participant attrition at 12-month follow-up. In order to attend the follow-up evaluation, officers had to be on a day shift and obtain permission from their shift supervisor to take the

TABLE 1 | Demographic summary.

	Experimental group		Control group	
	Pre- and post-intervention	12-month follow-up	Pre-intervention	12-month follow-up
n (Female)	82 (12)	38 (7)	105 (19)	27 (1)
M age (SD)	33.3 (6.16)[a]	32.3 (5.67)[c]	34.3 (6.55)[e]	33.6 (6.50)[g]
M years of service (SD)	7.48 (5.32)[b]	7.2 (5.75)[d]	8.2 (5.42)[f]	8.0 (5.22)[h]

[a]*Data from n = 104.*
[b]*Data from n = 157.*
[c]*Data from n = 32.*
[d]*Data from n = 34.*
[e]*Data from n = 51.*
[f]*Data from n = 84.*
[g]*Data from n = 34.*
[h]*Data from n = 34.*

time to attend. As the police service and researchers were unable to pay officers for overtime to attend the follow-up evaluation, officers were not incentivized to attend on personal time. Flow of participants through the study design are shown in **Figure 1**.

All participant data was de-identified and is securely stored on password-protected internal servers hosted by the university and accessible only by approved members of the research team. No research data was shared with or stored at the police agency from which participants were recruited, and all police evaluators were blinded to participant group allocation. All research procedures were approved by the University of Toronto Research Ethics Board, and all subjects gave consent in writing prior to participating in the study in line with the guidelines of the Declaration of Helsinki. All de-identified data, materials, and methods can be made available upon request to the corresponding author.

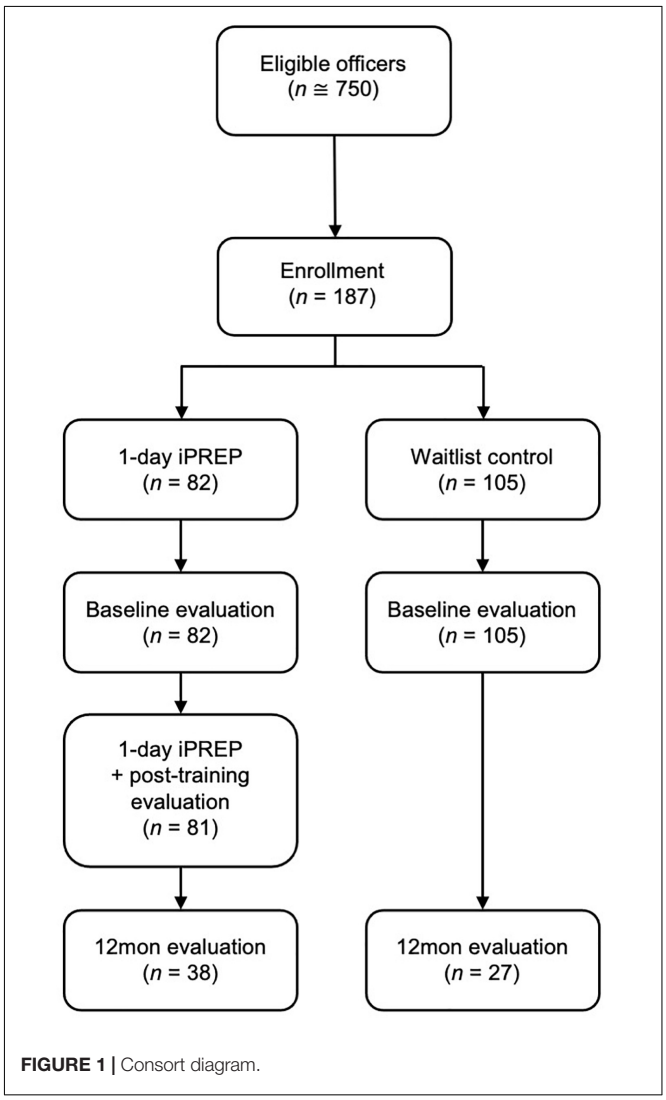

FIGURE 1 | Consort diagram.

Procedure

Baseline/Pre-intervention Evaluation

Researchers were allowed to recruit participants for the baseline evaluation and 1-day AM intervention during the agency's annual UOF/firearms recertification days, which included scenario-based evaluations and firearms testing, between 2017 and 2018. Members of the research team attended morning roll call and described the study aims and requirements of the 1-day AM intervention. Those officers who volunteered to participate in the study would be observed during their recertification scenarios by members of the research team to collect their behavioral data (i.e., lethal force decision-making) in addition to physiological HR data for research purposes. All potential volunteers were informed that participation in the research study was independent from their agency evaluation. Upon volunteering, participants were taken to another room, given a verbal explanation of the consent form, then given time to read the consent form and sign it. Once participants provided their written informed consent they were fitted with medical-grade HR monitors (BodyGuard 2, FirstBeat Technologies Ltd., Jyväskylä, Finland). Next, participants were assigned to the experimental or control group according to the criteria and procedures described above. Prior to returning to the larger group to complete their annual recertification assessments, resting HR was obtained while officers were in a seated position for 5 min (see section "Measures").

As researchers were not permitted to attend firearms assessment, lethal force decision-making was observed during reality-based scenarios that were designed by UOF instructors, who were not part of the research team, to evaluate officers' UOF decision-making and situational awareness skills. Reality-based scenarios involve actors, staged environments, and props to increase the ecological validity of simulated encounters. Pre-recorded video scenarios were used at pre-intervention and 12-month follow-up evaluations (three at each time point) because the partnering police service had integrated them into their annual recertification evaluation program as a more resource-efficient way of offering additional training and evaluation scenarios. For all scenarios, participants were outfitted with training versions of all their standard issue police gear where all projectiles were removed [e.g., training pistol, inert oleoresin capsicum (OC) spray, training baton, and training conductive energy weapon (CEW)]. Consistent with the police service's recertification procedures, scenarios were completed in pairs. To ensure that members of the research team could adequately record the start and stop time of the scenarios (i.e., to match to HR data) and behavioral outcomes (i.e., whether or not a lethal force error was made), only one officer in each pair was a study participant. Police instructors were blinded to which officer was a study participant and to their group assignment.

All participants completed two live scenarios and three video scenarios during the pre-intervention evaluation that involved typical encounters attended by officers at that service (see Reality-Based Scenario Descriptions). Each scenario required either a "shoot" decision (i.e., using lethal force when situational requirements had been met) or "no-shoot" decision (i.e., not using lethal force and instead employing verbal and/or non-lethal force technique according to situational requirements). Scenarios were designed by certified police UOF instructors in accordance with provincial recertification standards and were not designed or scored by the researchers.

Upon completion of each scenario, the facilitating instructor scored officers by filling out an evaluation sheet, as per standard assessment protocols, and provided them with verbal feedback on their performance. For the purpose of this study, instructor-rated errors in participant's use of lethal force was obtained (i.e., shooting when they were not supposed to, or failing to shoot when required to). At the end of the scenario training block, officers' HR monitors were removed and returned to the research team prior to returning to their regular duties (i.e., continued assessment or work duties).

Follow-up Evaluation

Participants in the experimental and control groups were invited to participate in a 12-month follow-up evaluation day that was not part of their agency's annual recertification procedures, but that the officers were paid to attend if permitted as part of their regular duties. A total of n = 38 (46% return rate) participants from the experimental group and n = 27 (26% return rate) participants from the control group attended 12-month follow-up evaluations. Similar to pre-intervention procedures, officers were fitted with training equipment and HR monitors prior to providing 5 min of seated resting HR data and completing scenarios, which were facilitated and evaluated by certified UOF instructors. All participants completed two live and three video scenarios that were designed by UOF instructors to reflect a similar level of complexity and number of lethal force decision-making opportunities as the pre-intervention scenarios (see Reality-Based Scenario Descriptions).

1-Day AM Intervention Protocol

The current 1-day AM intervention was a modified version of a previously established 4-day AM protocol (Andersen et al., 2015, 2016, 2018). The components of the modified protocol are as follows:

- Psychoeducation: The intervention began with approximately 60 min of psychoeducational classroom instruction on stress physiology, and its impacts on decision-making and performance. Related topics included the link between the brain, heart and lung function, chronic stress, and how situational awareness can be affected during stress. Content was gleaned from recent research articles on stress, health, and performance cited in the introduction of this paper and in previous publications (see Andersen and Gustafsberg, 2016).

- HRVBF: Given the shortened program length, officers were introduced to HRVBF using the "Inner Balance" application in the "Coherence Advantage" app (HeartMath, Inc.). This HRVBF program was the only commercially available app at the time of the study that could provide an HRVBF training protocol in a condensed time frame. Participants were given a short (∼30 min) opportunity to learn the HRVBF equipment and "Coherence" techniques. As described by HeartMath, coherence is a state in which the SNS and parasympathetic nervous system (PNS) are synchronized, producing an internal physiological state that promotes PNS dominance.[1] According to the HeartMath instructions, coherence is achieved in the following way: the app provides a screen displaying a circle that increases and decreases in size corresponding to the time it takes to inhale and exhale at a pace of 5 breaths per minute. A pulse oximeter clipped to the ear (Inner Balance Coherence Sensor, HeartMath, Inc.) communicates with the app and provides a biofeedback signal to the participant indicating how "successful" they are at achieving a coherent state by synchronizing the SNS and PNS through the prescribed breathing pace. If the person achieves a coherent (i.e., synchronized) state, they are "rewarded" with a green light on the app interface. In addition to the 30-min orientation and practice, participants were instructed to engage in the HRVBF techniques immediately before and after each scenario and in downtime between scenarios (see next section).

- Reality-based training scenarios: Scenarios were designed and facilitated/scored by two separate groups of certified

[1] https://www.heartmath.com/science/

UOF instructors that were independent of the research team in order to ameliorate any bias (i.e., in scenario design and outcomes). Following the HRVBF training, officers participated in seven live reality-based scenarios increasing in complexity and stress over the course of the day. Scenarios required officers to perform all relevant skills related to UOF encounters (i.e., de-escalation, tactical skills, verbal and physical communication, situational awareness). Participants were instructed to practice the HRVBF techniques immediately before and after each scenario in order to modify physiological responses to acute stress, as well as to increase the level of both PNS and SNS activation during scenarios and promote faster post-scenario recovery through PNS modulation. A member of the research team observed each participant as they completed the HRVBF techniques.

During the time between scenarios, participants engaged in several guided exercises in order to practice some of the theoretical topics introduced in the psychoeducational module, including:

- Component skills training to combat cognitive deficits: Police UOF training can often place officers directly into high-stress scenarios (i.e., "stress inoculation") without the opportunity to gradually learn de-escalation and UOF decision-making skills in a calm state and non-complex scenario. Evidence from adult learning theory and cognitive psychology clearly suggests that individual discrete or "component" knowledge and skills must first be learned before combining them into complex combinations that can be effectively employed in stressful contexts (Holmes and Collins, 2001; Di Nota and Huhta, 2019). Together with increasingly complex reality-based scenarios, expert trainers guided participants through critical and appropriate tactical and UOF responses as situations become increasingly faster and more time pressured.
- Enhancing sensory awareness: Once the officers have used the HRVBF device to determine they are in an adaptive physiological state to learn and perform, they engaged in discussion with the expert trainers on how sensory cues (e.g., lights, sirens) may prime or activate physiological stress responses, especially during high-stress situations (Divine, 2013).
- Visualization and mental rehearsal: Due to time restraints and modifications for the current 1-day protocol, officers were only able to engage in this exercise once. Following one reality-based training scenario, officers were asked to assume a comfortable position and mentally picture performing the previous scenario while maintaining a calm state. Officers were also instructed to visualize their actual performance, and then mentally rehearse optimal performance of the scenario by integrating the instructions and feedback from expert trainers. Mental rehearsal and visualization of optimal performance while in a calm state has been shown to solidify newly learned knowledge and aid in memory retention for new skills (Holmes and Collins, 2001). Mental rehearsal techniques have also been used to successfully improve police officer's performance and reduce threat perceptions prior to critical incident scenarios (Arnetz et al., 2009, 2013).

The AM training day ended with participants completing the same post-training scenario as participants in the 4-day intervention (Andersen et al., 2018), which was an extended active-shooter scenario that required two no-shoot decisions and one shoot decision.

Physiological Mechanisms Underlying the AM Intervention

Described elsewhere in greater detail (LeDoux and Pine, 2016), "fight or flight" responses are triggered by activation of the sympathetic branch (SNS) of the ANS following exposure to an acutely threatening or stressful situation. The SNS operates in coordination with the PNS, which is responsible for promoting restorative and regulatory processes in the body (e.g., immune functioning, growth, and repair). Healthy coordination between the SNS and PNS promotes effective functioning, recovery, and health, while overactivation of the SNS in the absence of PNS activity has been shown to impair perceptual and cognitive processes related to police UOF decision-making (Klinger and Brunson, 2009; Haller et al., 2014; Laborde et al., 2014; Roos et al., 2017).

An objective indicator of the coordination between the SNS and PNS is HRV, which can be measured by several metrics including respiratory sinus arrhythmia (RSA). RSA refers to the variation in the intervals between individual heartbeats as a person inhales and exhales. Specifically, HR increases during inhalation (shortening the time between heart beats) and slows during exhalation (lengthening the time between heart beats) (Lehrer and Gevirtz, 2014). As such, RSA reflects synchrony between the heart and respiratory system and plays a key role in the physiological basis of resilience. Clinical studies indicate that increasing RSA builds physical wellness capacity by strengthening an individual's long-term physiological reserves, theorized to occur *via* multiple pathways (i.e., baroreflex control, blood pressure regulation, and efficiency of pulmonary gas exchange) (Lehrer and Gevirtz, 2014; Lehrer, 2018). Psychophysiological research reveals a connection between respiration, arousal, and emotional control, such that the manner by which a person breathes sends signals to regions in the brainstem and forebrain that modulate arousal. For example, periods of slow breathing are associated with PNS stimulation, which may underlie the anxiety and stress-reducing effects of RSA (Mather and Thayer, 2018).

Measures

Lethal Force Decision-Making

Lethal force errors resulted from: (1) as the primary officer in each pair, failing to shoot during a shoot scenario (i.e., error of disinhibition); or (2) shooting during a no-shoot scenario (i.e., error of inhibition). Criteria for correct or incorrect performance were defined and evaluated by certified UOF instructors independent from the research team. Officers received

a score of 1 for each decision-making error and scores were analyzed as error rates (i.e., dividing the total number of errors at each time point by the total number of decision-making opportunities and converting to a percentage).

Autonomic Activation and Recovery

Participants had continuous HR data recorded at a rate of 1 Hz (1 recording/s) using Bodyguard 2 cardiovascular monitors (FirstBeat Technologies Ltd., Jyväskylä, Finland). The monitors were affixed to the torso using adhesive electrode patches and worn under the officer's clothing and equipment during all evaluations. At the end of each day, de-identified data was uploaded from each monitor to an external server for later offline analyses. Two cardiovascular measures were analyzed in the present study. The first is HR_Index, which is an index of the average peak HR (HR_Max) measured as the 5 s before and after the maximum HR achieved during each critical incident scenario relative to each officer's own average resting baseline HR (HR_Rest) recorded at the beginning of each evaluation day. HR_Index is computed as [(HR_Max − HR_Rest)/HR_Rest]. HR_Max was equal to or less than average HR_Rest in only $n = 1$ of 316 total cases, resulting in a negative HR_Index value. The second cardiovascular measure is HR recovery time (HR_Recovery), or the time (in seconds) for the officer's HR_Max to return to HR_Rest, which has been reported as an indicator of vagal (PNS) function (Thayer and Sternberg, 2006). HR_Max and HR_Recovery values were averaged across scenarios to obtain a single value at each time point for each officer and were included in statistical analyses described below.

To calculate the HR values used in this study, research assistants manually recorded the following events in the timestamped HR datasheet for each participant and on each evaluation day: (1) start and end time of 5 min of seated rest prior to any assessments to calculate HR_Rest; (2) start and end times for each live scenario and for the blocks of video scenarios in order to identify the 11-s average maximum HR (HR_Max), which were averaged at each timepoint. HR_Max was calculated by identifying the maximum HR achieved during each scenario (or block) and averaging this peak value with the HR 5 s before and after to compute a more stable value of maximal autonomic arousal and adjust for any single beat errors as in Andersen et al. (2018); (3) recovery time was manually extracted from the data by determining the number of seconds it took from the peak HR within each scenario (or block) for the officer to return to their HR_Rest for that day. If an officer did not return to a value equal or lesser than HR_Rest either before the start of the next scenario or before the end of the datasheet, no value was entered ($n = 51$, equally distributed between experimental and control groups at pre-intervention and 12-month follow-up evaluations) and were excluded from those specific analyses, but remained in the study overall. Of note, ∼27% of officers did not return to resting baseline, indicating no recovery during working hours. Data imputation methods were deemed inappropriate to use for missing values due to officers finishing the study at different times, and some took more or less time between scenarios.

Due to technology failure, three officers had no HR data at pre-intervention evaluation, eight officers are missing HR_Rest values (six pre-intervention, two at follow-up), and two officers (one experimental, one control) are missing all pre-intervention HR_Max values but have HR_Rest values. Outlier analyses reveal no participants had HR_Max values that exceeded three standard deviations from the mean. De-identified raw data used in the current statistical analyses are available upon request from the lead author and will require signing a confidentiality agreement to protect participant identity.

Statistical Analyses

To determine the number of participants necessary to detect effects, we used G*Power to conduct an *a priori F* test (ANOVA: repeated measures, within-between interaction) power analysis with the following parameters: effect size $f = 0.25$, $\alpha = 0.05$, power $(1 - \beta) = 0.95$, number of groups = 2, number of measurements (repeated-measures) = 2. The power analyses indicated a total sample size of 54 participants. Because our total sample size at each time point (pre-intervention: $n = 187$, 12-month follow-up: $n = 65$) exceeds this minimum, we have sufficient power to detect significant effects.

Normality assumptions were evaluated for all outcomes (lethal force error rates, HR_Index, HR_Recovery) at each time point (pre-intervention, post-training, 12-month follow-up) with Shapiro-Wilk tests. All lethal force error rates, all HR_Recovery, and 12-month HR_Index were not normally distributed ($ps < 0.05$) and were evaluated with non-parametric Mann Whitney *U* tests for between-group analyses ($k = 2$) and Wilcoxon Signed Ranks tests for pairwise within-group analyses. HR_Rest and HR_Max were normally distributed and compared using a paired samples *t*-test to evaluate whether critical incident scenarios elicited significant autonomic arousal relative to rest (see manipulation check).

To adjust for multiple planned comparisons (1 between-groups + 3 within-group time analyses × 3 variables = 12 pairwise analyses), an adjusted Bonferroni-corrected value of $p = 0.05/12 = 0.004$ was used to establish statistical significance. All analyses were conducted in SPSS (Version 27, IBM Corp., Armonk, NY, United States).

RESULTS

Lethal Force Decision-Making Errors

Overall, very low lethal force error rates were observed for both groups and over time (**Figure 2**). While error rates decreased from 3.7 to 1.9% immediately following the 1-day AM intervention, these changes were not statistically significant ($z = -0.746$, $p = 0.46$) and returned to 3.4% at 12-month follow-up ($z = -1.639$, $p = 0.10$). Error rates did not significantly differ for the control group at pre-intervention (i.e., baseline) (4.9%) and 12-month follow-up (6.5%, $z = -1.098$, $p = 0.27$). Between-group differences in error rates did not reach statistical significance even at uncorrected levels [pre-intervention: $U(187) = 4100.5$, $p = 0.41$; 12-month follow-up: $U(65) = 443.5$, $p = 0.22$].

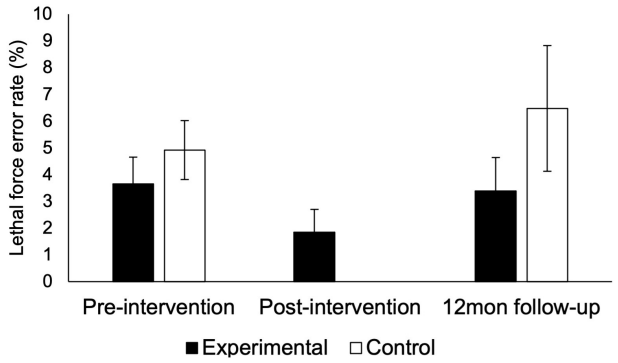

FIGURE 2 | Lethal force decision-making errors. Differences in lethal force error rates between groups and timepoints did not reach statistical significance. Error bars show standard error of the mean.

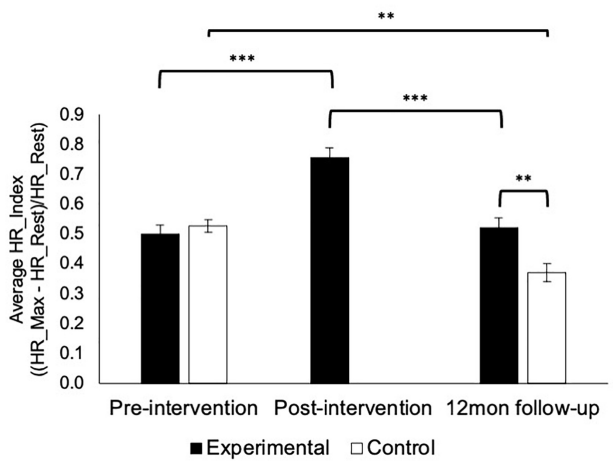

FIGURE 3 | Autonomic activation during critical incident scenarios. HR_Index increased significantly post-training among the experimental group before returning to pre-training levels at 12-month follow-up ($ps < 0.000$). HR_Index also significantly decreased among the control group at 12-month follow up ($p = 0.002$) and was lower than the experimental group ($p = 0.004$). Error bars show standard error of the mean. $^{***}p < 0.001$, $^{**}p < 0.01$.

Autonomic Arousal

To ensure reality-based scenarios elicited sufficient autonomic stress arousal, changes between HR_Rest and HR_Max were evaluated at each time point with a manipulation check. Resting HR and HR_Max did not differ significantly between groups at each time point at corrected levels of significance ($ps > 0.05/4 = 0.013$), therefore analyses and HR values reported in **Table 2** are averaged across groups. As with the HR_Index analyses, HR_Max was averaged across multiple reality-based scenarios performed during each evaluation timepoint. All scenarios revealed significant HR responses ($p < 0.000$) with large effect sizes according to Cohen's *d* (Cohen, 1988). Resting HR did not differ across time points [$F(2, 62) = 0.627$, $p = 0.537$], and thus did not confound the HR_Index analysis described below.

Relative increases in HR as measured by HR_Index did not differ between groups pre-intervention [$U(176) = 3549.0$, $p = 0.50$], but was significantly lower in the control group at 12-month follow-up [$U(63) = 690.0$, $p = 0.004$, **Figure 3**]. In addition, HR_Index increased significantly post-training for the experimental group ($z = 5.551$, $p = 0.000$) and returned back to pre-intervention levels at 12-month follow-up ($z = 4.565$, $p = 0.000$). HR_Index also significantly decreased between pre-intervention (i.e., baseline) and 12-month follow-up among the controls ($z = 3.029$, $p = 0.002$).

HR_Recovery time did not differ between groups at pre-intervention [$U(127) = 1714.0$, $p = 0.21$] but was faster among the control group at 12-month follow-up at uncorrected significance levels [$U(64) = 678.0$, $p = 0.012$, **Figure 4**]. HR_Recovery was faster among the experimental group from post-intervention to 12-month follow-up at uncorrected significance levels ($z = 2.763$, $p = 0.006$) and significantly faster from pre-intervention to 12-month follow-up among the control group ($z = 3.285$, $p = 0.001$).

DISCUSSION

The current study sought to investigate the effectiveness of a modified 1-day version of an established AM intervention that has been shown to reduce lethal force errors and improve autonomic functioning (i.e., activation during scenarios and post-scenario recovery from acute stress) (Andersen et al., 2015, 2016, 2018). Using a quasi-random pragmatic controlled trial study design, the current findings reveal no significant differences in lethal force errors between experimental and control groups (**Figure 2**). Additionally, physiological indicators of autonomic activation (**Figure 3**) and recovery (**Figure 4**) were not significantly improved for the experimental group that received the modified 1-day AM intervention, but were higher among the control group. Of note, a substantial number

TABLE 2 | Manipulation check: stress responses to critical incident scenarios.

Time	HR_Rest *M* (SD) *n*	HR_Max (during scenario) *M* (SD) *n*	*t*	*df*	*p*	Effect size (*d*)
Pre-intervention	78.79 (12.73) 177	117.53 (17.48) 181	−32.280	175	0.000	2.43
Post-intervention*	80.12 (10.31) 80	139.15 (18.02) 77	−28.295	76	0.000	3.22
12-month evaluation	79.48 (10.21) 62	115.50 (19.42) 64	−19.391	62	0.000	2.44

*Heart rate was measured in beats per minute (BPM). Average resting heart rate (HR_Rest) was obtained during 5 min of seated rest at the beginning of each evaluation day. Maximum heart rate (HR_Max) was averaged across multiple lethal force scenarios at each evaluation timepoint except for the post-intervention, which was one prolonged scenario involving three lethal force decisions. Means (M), standard deviations (SD), and the number of participants included in each analyses (n) are provided for each time point. *Only includes participants in the experimental group that participated in the 1-day AM intervention.*

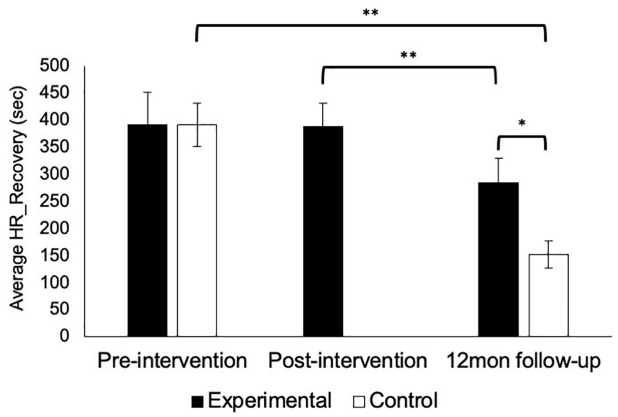

FIGURE 4 | Recovery from peak autonomic activation following critical incident scenarios. HR_Recovery did not significantly change following a 1-day AM intervention, but was faster at 12-month follow-up ($p = 0.006$). Participants in the control group also showed faster HR_Recovery at 12-month follow-up relative to pre-intervention values ($p = 0.001$), which was also faster than the experimental group at uncorrected significance levels ($p = 0.012$). Error bars show standard error of the mean. $^{**}p < 0.01$, $^{*}p < 0.05$.

(27%) of officer's did not recover (i.e., return to resting baseline) during the observation period, indicating a significant need for stress modulation skills. Despite calls for reform to police UOF training and education practices (Iacobucci, 2014; Dubé, 2016; Huey, 2018; Bennell et al., 2021; CCJ, 2021) and growing need for effective occupational health interventions (Weiss, 2019; Anderson et al., 2020; Di Nota et al., 2021), the current findings demonstrate that utilizing abbreviated training to save costs is not effective for rewiring core physiological and cognitive processes aimed at modulating stress responses to reduce UOF errors.

The Science Behind Police Resilience, Learning, and Performance Under Stress

Motivation to conduct the current study was informed by multiple perspectives, including an urgent need to identify effective training approaches that reduce lethal force errors (Iacobucci, 2014; Dubé, 2016; Huey, 2018; CCJ, 2021). Increased impairment to officer perception, UOF decision-making, and skilled motor behavior have been observed under conditions of increased threat (Klinger and Brunson, 2009; Nieuwenhuys et al., 2009, 2012). Due to the very nature of police work, officers are repeatedly exposed to a variety of potentially psychologically traumatic exposures (PPTEs) (Carleton et al., 2019). Stressful occupational exposures manifest as dysregulated stress physiology observed in both training and active-duty settings as well as in normative diurnal cortisol (Anderson et al., 2002; Andersen et al., 2016; Baldwin et al., 2019; Planche et al., 2019). Long-term exposure to occupational stress increases police officers' risk for developing PTSIs (Carleton et al., 2018) and suicidal thoughts, plans, and attempts relative to the general population (Di Nota et al., 2020). Accordingly, the current study also addressed an urgent need to identify effective organizational programming that supports resilience and wellness capacity in public safety professionals (Beshai and Carleton, 2016; Weiss, 2019). Existing organizational training programs that aim to build resilience and mitigate the onset of PTSIs following PPTEs showed limited effectiveness, but with promising results for protocols integrating HRVBF including iPREP (Di Nota et al., 2021). A recent paper by expert police researchers and practitioners posits that training police officers to recognize and modify internal physiology during stressful encounters is one of the most urgent training approaches to address lethal force errors and promote physiological resilience (Bennell et al., 2021). AM requires significant rewiring of highly complex and implicit physiological processes (i.e., RSA, HRV) *via* explicit practice with self-awareness (i.e., introspection) and breathing techniques (Lehrer et al., 2013; Arpaia and Andersen, 2019). Research on short (i.e., 4–6 h) police training durations show limited generalizability of complex police arrest and self-defense skills from training to field application (Renden et al., 2015). Together with the current results, these findings call into question the effectiveness of UOF training that lacks sufficient time for officers to learn, practice, and retain these skills under stressful conditions when implicit strategies are favored over explicit ones (Roos et al., 2017; Hine et al., 2018).

Balancing Organizational Needs and Barriers With Learning Theory

At the time the current study was conceptualized and delivered (2015–2017), there was a strong organizational demand to reduce the duration of police training and skills-based practice based on an increasing number of government-mandated certification and policy initiatives. Subsequently, systematic reviews of 1-day organizational training protocols among first responders have shown limited improvements to resilience that are not sustained (Di Nota et al., 2021).

The current AM intervention is the only organizational resilience promotion program that evaluates and seeks to improve complex cognitive, motor, and physiological regulation skills relevant to operational UOF decision-making (and specifically lethal force) under stress. The current findings confirm that shorter AM training comes at the cost of previously observed short- and long-term gains for longer HRVBF training protocols (Arnetz et al., 2009, 2013; McCraty et al., 2009; Andersen et al., 2015, 2016, 2018).

The existing empirical literature evaluating whether longer police training durations translates to greater gains in officer UOF performance is very limited. A recent study compared the effectiveness of single session, distributed (i.e., "booster" training), and block training approaches for defensive and control tactics in three recruit academies in the United States. Across protocol types that all consisted fewer than 80 min of training for any given skill, immediate post-training gains were lost over long-term follow-up (O'Neill et al., 2019). All of these protocols were representative of the type and duration of training offered at each police agency, which has to balance instructional needs with operational demands (i.e., number of available officers for training or field duty at any given time). Drawing from

learning theory, the deliberate practice framework has been suggested as an effective approach to acquiring knowledge in police work (Wolfe et al., 2020). Specifically, deliberate practice requires: (1) instruction and performance on a defined task, (2) immediate feedback, and (3) ample opportunity for repetition to refine performance (Ericsson, 2004). The current findings suggest that 1 day is simply not enough time to engage in effective deliberate learning strategies to promote gains in UOF performance and AM, which have been observed at longer training durations for the same protocol (Andersen et al., 2015, 2016, 2018).

Due to pronounced logistical constraints related to available training time and resources at the police agency where the current study was conducted, each component of the established AM training protocol was shortened or modified, resulting in a dramatically condensed learning exposure. As expressed by other police researchers, Wolfe et al. (2020) state that successful training programs "must be modified to fit the reality of policing operations. It is not possible to have officers engage in hours of deliberate practice like military personnel or competitive athletes. In other words, a successful deliberate practice program must find a way to increase the repetition of exercises [. . .] without unduly burdening the operational demands of a department" (p. 130). Therefore, the current investigation of a modified and abbreviated training intervention was a legitimate and urgent question to test. Consistent with the science of learning and retention (Kang, 2016), a lack of demonstrated benefit following 1 day of exposure to a variety of new concepts is unsurprising.

Limitations

Contrary to predicted improvements in autonomic regulation in the experimental group, HR_Recovery and HR_Index were higher at 12-month follow-up among the control group. While these unexpected findings are likely due differences in sample size and attrition, they also reflect central study limitations and pragmatic realities of applied police research. One such limitation was the relatively low recruitment rate that precluded larger sample sizes, lack of true random assignment to experimental and control conditions, and which also pronounced the effects of participant attrition. Failing to return for long-term follow-up evaluations undermines researchers' ability to evaluate potential sustained effectiveness of a training intervention. Although it could not be confirmed, attrition of the current samples can be attributed to several potential factors: a lack of research funding for incentive payments to off-duty participants, lack of interest in the study and/or optional AM intervention, officer turnover (i.e., assignment to different role or precinct), sick leave, vacation, or operational demands (i.e., assignment to night shifts, sudden changes to schedule for required duty on scheduled follow-up days).

Another study limitation includes the biofeedback protocol employed. At the time of the study, we used the Coherence Advantage HRVBF program (HeartMath, Inc.). Established HRVBF protocols and programs that aim to rewire autonomic functioning, including HeartMath, recommend users to engage with the training protocol for *multiple days and sometimes even weeks* at a time (McCraty et al., 2009; McCraty and Atkinson, 2012; Lehrer et al., 2013). In prior studies, the full AM protocol included longer psychoeducational, HRVBF, and active scenario-based practice sessions. Thus, deviating from the established protocol by using the biofeedback technology alone and for a limited time may not be sufficient to offer previously observed benefits in police (Arnetz et al., 2009, 2013; McCraty et al., 2009; Andersen et al., 2015, 2016, 2018). The ambulatory physiological measures used in the current study precluded separating autonomic arousal from physical (i.e., aerobic activity) sources. However, movement was restricted during reality based scenarios given the constrains of the rooms (e.g., no running or even fast walking was possible). Thus, the HR measure is the most robust biomarker as it is not significantly varied in response to minor movements given the low oxygen demands placed on the body while standing or shifting position.

IMPLICATIONS AND CONCLUSION

The growing number of instances where police officers misapply force due to stress-induced decrements to their perception, judgment, and decision-making demand an empirical evaluation of current police training and education practices.

The current study suggests that: (1) the psychophysiological mechanism (i.e., ANS modulation) that regulates UOF decision-making was not sufficiently trained in a modified 1-day protocol; and (2) there is an urgent need to experimentally examine all short duration UOF training protocols for effectiveness in skill development and generalizability to operational conditions. According to basic scientific evidence, a few hours of practice is simply not enough time to condition adaptive physiological responses and complex lethal force decision-making under stressful and realistic conditions. Effective learning requires initial encoding, as well as deliberate and repeated practice in varied, dynamic, and increasingly stressful contexts.

DATA AVAILABILITY STATEMENT

The datasets presented in this article are not readily available because demographic information (i.e., sex, age, years of service) may potentially identify research participants. Requests to access the datasets should be directed to JA, judith.andersen@utoronto.ca.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by University of Toronto Social Sciences, Humanities and Education Research Ethics Board. The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

PD: data analysis and manuscript writing. EB: data collection, organization, and analysis and manuscript preparation.

JA: conceptual framework, intervention co-development (HRVBF, cardiovascular physiology), and manuscript writing. PC: study conceptualization, study design, and editing. JPA: conceptual framework, co-development of the intervention (psychophysiology), data collection, and manuscript writing. All authors contributed to the article and approved the submitted version.

FUNDING

Funding of this project was provided by a grant from the Government of Ontario Ministry of Labour (ROP 15-R-021), which funded data collection and open access publishing. However, the Ministry had no other involvement in the conceptualization, design, analysis, decision to publish, or preparation of this manuscript. JPA and PD are now funded by Canadian Institutes for Health Research (CIHR) Team Grant, Mental Wellness in Public Safety – Police (433650) to examine AM interventions.

ACKNOWLEDGMENTS

We would like to acknowledge and thank all research assistants and volunteers in the Health Adaptation Research on Trauma (HART) lab who assisted in the collection and cleaning/coding of the data. Thank you to all the police officers who participated in the study. Thank you to the agency who collaborated with us to make the data collection possible.

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Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

frontiers in Psychology

ORIGINAL RESEARCH
published: 01 September 2021
doi: 10.3389/fpsyg.2021.702347

Teamwork on Patrol: Investigating Teamwork Processes and Underlaying Coordinating Mechanisms in a Police Training Program

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The Big Five theory suggests that five components in teamwork are essential for team effectiveness in stressful environments. Furthermore, three coordinating mechanisms are claimed to be decisive to upholding and informing vital teamwork processes. Although much research has been conducted into the Big Five theory and its components, to the best of our knowledge, no study has yet been made of the relative importance of the three mechanisms and their impact on team effectiveness. Also, only a few studies have tried to investigate whether the components and the coordinating mechanisms are trainable. This study aims to make a theoretical contribution to the part of the theory focusing on the coordinating mechanisms. Secondly, it investigates whether training can improve team performance. Working in teams of two, 166 police officers participated in a simulated operational scenario. Correlational analyses indicated that all Big Five teamwork behaviors and coordinating mechanisms relate to external ratings of team performance. Only the mechanisms of Closed Loop Communication (CLC) and Shared Mental Model (SMM) predicted performance indicators, with SMM predicting above and beyond the effect of CLC. No effect of the training program was found. The study provides new evidence in a police situation that the most important coordinating mechanism of the Big Five theory is that of shared mental models, which in turn has consequences for the type of training needed.

Keywords: shared mental models, trust, closed loop communication, training and development, teamwork processes

OPEN ACCESS

Edited by:
Mario S. Staller, University of Applied Sciences for Police and Public Administration in North Rhine-Westphalia, Germany

Reviewed by:
Nader Hanna, Macquarie University, Australia
Joni Tzuchen Tang, National Taiwan University of Science and Technology, Taiwan

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Specialty section:
This article was submitted to Educational Psychology, a section of the journal Frontiers in Psychology

Received: *29 April 2021*
Accepted: *15 June 2021*
Published: *01 September 2021*

Citation:
Espevik R, Johnsen BH, Saus ER, Sanden S and Olsen OK (2021) Teamwork on Patrol: Investigating Teamwork Processes and Underlaying Coordinating Mechanisms in a Police Training Program. Front. Psychol. 12:702347. doi: 10.3389/fpsyg.2021.702347

INTRODUCTION

In the aftermath of July 22, 2011, where a single terrorist killed 77 persons, the Norwegian National Police Directorate concluded that the police force capacity to perform sharp missions had unpredictable situations demand more than basic skills and procedures to be strengthened. Thus, the main object confronting a possible evolving life-threatening situation (e.g., a terrorist) was that the first patrol on site should be better at resolving emergency incidents, when there was no time to wait for force build-up (Politidirektoratet, 2013). Put together this require a focus on what and how to train. Training of police officers has traditionally been executed in a uniform manner, where

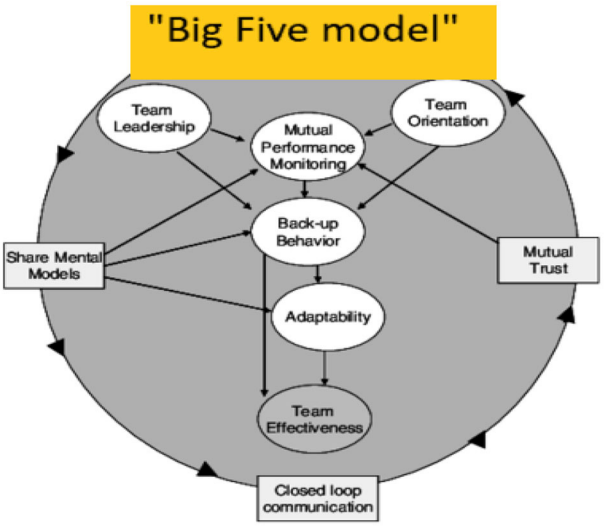

FIGURE 1 | Graphical representation of high-level relationships between the big five and the coordinating mechanisms (Salas et al., 2005).

curriculum and standard scenarios is the chosen form. However, unpredictable situations demand more than basic skills and procedures.

Improvement in this context entails training and Aguilar-Moya et al. (2013) categorized research on police training over a 23-year period (1988–2011) and showed that the most reflected descriptors in published articles were skills and management. "Skills" were often associated with and "mental health." Accordingly, despite an increase in articles published there seems to be a lack of scientific involvement in police training aimed at resolving violent and unpredictable situations. One important aspect in frontline policing is decision making under conditions of uncertainty and unfortunately this seems to rarely be the focus of training. Thus, there is a growing need for new police training research (Aguilar-Moya et al., 2014).

In Norway, a police patrol normally consists of two police officers. They may be defined as a team since they work toward similar goals and depend on each other to succeed (Stagl et al., 2007). It has been argued that, even if the individual team members are skilled and able, they do not always function as an effective entity (Hackman, 1990; Salas et al., 2005; Hopkin and Wise, 2018). Therefore, the ability of patrols to perform teamwork becomes essential to success, and the study of which and how factors influence the performance of emergency teams is imperative. Examples drawn from the police sector reveal a variety of factors, such as the impact of unit size (Terpstra, 2018), interservice cooperation (Sestoft et al., 2014), training platform for cross-national police (Jaspaert et al., 2019), and team attributes (Schaveling et al., 2017). Proposed mechanisms whereby police teams' performance is enhanced range from a focus on emotional aspects, such as cohesion and familiarity of team members, to cognitive mechanisms, such as the effective utilization of individual team members' knowledge structures (Cotard and Michinov, 2018). Transactive memory components represent an example of the latter (Cotard and Michinov, 2018), in which focus is placed on coordination and specialization within the team and its different team members. To face the situation at hand Salas et al. (2005) based on the notion of shared mental models (Cannon-Bowers et al., 1993) put forward a theory of shared cognitive structures to explain why and how some teams outperform others (see **Figure 1**).

Despite considerable research interest in teamwork, researchers continue to disagree as to which components subsume teamwork as a construct (Duel, 2010), and how it relates to team effectiveness. Salas et al. (2005) examined 138 teamwork models, and, based on similarities and what could be empirically tested, they proposed five core teamwork components. *Team leadership* entails the ability to direct and coordinate the activities of other team members. *Team orientation* is an attitude characterized by a tendency to take other team members' behavior and input into account during group interaction, and the belief in the importance of team goals over individual team members' goals. *Mutual performance monitoring* involves the ability to apply appropriate task strategies in order to develop a common understanding of the team environment. This again enables *backup behavior,* which entails team members' ability to anticipate each other's needs, through knowledge about their responsibilities, so that they can provide support with the proper action or information. Finally, there is *adaptability,* which concerns the team's ability to adjust team strategies and alter the course of action based on information gathered from the environment through the use of backup behavior and mutual performance monitoring (Salas et al., 2005).

The five teamwork behaviors are claimed to be essential to the promotion of team performance. The Big Five model has received considerable attention by practitioners, especially within the health industry, where several tools to diagnose team deficits or training needs have been developed based on the Big Five theory (e.g., TeamSTEPPS; Cooke, 2016; Weld et al., 2016). We have found only two empirical studies (Johnsen et al., 2016, 2019) investigating the Big Five within the police domain. Both indicated that police officers accede to the Big Five theory (i.e., high on perceived learning and relevance).

However, to work effectively as one team, team members must know their roles in the task, of the resources available, each other's capabilities and able to communicate freely and clearly. Hence, Salas et al. (2005) proposed three coordinating mechanisms as necessary prerequisites to ensure that the five teamwork behaviors are consistently updated, and that relevant information is distributed throughout the team. First, shared mental models (SMM), which are defined as an organized knowledge structure of the relationship among the tasks the team is engaged in and how the team members will interact (Cannon-Bowers et al., 1993). Secondly, closed loop communication (CLC), defined as the exchanging of information and coordinating actions through explicitly expressing feedback and response (McIntyre and Salas, 1995). Finally, mutual trust is when team members perceive intentions behind feedback as positive, so that all team members freely share information without process loss (Steiner, 1972). All three coordinating mechanisms are claimed to be decisive tools for upholding and informing the Big Five teamwork

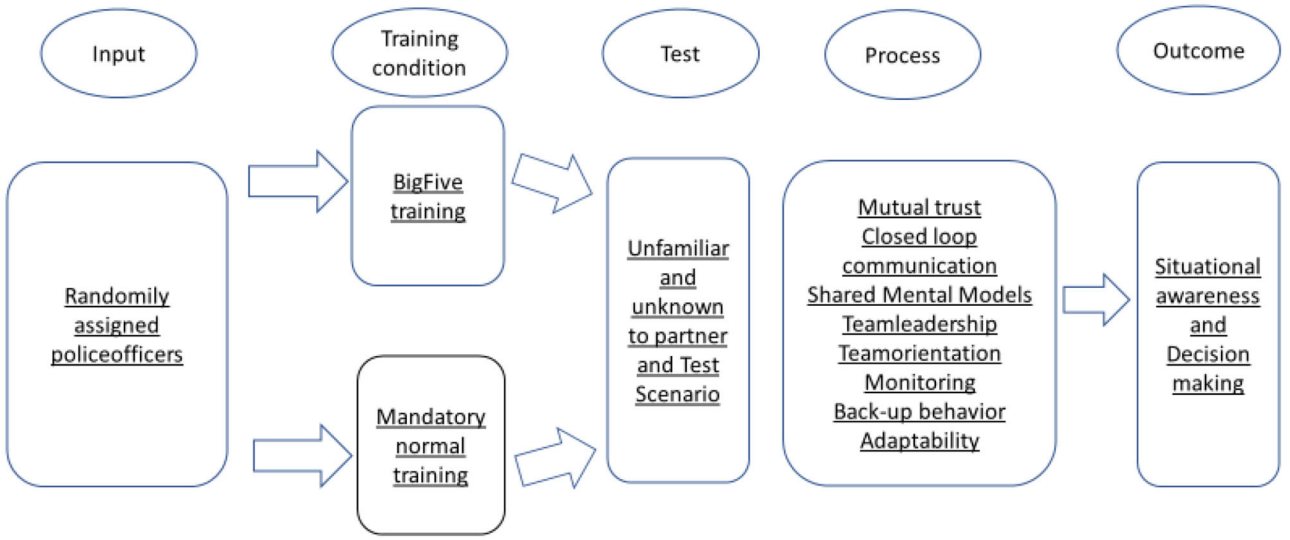

FIGURE 2 | Graphical representation of the research process using a Input-Process-Outcome design.

processes. However, the three underlying and theoretically based coordinating mechanisms have, to the best of our knowledge, not been collectively, empirically tested. Although there is much research that has been conducted into the Big Five theory and its components, to the best of our knowledge, no study has yet been conducted that investigates the relative importance of the three mechanisms on their impact on team effectiveness. Research supports the existence of these constructs when they are investigated separately, in pairs, or together with one or two of the five teamwork components (e.g., backup behavior and SMM, Schmidt et al., 2014). Notably, the three coordinating mechanisms may be intercorrelated and dependent on each other or vary in their importance. The relative importance of these mechanisms has theoretical and practical consequences and may implicate a different type or focus when training to improve teamwork skills. Few studies have tried to investigate whether the five components of teamwork and the three coordinating mechanisms are trainable.

Accordingly, the study has two aims. First, it intends to give a theoretical contribution to the Big Five theory by investigating the relative contribution of the coordinating mechanisms in predicting team performance. Secondly, it investigates whether a brief intensive training program can improve both the mechanisms and the five teamwork behaviors (see **Figure 2**).

Theoretical Background

Coordinating Mechanisms

Cannon-Bowers and Salas (1998) argue that, to enable a team to adapt effectively in a dynamic, stressful situation, team members must be able to predict what others in the team will do and what they are going to need in order to execute their intended behavior. The coordinating mechanism Shared mental models (SMM) is proposed to meet such a need. SMM is drawn from theories of individual mental models used to explicate individual cognitive functioning or understanding. At the individual level, mental models refer to a structure of known elements (e.g., declarative knowledge) and the relationship between those elements (Shavelson, 1974). These structures serve as mechanisms that people use in order to describe the purpose and form of a system, as well as its functioning in its present and future state (Rouse and Morris, 1986). Cannon-Bowers and Salas (1990) proposed extending the concept of individual mental models to the team performance domain, hypothesizing that team performance is a function of the extent to which members held similarly organized expectations in relation to the task or each other. SMM are defined as a shared organized understanding and mental representation of key elements of the team's relevant environment. These SMM enable team members to form accurate explanations and expectations of the task. This will in turn enable team members to coordinate their actions and adapt their behavior to the demands of the task and to other team members (Cannon-Bowers et al., 1993). SMM are assumed to enable team members to predict task needs and the actions of other team members, and thus enable them to adapt their own behavior accordingly without communicating explicitly.

A number of studies have indicated that SMM contributes to increased team effectiveness, such as better communication strategies and, in general, an increased effectiveness (e.g., Urban et al., 1995; Volpe et al., 1996). Stout et al. (1999) reported that better SMM resulted in better communication strategies and fewer errors. Furthermore, in a study of simulated anti-air warfare, Mathieu et al. (2000) reported that SMM was related to better accuracy, increased survival, and higher numbers of enemy aircraft shot down. "One challenge for the SMM concept is that at least seven terms have been used to define shared cognitive structures (e.g., shared cognition, teammind, teamthink, team cognition, and shared member schemas; Rentsch and Davenport, 2006). Accordingly do Ward and Eccles (2006) claim SMM too

be too theoretical and that more empirical documentation on its foundations is needed."

In order to coordinate effectively, correct information must be distributed within the team (Salas et al., 2005). Therefore, based on McIntyre and Salas (1995), the second coordinating mechanism Closed loop communication CLC was proposed. CLC is a communication model riginating from military radio transmissions based on verbal feedback to ensure proper team understanding of a meaningful message. CLC is a three-step process, where (1) the transmitter communicates a message to the intended receiver, utilizing their name when possible, (2) the receiver accepts the message with acknowledgment of receipt via verbal confirmation, seeking clarification if required, and (3) the original transmitter verifies that the message has been received and correctly interpreted, thereby closing the loop (Burke et al., 2004).

In a recent study of patient safety, better CLC was significantly and negatively associated with the number of critical incidents (Lacson et al., 2016). El-Shafy et al. (2018) further underlined the importance in a study of trauma team leaders that showed that CLC prevented medical errors, and also how it increased working speed and efficiency in pediatric trauma resuscitation. But there are also concerns as Salik and Ashurst (2020) points out, if all team members constantly initiate CLC, communication overload can result in a lack of leadership and delayed patient assessment and intervention. Another limitation is that different professions have different expectations regarding the content, timing, and generalized structure of information transfer, and may not grasp the roles and priorities of others (Smith et al., 2008). Another study of 16 emergency trauma teams showed that, despite a focus on the importance of CLC, the difficulty in achieving safe and reliable verbal communication within the interdisciplinary team remained (Härgestam et al., 2013). The study concluded that validated training models were called for, combined with further implementation studies. Espevik et al. (2011) showed that naval teams with superior SMM in a simulated operation also exhibit more CLC and perform better when faced with a novel and unknown situation.

A team also has to concentrate as much as possible on the task at hand without using cognitive and physical resources on tasks based on wrong or misunderstood intentions (Bandow, 2001; Webber, 2002). Therefore, the last proposed coordination mechanism is *mutual trust*. Ayenew et al. (2015) linked trust to superior safety performance in nuclear power plants. However, a meta-analysis also revealed a dual side of trust, where high levels of trust could lead to team members becoming too comfortable and less safe, whereas low trust might lead them to avoid the collaboration necessary to be safe (Breuer et al., 2016). Based on this, there seems to be a need for more research into training and intercorrelation between the coordinating mechanisms.

Salas et al. (2005) posits that the three coordinating mechanisms predict to which degree five teamwork components are up-to-date and correct information is distributed throughout the team. As such, all three must be understood as decisive prerequisites for the effect of the five teamwork behaviors. Further, they argue that the teamwork behaviors relate directly to performance. This is claimed to be because the increased sharing of information, the even distribution of workload, and the high level of coordination and monitoring increase the team's perception of the dynamic aspects of their surroundings. This again enables them to develop, consider, and evaluate different courses of action and finally act on the best of them. However, one challenge seems to remain unaddressed: the relative importance of the three mechanisms in their impact on team effectiveness has not been empirically investigated. This could have significant implications for the design of training and exercises.

Teamwork Behaviors

Since the Big Five model was presented in 2005, several studies have added to the original embedded empirical evidence that the Big Five behaviors were connected to performance (e.g., backup, Fincannon et al., 2008; monitoring, Albon and Jewels, 2014; adaptability, Uitdewilligen et al., 2018). Other studies showed similar connections, but few of them took the entire Big Five model into consideration when some of the components were studied. Therefore, most of the studies have investigated the five team processes by combining different team processes as well as organizational factors (e.g., staffing or structure). To the best of our knowledge, there are few studies that have investigated the effect of all five processes and the underlying coordinating mechanisms within the same study. One exception to this is Kalisch et al. (2009), who studied both the team processes and the coordinating mechanisms on nursing teams. These researchers utilized a qualitative method, leaving an open question of empirical quantitative support for the proposed team processes.

Study Aims

Within the police community, there were surprisingly few empirical reports using the five teamwork approach. One exception reported high levels of face validity when police officers rated a training program focusing on the Big Five theory. They also reported high levels of perceived relevance and learning effects of the training (Johnsen et al., 2016). Another case study discussed SMM and the five behavioral processes within a police context (Johnsen et al., 2019).

However, the paper focused on the introduction of the five teamwork behaviors as a tool in the selection process of police special forces and in the evaluation of training scenarios. Being a case-study, it has obvious limitations regarding the generalizability of its conclusions. In order to argue for the use of Big Five teamwork as a useable model in the operational police domain, a relationship must be established for each teamwork behavior and team performance (Hayes, 2018). One theoretical contribution is to investigate whether all coordinating mechanisms and Big Five teamwork behaviors are intercorrelated, and whether all the team processes are related to team performance. We therefore anticipate (H1) that all three coordinating mechanisms and five teamwork behaviors based on the Salas et al. (2005) model will relate positively to Situation Awareness (SA) and decision-making in the police domain.

Although it is a crucial element of the proposed model, Salas et al. (2005) do not give any empirically based argument for the relationship between the three coordinating mechanisms and team effectiveness. It is therefore important to investigate

to what degree the three coordinating mechanisms explain the performance of teams in the sense of the team's shared SA and decision-making behavior. Accordingly, three coordinating mechanisms were suggested, and different authors have emphasized and studied them differently. As mentioned, a study of teamwork in pediatric trauma resuscitation showed that CLC prevented medical errors (El-Shafy et al., 2018). Furthermore, in a study of software teams, trust and SMM were claimed to be of fundamental importance (Moe et al., 2010), and the two factors that made teams of naval cadets outperform other teams were better SMM and the ability to use CLC when they met an unknown situation (Espevik et al., 2011). None of these provide any evidence of the relationship between the three coordinating mechanisms, and the research only confirms what Salas et al. (2005) proposed—i.e., that they are all important.

Furthermore, Salas et al. (2005) deduce from a review of the literature that both trust and SMM are vital to mutual performance monitoring behavior. CLC is assumed to play a part in all coordinating mechanisms and Big Five teamwork processes. Salas et al. (2005) do not argue for the relative contributions of the mechanisms but mainly focus on the function of these (ensuring that information is distributed in the team). According to the initial proposal, trust only plays a part in how mutual monitoring behavior is understood and operates more as a barrier that hinders good teamwork if absent. SMM is a cognitive concept and enables the team to monitor, support and adapt more correctly. Theoretically, SMM is thought of as the core coordinating mechanism, and is viewed as being both the aim and basis for the Big Five teamwork processes. However, there are no empirical studies to back up such a claim. Therefore, we anticipate (H2a) a positive effect of each of the coordinating mechanisms on SA and decision-making, and (H2b) that an effect of SMM would be present even after controlling for both trust and CLC.

The importance of learning and continuous improvement will increase when a police patrol faces uncertain and unclear situations. The Big Five teamwork behaviors, with the three coordinating mechanisms, claim to respond to this. Accordingly, this paper finally aims to investigate whether the Big Five processes and coordinating mechanisms are trainable using a brief training program. A training program for frontline police officers that is perceived as relevant and with established learning effects, focusing on strengthening teamwork behaviors, tries to respond to this aim (see Johnsen et al., 2016 for an outline). We hypothesize (H3) that a training effect would occur with the trained group showing higher ratings of coordinating mechanisms, teamwork behaviors, and finally on SA and decision-making, compared to an untrained group.

METHODS

Subjects

A total of 166 police response personnel (30 females and 136 males) performing in teams of two (83 pairs) participated in the study. All subjects were employed by the West police district in Norway, which has a total of 1,300 employees, including civilian and non-operational personnel. A subsample of 27 of these teams (10 females and 44 males) also received the brief training program. The present study utilized the same sample as presented in an earlier study (Johnsen et al., 2017), and consisted of both urban and rural police officers as well as a variety of main functions. The functions included patrol officers, police dog handling, investigation, and officers attached to task forces for organized crime. The age of the subjects was categorized as below 25 years (4.9%), between 25 and 29 years (23.5%), between 30 and 39 years (41.5%), and between 40 and 57 years (30.1%). The sample consisted of 4.9% officers with <1 year of active duty, 22.8% who reported 2–5 years of experience, 42.6% who had been in the force for between 6 and 10 years, and 29.6% who reported having been a police officer for between 11 and 20 years.

Questionnaires

Based on the Salas et al. (2005) definition of the "Big Five" teamwork behaviors and the three coordinating mechanisms, a questionnaire for observer ratings by Subject Matter Experts (SME) was developed. Two SMEs initially rated all "Big Five" teamwork behaviors and coordinating mechanisms independently, and after each test they made a consensus-based decision for the patrol.

"Big Five" teamwork behaviors were rated from unacceptable (1) to exceptional (7) by the following statements from Salas et al. (2005):

Team leadership, the patrol effectively solved team problems (team roles and responsibilities were distributed in the team).
Team orientation, the goals of the patrol were placed above those of the individual (showed a high degree of involvement, participated actively, and showed good attitudes).
Mutual performance monitoring, the patrol adjusted and reinforced each other (feedback when wrong or right was accepted and implemented by team members).
Backup behavior, the patrol showed a high degree of backup behavior (team members helped/assisted without being asked, pushing of information).
Adaptability, the team showed the ability to adjust strategies (they had dynamic coordination to meet shifting internal and external needs).
Coordinating mechanisms were rated from unacceptable (1) to exceptional (7) by the following statements from Salas et al. (2005):
Mutual trust, the members of the patrol trusted each other (understanding and acceptance that feedback was intended to improve performance).
Closed loop communication (CLC), the patrol exchanged information, and coordinated actions through feedback and response.
Shared mental model (SMM), the patrol showed an ability to create a common understanding for the mission, and updated each other on the priorities and situation.
Team performance indicators. This variable was used as an outcome measure and entailed situation awareness and decision-making behavior. The patrol's ability to create SA (Endsley, 1995) was measured by an aggregated score of two questions: *the patrol discovered changes and mismatches in the*

situation (i.e., level 1) and *the patrol showed an ability to keep an updated and correct picture of the situation at hand* (level 2). Criteria-based evaluation of decision-making behavior consisted of accuracy, latency, and mission effectiveness (Cannon-Bowers and Salas, 1998) and was measured as the ability to evaluate, act, and the degree of solving the mission. Decision-making behavior was measured by an aggregated score of three questions: *the patrol showed an ability (a) to evaluate different courses of action (based on communication between team members, reports to the dispatch, adaptation of distances, preparation to use different aids, etc.), (b) to act (performance of tactics), and (c) to successfully accomplish its task/mission (handling of persons, control of the situation, adequate use of force, prevention of possible injuries etc.).* Since the focus of the present study was on team performance, no individual scores were used in the analyses.

Procedure

Before the start of the experiment, the participants read and signed an informed consent statement. They received information about their rights to leave the study at any time. No participants withdrew from the study, although some participants from the training group did not conduct the test scenario due to other police duties.

The participants were assigned to two groups. One group underwent the outlined training program at the Royal Norwegian Naval Academy. Personnel were randomly assigned to the trained or control condition. The allocation to groups was performed by the leaders of the training wing. Neither the observers nor the participants were informed of whether the enrollment was in a trained or a non-trained group. Two experienced police officers attached to the training wing, who are also engaged in regional police training on a daily basis, were used as subject matter experts (SMEs). Each of the SMEs had more than 20 years of service in the police force. Instructors attached to the training wing occupied this role based on their knowledge of police tactics and their ability to observe and guide colleagues (see Lavin et al., 2007, for a critical discussion of the use of SMEs). The leaders of the training wing were also involved in designing the study, including the variables used. The same SMEs observed and rated all 83 patrols. The SMEs were located in the same room about 10 feet from the participants with no obstruction to their view of the scenario. However, one exception from this was the driving phase for the patrol, where, due to practical reasons, the observers were unable to observe the patrol. The SMEs were blinded to which teams were in the two training conditions. Only the consensus scores were recorded. The SMEs' evaluations were filled in immediately before the debriefing of the police officers. Since the test was performed as part of the annual training, the presence of the SMEs following the execution of the scenario was consistent with standard procedure during training. This, together with the time passed since the training program was carried out, minimizes the possibility of priming the trained group.

Test situation. The test was executed at the police training facility as a part of their annual retraining program. The criteria for developing the scenario were that it should be realistic, operationally relevant, critical (by posing a threat to the officers, perpetrator and civilians), as well as "foggy," in order to induce variation in SA and decision-making. All police officers were randomly assigned to a patrol. None of the teams consisted of members that regularly conducted operational patrols together.

The instructions were given orally while the subjects were seated in a patrol car, and consisted of a verbal report from the dispatch central. The message was that a robbery had taken place and that a knife had been used. This showed willingness to use deadly force. The perpetrator was observed entering a hostel known for harboring several previously convicted persons. The mission was to guard the back door while another unit entered through the front door. The drive to the hostel took 5 min. During this period, the subjects were seated in the car, preparing themselves for the task at hand. No restrictions on the officers were communicated, and an order for armament was issued. Since the Norwegian police is unarmed, the standard procedure involves the storing of weapons (handgun and MP5) in the patrol car, in addition to heavy body-armor and an armored shield. Thus, the officers were armed with a sidearm, baton, pepper-spray, and light body-armor. Heavy body-armor (including helmet with visor), a shield and an MP5 were optional. After positioning themselves at the back door, two persons would exit through the door. The first person was similar to the description of the perpetrator except for two minor, but critical, features. The color of his pants was light gray instead of black, and he carried a short umbrella (not a knife). This manipulation was designed in order to have a salient inject tapping into levels one and two of Endsley's (1995) model of SA. The second person, the perpetrator, would come through the door 30 s later. He had one hand in his pocket, and during the interaction he would take it out holding the knife, and further threaten the officers. The task of the patrol was to handle both situations, almost (30 s) simultaneously.

The training program. The trained group received an 8-h training program in advance of the test scenario. The program focused on SA, Big Five team processes, and the coordinating mechanisms, mutual trust and communication in teams and decision-making. The time was divided, allocating 3 h both for SA and team training, respectively. The remaining 2 h were allocated to personal reflection and a scenario at the shooting range executed individually. An extensive outline of the theoretical foundations and the training program is described in Johnsen et al. (2016).

SA and Big Five teamwork training consisted of video simulation that included a freeze technique (Flin et al., 2008). Significant focus was placed on the detection of critical elements (SA Level 1). The participants were also challenged to use Big Five teamwork categories and suggest what they, at this stage, wanted to inform or agree upon with their partner. Lectures in SA, "Big Five" teamwork, and coordinating mechanism behavior were held.

In order to enhance team performance, a lecture based on the Salas et al. (2005) model was delivered, followed by a practically oriented group session. An extensive outline of the theoretical foundations and the training program is described in Johnsen et al. (2016). The group was placed in a situation with time

constraints, where they were blindfolded and challenged to solve an unfamiliar problem. One of the team members acted as team leader, and was unable to view the process of executing the task, only communicating to the rest of the team through an intercom. One of the main focuses of the training was to exemplify the pushing of information. By separating the leader from the team, the team is forced to push information to the leader, and blindfolding the team members presents an opportunity to highlight the importance of the pushing of information to the team members. After a predetermined period of time, one of the blindfolded team members was secretly given vital information, which, if the other team members responded according to the Big Five theory, would enable the team to solve the problem. The importance of planning (i.e., assigning roles and responsibilities), information exchange (pulling and pushing of information), and monitoring was emphasized during the training session. This was viewed as crucial in scenarios with both a short and long time-frame.

Design and Statistics

Group differences between the subsample exposed to training and controls were tested using *t*-test for independent samples. The relationship between team behavior and performance was tested by means of Pearson product moment correlation (H1). The relative contributions of coordinating mechanisms on team effectiveness were tested using multiple regression (enter methods; H2a/b). Multiple regression is a suitable method for studying separate and collective contributions of one or more independent variables on the variation of a dependent variable (Wampold and Freund, 1987). Results from the multiple regression were followed up using hierarchal regression (H2b). Only variables contributing significantly in the multiple regression were included in the hierarchal analysis. The results of the regressions analysis are presented as both unstandardized and standardized effects and adjusted R was used in order to present magnitude of explained variance.

The relationship between team behavior and performance was investigated by means of Pearson product moment correlation. The contributions of coordinating mechanisms and team behavior on team performance indicators were calculated using multiple regression (predictor variables were entered in one block). The Variance Inflation Factor (VIF) was calculated as an index of multicollinearity. This index is one of the most common tools used to determine the inflation in the variances of the parameter estimates due to multicollinearity caused by correlated independent variables (Vatcheva et al., 2016). Although no exact cut-off point has been established, a common practice is to consider VIFs <10 as acceptable (Kutner et al., 2004; Vatcheva et al., 2016). The collinearity statistics showed all VIFs being within this criterion for both the dependent measure of SA and decision-making behavior. The collinearity diagnostics using SA as a dependent variable showed adaptability with the lowest (VIF = 5.84) and support behavior with the highest index (VIF = 8.52). When decision-making behavior was used as an outcome measure, SMM revealed the lowest (VIF = 5.29) and team orientation showed the highest coefficient (VIF = 9.56). Results from the multiple regression were followed up by means of hierarchical regression with the aim of calculating the relative contributions that the separate coordinating mechanisms exerted on performance indicators. Only variables contributing significantly in the multiple regression were included in the hierarchical analysis. The results of the regressions analysis are presented as both unstandardized (*B*) and standardized effects (in tables), and adjusted R was used in order to present magnitude of explained variance. Group differences were explored using *t*-test for independent samples. All statistics were performed using SPSS version 25.

RESULTS

Correlational Analyses

In order to explore if all three coordinating mechanisms and five teamwork behaviors relate positively to performance indicators (H1), the correlational analyses revealed significant intercorrelations for all measures included in the analyses (see **Table 1** for a detailed description of coefficients and significance levels). Regarding performance indicators, both the lowest and strongest coefficients were found for Decision Making Behavior (see **Table 1** for a detailed description of coefficients and significance levels).

Regressing Situation Awareness onto "Big Five" Teamwork Behaviors

When regressing SA on the "Big Five" teamwork behaviors (H2a), the results of the analysis revealed a significant model ($F = 116.53$, $p < 0.001$). The model explained 87.6% of the variance in SA. However, the regression analysis showed that only team leadership, backup behavior, and adaptability were significantly related to SA. The same analysis revealed no significant relationship when SA was regressed on team orientation and monitoring (see **Table 2** for unstandardized and standardized effects, as well as *t*-values and significance levels).

Regressing Decision-Making Behavior Onto Big Five Teamwork Behaviors

When regressing decision-making behavior on the Big Five teamwork behaviors, a significant model occurred ($F = 105.52$, $p < 0.001$). The model explained 87.3% of the variance in decision-making behavior. As can be seen in **Table 3**, the regression analysis revealed significant effects only for monitoring and adaptability. No relationship was found when SA was regressed on team orientation, team leadership, and backup behavior (see **Table 3** for details).

Regressing Situation Awareness Onto Coordinating Mechanisms

A significant model including all three mechanisms (H2b) occurred when regressing SA onto the coordinating mechanisms ($F = 123.73$, $p < 0.001$). The model explained 81.8% of the variance in SA scores. Significant effects were found only for CLC and SMM. Therefore, no relationship was found when the SA were regressed on mutual trust (see **Table 4** for details of effects, error terms, and significance levels).

TABLE 1 | Means (M), Standard Deviations (SD), and Intercorrelations between the coordinating mechanisms, the big-five teamwork processes and performance indicators.

Team process	1	2	3	4	5	6	7	8	M	SD
1. Team leadership	–								4.19	0.92
2.Team orientation	0.89**	–							4.37	0.89
3.Monitoring	0.77**	0.83**	–						4.14	0.98
4.Backup behavior	0.78**	0.86**	0.92**	–					4.13	1.06
5.Adaptability	0.79**	0.83**	0.83**	0.84**	–				4.11	1.00
Coordinating mechanism										
6.Mutual trust	0.90**	0.87**	0.78**	0.80**	0.82**	–			4.33	0.80
7.Closed loop communication	0.82**	0.85**	0.87**	0.87**	0.86**	0.83**	–		4.14	1.08
8.Shared mental models	0.87**	0.86**	0.76**	0.76**	0.84**	0.89**	0.79**	–	4.23	0.86
Performance indicator										
9.Situational awareness	0.84**	0.86**	0.88**	0.89**	0.89**	0.83**	0.88**	0.83**	4.12	0.96
10.Decision-making behavior	0.80**	0.85**	0.90**	0.89**	0.87**	0.80**	0.86**	0.81**	23.24	3.68

**$p < 0.01$.

TABLE 2 | Unstandardized and standardized coefficient (β), standard error, *t*-values, and significance levels for situation awareness regressed upon team behavior.

Team behavior	Unstardadized beta	Standard error	β	*t*-value	Significance level
Team orientation	0.01	0.22	0.01	0.04	0.967
Team leadership	0.42	0.18	0.21	2.39	0.019
Monitoring	0.35	0.19	0.19	1.86	0.067
Backup behavior	0.48	0.19	0.28	2.49	0.015
Adaptability	0.59	0.15	0.33	4.02	0.000

TABLE 3 | Unstandardized and standardized coefficient (β), standard error, *t*-values, and significance levels for decision-making behavior regressed upon team behavior.

Team behavior	Unstardadized beta	Standard error	β	*t*-value	Significance level
Team orientation	0.21	0.38	0.06	0.56	0.578
Team leadership	0.27	0.30	0.08	0.88	0.382
Monitoring	1.22	0.32	0.40	3.77	0.000
Backup behavior	0.55	0.33	0.20	1.68	0.097
Adaptability	0.75	0.25	0.25	2.98	0.004

No Further Regression Analysis Including Trust Was Therefore Performed

In order to investigate the relative contribution for each of the coordinating mechanisms in explaining the variance in SA scores, a hierarchical regression analysis was performed. The results showed a significant effect of both CLC and SMM. In the first step, CLC was entered as an independent variable. A significant model occurred [$F_{(83)} = 280.26$, $p < 0.001$], explaining 77.6% of the variance. In the second step, SMM was entered in addition to CLC.

TABLE 4 | Unstandardized and standardized coefficient (β), standard error, *t*-values, and significance levels for situation awareness regressed upon coordinating mechanisms.

Coordinating mechanism	Unstardadized beta	Standard error	β	*t*-value	Significance level
Mutual trust	0.21	0.26	0.09	0.81	0.421
Closed loop communication	0.96	0.15	0.57	6.54	0.000
Shared Mental Models	0.63	0.22	0.30	2.88	0.005

TABLE 5 | Hierarchical regression analyses of situation awareness regressed upon closed loop communication and shared mental model.

Model	Team behavior	Unstardadized beta	Standard error	β	*t*-value	Significance level
1	Closed loop communication	1.48	0.09	0.88	16.74	0.000
2	Closed loop Communication	1.01	0.28	0.60	7.87	0.000
	Shared Mental Models	0.75	0.16	0.35	4.62	0.000

In step two, the significant model [$F_{(83)} = 186.06$, $p < 0.001$] explained an additional 4.7% of the variance. Also in this model, CLC revealed a significant contribution in explaining the variance in SA scores. When adding the independent variable of SMM, a significant relationship was found indicating a unique effect of SMM on SA, even when controlling for CLC (see **Table 5** for details).

Regressing Decision-Making Behavior Onto Coordinating Mechanisms

When regressing decision-making behavior on coordinating mechanisms of the theory, a significant model including all three

TABLE 6 | Unstandardized and standardized coefficient (β), standard error, *t*-values, and significance levels for decision-making behavior regressed upon coordinating mechanisms.

Team behavior	Unstardadized beta	Standard error	β	*t*-value	Significance level
Closed loop Communication	1.53	0.27	0.56	5.74	0.000
Mutual trust	0.22	0.48	0.06	0.46	0.645
Shared Mental Model	1.10	0.40	0.32	2.74	0.008

TABLE 7 | Hierarchical regression analyses of decision-making behavior regressed on closed loop communication and shared mental model.

Model	Team behavior	Unstardadized beta	Standard error	β	*t*-value	Significance level
1	Closed loop Communication	2.36	0.16	0.86	14.95	0.000
2	Closed loop Communication	1.59	0.23	0.58	6.80	0.000
	Shared Mental Model	1.22	0.30	0.35	4.14	0.000

mechanisms was found ($F = 94.16$, $p < 0.001$). The model explained 77.3% of the variance in decision-making behavior. Also in this analysis, the only significant predictors were CLC and SMM. As for the analysis of SA, no relationship was found when the performance indicator of decision-making behavior was regressed on trust (see **Table 6** for details of effects, error terms, and significant levels).

No Further Regression Analysis Including Trust Was Therefore Performed

In order to follow up on the regression results and to further investigate the relative contribution of the separate coordinating mechanisms, a hierarchical analysis identical to that for SA was performed. In the first step, CLC was entered, resulting in a significant model [$F_{(83)} = 223.44$, $p < 0.001$), explaining 73.1% of the variance in decision-making behavior. In the second step, SMM was added to the model.

Step two also revealed a significant model [$F_{(83)} = 17.13$, $p < 0.001$], which explained an additional 4.7% of the variance. CLC also revealed a significant effect in this model. In addition, step two exposed the independent variable of SMM as a significant contributor. Therefore, when using decision-making behavior as performance indicator, and controlling for CLC, a unique effect of SMM was found (see **Table 7** for details).

Ten *t*-tests were conducted in order to test the effects of the brief training program (H3), using team performance, as well as all Big Five team processes, and all three coordinating mechanisms as dependent variables. The results showed no significant difference between the untrained and trained groups for either of the variables studied.

DISCUSSION

According to this study, all Big Five teamwork behaviors and the coordinating mechanisms seem to correlate with external ratings of team performance indicators (i.e., SA and DM). The regression results showed that four of the five teamwork behaviors were related to either SA or decision-making behavior. Surprisingly, team orientation did not show any significant effect. The results from the regression analyses showed that the coordinating mechanisms of CLC and SMM predicted team performance, with SMM predicting above and beyond the effect of CLC. Contrary to this, no significant effect occurred when measures of performance were regressed upon trust. No effect of the training program occurred since the trained group did not show more of the Big Five teamwork behavioral markers or coordinating mechanisms, nor better performance compared to the untrained group.

Big Five Teamwork Theory and Performance Indicators

Our first hypothesis was to explore whether all components were positively relevant to team performance indicators. The use of dependent measures of SA (Endsley, 1995) and decision-making behavior (Cannon-Bowers and Salas, 1998) revealed a correlation between all elements in the model and the indicators of performance used. In addition, four of the five teamwork behaviors explained a variance in SA, decision-making or both. Only team orientation failed to do so. This is the first study using a quantitative approach to show that all Big Five teamwork behaviors and the coordinating mechanisms seem to be connected to performance (see Kalisch et al., 2009 for an exception). Furthermore, the coordinating mechanisms were highly intercorrelated. On a theoretical level, this lends support to the proposed model. On a practical level, it could be argued that a police patrol that executes all Big Five teamwork behaviors seems to be more able to perceive and comprehend the situation the team is facing. However, caution should be exercised since this conclusion is based on correlational analysis. Also, the results of analyses of the three coordinating mechanisms are in line with the Big Five teamwork behaviors. It was interpreted that they provide essential coordination to secure team output by being highly correlated with the Big Five team processes. Therefore, we argue that this provides new evidence that all the teamwork behaviors within the Big Five theory ensure that a team, in a stressful new, ambiguous and unclear operational situation, is more efficient. This goes beyond previous findings, where the focus seems to be on one or two teamwork behaviors and not the entire Big Five theory. This study is therefore the first to give empirical, quantitative evidence that the performance of police patrols is related to whether and how they carry out Big Five teamwork behaviors and coordinating mechanisms. This could be generalized for other teams that have to deal with uncertainty in high stress situations (e.g., military personnel, firefighters, or health workers in an ongoing emergency situation).

Importance of Coordinating Mechanisms

The notion that teamwork is associated with team performance is hardly revolutionary. However, Salas et al. (2005) suggested three coordinating mechanisms, which do not determine how inputs are incorporated, but ensure that the Big Five teamwork components are consistently updated and that relevant information is distributed throughout the team. In our view, this is the most noteworthy and novel part of the Big Five theory approach to teamwork. The predictive power of the coordinating mechanisms on team performance has attracted little attention and, as such, was the main focus of the present paper.

Contrary to our expectation, trust did not explain any variance in either SA or decision- making behavior. The importance of different levels of trust in teams has been noted by McComb et al. (2017). In a quantitative study, trust and SMM were tested for group differences between nurses and physicians. Differences in perceived role responsibilities were interpreted as being low SMM but, more interestingly, nurses trusted physicians more than vice versa. Although McComb et al. (2017) measured SMM and trust, they did not test the model in relation to performance. However, we find it interesting that both professions showed a high level of trust toward other members of their own profession. Therefore, there may be similarly high levels of trust between police officers, as they also understand themselves as belonging to a profession with a certain expertise, responsibility and collectiveness (Huntington, 1981).

Trust could be viewed as a belief system, and it is defined as a willingness to be exposed to vulnerable situations as a consequence of others' decisions or behavior because one expects these to be well-intended (Olsen et al., 2020). This belief system could impact the Big Five team processes by means of increased information sharing, coordination, and a willingness to listen to and support other team members. The correlation between trust and team performance indicators did not hold up in the regression analyses, indicating that the effect was caused by other variables not controlled for in the present study. The same line of thinking may apply for the Big Five teamwork behaviors, with team orientation failing to explain any variance in performance indicators. Salas et al. (2005) argue that team orientation is an attitude, and one explanation could be that team orientation involves some of the same properties as trust. Therefore, team orientation is also part of a belief system, where one expects other police officers to have good intentions. Accordingly, one could argue that police officers take for granted that other police officers value the goals of the patrol over those of the individual (i.e., definition of team orientation). We suggest that trust and team orientation are addressed in future research concerning bases for swift trust, attitudes, beliefs, and behavior within professions.

On the other hand, CLC predicted team performance indicators. This is in line with Espevik et al. (2011), who showed that superior-functioning teams of naval cadets met a new and uncertain situation with CLC. Also in the present study, the test situation placed each patrol in a new and uncertain situation, including unknown team members. Therefore, this study provides evidence that CLC is an important coordinating mechanism to update all Big Five teamwork behaviors, and in a way that results in better SA and decision-making behavior.

The coordinating mechanisms CLC and SMM are both mechanisms related to generating, maintaining, and altering knowledge structures in the team. This is performed by describing, clarifying, and projecting into the future, and, as this study shows, is decisive for a police patrol. Salas et al. (2005) argue that the importance of SMM and CLC increases when teams must perform in stressful conditions. However, in the present study, SMM predicted team performance even when controlling for CLC. This indicates that, even if both mechanisms are important, SMM seems to be more crucial. SMM represents an explanation for how the environment is functioning, whilst CLC represents the ability to get this understanding across to all team members (Espevik et al., 2011). CLC contributes to these knowledge structures by questioning and confirming the reality of the SMM currently existing in the team, causing an interaction between CLC and SMM. However, without a shared understanding (i.e., SMM), CLC has less to contribute because explicitly sending and receiving information becomes pointless without prior understanding. This interaction could be a prerequisite for increased performance by the team. Therefore, CLC and SMM increase performance by generating and maintaining relevant cognitive structures representing the situation at hand, and this eventually results in an enhanced SA and decision-making, and ultimately in actions.

With some exceptions, the results from this study are in line with the SMM theory and expand previous knowledge by empirically showing that shared mental models are the most decisive mechanism for team performance when the team approaches unclear, dangerous and difficult situations. This finding gives strong indications as to what type of training is necessary for teams that intend to cope in stressful environments.

Big Five and Trainable?

We aimed at investigating whether Big Five teamwork and the coordinating mechanisms are trainable. In doing so, we relied on a brief training program that had previously been reported to have an effect on subjective learning as well as being relevant to operational scenarios (Johnsen et al., 2016). The scenario-based training gave the participants new experience and opportunities to identify knowledge gaps on which he/she could reflect (concrete experience) and to try out new ways of coping. Although the training program has shown to be effective both on subjective ratings of SA and target handling (Saus et al., 2021), no effect was found for the variables generated from the big five model using external SMEs as evaluators.

Even briefer training interventions than in this study have shown effect. For instance, Israel et al. (2014) reported a positive effect from a 5-h training program aimed at making law enforcement personnel work more effectively when meeting sexual minorities. However, this was on an individual level, and it is fair to suggest that the team context makes training more complicated, and therefore more time is needed. Saus et al. (2021) have shown the effects on SMEs' ratings of more non-specific measures of teamwork, such as internal and external communication, and the dynamic positioning of the team members relative to each other in target handling. However, the present study showed no effects when teamwork was measured

as a specific theory-derived behavior. It is also possible that other intra-social mechanisms offset learned teamwork behaviors. For example, the composition of teams using police officers unfamiliar to each other and coming from different police units may have been subject to effects of key characteristics described in social identity theory (Tajfel and Turner, 1986). The passing of time between the training intervention and the test may also have played a part, as this was between 2 and 6 months. Apart from time, there could also be other explanations, such as content, design, or a lack of motivation for training.

We would argue that an 8-h training program is too short in which to learn and master complicated cognitive mechanisms such as mental models and to make them shared. Therefore, future research should devote more time and effort to the training interventions, and concentrate on cognition understood as SMM, and connect these to the Big Five teamwork behaviors.

Limitations

Some caution should be noted regarding the high intercorrelation values obtained. Although the collinearity diagnostics stated that the variables were within an acceptable range, it could be that the subject matter experts treated the Big Five teamwork behaviors, coordinating mechanisms, and the performance indicators as similar concepts when they evaluated the police patrols. The evaluation was based entirely on SMEs' consensus ratings. This could also cause a problem since there is no measurement of variability between the raters, which results in a lack of reliability testing of the rating system. The procedure whereby two experienced police officers should agree on the score was intended to increase the possibility of differentiating between the concepts and to make the score more reliable and valid. Also, neither during the execution of the testing nor in the "hotwash" with the SMEs and the role players after the testing, did the variation of scores turn up as a problematic issue.

Multiple-item scales are favored to measure psychological constructs (Nunnaly, 1967), and this study relies on single-item measures. However, Wanous et al. (1997) and others support the use of single items. This is founded on empirical data showing high test-retest reliability (Littman et al., 2006), as well as high correlations with multiple-item scales (Wanous et al., 1997). The validity is also revealed by single-item measures effectively predicting outcomes (Nagy, 2002). Although there are limitations, potential advantages should be noted for the use of single items. These include cost-efficiency, greater face validity, and a possible increased willingness of respondents to take time to complete the questionnaire instigated by a less intrusive method compared to the use of multi-item scales.

Another limitation was the lack of observations during the driving or planning phase. However, the use of SMEs as raters made it possible to take into consideration part of the consequences of planning, such as (for example) their performance relative to their chosen equipment.

CONCLUSIONS

To sum up, correlational and regression analyses of police patrols indicate that all "Big Five" teamwork behaviors and coordinating mechanisms are connected with external ratings of team performance indicators in stressful operational situations. Therefore, both the three coordinating mechanisms and the five team processes derived from the Big Five theory were related to increased performance. The study showed that only CLC and SMM predicted team performance in a regression analysis, with SMM predicting above and beyond the effect of CLC. Contrary to this, trust did not explain variance in team performance, which was interpreted as being caused by a generally high level of trust within the police force. The study provides new and strong evidence of SMM as the most important underlying factor for the Big Five theory. No effect of the training program occurred, since the trained group did not show more of the Big Five teamwork behavioral markers, nor better performance compared to the untrained group. This may be due to the 8-h training program being too short in order to learn and master complicated cognitive mechanisms such as SMM, or because other intrasocial mechanisms (e.g., social identity theory) offset any potential learned teamwork behavior during short, critical, and high-intensity scenarios.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by NSD—Norwegian centre for research data. The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

RE conceived of the presented idea, developed the theory, and planned the experiments. RE and BJ processed the experimental data, performed the analysis, drafted, wrote the article, and designed the figures. All authors carried out the experiment, discussed the results, and commented on the manuscript.

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frontiers in Psychology

BRIEF RESEARCH REPORT
published: 17 September 2021
doi: 10.3389/fpsyg.2021.727341

Police Officers' Ability in Recognizing Relevant Mental Health Conditions

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The recognition of certain mental health conditions is important as this requires police officers to communicate and behave in an adjusted manner with affected individuals. The objective of the present study was to test police officers' knowledge about mental health symptoms as a component of their mental health literacy (MHL) and to examine if police officers' perceived knowledge corresponds with their actual knowledge. A questionnaire was used to assess for MHL representing mental health conditions which occur frequently in police requests (schizophrenia, bipolar disorder, depression, post-traumatic stress disorders, and emotionally unstable personality disorder). Furthermore, the questionnaire assessed the frequency of police requests, the officers' perceived knowledge regarding mental disorders and their sense of feeling sufficiently trained to deal with these kinds of requests. Eighty-two police officers participated in the study. Police officers' actual knowledge about mental health conditions did not correspond with their perceived knowledge. Participants revealed a moderately high level of overall knowledge which differed with regard to symptoms of each of the five mental health conditions. The mental status of a paranoid schizophrenia was best identified by the police officers and the majority correctly allocated the symptoms. Post-traumatic stress disorders and manic episodes were only identified by a minority of police offers. Police training geared to prepare for requests involving individuals with mental disorders should expand this limited knowledge transfer and focus on a broader variety of mental health conditions that police officers frequently encounter in requests.

Keywords: individuals with mental disorders, training, mental health conditions, mental health literacy, police

OPEN ACCESS

Edited by:
Craig Bennell, Carleton University, Canada

Reviewed by:
Jennifer Lavoie, Wilfrid Laurier University, Canada
Adam Vaughan, Texas State University, United States

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Specialty section:
This article was submitted to Educational Psychology, a section of the journal Frontiers in Psychology

Received: *18 June 2021*
Accepted: *16 August 2021*
Published: *17 September 2021*

Citation:
Wittmann L, Groen G, Hampel P, Petersen R and Jörns-Presentati A (2021) Police Officers' Ability in Recognizing Relevant Mental Health Conditions. Front. Psychol. 12:727341. doi: 10.3389/fpsyg.2021.727341

INTRODUCTION

There is a large body of research examining interactions between police forces and individuals with a mental health condition (Vigours and Quy, 2017). Previous research examined the frequency (Livingston, 2016), circumstances (Charette et al., 2014), and the subjective experience of affected individuals (Livingston et al., 2014b; Soares and Pinto da Costa, 2019) as well as involved police officers in these interactions (Wittmann et al., 2021c). Additionally, there are studies suggesting that police officers regularly encounter individuals diagnosed with schizophrenia, bipolar disorder, depression, post-traumatic stress disorders (PTSD) or emotionally unstable personality disorders (EUPD; Resnick et al., 2000; Kesic et al., 2013; Jones and Thomas, 2019;

O'Neal, 2019). The crisis intervention team training (CIT) program proposes that police officers require knowledge about different kinds of mental health conditions in order to correctly detect them in real life situations (Watson and Fulambarker, 2012; CIT International, 2019). It is thought that the ability to recognize and identify certain mental health conditions enables police officers to adjust their communication strategies and behavior with a focus on procedural justice, empathy and patience to prevent the risk of escalating violence and traumatic experiences (Desmarais et al., 2014; Livingston et al., 2014a; Wittmann et al., 2021b). Knowledge about and recognition of mental health conditions is one component of the mental health literacy (MHL) concept. MHL was first described by Jorm et al. (1997) and builds upon the concept of health literacy (Nutbeam, 2000; World Health Organization, 2013). Components of MHL include (a) the ability to recognize specific disorders or psychological distress; (b) knowledge and beliefs about risk factors and causes; (c) knowledge and beliefs about self-help interventions; (d) knowledge and beliefs about available professional help; (e) attitudes which facilitate recognition and help-seeking; and (f) knowledge of how to seek mental health information (Jorm, 2000).

In their regular practice, German police officers are not expected to be able to identify the wide range of symptoms indicating potential mental health symptoms, but they need to be able to recognize certain mental health conditions. However, there is evidence that police officers only identify mental health problems in 50% of the encounters they have with individuals with mental health issues (McKinnon and Grubin, 2013). To this date, there is a paucity of research examining whether German police officers are capable of correctly identifying individuals suffering from poor mental health. The aim of the present study was therefore to test German police officers' knowledge about mental health symptoms and draw conclusions about the extent to which they are mental health literate. In addition, we tested if police officers' perceived knowledge corresponded with their actual knowledge.

MATERIALS AND METHODS

Materials

Two of the authors, a clinical psychologist and a police officer, constructed the questionnaire to assess for MHL based on the criteria of the International Classification of Diseases and related Health Problems 10 (ICD-10; WHO, 2015). We chose five mental health disorders which occur frequently in police requests: schizophrenia, bipolar disorder, depression, PTSD, and EUPD (Resnick et al., 2000; Kesic et al., 2013; Jones and Thomas, 2019; O'Neal, 2019). The questionnaire contained the description of 17 symptoms using clinical terminology (e.g., paranoid delusions) which participants had to assign to one of five different mental health conditions. We used the terminology of the ICD-10 to label symptoms and mental health disorders. To meet the requirements of a practical oriented approach certain symptoms were selected which are (1) characteristic for the respective diagnosis and (2) salient in the communication or the interaction with an individual. Furthermore, the questionnaire inquired about age, gender, and years of service. The frequency of police requests involving individuals with mental disorders was assessed on a five-point Likert scale from several times a day to never before. Police officers were also asked to evaluate their perceived knowledge regarding mental disorders and sense of feeling sufficiently trained to deal with these kinds of requests on a five-point Likert scale (1 = *very poor* to 5 = *very good*). To assess the affective component of these interactions, participants were asked a single choice question measuring if they felt predominantly safe, tensed, uneasy or overwhelmed in requests involving individuals experiencing a mental health condition.

Procedure

The stratified data collection was performed over two weeks in June 2020. Participating frontline police officers were recruited in a large German city. In order to achieve a representative sample of the city, five police departments located in the center and in the western, eastern, southern, and northern districts were chosen. Pervious research showed that police interactions with individuals with mental illnesses are not equally allocated in neighborhoods (Krishan et al., 2014). Therefore, we deemed this approach necessary as different police departments were located in neighborhoods with potentially differing frequencies in police request involving mental disorders. A paper-pencil survey was used as the most practical approach to collect data in the field. The questionnaires were distributed to the selected police departments by a police officer student and handed to the post office boxes of all frontline police officers of the respective police department. Additionally, the superintendents of each unit were personally informed about the study. Based on preliminary considerations of the manpower of each department it was deemed sufficient to provide each department with $N = 40$ questionnaires resulting in a potential sample of $N = 200$. Additionally, participants were provided with a letter informing about the study and an informed consent form. Participants were able to contact a researcher for any questions regarding the study. Questionnaires and informed consent forms were collected separately in two different sealed boxes over a period of two weeks. This period was chosen in order to increase the response rate in case some police officers would be on vacation or attend training. The sealed boxes were only opened by the researchers to maintain anonymity and confidentiality. The study was reviewed by the respective police academy. This included the involvement of the staff council. In addition, the research is in accordance with the Declaration of Helsinki.

RESULTS

Participants

A total of $N = 82$ (response rate = 41%) police officers participated (33 female, 40.2%) in the study. The age ranged most frequent from 26 to 35 years ($n = 26$, 32%) and most police officers ($n = 24$, 29%) had spent less than 6 years in service. Most participants ($n = 51$, 62.2%) experienced police requests with

individuals with mental disorders several times per month. The majority ($n = 52$; 63.4%) estimated their knowledge in the category as moderate (see **Table 1**). The majority of participants ($n = 47$; 57.3%) reported they had felt tense during interactions with individuals with mental disorders, about a quarter (24.4%) of the participants felt safe, 14 (17.1%) participants felt uncomfortable, and one (1.2%) participant felt overwhelmed.

Overall Mental Health Literacy

In order to test if police officers' actual knowledge corresponded with their perceived knowledge we calculated a knowledge score. This score represents how many symptoms were correctly assigned to one of the five mental health conditions resulting in a possible range from 0 (*all incorrect*) to 17 (*all correct*). This score was available for $n = 52$ participants due to missing values. Participants average knowledge score was $M = 10.94$ (SD = 2.26). A Spearman rank correlation did not show a significant association between the police officers' actual knowledge and subjective knowledge.

Paranoid Schizophrenia

Fifty-one (62.2%) participants correctly identified the three key symptoms of paranoid schizophrenia (see **Table 2**). Paranoid delusions ($n = 67$; 81.7%), bizarre delusions ($n = 63$; 76.8%), and acoustic (auditory) hallucinations ($n = 67$; 81.7%) were to the same extent correctly identified as symptoms of a paranoid schizophrenia.

Emotionally Unstable Personality Disorder (Borderline Personality Disorder)

No participant correctly identified all three symptoms of an EUPD. Self-harming behaviors, including suicide gestures, were correctly assigned to EUPD by 54 participants (65.9%). Outbursts of emotions due to emotional liability were identified by 33 (40.2%) participants as a symptom of EUPD and seven (8.5%) participants assigned chronic feelings of emptiness to the disorder.

Post-traumatic Stress Disorder

Twelve participants (14.6%) correctly identified all four symptoms of a PTSD. Flash backs were identified by the majority of the police officers ($n = 75$; 91.5%) as a specific PTSD symptom. Sleeping disturbances ($n = 56$; 68.3%) and enhanced startle reactions ($n = 47$; 57.3%) were frequently identified as a PTSD symptom, whereas avoidance behaviors were only identified by one in four participants ($n = 20$; 24.4%).

Manic Episode

All symptoms of a manic episodes were only identified by 14 (17.1%) participants. Elevated mood ($n = 48$; 58.5%) and inflated self-esteem and grandiose ideas ($n = 46$, 56.1%) were more frequently perceived as qualifiers for a manic episode than overactivity ($n = 37$; 45.1%) and reckless behavior ($n = 32$; 39%).

Depressive Episode

Thirty-six participants ($n = 36$; 44%) identified all four symptoms of a depressive episode. Reduction in energy ($n = 68$; 83%) and lowering of mood 68 (83%) were identified more frequently as depressive symptoms compared to suicidal thoughts ($n = 50$; 61%) and sleep disturbances ($n = 56$; 68.3%; **Table 2**).

DISCUSSION

The aim of the present study was to test police officers' MHL with regard to their knowledge of relevant mental health conditions. Our first finding is that police officers have a moderate knowledge of the symptoms of mental illnesses that they encounter more frequently during police requests. Second, police officers revealed a differentiated knowledge about mental disorders in general: A diagnosis of paranoid schizophrenia was identified most frequently by participants (62%) and the majority correctly allocated the respective symptoms to the disorder. A depressive episode was the second best identified mental health condition in our sample (44%). This is in line with research demonstrating that higher rates of individuals diagnosed with schizophrenia or depression compared to other mental disorders come in contact with police (Kesic et al., 2013; McKinnon and Grubin, 2013). Additionally, McKinnon and Grubin (2013) showed that police officers detected symptoms of schizophrenia more commonly compared to other mentals health conditions (e.g., intellectual disabilties). However, one could argue that German police training focuses specifically on schizophrenia and therefore police officers present with a broader knowledge (Wundsam et al., 2007; Wittmann et al., 2021a). In contrast, PTSD (15%) and manic episodes (17%) were only identified by a minority of police offers and EUPD by none of the participants. This finding is unexpected, as police encounters with individuals diagnosed with bipolar disorders and EUPD occur relatively often in police requests (Gandhi et al., 2001;

TABLE 1 | Frequency distribution of age, years spent in service, frequency of requests involving individuals with a mental disorder, and perceived knowledge.

Age	18–25	26–35	36–45	46–55	>56
N (%)	17 (21%)	26 (32%)	25 (30%)	11 (13%)	3 (4%)
Years spent in service	<5	6–15	16–25	26–34	>35
N (%)	24 (29%)	23 (28%)	23 (28%)	7 (9%)	5 (6%)
Frequency of requests	Multiple times per day	Multiple times per week	Multiple times per month	Less than once in a month	Never before
N (%)	51 (62.2%)	23 (28%)	6 (7.3%)	2 (2.4%)	–
Perceived knowledge	Very good	Good	Moderate	Poor	Very poor
N (%)	2 (2.4%)	21 (25.6%)	52 (63.4%)	7 (8.5%)	–
Sense of feeling trained *N* (%)	–	13 (15.9%)	38 (46.3%)	27 (32.9%)	4 (4.9%)

TABLE 2 | Correct and false allocations of the 17 symptoms and five mental health conditions.

	Correct, *n* (%)	False, *n* (%)	Missing, *n* (%)
Paranoid schizophrenia	51 (62.2%)	22 (26.8%)	9 (11%)
Paranoid delusions	67 (81.7%)	10 (12.2%)	5 (6.1%)
Bizarre delusions	63 (76.8%)	15 (18.3%)	4 (4.9%)
Acoustic hallucinations	67 (81.7%)	8 (9.8%)	7 (8.5%)
Emotionally unstable personality disorder (EUBD)	–	62 (75.6%)	20 (24.4%)
Liability to outbursts of emotion	33 (40.2%)	40 (48.8%)	9 (11%)
Chronic feelings of emptiness	7 (8.5%)	68 (82.9%)	7 (8.5%)
Self-destructive behavior, including suicide gestures	54 (65.9%)	10 (12.2%)	18 (22%)
Post-traumatic stress disorder (PTSD)	12 (14.6%)	51 (62.2%)	19 (23.2%)
Avoidance behavior	20 (24.4%)	50 (61%)	12 (14.6%)
Flashbacks	75 (91.5%)	5 (6.1%)	2 (2.4%)
Enhanced startle reactions	47 (57.3%)	32 (39%)	3 (3.7%)
Sleeping disturbances	56 (68.3%)	11 (13.4%)	15 (18.3)
Manic episode	14 (17.1%)	49 (59.7%)	19 (23.2%)
Elevated mood	48 (58.5%)	27 (33%)	7 (8.5%)
Overactivity	37 (45.1%)	36 (43.9)	9 (11.0)
Reckless behavior	32 (39%)	43 (52.4)	7 (8.5%)
Inflated self-esteem and grandiose ideas	46 (56.1%)	30 (36.6%)	6 (7.3%)
Depressive episode	36 (44%)	23 (28%)	23 (28%)
Reduction in energy	68 (83%)	7 (8.5%)	7 (8.5%)
Lowering of mood	68 (83%)	3 (3.6%)	11 (13.4%)
Suicidal thoughts	50 (61%)	13 (15.8)	19 (23.2%)
Sleep disturbances	56 (68.3%)	11 (13.4%)	15 (18.3%)

Kesic et al., 2013). There are two possible explanations for this result. First, the low detection rates may be due to the symptoms we selected that police officers were not familiar with. Second, it is possible that police officers knew the symptoms but were not able to assign these to the corresponding mental health condition. Thus, we suggest that police training that sufficiently prepares police officers for requests involving individuals with mental disorders should focus on expanding police officers' knowledge transfer with a focus on a broader variety of mental health conditions that occur frequently in police requests.

Limitations

The present study has certain limitations with regard to the measurement and sample used and these should be considered when interpreting the results. First, the questionnaire was constructed in order to test for certain symptoms of selected mental disorders. When describing symptoms we used a clinical terminology offered by the ICD-10 (WHO, 2015). It is possible that participants were not familiar with these terms which could have resulted in unanswered questions or guessing. Future research should examine which terminology police officers use in their daily routines to describe signs of mental symptoms. Second, we only used a limited number of three to four of the symptoms listed in the ICD-10 to represent each mental disorder, which may have limited the validity of the questionnaire. Additionally, some of the symptoms could exist in multiple types of mental illness even if the ICD-10 suggest a clear distinction. The rationale behind this, was our assumption that police officers in the field may also only use selected indicators to screen for mental health conditions instead of conducting comprehensive diagnostics. Third, the present study did not consider co-occurring mental disorders, however there is a certain amount of individuals that experience multiple diagnoses (Jones and Thomas, 2019). Fourth, the present study comprised a relatively small sample size. We cannot rule out a selection bias, however another recent German study showed comparable sociodemographic characteristics of the police officers sample (Wittmann et al., 2021c). In addition, the sample size is sufficient considering the explorative character of the study. Future research should apply established MHL scales in the field of police work (O'Connor and Casey, 2015) with larger and more representative samples. Further research is needed that examines police officers' abilities to detect if an individual is experiencing active symptoms of a mental health condition in real life encounters as our results are limited to tested knowledge.

CONCLUSION

The results indicate that German police officers have a moderately high overall but distinct knowledge regarding symptoms of specific mental health conditions. Symptoms of paranoid schizophrenia were correctly identified by the majority of the police officers. Police training that aim to prepare for requests involving individuals with mental disorders (e.g., police use of force training) should also include other mental health conditions known to be relevant for police encounters with individuals with mental health problems, such as EUPD, PTSD, manic episodes and depressive episodes. Future research should examine MHL in police officers with more established measures and in more representative samples.

DATA AVAILABILITY STATEMENT

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author.

ETHICS STATEMENT

Ethical review and approval was not required for the study on human participants in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

LW and RP collected the data and performed the analyses. LW, AJ-P, and GG wrote the original draft. LW, AJ-P, GG, and PH contributed to the article. All authors contributed to the article and approved the submitted version.

FUNDING

We acknowledge financial support for Article Publication Charges by Land Schleswig-Holstein within the funding programme Open Access Publikationsfonds.

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Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

frontiers in Education

ORIGINAL RESEARCH
published: 22 November 2021
doi: 10.3389/feduc.2021.731320

Experience, Seniority and Gut Feeling—A Qualitative Examination of How Swedish Police Officers Perceive They Value, Evaluate and Manage Knowledge When Making Decisions

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There is a debate in current scholarship regarding whether or not education and training is an effective tool to change police officers' conduct. Compared to the United States, Sweden has longer training for officers who experience 2 years of academic training and 6 months of practical training. The Swedish police training is also, contrary to the American training, standardized. This paper aims to investigate how Swedish officers value, evaluate and manage knowledge when making decisions. To examine this further 27 qualitative interviews were conducted with 14 male and 13 female Swedish police officers during 2018. The interviews were analyzed using inductive thematic analysis in both English and Swedish to uncover themes and codes. Findings suggest that police officers utilize experience, seniority, and gut feeling when valuing, evaluating and managing knowledge. Furthermore, the results imply that certain types of knowledge are valued differently by officers. These findings can inform how and if education can be used as a tool to potentially change how officers in the US and other countries make their decisions.

Keywords: knowledge, police training, Swedish police, knowledge hierarchy, decision making

OPEN ACCESS

Edited by:
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Specialty section:
This article was submitted to Educational Psychology, a section of the journal Frontiers in Education

Received: *26 June 2021*
Accepted: *01 November 2021*
Published: *22 November 2021*

Citation:
Eliasson M (2021) Experience, Seniority and Gut Feeling—A Qualitative Examination of How Swedish Police Officers Perceive They Value, Evaluate and Manage Knowledge When Making Decisions. Front. Educ. 6:731320. doi: 10.3389/feduc.2021.731320

INTRODUCTION

Police officers make many decisions every day. For example, officers decide what information goes into police reports, which car they should stop in the street, and whom they should arrest. Although many things may guide these decisions, one of the essential factors is knowledge. Thus with the many decisions officers make every day, officers are forced to practice knowledge application, i.e., utilize knowledge to make decisions. Police officers make decisions that impact individuals. Extensive scholarship highlights that officers make biased decisions that negatively impact non-whites (Brunson, 2007; Quinton, 2015; Vito et al., 2017) and stigmatized populations such as individuals with a prior criminal history (Tillyer, 2014). Education and training are some of the tools that are often suggested to try and minimize the biased decisions officers make (Krameddine and Silverstone, 2015). However, empirical evidence provides mixed support for the effectiveness of education to change officers' behavior (Malmin, 2012; Bruns and Bruns, 2015).

To further explore potential educational and training initiatives in the US police, this paper will examine how Swedish officers describe evaluating and managing knowledge. Sweden has a two-and-a-half year-long training that heavily relies on theoretical and academic training to provide officers with extensive academic training. This paper aims to understand how Swedish police officers

describe evaluating if certain knowledge is applicable or not, how officers value different types of knowledge in relation to each other, and how officers manage knowledge when making decisions. The research question guiding this present study is: How is knowledge valued, evaluated, and managed by Swedish police officers? I will answer this question by analyzing 27 semi-structured interviews with Swedish police officers.

Police officers describe knowledge as an essential aspect of the job. However, knowledge comes in different types, according to officers (Eliasson, 2020). For example, officers describe that knowledge can be theoretical and practical (Eliasson, 2020) and to familiarity and experience (Holgersson and Gottschalk, 2008; Holgersson et al., 2008; Karp and Stenmark, 2011). However, there is a gap in the current literature addressing police and their understanding of knowledge (Eliasson, 2020), more specifically studies which address how officers perceive that they manage, navigate and value different types of knowledge. This study can contribute to the gap in current empirical scholarship by further expanding the concept of knowledge and understanding how it is thought of and used by officers. Through this contribution more knowledge can be gained of how educational requirements and pre-employment training will not necessarily be enough to elicit desired behaviors and reduce misconduct/bias.

Furthermore, by understanding how Swedish officers value, evaluate, and manage knowledge, we can learn more about how officers with extensive academic training use knowledge. The implications of these findings can be further discussed in relation to US policing and inform how and if education can be used as a tool to potentially change how officers in the US make their decisions. Thus the findings can inform policymakers and policing organizations of how officers' application of knowledge could be explored to develop strategies best contributing to reforming or changing the police and their practices. Findings can also contribute to sharing knowledge on how police officers make decisions and which actions are needed to change the decision-making process that potentially leads to police misconduct, which, to an extent, reduces the police's legitimacy among civilians.

KNOWLEDGE AND EXPERIENCE

Many notions are considered when officers make decisions; two example are knowledge and experience. While experience and knowledge are terms commonly used, the meaning of these terms is dynamic and can vary depending on the context in which they are discussed (Hoel and Barland, 2020). Although this paper does not aim to discuss how officers understand and perceive knowledge (i.e., Eliasson, 2020), it is essential to understand how concepts such as knowledge and experience are conceptualized.

Experience and knowledge are heavily intertwined and do not operate independently of each other (Dewey, 2005) and should thus not be dichotomized. For example, previous scholars have examined the impact experience and training have on officers' conduct and decision-making and argue that they both can improve the outcome of police use of force (Johnson et al., 2018). More specifically, officers with more experience utilize less verbal and physical force (Paoline and Terrill, 2007), and that shootings involving officers decrease with seniority (McElvain and Kposowa, 2008). However, existing scholarship shows that police officers often think of experiences as having a practical component related to occupational tasks that are learned and conducted in the field. On the other hand, knowledge is often thought of as information obtained through academic or theoretical contexts. (Aas, 2016; Karp and Stenmark, 2011; Eliasson, 2020). Several studies have found that the differences between these two concepts are highlighted when officers discuss what type of expertise they think are the most important in their occupational role (Holgersson et al., 2008; Holgersson and Gottschalk, 2008; Gottschalk and Dean, 2010; Fekjær et al., 2014; Back, 2015).

Experience and knowledge are often studied in relation to specific decisions police make or specific points of conduct. For example, previous studies have examined how experience and knowledge influence the use of force (Johnson et al., 2018; McElvain and Kposowa, 2008; Paoline and Terrill, 2007), perception of performance (Bruns and Bruns, 2015), complaints against officers (Gottschalk and Dean, 2010), and interactions with civilians (Shjarback and White, 2016). Although these studies offer robust and valuable knowledge about the context in which knowledge and experience operate, it is also of value to understand how officers perceive that they navigate knowledge on a more general level. By learning more about how officers perceive that they navigate knowledge and experience in their occupational role on a general level, we can learn more about the attitudes officers have on what skills and information they perceive as valuable while thinking about their profession on a more holistic basis level. Thus, this paper's findings aim to inform the overall understanding of officers' perception of navigating knowledge and experience in their occupational role rather than decisions in a specific context.

POLICE TRAINING

Two of the most suggested efforts to impact police behavior and their decisions are education and training (Chappell and Lanza-Kaduce, 2010; Hallenberg, 2012). Education refers to the schooling that officers have before becoming police officers, such as high school diplomas or college degrees and training refers to the training officers obtain in the academy.

Although some scholars argue that the police profession is a craft that relies on craftsmanship obtained that is not obtained from science (Wilson, 1968), the push for professionalizing the police has drawn attention to the role education, and training has for professionalization and changes in police conduct (Suss and Boulton, 2018).

It is important to highlight that the empirical support for the impact education has on police behavior and changes in behaviors are mixed (Conti and Nolan, 2005, Fekjær et al., 2014; Paterson, 2011). For example, Shjarback and White (2016) found that agencies requiring officers to have an

associate degree before hiring had a lower frequency of citizens' complaints than agencies with only a high school degree. However, no significant findings were found for the number of training hours in the academy, field training, or in-service officers had. Another study finds that highly educated supervisors and trained moderate subordinate officers use high levels of force (Hyeyoung and Lee, 2015). Based on these findings, one can conclude that although empirical findings support that education may have an impact on specific aspects of policing, the extent to which education sufficiently can change or impact officers' conduct is debated.

In addition to education, training is another aspect that is often proposed as a way of changing officers' behavior. However, scholars highlight numerous challenges with the way current officer training is conducted in the US. Thus, scholars have argued for reforming the current police training, changing aspects of existing or introducing new training incentives (Birzer, 2003). For example, scholars argue that police training is a tool to break down barriers against stigmas about mental health and other perceptions officers may have adopted due to inherited norms in police culture (Papazoglou and Andersen, 2014). Thus, officers' training is one of the critical propositions when trying to develop strategies for improving the US police (Haberfeld 2002; Papazoglou and Andersen, 2014) and their relationship with the community (Skogan et al., 2013).

These problems are exemplified through the numerous studies reporting on implicit biases among police, biased decisions against non-whites (Brunson, 2007) and overuse of force and violence. In addition, empirical evidence suggests that the way training, more specifically in the US, is designed today does not change officers' perceptions or behaviors. For example, a study examining academy training's impact on already existing high levels of colorblind racial ideology among police trainees finds no significant changes in the officer's racial perceptions after finishing the academy (Schlosser, 2013). Thus, the current efforts to train officers in diversity and reduce non-biased perceptions about race are insufficient to change already existing negative racial perceptions. Another challenge of the current way police training is conducted in the US is that it is not standardized (Connelly et al., 2019), which means that various officers in various states and even in the same state can have different curricula (Blumberg et al., 2019). In light of not having standardized training, there is a need to understand what effective training is to ensure fair and effective police (Connelly et al., 2019).

Although studies are addressing the benefits of training officers (Hyeyoung and Lee, 2015; Shjarback and White, 2016), scholars argue that the way current training is facilitated in the US does, for example, not reduce or encourage change in offers perceptions on notions such as race and diversity (Schlosser, 2013). Due to the limited aspects of current police training, scholars have suggested a wide range of implementations for changing and reforming officers training in the US, which for example, has included increasing the theoretical aspect of training to complement the already extensive practical training of officers (Blumberg et al., 2019).

Swedish Police Training

During the recent 2 decades, the Swedish police academy has focused on increasing the academic training of officers. During the 1990s, Swedish police training was heavily examined and evaluated to best train officers (Karp and Stenmark, 2011). One of the implications of this examination was that the police training should include more problem-oriented learning and subject integration (Andersson, 2007), which set the guidelines for the reformation of the Swedish police training. Although there have been alterations of the police training in Sweden during the last 2 decades, one of the core aspects of the training is that there should be a theoretical foundation of the tactics and practical knowledge evaluation that officers conduct in their occupation (Adang, 2013).

The current setup of the Swedish police academy is that it consists of 2 years of theoretical training and 6 months of practical training. Thus there is no other formal educational requirement. During the academic portion of the training, trainees take courses that engage with individuals in demanding situations, such as individuals with suicidality and psychological distress (Ghazinour et al., 2019) and take law and social science-oriented classes. The Swedish police training is standardized and is currently offered by five universities in Sweden.

Although evoking a more theoretical training for officers, which aims to better prepare officers for the demanding nature of the occupation, Karp and Stenmark (2011) highlight that newly trained officers are exposed to contradictory forces once entering the field. Although newly trained officers obtain extensive theoretical and practical training, they are subjected to strong professional norms once entering the field. These professional norms are defined by officers working in the field and consist of perceptions, beliefs, and definitions of the knowledge and skills essential for policing. And these professionals' norms do, according to Karp and Stenmark, these professionals' norms impact the way newly graduated officers learn as they come out in the field and have implications for how they will conduct their work later on in their career (Chappell and Piquero, 2004). Thus although Swedish officers receive expensive training in the academy, the socialization and exposure to professionals norms once entering the field can permeate the training they have obtained in the academy.

Current policing scholarship fails to address in-depth how officers discuss knowledge in combination with professional norms. More specifically, scholarship fails to address what officers argue are the most essential and valued knowledge in their profession. This study aims to address this gap in the literature but qualitatively analyze how 27 Swedish police officers describe what knowledge is most valuable in policing and what type of knowledge they use when making professional decisions. By understanding more about how officers manage, evaluate, and value knowledge, we can understand how to develop educational efforts to reduce biased acts and officers' decisions. Thus, the goal is to expand the idea of "knowledge" from theoretical training provided in school and preservice training to experience gained on the job.

MATERIALS AND METHODS

In this study, I conducted 27 semi-structured interviews with Swedish police officers to understand more about officers and their professional knowledge. The data was collected during the spring of 2018 and was conducted by the author, a native Swedish speaker. The Swedish population was chosen for this study because compared to the United States, Sweden has longer training for officers who experience 2 years of academic training and 6 months of practical training. By examining how a country with police training is heavily influenced by academic and theoretical aspects and is centralized, we can learn more about what possible implications these aspects have on officers' attitudes and usage of professional knowledge, which can inform possible efforts to change police training in other countries with less academic training such as the US. This paper is a part of a larger study that focuses on professional attitudes and perceptions of Swedish officers (Eliasson, 2020).

The interviews lasted 30 min to 1.5 h and were conducted at either a police station, the officers' home or the researcher's home. A qualitative semi-structured approach was chosen to study this topic because it allowed the interview to have a conversational structure and allowed the officers to ask questions to the interviewer if there was a need for clarification, the same being for the interviewer and the interviewer respondent.

The respondents were asked a variation of questions regarding different areas of policing. However, the key notions explored in this paper are perceptions of knowledge and how knowledge was perceived to be used by officers when conducting occupational tasks.

The interviews were conducted in Swedish, and I, a native Swedish speaker, then transcribed them in Swedish and translated them into English. Once themes and nuances were created, I compared and contrasted the two analyses made, one in each language, and ensured no language differences or thematic differences in the findings. I recorded the interviews on tape-recorded, and all the officers agreed that their Swedish statement would be transcribed by me and translated to English by me. When translating the verbatim quotes from officers, I made sure to stay as close to the Swedish expressions as possible to increase certain statements' integrity and meanings in Swedish. However, some of the wording I altered to convey the Swedish meanings accurately in English.

The strength of utilizing qualitative methodology in this study is that it captures meanings of notions such as knowledge and information and enables us to understand more about concepts such as knowledge which can be viewed as rather abstract. Specifically, this study provides an insight into the police officers' perception of their occupational tasks and how they use knowledge in their own words (Esterberg, 2002). However, a weakness with using interviews is that the study will not be able to capture the actual behavior of the officers but only can grasp how police officers themselves perceive their knowledge of navigation in their occupation. Thus, the findings in this study will not reflect officers' actual behavior (Denscombe, 2009).

As with every methodology, there is a wide range of limitations using qualitative methods. Specifically, challenges arise with validity and reliability (Esterberg, 2002). In this specific study, several steps were taken to increase the validity of the findings. Firstly the several rounds of analysis and coding conducted on both the Swedish and the English transcripts were done to improve the authenticity and integrity of the data (Denscombe, 2009). Secondly, the study acknowledges that self-reporting could be considered not reliable when discussing specific behavior. However, this study does not aim to study specific behavior but rather to understand how officers describe and perceive their behavior. Thus, although the accuracy of self-reporting can pose an issue, this study's ultimate goal and findings do not focus on actual conduct and specifically highlight the value of self-reporting since it is the perceptions officers describe that are the aspect studies. The study acknowledges at an early stage that the findings are based on self-reporting and do not make statements about officers' actual behavior. Thirdly, several steps were taken to be transparent in the coding and analytical process. For example, a coding book was developed in the initial stages of the coding process to provide a systematic practice for code application. Furthermore, if respondents did not adhere to the belief of the majority or provided non-responses, this is stated throughout the result section, and percent estimates are disclosed to give specific insight into how widely the perceptions were shared across the sample (Esterberg, 2002; Franklin and Ballan, 2001).

Recruitment

I selected participants using snowball (Biernacki and Waldorf, 1981; Handcock and Gile, 2011) and purposeful sampling methods (Emmel, 2013) to recruit respondents. I was intentionally targeting police officers working in the southern region of Sweden because it was geographically possible for me to interview these respondents. After identifying key gatekeepers, they gave me additional information to respondents who they thought would be willing to participate in my study. Thus, the only requirement that I had for respondents was that they were police officers and working in the southern region of Sweden. Thus, the requirement method of this present study reflects a mixed usage of snowball sampling and purposeful sampling.

Sample

I used purposeful snowball sampling to obtain the respondents. Guidelines for determining sample size for qualitative study tend to suggest sample sized ranging from 5 to 50 (Dworkin, 2012). Although there is a wide range of sample sizes in qualitative scholarship which specifically use interviews to examine various aspects of policing, most studies have sample sizes range from 9 to 38 (Brown et al., 2020; Lone et al., 2017; Lumsden, 2017; Reynolds et al., 2018; Rhodes et al., 2006). Despite that sample size have an impact on the finding's generalizability, much qualitative scholarship relies on saturation to determine sample size (Malterud et al., 2016). In this study I chose to use saturation point to determine sample size as suggested by Malterud et al. (2016) and the final samples size of 27 interviews. These 27 interviews fell in the range of suggested sample sizes for qualitative studies (Dworkin, 2012) and the range of sample size in existing qualitative studies examining police officers

(Rhodes et al., 2006; Lone et al., 2017; Lumsden, 2017; Reynolds et al., 2018; Brown et al., 2020).

I interviewed 27 police employees during the spring of 2018, who all worked in Sweden's southern police district. Sweden has seven police districts based on geographical areas in Sweden, including various urban, suburban, and urban areas. The interview sample consists of 52% (n = 14) males and 48% (n = 13) females. The respondents ranged between 27–64 years old, and their experience in the profession ranged between 2 and 40 years.

Both police officers and civil workers are employed by the Swedish police. I aimed to interview an equal number of civil employees and police officers; however, the final sample consisted of 6 civil employees (22%) and 21 police officers (78%). Since the civil employees represent less than 30% of the sample, I do not compare the two groups in the analysis. The justification for including civil workers in this study lies in that they are a curtail part of the Swedish police force and conduct many similar tasks as police officers, such as investigation interaction with defendants and victims. The main difference between police officers and civil employees is that police officers have attended the police academy and civil employees have revived shorter training within the police organization and often have a bachelor's degree from a university. In addition civil employees are not allowed to carry a gun or patrol the streets and instead often work as investigators. Other scholars have highlighted the value of including civil employees when studying the police (Lumsden, 2017). Thus, I included civil employees responses to reflect the true make-up of the Swedish police and because they also have valuable perceptions of occupational knowledge and experiences due to their extensive occupational overlap with police officers. In this paper, the civil police employees will be referred to as "civil workers" when quoted, and police officers will be referred to as "police officers" Furthermore.

Analytical Approach

When all the interviews were collected, they were transcribed and themed using an inductive thematic analysis to identify how police employees assess victims and victimization. A thematic analysis was chosen as the analytic strategy because it highlights broader trends in the data and can emphasize nuances within the themes and trends. The inductive thematic analysis highlights themes related to the data and not any theoretical or previous empirical assumptions or trends. This choice was motivated because there is no goal to hypostasis testing nor prove a theory right or wrong. Thus, the key aspect of thematic analysis is identifying patterns in data.

The analytic process of this study is similar to the six analytical steps described by Braun and Clarke (2013). The first phase involved familiarizing with the data, including reading transcripts and listening to the interviews three times. During the second phase, the transcripts were read a fourth time and general codes were produced describing their training, how they perform occupational tasks and their perception of occupational knowledge and their role as officers. During the third and fourth phase, themes were generated based on the codes developed in phase two, and these themes were reviewed in relation to both the Swedish and English versions of the transcripts. During the fifth phase, the themes were defined and contextualized regarding how officers perceived knowledge they use in an occupational context. During this phase, the themes of knowledge hierarchy and mechanisms navigating knowledge such as gut feeling were developed. Finally, the codes and themes were categorized and developed during the sixth and final phase until saturation was reached.

RESULTS

This study aimed to understand how Swedish police officers value and manage knowledge in an occupational context. By learning more about how officers value, evaluate and manage knowledge, we can learn more about how officers make decisions and what factors impact their conduct. This result section will describe officers' perception of knowledge in relation to occupational tasks, decision-making, and assessments in their daily work. The three major themes that emerged through an inductive thematic analysis were individual experience, seniority, and gut feeling. Experience was discussed from an individual perspective which highlights how officers use experiences they have gained personally, experience that is shared from other colleagues, which is often accompanied and associated with seniority and gut feeling which officers used to navigate the various types of knowledge they have when making decisions.

PERSONAL EXPERIENTIAL KNOWLEDGE

The most discussed aspect of how Swedish officers make decisions was experience, which was in one way or another mentioned by all 27 officers interviewed. When asked how they made decisions in their job, almost all officers responded by stating "experience." For example, one officer said, "Experience, experience, experience. You build your experiences from situations, so when you are put in front of a new situation, you relate to the old stuff you have been through" (*Male, 44 years old, Patrol, 9 years of experience*). As this officer highlights, in line with other officers, experience is perceived as essential when conducting police work. However, experiences were not only discussed in regard to what officers experience in the field but also that experience provides a reference for familiarity to situations and decisions that officers face on duty. Officers further explain experience as something that accumulates over time, and it provides them with a tool to assess situations they encounter in the field. For example, a female officer explained that her previous experience at crime scenes gives her something to compare current situations to:

> Some things you can see are not right...you notice that a person is lying. A burglary, for example... It is extremely unusual that it happens in an apartment... It does not look like it should look like with burglaries, cash and another lot of expensive valuables is stolen, but you see that this is not what a burglary looks like, and you have

> been on 1,000 burglaries... It is more like "here is how someone else thinks a burglary looks like," but you know based on your experiences that the story is not true. It does not fit together. *Female, 34 years old, Patrol, 4 years of experience.*

The officers explain that if a situation she faced did not align with her previous experience, it was an indication that something may be "wrong" or "incorrect" in the situation she is facing. Thus, the knowledge she acquires through previous experiences informs her decisions in the field later on in her career. Approximately 70% of the officers discuss similar scenarios, where prior knowledge provides a "framework," which they rely on when navigating how to handle situations they face. However, officers highlight that although that knowledge from previous experiences is essential to how they make decisions, it is essential to critically evaluate their own experiences and remember that the knowledge they gain from previous experiences is not objective. One officer explains:

You have a certain set of prejudices with you, which is based on your work experiences . . . however, my experiences are not empirically tested. Let us say; If I have stopped 20 people last week and they all turn out to be Romani—then the experience says...what does it say? Is it random or a pattern . . . that perhaps some groups of Romani are more criminal? If you just presented it straight up—then it is a prejudice. It is not empirically tested, not facts. But it is an experience . . . you have to have a critical attitude to your own experiences. Then you have the laws and the rules and what we also apply. *Male, 32 years old, Patrol and Investigator, 4 and half years of experience.*

As the officer highlights, although experience is one of the most emphasized aspects of navigating decision-making, it is essential to be aware that experience is subjective and needs to be evaluated critically. According to the officers, one way to be critical is to differentiate between personal experience and personal occupational experience. Many of them express that although occupational experience is the direct experience that impacts their decisions, personal experience is also present.

> You always have your own opinion, I think it has to do with what you have for background in general . . . if you become a police officer, if you have done something else before and have more life experience in general... I think that is positive. *Male, 42 years old, Patrol 9 years of experience.*

Personal experience does not, according to the officers, have to be obtained through their occupation but can be based on events in their private life or life before becoming an officer, while personal occupational knowledge refers to the knowledge officers acquire while on duty. Having a critical mindset towards where the experience comes from is evaluating the experiential knowledge. Thus, what emerged from the interviews was an inherent perception of personal experience being valued lower than occupational experience, potentially due to the desired perception of maintaining a sense of professionalism.

KNOWLEDGE FORM COLLEAGUES

The shared experience was contrasted against personal experience, in two ways, the first was that it is used as a tool to evaluate the individual experience. Thus, a way officers express critical evaluation of their own experiential knowledge was by explaining the importance of colleagues' experience, specifically how colleagues' experiential knowledge is used as a reference and their own personal occupational experience. This reference process reflected either a confirmation of officers' own knowledge or was used as a guideline when their own knowledge was not enough.

> Within the police, police experiences are always the most important experience. Which I do not agree with . . . you have the (personal) experience, and you have it with you. However, one should not forget that it is good to get some other inputs to . . . an older colleague's experience usually weighs quite heavily, but one should not follow it blindly. *Male, 42 years old, Patrol 9 years of experience.*

The second function of shared experiences one it acted as a source of knowledge when there was no or a lack of personal knowledge highlighting that knowledge is shared between colleagues. One officer stated: "It is partly learning by doing, it goes from colleague to colleague. You check how others handle things, of course also legal texts, how they should be handled" (*Female, 29 years old, Patrol and Investigator, 3 years of experience*). All of the officers spoke about how important learning from colleagues is when working as police officers, from the early days as new officers and later on during their career. Officers spoke about this shared experiential knowledge as something that, together with the personal experiential knowledge, is higher valued than personal experiential knowledge in isolation. Thus, it was evident that shared knowledge, combined with personal occupational knowledge, is more important than singular personal knowledge from one officer.

THE "IDEAL KNOWLEDGE"

Although shared experiential knowledge combined with personal experiential knowledge is valued high among the officers, one type of knowledge seems to be valued higher. Experiential knowledge from senior officers with several years on the job is often seen as the most desirable knowledge and overrides other types of knowledge. All officers express that knowledge from more senior colleagues reflecting their experience impacts how they navigate making decisions when they do not know how to solve a situation. One officer states: "You rely on an older colleague" (*Male, 42 years old, Patrol, 9 years of experience*). Knowledge and experience from senior colleagues are perceived by officers as important throughout different stages of their careers as officers. However, senior colleagues'

experiences and knowledge are essential when navigating decisions as a new officer.

> You learn from the people who have worked longer. That is how it works most smoothly. When you see positive things from someone who has worked for a while, you take it with you and try to do the same. Although no situation you face is the same, one tries for example, it can be that a person (senior colleague) usually tells a special joke in a situation, and it works, then I also tell that joke. There are such little things and bigger things. How to handle security in certain situations and so on... *Female, 34 years old, Patrol, 4 years of experience.*

There are several aspects of senior colleagues' experience that other officers can utilize. For example, jokes or jargon may be used to light up the officers' interactions. Officers also explain that it is not only the seniority of knowledge that impacts how they make decisions. They note that the law is essential when navigating occupational decisions.

> Some work tasks were (learned) through officers through practical exercises. There is much focus on legal support and paragraphs, but you must know what (goals) you are working towards. You learn by hand from other colleagues. *Female, 38 years old, Investigator, 8 years of experience.*

However, as seen in previous empirical work (Eliasson, 2020), officers differ between theoretical and practical knowledge and value practical knowledge based on experience higher than theoretical knowledge. Almost all Swedish officers highlighted that experience impacted their decisions, but only a few officers expressed that the law affected their decisions. One officer stated: "Through older colleagues . . . mostly. One had to be legally clear on what I had to do and not. The practicalities I got from older colleagues showing me" (*Male, 42 Years old, Patrol, 17 years of experience*). Although both "sources" of knowledge may impact decision-making, Swedish officers frequently discuss experience as more essential than the law in policing.

As the interviews went on, there seems to be an unspoken rule that reinforced senior knowledge as the most influential and valued knowledge. This unspoken rule suggests that the occupational hierarchy reinforces the idea that certain types of knowledge, specifically senior colleagues' experiential knowledge, are the most valuable knowledge. One officer stated:

> In the police, it has always been that the younger ones (officers) should know their place and "follow the line." It has changed, but it still exists . . . It used to be more, but sometimes you could hear when you make suggestions—"no, we have always done it like this, and therefore it will continue." But then there are colleagues who are open to listening—and say, "good, why I did not think of that." But it is not always easy to get new ways of thinking implemented. *Female, 34 years old, Patrol, 4 years of experience.*

In line with a few others, this officer expresses a hierarchy in relation to occupational rank and dynamics between officers, which has implications for officers' decision-making. Close to 40% of the officers express that seniority impacts decision-making when patrolling with a more senior colleague. This seems to reflect an unspoken professional norm that reflects "how things are done" will continue to be done, this was further reinforced by a senior officer. The senior officer expresses that now when he is the more senior colleague, he is expected to take on a specific role as teaching others and be a point of guidance, which he used to have someone else be for him.

> Now I have become this older colleague, so now, when they come back completely new, I have the responsibility to take care of the new, the same way that I have been treated . . . *Male, 42 years old, Patrol, 17 years of experience.*

Thus, seniority is recognized by younger officers who learn from more senior officers, but it is also acknowledged by senior officers who become expected to carry on the legacy of teaching and guiding newer officers.

Overall, officers regard knowledge coming from more senior colleagues as one of the ultimate impactors of their decisions. The officers highlight that it is the word of an older colleague that is valued highly and a part of the organizational structure and is used when teaching new officers how to conduct their job. This finding is important because it highlights that specific knowledge is valued higher and alludes to how knowledge is valued, evaluated, and managed according to professional norms within the police. The police's professional norms and structure contribute to the way knowledge is valued, evaluated, and managed by officers by providing them with spoken and unspoken rules saying that knowledge from more senior officers is considered very valuable along with knowledge from other colleagues combined with knowledge from other colleagues personal experiential knowledge.

GUT FEELING—A TOOL TO NAVIGATE EXPERIENCE AND KNOWLEDGE

The third and final aspect of valuing, evaluating, and managing knowledge is gut feeling which officers describe as a tool that officers express using when deciding what type of knowledge to draw from. Although the officers express that experience was essential and that the most valued experiential knowledge came from senior colleagues, they all note that the ultimate tool they use when deciding what to do is gut feeling. Gut feeling helps them manage what type of knowledge they decide to use, i.e., their own experience, more senior colleagues, or legal paragraphs.

When explaining what gut feeling is, many officers show difficulty describing it in one word. They explain that gut feeling is not one thing but rather something generated from

multiple factors, which creates a "sense" or a "feeling." One officer says: "You get a gut feeling...It is an experience you bring with you. Knowledge about people, meetings with people, you build it up" (*Male, 44 years old, patrol, 9 years of experience*). This officer highlights how the gut feeling in his eyes is not coming from one specific thing but rather from experiences in the field and meetings with people. Officers then carry this with them from situation to situation and the gut feeling further develops every time an officer encounters a situation. When asked to explain or define what a gut feeling was, one officer replied:

> You get a certain gut feeling. I would say that in most cases, it is a gut feeling. When we choose to stop a car, why do we choose to stop a specific car and not another . . . I think it has to do with experience, and then it becomes unconscious knowledge, so I think that you look at certain patterns...you see what does not belong with the norm and the usual. I think you get better at discovering such stuff. *Male, 42 years old, Patrol, 9 years of experience*.

Several officers talk about gut feeling as a vessel that manages the various kinds of knowledge the officers have. As they face situations in the field, the knowledge from experience builds up a gut feeling used by the officers to manage how to decide in a certain situation. Two officers explain the process further:

> It comes from the spine, stomach, and chest at once. I feel that something is wrong. It is often right. This is true when someone says something that is not the truth. It is not true, it does not add up . . . It is the experience, when something is correct, then it feels correct, and it is very often right . . . the evidence speaks the whole time . . . but it is often that the gut feeling is right. But equally, when we feel that something is not right and we investigate, but we find no evidence in phones and computers when we go through. *Male, 42 years old, Investigator, 18 years of experience*.

> A lot is gut feeling, it is this feeling one gets. Sometimes it can be wrong, and sometimes it can be right. But it is also a lot that you write and report . . . but partly the gut feeling... *Female, 29 years old, Patrol and Investigator, 3 years of experience*.

These officers explain how gut feeling is related to experience and knowledge, impacting how they make their decisions and conduct. The experienced officers obtain a foundation that creates a gut feeling that is later used in other situations. This process can be argued to permeate what actions the officers take in a certain context or situation. The gut feeling becomes an inner tool for the officers to use to manage and apply knowledge before they act.

Altogether, it is essential to note that the gut feeling and experience should be viewed as tools that work independently or in a vacuum. They are not notions that are not impacted by external factors, such as organizational norms. Thus, the way officers manage what knowledge to use when making a decision is heavily affected by the norms implemented within the police force, which is supported by previous empirical findings (Karp and Stenmark, 2011). More specifically, the norms reinforce the phenomenon that certain knowledge is valued higher and should be valued higher. However, using officers' perception and doing an inductive exploration of how knowledge is valued, this study cannot assert that one factor has a higher numerical impact than the others but instead describes the themes and aspects that emerged when talking to the officers.

DISCUSSION

This study's major finding suggests that officers perceive experience, seniority, and gut feeling to be influential when valuing, evaluating and managing knowledge. For example, while explaining how they make assessments or make decisions, many officers use the word "experience" to derive where their knowledge originates from. In addition to this, many officers use the term "gut feeling" when describing how they make certain decisions. The third and final finding suggests a hierarchical evaluation of knowledge, mostly related to the type and quantity of knowledge a police officer has. For example, the knowledge that seems to be valued highest in the knowledge stems from policing experience and not theoretical training (Eliasson, 2020). However, the more policing experience someone has, the more respected they are by other police officers and the more that experience is considered important by the other officers. These findings reflect and further expand on other empirical findings related to police and occupational knowledge, highlighting the importance of practical knowledge (Holgersson et al., 2008; Holgersson and Gottschalk, 2008; Gottschalk and Dean, 2010).

However, the in-depth exploration provided in this paper of how officers' knowledge perceptions give a broader understanding of how police officers, according to themselves, make decisions, value, and manage knowledge. Based on the findings in this paper, a process related to how knowledge is valued and managed by police officers emerges. This process consists of professional norms that reinforce how individual officers and the organization value occupational knowledge. The police's occupational norms create a "knowledge hierarchy" or "knowledge cycle," where knowledge from senior officers is valued the highest within the police force.

When analyzing the hierarchical knowledge evaluation further, the findings in this study alludes to that aspects of the hierarchy's evaluation are based on that knowledge is categorized by officers (Eliasson, 2020). The knowledge generated through peer modeling in the field is viewed as more desirable by the police. This knowledge's key factors are that it is more related to practical and experiential knowledge, and officers learn it from senior colleagues who inhabit extensive occupational knowledge.

This paper's findings contribute to an analytical suggestion of this knowledge cycle that can be interpreted as regenerative.

Almost all officers value the importance of learning from other police officers. However, what could be considered a significant finding in this data is that more senior officers have an essential role in the learning process. Suggesting that although other officers impact their learning, there is a special meaning attached to learning from more senior officers and can imply that certain relationships' may be meaningful than others when learning. The practical implications of these findings are that senior officers may be most in need of post-employment training since they are such important role models or that formal mentoring programs may be needed to formalize this passing on of the knowledge from senior officers. Thus, these findings imply that it is essential to involve senior colleagues in the training initiatives to change police behavior.

However, this paper offers additional knowledge and how it is valued and managed by officers. According to the officers, senior officers' knowledge is more desirable because senior officers manifest "ideal" knowledge in the knowledge hierarchy. There is a specific meaning attached to the hierarchy between younger officers and senior officers created by police norms. The senior officers become meaningful because the police organization's norms reinforce the value of senior knowledge and become an essential product of reinforcing the importance of senior knowledge. Thus, senior officers have desirable knowledge and teach new police officers that the senior knowledge should be valued highly according to the organizational norms, thus creating a cycle. The importance of seniority withing the police if something that has been highlighted by several previous empirical studies (Hoel and Barland, 2020; King, 2005; Karp and Stenmark, 2011).

The findings of this study specifically contribute to the existing scholarship by highlighting the various nuances of how knowledge is navigated by for example highlight the ties to organizational norms which are confirmed by other policing scholars which discuss organizational norms and police conduct (Andersson, 2007; Chappell and Lanza-Kaduce, 2010; Karp and Stenmark, 2011; Lone et al., 2017). The organizational norms that power the knowledge hierarchy can be explained as a semi-hidden structure embedded within the police organization. This paper's findings, supported by Eliasson (2020) findings, argue a certain type of knowledge being viewed as more desirable because it is passed down from one officer to another. Hence the meaningfulness of differentiation between different kinds of knowledge is passed down generationally in the occupational context by more senior officers and learned by new officers. Since the desired notions, such as experience and gut feeling, according to officers developed through experience, the more senior officers become teachers because they have what is considered the desired by the knowledge hierarchy. However, they also become important actors that generate the notions of what is desired based on the fact that they are the teachers.

All officers acknowledge that training and learning take place early on in their careers as officers. However, they make a clear distinction between the knowledge they associate with the academy and the knowledge they learn from other more senior officers in the field which is highlighted by previous findings (Eliasson, 2020; Hoel and Dillern, 2021). This distinction becomes important because it results from the knowledge hierarchy that they have experienced as police officers. Hence, many officers associate the knowledge learned during the training in the field by senior officers as more desirable than prior education or training because of what seems to be an organizational invoked belief of what should be more desirable. Consequently, a regenerating cycle powers the police's knowledge hierarchy, making experiential knowledge passed down by more senior officers and what is considered the most desirable, which emphasize the impact of the organizational structure of the police (King, 2005).

This study's findings imply that changing the way officers apply knowledge when making decisions is not only related to educating individual officers or exposing individual officers to experiential knowledge highlighting change, which is a notion that have been discussed by scholars examining the effectiveness and impact of police training and education (Haberfeld, 2002; Conti and Nolan, 2005; Karp and Stenmark, 2011; Paterson, 2011; Aas, 2016; Connelly et al., 2019; Hoel and Dillern, 2021). The findings contribute to and reaffirms the current scholarship by finding that the application of knowledge conducted by officers is highly related to organizational and occupational norms within the police, which reinforces and regenerates the value hierarchy of knowledge. These norms are central aspects of making changes within the police on how information is valued, evaluated and managed when making decisions that could lead to differential treatment or misconduct. Thus, only introducing more training or changing the current training of officers may not have the desired impact on changing officers' behavior since it does not address the professional norms, which, according to officers, are highly influential on their occupational conduct.

Overall the findings in this paper contribute to international scholarship that examines policing by highlighting how Swedish police employees perceive themselves as navigating knowledge. Many existing studies specifically examine how Scandinavian police officers navigate various aspects of their job and how training, education, and experience impact their professional conduct (Karp and Stenmark, 2011; Adang, 2013; Lone et al., 2017; Hoel, 2019; Hoel and Barland, 2020; Hoel and Dillern, 2021). This paper contributes explicitly to this scholarship by describing how officers perceive themselves navigating decisions made in an occupational context and situates this knowledge navigation within existing social, organizational, and power relationships within the police force.

Based on the findings in this paper, policy suggestions that aim to change police officers' occupational decision-making and conduct also need to focus on changing the professional norms within the police organizations. Since the findings in this paper and previous research show that the time officers spend with colleagues, especially more senior colleagues, are highly influential on the officers' conduct, it is essential to address the occupational norms that officers collectively abide by. By specifically addressing the existing occupational norms and encouraging independent critical thinking, new officers can question the existing norms or learn how to navigate the existing power structure which exists within the police and impacts the occupational norms. Thus, education and training

could encourage critical reflection among individual officers and further involve senior officers in education and training initiatives.

Additionally police makers could specifically focus on how to further incorporate their theoretical and academic training efforts in more interactive learning environments. The findings in this study highlight that current policy efforts which incorporate theoretical or academic knowledge to change police officers conduct may be informed by incorporation of more interactive teaching methodologies. By using interaction methodologies that reflect practical learning yet inserting theoretical knowledge in practical settings police officers' perceptions of theoretical or academic knowledge could potentially be dismantled.

This study has limitations; firstly, this study can only account for the perceived ways in which knowledge is applied. Thus the findings do not attest to how officers actually manage knowledge when they make a decision. Although this is a limitation of the study, there is still value to understanding how officers perceive themselves valuing, managing and navigating knowledge because it gives an insight into how officers themselves perceive knowledge. This insight can contribute to broadening the understanding of how knowledge is conceptualized within the police. Secondly, findings are based on 27 interviews which offer challenges for extensive generalizability of the results. However, this limitation is present in many qualitative studies. Finally, although the sample size is a limitation, the interviews were conducted until saturation was reached, suggesting that the emerging themes are relevant for a larger population beyond the sample size.

In light of the findings in this study, future research should focus on understanding how experience could be incorporated into current police training and how mentorship could be further integrated into the academy training of officers. Furthermore, research should also examine the effects of standardized training of officers in contrast to non-standardized training to understand what type of training is more efficient to ensure effective police conduct and non-biased decision-making.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusion of this article will be made available by the author, without undue reservation.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by the IRB. Written informed consent for participation was not required for this study in accordance with the national legislation and the institutional requirements.

AUTHOR CONTRIBUTIONS

The author confirms being the sole contributor of this work and has approved it for publication.

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Conflict of Interest: The author declares that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

frontiers in Education

CONCEPTUAL ANALYSIS
published: 07 January 2022
doi: 10.3389/feduc.2021.796765

Changing Police Personal Safety Training Using Scenario-Based-Training: A Critical Analysis of the 'Dilemmas of Practice' Impacting Change

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This paper outlines an analysis of using Scenario-Based-Training (SBT) to change officer Personal Safety Training (PST) based on existing research evidence and reflections from supporting a National Police Agency attempting to change PST practice. SBT is interrogated in light of its underlying assumptions and situated within the ambiguities, tensions and compromises inherent within police training cultures. Using Windschitl's framework of conceptual, pedagogical, cultural, and political dilemmas this paper analyses the forces impacting using SBT to change PST. An alternative agenda for change is presented to develop skilled officers and trainers equipped with innovative pedagogies to 're-culture' PST.

Keywords: scenario-based-training, police training, officer safety, use-of-force, practice issues

OPEN ACCESS

Edited by:
Mario S. Staller, University of Applied Sciences for Police and Public Administration in North Rhine-Westphalia, Germany

Reviewed by:
Oliver Bertram, Bundeskriminalamt, Germany
Louise Porter, Griffith University, Australia

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Specialty section:
This article was submitted to Educational Psychology, a section of the journal Frontiers in Education

Received: *17 October 2021*
Accepted: *13 December 2021*
Published: *07 January 2022*

Citation:
Cushion C (2022) Changing Police Personal Safety Training Using Scenario-Based-Training: A Critical Analysis of the 'Dilemmas of Practice' Impacting Change. Front. Educ. 6:796765. doi: 10.3389/feduc.2021.796765

INTRODUCTION

Police officers deal with potentially dangerous or violent encounters daily (Rajakaruna et al., 2017), in some cases necessitating the use of force (Di Nota and Huhta, 2019). Use of force decisions remain a source of concern for the police and the public (Andersen and Gustafsberg, 2016; Cushion, 2020; Todak and James, 2018; *inter-alia*). To deal with volatile and violent encounters that present "complex, multi-faceted and sometimes subtle problems' (Waddington et al., 2006, p. 182), police officers are trained in arrest and self-defence skills—known in the United Kingdom as Personal Safety Training (PST). However, PST has been subject to criticism in terms of content, delivery, and effectiveness (Waddington et al., 2006; Renden et al., 2015b; Cushion, 2020), with recognition that this training needs to be 'overhauled' (College of Policing 2020). Rather than specific techniques or 'system', the 'what' of PST, this paper focusses on the 'how', or pedagogy, which currently aligns with a 'traditional' model of police training (cf. Cushion, 2020). This is "a behavioral and militaristic model of training rooted in obsolete and counter-productive practices long ago abandoned by educators and other occupational and professional communities" (Cleveland and Saville, 2007, p. 3) that is recognizable in the United Kingdom and internationally. A training model that, arguably, does not develop perception, judgement, decision-making, critical thinking, or competence (cf. Rajakaruna et al., 2017). An 'overhaul' of PST in the England and Wales has provided an opportunity to improve the 'traditional' delivery of police training and explore alternative pedagogical approaches to deliver innovation to police training systems that can have impact for policing that involves 'police-citizen' encounters (cf. Wolfe et al., 2019).

The use of Scenario-Based-Training (SBT) pedagogies in police, military and other practice domains is not new (e.g., Birzer and Tannehill, 2001; Birzer, 2003; McCoy, 2006; Cleveland and Saville, 2007; Alison et al., 2013) and in police training SBT has established itself (e.g., Renden et al., 2015; Di Nota and Huhta 2019; Preddy et al., 2019), with Di Nota and Huhta (2019) referring to SBT as the "gold standard for complex motor learning for police" (p. 10). While establishing a toehold (cf. Werth, 2011; Rajakaruna et al., 2017; Bennell et al., 2020), there remain several issues with SBT's adequacy, implementation, and development (cf. Rajakaruna et al., 2017). Indeed Rajakaruna et al. (2017) point out that although Scenario-Based Training aims to enable officers to develop their skills in perception, judgement, and decision-making reviews of training demonstrate inadequacies in the way that training is delivered (e.g., Clarke and Armstrong, 2012; Morrison and Garner, 2011; Rostker et al., 2008). For example, time spent in scenarios is limited, instructors fail to provide feedback on officer performance and fail to demonstrate what constitutes effective performance (Rajakaruna et al. (2017)–in the case of the current research, these training issues are exacerbated when SBT is misunderstood, misapplied, and conceptualised within existing training frameworks–all issues explored in greater detail through the dilemmas framework.

Implementing changes to PST using SBT requires changes to current training, including acquiring new skills for officers and trainers, as well as understanding and making personal sense of learning; aligning the culture of police training with an alternative training philosophy; and dealing with the widely reported tradition and conservatism that has can work against and resist efforts to change (e.g., Karp and Stenmark, 2011; Werth, 2011; Basham, 2014; Wolfe et al., 2019; Belur et al., 2020; Shipton, 2020). No literature systematically examines the challenges faced in changing PST in the United Kingdom and little addresses these issues internationally when using innovative training practices, particularly SBT as a pedagogical approach. Research specifically considering PST (e.g., Buttle, 2007; Cushion, 2020) in the United Kingdom has not explored the articulations between police trainers, conceptual understandings, pedagogical practices, and the wider cultural and political realities of police training.

Using Windshcitl's (2002) framework of 'practice dilemmas' to build an analysis, this paper draws on existing police research in use-of-force training and SBT from the United Kingdom, Europe, North America and Australia. This is in addition to drawing on our experiences of supporting a national initiative across 43 police forces in England and Wales to change the PST curriculum and the 'train-the-trainer' training. The research does not focus on the local issues of a particular cohort of police *trainers* but looks across PST *training* more broadly in terms of research and practice. Analysing training practice, and the implementation of change, represents something of the ambiguities, contradictions and compromises of the endeavor. In this sense, 'dilemmas' (Windshitl, 2002) are aspects of trainers' (and our) experiences that impact the realization of SBT and changes to PST. The significance of this work lies in providing an analytical framework for considering critically trainers' practice and the issues impacting the implementation of SBT, offering the means through which trainers and trainer educators can examine their practice critically. Used as a heuristic, the analysis raises questions for practitioners to interrogate their own beliefs and pedagogy, conceptualize the wider social forces impacting practice, while providing signposting for policy makers to an alternative agenda for PST, trainer education and development.

BACKGROUND: PERSONAL SAFETY TRAINING, LEARNING AND SCENARIO-BASED-TRAINING

Before considering the dilemmas framework, it is worthwhile discussing something of learning, SBT and PST. There are different ways of understanding learning and these frame theories, models, and subsequent training practice. Recognising this means that what Windshcitl (2002) describes as 'intellectual anchors' are needed by academics and trainers to support thinking about police training (cf. Werth, 2011). Despite calls to structure police training according to 'adult learning principles' (e.g., recognising previous experience and knowledge, active involvement in the learning process) from evaluation studies and systematic reviews (e.g., Belur et al., 2020; Lettic, 2016; Jenkins et al., 2020; Rosenbaum and Lawrence, 2017; Shipton, 2020; Werth, 2011; *inter-alia*) current PST practice and pedagogy characterizes learning as 'procedural motor learning' or 'skill acquisition' (e.g., Renden et al., 2015a; Di Nota and Huhta 2019; O'Neil et al., 2019). Thinking about training this way carries underlying assumptions about learning, with a functionalist, individual and behavioural focus construed as an unproblematic process of transmission and assimilation. As Di Nota and Huhta, (2019), and O'Neil et al. (2019) *inter-alia* argue, this simplistic, linear view separates operational conditions and training, assuming officers are empty vessels to be filled, and trainers transmit training as a neutral media that delivers a prescribed and standardized 'curriculum' or 'toolbox'.

This conceptualization has created a dominant training paradigm for PST. Research evaluating use-of-force training (e.g., (Koedijk et al., 2019; Cushion, 2020; Staller et al., 2021), shows that officers tend to train isolated skills and techniques first, repeating repetitions of one technique at a time practiced in pairs, before moving on to practice another isolated skill–with Cushion (2020) showing that this type of training form often accounts for the largest proportion of activity in United Kingdom PST. Contemporary learning research and understanding (e.g., Soderstrom and Bjork, 2015) and research examining police training (e.g., Staller and Koerner, 2019) have challenged the assumptions of this approach. First, that 'isolation' of parts only to integrate them later in a more complex movement, or isolating the movement from the operational context, has met with criticism from evaluation studies with regards to transfer (e.g., Jager et al., 2013; Renden et al., 2014; Renden et al., 2015a; Renden et al., 2015b; Staller and Koerner, 2019). Framing isolated practices at the beginning of training dis-integrates the training, resulting in techniques being decoupled from

decision-making and context. Research into learning (Soderstrom and Bjork, 2015) suggests such an approach may result in improvement in some performance in the immediate and short-term. However, performance gains fool trainers and learners that learning has taken place, and in police training can create powerful illusions of competence (cf. Cushion, 2020). Hence this training mode is appealing as rewards can seem to be gained immediately, reinforcing perceptions of 'effective' training. However, changes in short-term performance bear no relationship to long-term learning and transfer (Soderstrom and Bjork, 2015). Ultimately officer performance will decrease, and this has been shown to particularly be the case when training has been tested through encountering difficult and stressful conditions (Andersen and Gustafsberg, 2016; Renden et al., 2014; Renden et al., 2015a; Renden et al., 2015b). Indeed, evidence evaluating police training shows that under threatening conditions, police officer's performance decreases as training is insufficient to inhibit stimulus-driven reactions (fear of getting hit) and avoidance behaviours (Renden et al., 2014; Andersen and Gustafsberg, 2016; Cushion, 2020).

A linear or modular approach that positions techniques/skills first often results in 'end-on-end' or 'blocked' practice; reviews and evaluation studies have shown training in this way is a significant consumer, or even a waste, of training time (O'Neil et al., 2019; Bennell et al., 2020; Cushion, 2020; Staller et al., 2021). Learning requires direct and successful contact with appropriate learning tasks (Carpenter et al., 2012; Cushion, 2020) providing task engagement. If the task is too easy or too difficult, engagement will be insufficient for learning. Indeed, previous PST research (cf. Cushion, 2020; Jager et al., 2013; Renden et al., 2014, 2015b) suggests a combination of low level of engaged activity, limited number of repetitions, and ecologically weak practice conditions (lack of realism) make it less likely that police officers will perform under pressure. Learners need to accumulate experience by performing skills under complicated and realistic circumstances (cf. Andersen and Gustafsberg, 2016; Staller and Koerner, 2019). Further, in addition to 'time on task', the type of practice activities is key, with repeated experiential and reality-based practice linked to performing more effectively in use of force situations (e.g., Broome, 2011; Murray, 2004; Staller and Zaiser, 2015; Hine et al., 2018 *inter-alia*). Indeed, SBT has been shown to improve officer performance under pressure (e.g., Hulsof and Spapens, 2014; Renden et al., 2015b) and high-fidelity (i.e., realistic) scenarios should be included in integrated de-escalation and use-of-force training (Rajakaruna et al., 2017; Staller and Koerner, 2019; Bennell et al., 2020).

SBT is a broad conceptualization of training concerned with the authentic, safe replication of the characteristics of the operational environment (Alison et al., 2013; Wollert and Quail, 2018; Jenkins et al., 2020). Research (e.g., Wheller and Morris, 2010; Wheller et al., 2013; Miller and Alexandrou, 2016) shows that 'modelling behaviours' through SBT is more likely to impact 'street-level' officer behaviour and can improve 'traditional' delivery of police training. SBT is a holistic training approach that when delivered in an authentic and consistent manner encourages learner-centred training when tactics, decision-making and problem-solving are critical (Birzer and Tannehill, 2001; Birzer, 2003; McCoy, 2006; Cleveland and Saville, 2007; Werth, 2011; Rajakaruna et al., 2017). Indeed, reviews (e.g., Jenkins et al., 2020) and empirical research (e.g., Andersen et al., 2016) have shown that SBT when mapped onto the operational environment replicate 'real life' conditions and is effective in transferring technique and decision-making. Therefore, SBT develops decision-making under pressure as every practice attempt requires the learner to read the situation [people (self, colleagues, subject(s)); deal with variability (transitions, stages of escalation/ratios); and be aware of their environment (stability/variability)].

Authentic SBT is a conceptual approach, based on concepts, tactics and strategies rather than skill. The pedagogical focus switching to increasingly complex 'whole' scenarios/situations (i.e., radio-call to event resolution) (cf. Rajakaruna et al., 2017; Jenkins et al., 2020). In other words, scenarios are practiced in simplified and modified forms initially, while retaining the integrity or 'realism' of the practice conditions. The degree of simplification is led by officer skill level (Wickens et al., 2013; Bennell et al., 2020), and modification principles are used to reduce the demands on the learner, while being appropriate to skill level (Wickens et al., 2013; Jenkins et al., 2020), highlighting *through* the scenario what is important to learn. Isolated skill development is utilized but not isolated or front loaded before taking part in a scenario. Instead, the scenario retains 'perception and decision making' so the learner understands when and why the skill is needed. Thus, cognitive development through decision-making and tactical exploration are combined with skill-development and knowledge-development, and advanced together in meaningful and realistic practice - progressed together in-context does not leave these connections to be made by the learner. This understanding provides motivation for learners, something often eroded by isolated skill development.

ANALYTICAL FRAMEWORK: DILEMMAS

Applying Windschitl's framework of dilemmas (conceptual, pedagogical, cultural and political) enables a viewing of the trainer, officer, contexts and their learning as inextricably inter-related. This provides a lens to investigate PST and SBT as constructed and embedded within training contexts. The four-part model acts as a heuristic, moving from the individual trainer (personal and intellectual) to more abstract views of training, and the application of SBT in practice from a broader police organization and cultural/historical perspective (social and structural) (Windschitl, 2002; Cushion, 2013). This enables critical questions to be asked about trainers' beliefs and practices while understanding contextual and wider social forces. Importantly, Windschitl (2002) argues that the four dimensions capture the challenges in practice environments; the failure to attend to any one of the dimensions can compromise or doom attempts to implement "progressive pedagogies...(where)...addressing each of the dimensions is necessary but insufficient by itself to realize new visions of learning" (Winschitl, 2002, p. 132).

CONCEPTUAL DILEMMAS

Conceptual dilemmas are rooted in trainers' understanding of learning and underlying assumptions and beliefs. Implicit assumptions about training and learning also inform their practice and the degree to which they understand and apply training pedagogies. Recent research from a range of police training settings (e.g., Shipton, 2012, 2020; Basham, 2014; Belur et al., 2020; Cushion 2020; Staller et al., 2021) suggests that police training practice and knowledge is most often developed by informal sources, particularly observation and experience (Koerner and Staller, 2020; Rajakaruna et al., 2017; Bergman et al., 2018). This results in practice based on history and tradition (Karp and Stenmark, 2011), rather than empirical evidence, with Koerner and Staller (2020) and Koerner and Staller (2019b) arguing that decisions within the 'how-dimension' of police training are less the result of professional trainer education than an (uncontrolled) effect of socialization, resulting in a self-referenced, anecdotal approach to training practice based on 'what-works' and what trainers perceive 'gets results' (Cushion, 2020). Bruner (1999) names this 'folk pedagogies' i.e., strong views about how people learn and what is 'good' for them. Based on established 'traditional' pedagogy this sets limits to what is regarded as useful in the profession and what actions, behaviours, and attitudes are considered acceptable (Waddington, 1999; Karp and Stenmark, 2011; Beighton et al., 2015). Traditional police training pedagogy has been characterized as militaristic, instructor-centric, linear, based on behavioural education ideology, and list-orientated (e.g., Beighton et al., 2015; Basham, 2014; Cushion 2020; Staller et al., 2021; Werth, 2011; O'Shea and Bartowiak-Théron, 2019; *inter-alia*). Resulting in a training model and "pedagogical practices that reflect doctrinal values rather than educative values. . .[that] limits intellectual stimulation" (Densten cited in Ryan, 2006, p. 7–8) where police training and instructors are wedded in a "very behavioral and militaristic environment" (McCoy, 2006, p. 29).

Therefore, training ideologies are the frameworks producing and reproducing 'folk pedagogies' where practice and practitioners become "dogmatic and petrified because they are protected" and resistant to "criticism from within and without" (Piggott, 2011, p. 8). Indeed, police training is characterized by an "insular and defensive culture" that seeks to maintain the status quo, positioning "training in a traditional, technical framework" (Ryan, 2006, p. 3), where "learning is at best trivialized, at worst, never evaluated, taken-for-granted" and "is bound up in notions of liability and control" (Ryan, 2006, p. 4). Consequently, PST in the United Kingdom and beyond is guided by tradition, circumstance and external authority (cf. Buttle, 2007; Basham, 2014; Rajakaruna et al., 2017; Cushion 2020). In England and Wales police officers are currently trained in a 'largely off the shelf' and 'stereotyped catalogue' (Waddington et al., 2006, p. 181) that fails to simulate the conditions an officer experiences in real-world encounters (e.g., Waddington et al., 2006; Cushion, 2020) a position replicated internationally (e.g., Renden et al., 2015; Andersen et al., 2016). There is little evidence supporting the efficacy of current prescribed training regimes (Waddington et al., 2006; Cushion, 2020) resulting in PST skills that do not necessarily transfer to the criterion environment of dealing with violent encounters (e.g., Jager et al., 2013; Renden et al., 2015); instead, officers struggled to apply taught techniques (e.g., Jager et al., 2013; Renden et al., 2015a).

Another outcome of 'folk pedagogy' is that trainer's abstract SBT, or parts of it, resulting in distorted understanding and inadequate application. Indeed, while recent research (e.g., Bennell., *et a al*., 2020; Hine et al., 2018; Di Nota and Huhta 2019) shows SBT as crucial to, and effective for, de-escalation and use-of-force training, there remain considerable conceptual and practical misunderstandings. For example, because of the dominance of a linear, process-product and 'skills' first approach to learning (Di Nota and Huhta 2019; Staller and Koerner, 2019; Cushion, 2020), scenarios typically play a relatively small part in training programs (Rajakaruna et al., 2017; Cushion, 2020; Koerner and Staller, 2020). In our experience from this project, it is not unusual to hear that 'SBT is nothing new' or 'we've been doing SBT for years'. However, typically, this means that scenarios are positioned as a tool for officers to demonstrate performance of 'pre-loaded' skills or for application 'in-context' after techniques are mastered (Koedijk et al., 2019; Cushion 2020; Staller et al., 2021). This positions scenarios at the end of a linear training sequence where they are often connected to an assessment of training (Constable and Smith, 2015). Put simply, SBT is often abstracted to a means to test skills and positioned after isolated practices have been completed. Currently, SBT is not viewed as a holistic training approach that encourages learner-centred training where skill, tactics, perception, judgement, decision-making and problem solving are critical and connected.

Drawing on evidence informed learning principles (e.g., Mayer, 2004; Kirschner et al., 2006; Cushion 2013), meaningful learning occurs when officers are connected to, and make sense of, what is to be learned, identify relevant knowledge and information, and organize it into a coherent structure integrated with their existing knowledge. Therefore, as Wolfe et al.'s (2019) evaluation study of use-of-force training demonstrates, an understanding of the purpose and outcome of skills is essential to understand their connection to strategies and tactics, particularly if officers believe they are already skilled. Just 'doing a scenario' does not guarantee connection with the to-be-learned material, and guidance is required ('*through*' the scenario–using modification principles; '*in*' the scenario–with the trainer and peers; and at the end through reflection and de-briefing) (Rajakaruna et al., 2017). Learning requires participation as well as skilful and progressive practice and instruction that shifts the focus of training from performance and assessment to skill development and learning (Rajakaruna et al., 2017)–a shift trainers in the England and Wales require support to do.

Elements of SBT have been identified within trainers' practice in the United Kingdom and internationally (e.g., Constable and Smith, 2015; Rajakaruna et al., 2017; Cushion, 2020), but intermingling with traditional approaches. Importantly, trainers in these circumstances fail to recognize or understand the contradictions in conceptions of practice and learning from SBT versus a linear, behavioural approach. In education, Davis

and Sumara (2003) describe an 'epistemological gap', the language of an 'alternative approach' but with limited conceptual or practical understanding, while Fullan (1991) argues that for teachers (*sic* trainers) who attempt to implement innovative pedagogies, "it is possible to change on the surface by endorsing certain goals, using specific materials, even imitating the behavior without specifically understanding the principles and rationale for change. Moreover. . .it is possible to value and even articulate about the goals of change without understanding the implications for practice" (p. 40). Evidence from police trainers around the world suggests that trainers' previous experiences serve as a screen through which new knowledge has to pass (cf. Basham, 2014; Beighton et al., 2015; O'Shea and Bartowiak-Théron, 2019; Belur et al., 2020; Koerner and Staller, 2020.). Therefore, new ideas, techniques and practices are not accepted whole-scale and changes to training come through serendipitous methods or from 'irresistible forces' (Young, 1991; Constable and Smith, 2015). 'Cherry picking' ideas that fit their beliefs, while rejecting or resisting others that are more challenging, enables PST trainers to adopt seemingly novel or original aspects of SBT, while preserving their fundamental beliefs about training and learning. In education, Hargreaves (1994) describes this as 'safe simulation', and in the United Kingdom it is common to see elements or imitations of SBT practiced with minimal disruption to training norms and traditions and police culture. Fragmented SBT based on limited or superficial understanding can result in practice mutation, where "pernicious, predictable mythology and pseudo principles" (Windschitl, 2002, p. 139) distort it.

PEDAGOGICAL DILEMMAS

Pedagogical dilemmas refer to trainers' pedagogical practice, their behaviour, practice structures, and all related activity contributing to learning environment design (Windschitl, 2002), and intersect to some degree with the other dilemmas. In particular, trainers across a range of police settings often do not realize the influence of their personal experience nor appreciate the ways in which their powerful assumptions about training guide their practice (Werth, 2011; O'Shea and Bartowiak-Théron, 2019; Cushion 2020) i.e., conceptual dilemmas.

For trainers with a 'traditional' linear, trainer-centred, skills first focus, SBT will require a fundamental shift in how they train. Indeed, as Belur et al. (2020) suggest the trainer's role in approaches, such as SBT, is notably different to traditional, trainer-focused models of police training (cf. Makin, 2016). This requires in-depth knowledge of learner-centred learning methods that are often contrary to the model under which trainers were themselves trained (Lettic, 2016; Koerner and Staller, 2019; Koerner and Staller, 2020; Belur et al., 2020); a shift to a more interactive, complex, and unpredictable learning environment (Werth, 2011; Cushion 2013; Cushion, 2020; Jenkins et al., 2020). Trainers are repositioned in training to stand back, observe more, act as a facilitator being less directive, to "live in the background . . . which is a difficult role to assume when the instructor is used to being the focus" (King Stargel, 2010, p. 140; Belur et al., 2020). Paradoxically, trainers have to come out of their 'comfort zone' to see the big picture because training with SBT is more complex than traditional training, requiring greater preparation, more concentration and 'noticing', and an overall greater pedagogical responsibility (King Stargel 2010; Werth, 2011; Belur et al., 2020). As Belur et al. (2020) and Shipton (2012) argue, trainers must develop specific facilitation skills that requires more than providing 'hints' to unambiguous right answers, and instead trainers maybe required to model, scaffold, question, guide, advise, de-brief, converse, offer heuristics or conceptual structures (cf. Cushion, 2013; Lettic, 2016).

In education, Cremin (1961) notes that "in the hands of first-rate instructors, innovations worked wonders; in the hands of too many average teachers (*sic* trainers), however, they led to chaos" (p. 348). The quality and effectiveness of PST can be low (Waddington et al., 2006; Rajakaruna et al., 2017; Cushion, 2020; Staller et al., 2021). While having strong content knowledge ('what to teach') (Cushion, 2020), our experiences support the research in suggesting trainers are unable to facilitate scenarios well or conduct instructional conversations (cf. Rajakaruna et al., 2017) not knowing how, having never experienced sufficient guidance in trainer education, nor seen effective models in action (cf. Basham, 2014; Bennell et al., 2020; Shipton 2020). Indeed, Shipton (2020) notes that trainers wanted to be more effective at facilitating learning but did not possess the necessary skills (cf. Bennell et al., 2020). Also, some trainers did not see the value in developing these skills and were happy in a traditional training paradigm and not engaging with SBT, even when this was an espoused training approach in their organization (Werth 2011; Shipton 2012; Basham, 2014; Makin, 2016).

It is not only a dilemma to need additional pedagogical expertise (Shipton 2012, 2020; Basham, 2014; Rajakaruna et al., 2017; Belur et al., 2020), but utilizing SBT also requires in-depth subject knowledge (Cushion, 2013). Knowledge gaps can be challenging and can lead to frustration for trainers and officers (Lettic, 2016; Belur et al., 2020). Indeed, as Shulman (1987) in education argues knowledge and understanding are even more critical than for more traditional alternatives. Trainers need to be aware of 'teaching-points' and the principles underlying them, as well as the variety of ways these can be looked at and developed in and through a scenario. For example, trainers lack of underpinning knowledge can be exposed in the planning process when designing scenarios and appropriate instructional strategies. Also, during training when trainers can struggle to step back and observe and find the manipulation or layering of learning through the scenario difficult, as we have found, becoming 'lost in the chaos'. For example, a trainer not understanding how, during a scenario, to modify or condition to bring out learning points or missing 'coachable moments' because everything is happening at full-speed.

The outcome of these pedagogical dilemmas is that training and the application of SBT becomes limited by the trainers' role frame (Schön, 1983). That is, the trainers' education, knowledge and experience of training 'frames' what is seen and the potential for learning (and change). Pedagogical dilemmas will shape how a trainer engages with practice and shape the possibilities for

implementing SBT. There is an important interplay between knowledge, experience and practice. Limited knowledge constrains 'seeing' and diminishes action i.e., training is reactive, but within existing knowledge and understanding. Research in police training (cf. Cushion 2020; Koerner and Staller, 2020; O'Shea and Bartowiak-Théron, 2019) has shown that trainers are also more likely to stick with traditional methods, trainer-led and trainer-controlled PST, training is less dialogic and interactive, with officers as passive receivers of information from a one-directional transmission. In this case, traditional approaches are based on a lack of knowledge rather than specific opposition to SBT (Shipton, 2012; Basham, 2014; Koerner and Staller, 2020).

CULTURAL DILEMMAS

Trainers' pedagogical practices are always situated in a larger context which is more than the 'container' into which they are dropped (Cushion, 2013). Context includes backgrounds and physical abilities; roles and responsibilities, prior knowledge and experiences, program design, curriculum, and learning activities, all in addition to police history, cultures and structures (Loftus, 2010; Belur et al., 2020; Shipton, 2020). The complex interaction of these factors influences the meaning that trainers and officers make of the learning process. Such factors can impact the learning environment in overt and covert ways and can be powerful in terms of a tacitly understood framework of norms, expectations and values; a training culture (Wolfe et al., 2019; Belur et al., 2020; Cushion, 2020; Shipton, 2020).

Creating patterns of beliefs and practices in trainers that enable an application of SBT (or any innovative pedagogy) will inevitably require usurping dominant police training cultures (Charles, 2000; Karp and Stenmark, 2011; Cushion 2013, 2020; Belur et al., 2020), and developing a stronger training culture mentality (Wolfe et al., 2019). The difficulty of which was recognized by Charles (2000, p. viii) who in implementing a new learning model into police training required "an organizational transition of epic proportions". The influence of police culture was similarly identified as an impediment to newer, more innovative and 'better' training models because of a "subcultural preference towards traditional approaches" (Chappell, 2007, p. 501; Beighton et al., 2015; Karp and Stenmark, 2011; Wolfe et al., 2019).

Our experiences across this project to date have supported the notion that police training has a persistent and resilient culture (Werth, 2011) providing images for PST about what it means to be being trainers (knowledge holders) and learners (passive receivers) (Lettic, 2016; O'Shea and Bartowiak-Théron, 2019; Shipton, 2020). A culture that has remarkable continuities and inertia within police values, assumptions, and practice (Loftus, 2010; Beighton et al., 2015). With research in the United Kingdom reporting resulting in an extraordinary sameness in PST over time (Buttle, 2007; Cushion, 2020). PST features high levels of trainer-led instruction and a predominance of isolated, dis-integrated and repetitive 'drills', where trainers talk most of the time and officers listen (Waddington et al., 2006; Buttle, 2007; Cushion, 2020; Staller et al., 2021)–skills need to be learned first, and training *never* starts with a scenario, they should be at the end, or as part of an assessment.

This overly controlled and trainer-led training culture is supported in-part by the trainers' beliefs; the simple and seductive premise of 'being-right' based on years of experience (Windschitl 2002). This has remained unchallenged because, as Shipton (2020) argues, effective change from authority driven trainer-centred practice towards evidence-based learner-centred practice has been restricted by the insulation of the police from the field of adult education, and the influence of policing sub-culture (Chan et al., 2003; Karp and Stenmark, 2011; Beighton et al., 2015; Wolfe et al., 2019). However, if PST is to 're-culture' (Windschitl, 2002) the first obstacle to overcome is the experiences of trainers and learners. As Gundhus (2013) argues, new knowledge regimes are often met with resistance, not only because of the stubbornness of police occupational culture, but because they threaten what is perceived, in this case by trainers, as their meaningful professional practices. Receptivity to change is impacted by practice that differs from traditional in-service experiences (Wolfe et al., 2019). In other words, a highly contextual discourse has emerged that imposes and enforces a 'correct way' to train and be a trainer of PST. Therefore, trainers authenticate certain types of collective knowledge, and a discourse used in training in this way helps create and re-create the training field, giving certain practices an entrenched legitimacy (Belur et al., 2020). Prior socialization along with established beliefs and traditions reinforce this image and validate and acknowledge practice as 'effective'. With research confirming that this becomes a self-confirming loop (Kaminski and Martin, 2000; Cushion 2020; Koerner and Staller, 2020) and beliefs regarding effective and appropriate training reproduce and reinforce the traditional approach (Basham, 2014). To enact meaningful change, therefore, requires trainers to, "confront experiential knowledge" (O'Shea and Bartowiak-Théron, 2019, p. 290; Wolfe et al., 2019).

This training culture can also be seen in terms of fulfilling the requirements of the training role. PST discourses have been reported as not being about effectiveness or skill development but prioritising managing time pressures and 'getting officers through' uninjured (cf. Cushion, 2020). This means a narrow view of training that excludes 'realistic' practices (Beighton et al., 2015; Cushion, 2020). Moreover, this overly cautious, or 'risk averse culture' (Heslop, 2011), is reflective of its conservative nature rather than genuine risk, but only serves to reinforce operational incompetence (Beighton et al., 2015; Cushion 2020). As a result, this sees the trainer attempting to control as many variables as possible, and this imperative of control is a habit that many police trainers bring to a traditionally militarized and behaviourist training context (White 2006; Shipton, 2020)–in our experiences of this project trainers have wrestled with letting go of control and re-positioning themselves to centre the scenario and the learners. This means 'tried and tested', traditional methods that prove trainer knowledge and expertise but also are considered 'safe'. The consequence of this is that officers are, in-turn, socialized into expecting a particular type of PST experience, and can resist other training methods (Wolfe

et al., 2019). This has implications for cultural change as PST becomes a historical and traditional thread where experiences are powerful, long lasting, and have a continual influence over pedagogical perspectives, practices, beliefs and behaviours (Koerner and Staller, 2019; Koerner and Staller, 2020; Wolfe et al., 2019). The driver for practice is therefore not evidence-based learner-centred pedagogy, but often an inward-looking tradition (Lumsden, 2017), or uncritical inertia. This means that PST trainers, who are largely drawn from rank-and-file officers, already have an understanding of PST based on experience that filters new methods. Moreover, we have found that the in-depth knowledge of learner-centred learning methods that SBT requires are often contrary to the model under which trainers were themselves trained (cf. Lettic, 2016; Wolfe et al., 2019; Belur et al., 2020) and which they experienced as officers (Koerner and Staller, 2019, 2020; Wolfe et al., 2019).

POLITICAL DILEMMAS

Political dilemmas refer to those aspects of practice that are linked with the exercise, distribution, preservation, or redistribution of power among participants in an educational enterprise (Windschitl, 2002). Any innovative pedagogy, such as SBT, can generate controversy and possibly conflict. Indeed, there are strong differences in opinion surrounding changes to police training among its stakeholders (e.g., policy makers, trainers, management, officers, as well as the public) (Di Nota and Huhta 2019). As a result, updating police training can be met with controversy, despite evidence for the benefits of different training approaches (Di Nota and Huhta 2019; Wolfe et al., 2019), and a societal need for changes to policing practices (Makin, 2016; Di Nota and Huhta 2019). Moreover, trainer's practice reflects and refracts wider social forces from interested parties such as stakeholders, producers of knowledge, and wider society (Karp and Stenmark, 2011). Thus, doing SBT and its outcomes, as well as establishing a training environment conducive to implementing it, can have wider political implications.

While PST pedagogy has remained consistent over time and across organizations, O'Neil et al. (2019) observed that there can be considerable variability in the content and duration of PST between organizations, while Cushion (2020) reports within police organization variability. In the United Kingdom, similar to other countries (cf. O'Neil et al., 2019), the detailed choice of PST curriculum and pedagogy are currently devolved to forces. However, the College of Policing (CoP)–the national professional body for policing in England and Wales–is overhauling current PST and replacing it with a new national curriculum, including recommended contact time with trainers (College of Policing 2020) moving away from in-house driven training (Beighton et al., 2015; Lum and Koper 2015). Such organizational leadership and support are to be applauded as research shows that organizations can maximize the impact of training and play key roles when training is being developed and delivered (Bennell et al., 2020), and without organizational commitment, training is likely to be sub-optimal (e.g., Andersen et al., 2016; Belur et al., 2020; Bennell et al., 2020).

That said, using SBT to change PST will stand or fall on effective teaching and learning, therefore the need for quality trainers is paramount; trainers who are pedagogically imaginative, dynamic, and thoughtful, who think creatively about alternative ways of training, and are, as a result, better prepared to respond to the realities of their professional work. This requires considerable pedagogical authority and autonomy in trainers. However, there is a danger in standardizing and controlling practice with a national curriculum that homogenizes practice under the banners of modernization and professionalization (Lumsden 2017). Officers often portray policing as a craft where experiential learning and experienced officers are valorised (Lumsden, 2017). Centralized changes can expose tension and resistance between the police organization and street-level police occupational culture, demonstrating differences between management objectives and practitioner views (Gundhus 2013; Lumsden, 2017). Indeed, Heslop (2011) and Goode and Lumsden (2016) highlight the ways in which the police are becoming increasingly micro-managed, bureaucratic and risk averse, increasingly 'McDonaldized' (Goode and Lumsden, 2016). Indeed, any 'professionalization' of training appears problematic if PST curricula are overly controlled and defined higher up the administrative chain. For SBT in particular, trainers given standardized knowledge and strategies reduce scenarios to the application of a generic set of rules. We have found in line, with others (e.g., Rajakaruna et al., 2017; Jenkins et al., 2020), that this can be easily presented as a predictable linear process where scenarios become overly scripted 'walk-throughs' to a desired response devoid of perception, judgement and decision-making Paradoxically, while the police and their communities demand innovative and sophisticated training, arguably, national policy could inadvertently discourage such training, or build-in inadequacy into SBT (cf. Rajakaruna et al., 2017).

Debate among policy makers, trainer education and trainers about the logic of the means (how and what) of training also diverts attention from more fundamental questions about the nature and aims of training (why and who for) (Cushion, 2013). PST is currently very focused and specific, but has a narrow operational focus attempting to transmit and develop proficiency in a series of skills and techniques, (Rostker et al., 2008; Morrison and Garner, 2011; Rajakaruna et al., 2017). However, in addition to its overt curriculum, an informal or 'hidden curriculum' exists, a set of implicit messages that officers experience in and through training processes which reinforce or challenge attitudes, values, and expectations (Cooper, 2009; Cushion, 2020). Police training contributes to the production and reproduction of social structures through its 'hidden curriculum' (cf. White, 2006), including derogatory discourses that can denigrate and stigmatize (Beighton et al., 2015). In PST, for example, promoting 'hyper-masculinity' and sexism (Cushion, 2020), as well as an over-focus on danger and authority (Constable and Smith, 2015) to the detriment of the effectiveness of training for all and a more expansive understanding of training and the police officer role (Constable and Smith, 2015; Cushion, 2020). Consequently, police training is an inescapably political act, not apolitical or neutral.

Tradition provides an overriding, powerful, and historical view of what trainers *should* do and what training *should* look like (Beighton et al., 2015; O'Shea and Bartowiak-Théron 2019). Innovative pedagogy, despite being evidence-based, suffers an underlying disadvantage as it can be viewed as a questionable alternative to existing practice (cf. Windschitl, 2002; Wolfe et al., 2019). The durability of this notion is evidenced through SBT with over thirty years of history, and problem-based approaches in wider education existing even longer than this, remains a training 'alternative'. Indeed, police training discourse (of which this paper is a part) privileges the status quo by associating training models where skills are mastered first with 'traditional', 'historical', and 'fundamental' training, while SBT is 'alternative' or 'innovative', thus forming a subtle but coherent set of rationalities. Therefore, far from being benign activities, training and trainer education, always contain and advance values and agendas. As such, implementing SBT and critically examining and challenging beliefs, practices, and discourse becomes political. SBT challenges existing assumptions and therefore beliefs about learning and knowledge about training practice becomes less absolute. Consequently, trainers are forced to confront their own uncertainties, and even their own inadequacies, and as training and trainer education exists in organisations, the status quo becomes threatened making stakeholders uneasy, uncomfortable and even resistant (cf. Loftus, 2010; Gundhus, 2013; Goode and Lumsden, 2016).

DISCUSSION

Windschitl's (2002) dilemmas are a useful heuristic to illustrate the complexity of training, and the multiple and layered issues that must be confronted to implement change. The categories show the precarious nature of implementing SBT to develop PST, and the issues that can influence the likelihood of innovative pedagogies surviving, being resisted or eventually 'washed out'. Importantly, this paper demonstrates that 'knowledge' of SBT, even its applied principles, is insufficient, and that implementation involves more than simply providing trainers with a 'toolbox' of skills and a 'list of scenarios'. Operationalizing SBT for PST requires a host of knowledge, understanding, practices, strategies, coherent arguments, and critical thinking, all of which are conspicuously absent from trainer education and the rhetoric of trainer development (e.g., Berg, 1990; McCoy, 2006; Werth, 2011; Shipton, 2012, 2020). Arguably, implementing authentic SBT and, for example, starting training with a scenario is so conspicuous, so unlike typical training, that it becomes subjected to an unwarranted level of scrutiny and subject to an intensification of accountability. However, in reality traditional, linear, 'block and checklist' (O'Neil et al., 2019) approaches do not currently face a similar level of challenge and, as Windschtil argues, "although perennially ineffective are rarely subjected to fundamental critique" (2004, p.160).

So, the challenges to implement SBT as a vehicle to change PST seem significant. Of course, as we have found, some trainers can successfully employ SBT and reflect upon and change the nature of their training practice (Werth, 2011). How can training ensure the implementation of innovative pedagogy and the development by design of these kinds of skilled trainers? Research indicates that currently 'train-the-trainer' training typically delivers content knowledge rather than the ability to facilitate learning processes (e.g., Berg, 1990; McCoy, 2006; Werth, 2011; Shipton, 2012, 2020), where development is seen almost exclusively as expanding and presenting content knowledge. Whilst it is recognized developing content knowledge is vital for any police trainer, this limits capacity for them to promote deeper learning (McCoy 2006; Shipton, 2020). This model does not address the conceptual or pedagogical dilemmas of practice as it is inadequate in giving trainers an awareness of their own beliefs and assumptions about training, developing an understanding of learning. Such an approach, with its very narrow and technical focus, does not address the complexities of practice and therefore does not broach the social, cultural, and political dilemmas of training practice. Indeed, it is necessary to be aware of the assumptions about learning that underpin any method of teaching, particularly when such assumptions challenge beliefs about learning (Cushion, 2013). However, there remains a considerable challenge to address trainer's conceptual dilemmas created through the embodied and unarticulated beliefs about learning and training. SBT can invoke initial scepticism because it confronts these beliefs (Irby, 1996; Shipton, 2012), thus presenting the dual challenge of transforming beliefs about training and learning whilst also providing specific training/facilitation skills. To address these conceptual dilemmas, trainer education, and train-the-trainer, therefore, needs to provide an environment where practice and the practice of others can be interrogated, and assumptions made explicit. Uncovering assumptions and beliefs emancipates practitioners from their dependence on habit and tradition providing them with the skills and resources to enable reflection and to examine critically the inadequacies of different conceptions of practice (Carr and Kemmis, 1986; Cushion, 2013) and thus address pedagogical dilemmas. However, learning in this way is beyond existing conceptions of trainer education which is an additive, 'retooling' according to behavioural assumptions (grafting new 'skills'/knowledge onto an existing repertoire) (Beighton et al., 2015) rather than a critically transformative (deconstructing taken-for-granted beliefs, assumptions, knowledge and habits, and rebuilding practice) move away from assimilation, dissemination and application (Beighton et al., 2015; Shipton, 2020).

To problematize ideas about training, in addition to information about SBT, trainers could benefit from case examples from other trainers illustrating the experiences of those who have attempted to change PST practice and culture. Currently, existing research and guidance about SBT is useful (e.g., Hine et al., 2018; Bennell et al., 2020; Jenkins et al., 2020) but remains compelling rhetoric and too idealized, providing prescriptive lists, principles, and decontextualized examples, that do not engage with the issues and challenges of 'doing' training in context. To address pedagogical dilemmas head on

trainer education should (correctly) model context specific SBT, enabling understanding of the increasing complex and representative layering of learning through versions of the whole, as well as the array of modification principles. Trainers require *in-situ* support in understanding differences between their existing practice, attempts at SBT, and authentic SBT and recognizing the distance between existing practice and understanding.

In developing SBT, and in addition to education and development, trainers must also create opportunities to speak with others. Communities of practice (CoP) (Lave and Wenger, 1991) are a means to understand and structure trainer learning (cf. Jenkins et al., 2020). While the rhetoric of communities of practice is appealing, the reality of trainers' lives can make them difficult to sustain within the nature of day-to-day police training routines and regularities that can promote trainer isolation. Where trainers do discuss training, this often remains at an instrumental level merely passing on 'survival tips' or 'tricks of the trade', leaving unexamined and unchallenged contextual norms and culture, thus not addressing cultural and political dilemmas of practice. Ways to initiate and mediate new kinds of conversations are needed, and partnerships and coalitions to create a critical mass within a community to advance ideas and thinking are required. Such an approach holds the promise of deeper, reflective conversations that foreground cultural and political dilemmas of practice.

CONCLUSION

The very features that render any innovative pedagogy such as SBT effective in training practice are those that provide most challenge and the catalyst for practice dilemmas. When used in an uncritical or unsophisticated way, or fragmented and promoted with pseudo-principles and little understanding, any innovative pedagogy will struggle to gain traction and acceptance. However, when practice is premised on authentic SBT, it can be an important catalyst for change (Beighton et al., 2015; Bergman et al., 2018; Belur et al., 2020; Bennell et al., 2020). To challenge and change existing practice requires a 'jointly fashioned vision of transformation' (Windschitl, 2002), with academics, trainers, and trainer educators working in partnership to deliver education and training (cf. Beighton et al., 2015; O'Shea and Bartowiak-Théron 2019; Wolfe et al., 2019; Belur et al., 2020; Shipton, 2020). Such an alliance should provide the theoretical knowledge and practice tools to convert dilemmas into attributes that facilitate the development of PST and the realization of SBT. This is a vision of practitioners that Windschitl, (2002) describes as having conceptual understanding, pedagogical expertise, cultural consciousness and political acumen.

AUTHOR CONTRIBUTIONS

The author confirms being the sole contributor of this work and has approved it for publication.

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Conflict of Interest: The author declares that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

frontiers in Psychology

ORIGINAL RESEARCH
published: 17 January 2022
doi: 10.3389/fpsyg.2021.798067

Police Training in Practice: Organization and Delivery According to European Law Enforcement Agencies

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Police training plays a crucial role in the development of police officers. Because the training of police officers combines various educational components and is governed by organizational guidelines, police training is a complex, multifaceted topic. The current study investigates training at six European law enforcement agencies and aims to identify strengths and challenges of current training organization and practice. We interviewed a total of 16 police instructors and seven police coordinators with conceptual training tasks. A thematic analysis (Braun and Clarke, 2006; Terry et al., 2017) was conducted and results organized in the two main themes evident across all six law enforcement agencies: organization of training and delivery of training. Results show that governmental structures and police executive boards are seen as the primary authorities that define the training framework in which police instructors operate. These administrative structures regulate distant and immediate resources, such as available training time, training facilities, equipment, and personnel. Within the confines of available resources and predetermined training frameworks, results indicate that police instructors thoroughly enjoy teaching, creating supportive and motivating learning environments, and applying their personal learning perspectives to training. Nonetheless, police instructors are critical of the level of training they are able to achieve with the available resources.

Keywords: police training, didactics, curriculum evaluation, police instructors, assessment

OPEN ACCESS

Edited by:
Craig Bennell,
Carleton University, Canada

Reviewed by:
Scott Blandford,
Wilfrid Laurier University, Canada
Konstantinos Papazoglou,
Pro Wellness Inc., Canada

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Specialty section:
This article was submitted to Educational Psychology, a section of the journal Frontiers in Psychology

Received: *19 October 2021*
Accepted: *21 December 2021*
Published: *17 January 2022*

Citation:
Kleygrewe L, Oudejans RRD, Koedijk M and Hutter RIV (2022) Police Training in Practice: Organization and Delivery According to European Law Enforcement Agencies. Front. Psychol. 12:798067. doi: 10.3389/fpsyg.2021.798067

INTRODUCTION

Police training plays a crucial role in the development of police officers. Compared to other occupations, police officers spend the entire beginning of their policing career training and preparing for the job (Wilson et al., 2010). Police cadets may spend up to three years in basic training before they are considered police officers and encounter any job-specific situations independently. This comparatively long period of initial training makes sense when considering that police officers respond to diverse and complex on-duty demands on a daily basis (Anderson et al., 2002; Gershon et al., 2009; Paton, 2009).

Police officers are tasked with enforcing laws, protecting civilian life and property, responding to (emergency) calls, and apprehending and arresting criminals, to name only a few. Consequently, it is likely for police officers to encounter complex, high-risk situations (Marenin, 2004; Waddington et al., 2012). Dealing with these high-risk situations adequately requires expansive knowledge and skills, which police officers ought to acquire in training. Police academies and law enforcement agencies are responsible for equipping officers with the relevant skills to successfully resolve any on-duty demands placed upon them (Chappell, 2008).

The common objective of police training has hardly changed over time – to help police officers perform their job (Ness, 1991; Koedijk et al., 2019). However, what police training consists of has changed significantly over the years. Traditional policing required police officers to possess self-defense, arresting, shooting, and driving skills, which was reflected in training that focused primarily on teaching these physical activities (Chappell, 2008). Current policing places a focus on additional skills such as communication, problem-solving, and decision-making (Birzer and Tannehill, 2001; Blumberg et al., 2019). To facilitate these skills in the context of policing, police academies and law enforcement agencies needed to adjust the structure, content, and delivery of their formal training (Marenin, 2004). Traditionally, police instructors taught their students knowledge and skills using a uniform, linear training approach (Birzer and Tannehill, 2001; McCoy, 2006). For instance, teaching cadets self-defense skills would require instructors to explain the exact techniques and to illustrate a fixed set of movements for cadets to observe and apply in a static, low pressure setting. Considering that police officers encounter complex and dynamic incidents, where decision-making, situational awareness, and communication skills might be decisive for the outcome, the traditional, uniform approach to training seems to have little to do with the realities of police work (Renden et al., 2015).

Recent literature in the field of police training investigated how to better facilitate skills and improve specific components of police training. For instance, Di Nota and Huhta (2019) have illustrated how realistic and immersive scenario-based training can improve police officers' skills such as situational awareness and decision-making. Similarly, integrating elements of anxiety and stress into training — akin to what police officers would experience in high-risk on-duty situations — has shown to improve use of force performance under stressful conditions and paved the path for police training to become more realistic (Oudejans, 2008; Nieuwenhuys and Oudejans, 2011; Andersen et al., 2016). Furthermore, police instructors are called to create learner-centered training environments that foster the "exploration and learning of functional solutions" to reduce the gap between police training and police work on duty (Koerner and Staller, 2021, p. 10; White and Escobar, 2008). This means moving away from traditional classroom-based, trainer-centered teaching to enhance performance, skill transfer, and retention.

While research has contributed immensely to the quality of police training, current literature is yet to provide a comprehensive overview of police training across law enforcement agencies. Two reasons, in particular, might explain the lack of a cross-cultural overview of police training. First, almost every law enforcement agency organizes the frequency, duration, and content of their training differently (Marenin, 2004). This is due to many factors. The availability of resources and budget for training may determine how much and how often training can be conducted (White and Escobar, 2008), while the content of training will vary as it is tailored to particular needs of the region of operation. For instance, urban and rural environments pose different sets of challenges to police work which should be reflected in the training of police officers (Crank, 1990; Huey and Ricciardelli, 2015). Second, societal or situational influences (e.g., occurrence of a terror attack, see Henry, 2002), changing policies (e.g., implementation of COVID-19 measures, see Laufs and Waseem, 2020; Frenkel et al., 2021), and technological advances (e.g., the integration of the body cam, see Koen et al., 2018; development of VR training, see Giessing, 2021) may call for specific adjustments in structure and content of police training. The concurrence of organizational, situational, and technological influences is what makes training practices unique to each law enforcement agency. As a consequence, the landscape of police training across law enforcement agencies is extremely diverse.

Although the diversity of training practices across European law enforcement agencies may explain why thus far no cross-cultural overviews of police training are collated, this does not mean that such an overview would be of no use. An overview featuring the commonalities and differences of European training practices highlights the diverse contexts in which law enforcement agencies educate and train police officers. This will, due to the variety in training practices, encompass a broad range of solutions law enforcement agencies have found for a broad range of issues with training. This may allow law enforcement agencies to learn from good practices in the training of other agencies and may help them to identify their own strengths and challenges in training more clearly. At the very least, law enforcement agencies may learn that they are not alone in particular aspects of training they struggle with and can be invited to join forces with other agencies to try and find improvements or solutions. These functions of a cross-organizational overview of training practices will be particularly salient if gained from the perspective of the actual law enforcement agencies and their personnel who conceptualize and deliver the training. In addition, the law enforcement agencies' perspectives will benefit researchers on police training as it allows them to focus on current and practically relevant training areas that may necessitate further (scientific) attention. Evidence-based practice and practice-based evidence go hand in hand (or at least they should). As such, an overview of the intricacies of police training as experienced by law enforcement personnel such as training instructors is important and informative for police practitioners and researchers alike.

Manning (2009) eloquently argued that "police practices are well understood within the police world, and the reporting, designed for external audiences, is a shadowy figure" (p. 462). To shed light on the world of police training, we aim to gain insights into the commonalities and differences of European training practices and identify their strengths and challenges

according to those who conceptualize, organize, and provide the training. Gaining insight into the strengths and challenges of police training as experienced by European law enforcement agencies will provide police practitioners and researchers an opportunity for optimizing the current state of police training.

MATERIALS AND METHODS

Research Design

We utilized a qualitative research design to investigate the current state of police training at six European law enforcement agencies. We conducted individual interviews with police coordinators and instructors with the aim to identify strengths and challenges in police training.

Prior to conducting the interviews, we requested and received training-related material such as training and assessment manuals, lesson plans, training protocols, and training policies. We have studied these in detail to familiarize ourselves with the content and context in which police training takes place at each of the six law enforcement agencies. Reviewing the training-related material provided input for the interview guides and provided the interviewer with information on the language use and job-specific terminology expected from participants.

Participants

In total, 21 semi-structured interviews were conducted on training sites at six European law enforcement agencies. The agencies were located in the Netherlands, Germany, Sweden, Romania, and Belgium. We interviewed a total of 23 participants (two female). 16 participants were police instructors with an average age of 39.75 years (SD = 6.59) and an average police work experience of 15.56 years (SD = 8.34). Seven were training coordinators (department heads, unit leaders, or instructors with conceptual tasks or other coordinative roles in police training) with an average age of 47.43 years (SD = 5.29) and an average police work experience of 26.86 years (SD = 7.32). The participants had knowledge of, and expertise in, the training of police cadets, the continued professional development of police officers, special forces officers, and police instructors. The profile of the participants of each law enforcement agency is further described in **Table 1**. To comply with confidentiality agreements with the law enforcement agencies, the participants and their respective organizations are anonymized. Ethical approval was obtained from the Social and Societal Ethics Committee of the Katholieke Universiteit Leuven as part of the SHOTPROS project (work package 9: ethics) which is funded by the European Union's Horizon 2020 Research and Innovation Programme (Grant number: 833672).

TABLE 1 | Profiles of the participants per law enforcement agency.

Organization	Participants
LEA 1	Instructor with conceptual training tasks (TC1).
	Instructors of continued professional development topics (I1, I2).
LEA 2	Instructor of shooting, close combat, and tactical training, with conceptual training tasks (TC2).
	Instructor of firearms instruction (I3).
	Instructor of tactical procedures of extreme violence and firearms instruction (I4).
	Instructor of firearms and equipment and fitness training (I5).
LEA 3	Weapon unit leader with coordinative training tasks (TC3).
	Instructor of firearms and equipment (I6).
LEA 4	Instructor coordinator with conceptual training tasks (TC4).
	Instructor and patrol officer (I7).
	Instructor of security detail personnel with organizational tasks (I8).
	Instructor of tactics, firearms instruction, first aid, and communication and border patrol officer (I9).
	Instructor of self-defense and tactical procedures and patrol officer (I10).
LEA 5	Head of instructor qualification unit for operational training (TC5).
	Instructor with conceptual tasks (TC6).
	Instructors of qualification and development of police instructors (I11, I12, I13, and I14).
LEA 6	Instructor with coordinative training tasks (TC7).
	Instructor of firearms and self-defense and military instructor (I15).
	Instructor of communications and military instructor (I16).

"TC" refers to training coordinators; "I" refers to instructors. Coordinative training tasks refer to tasks in which training aspects are coordinated (e.g., scheduling, availability of instructors, personnel, location, etc.). Conceptual training tasks refer to tasks in which trainings are conceptualized (e.g., development of a training module, training plan, or training lesson, etc.).

Interview Guides

Based on the initial review of the training documents from law enforcement agencies, we developed two separate interview guides: one for interviews with police training coordinators with conceptual training tasks and one for interviews with police instructors. The interview guide for training coordinators consisted of discussion topics regarding the frequency, duration, and components of training, assessment and evaluation of officers, training for stressful situations and decision-making, an evaluation of the current training curriculum, and effective and innovative training practices. The interview guide for police instructors consisted of opinion inquiries regarding the overall experience as an instructor, their favorite parts of training, training methods they commonly implement in their training, and their views on what constitutes effective training. The interview guides can be requested from the first author.

Procedure

To capture diverse perspectives of European police training, the first author visited the locations of six European law enforcement agencies in five different countries. To recruit participants for the interviews, we utilized purposive sampling where contact persons at each law enforcement agency referred us to key informants who further helped us recruit potential participants for the current study (Smith et al., 2009). All interviews were conducted by the first author, whose native language is German and who is fully proficient in English. To participate in the study, participants had to be (a) proficient in English or German, (b) provide operational police training as an instructor, or have a role in the conceptualization and organization of operational police

training. Prior to visiting the location of the law enforcement agencies, our contact person ensured that at least one participant was in a position to be interviewed as training coordinator. Additional interviews with instructors were conducted based on the availability of instructors on location. We conducted all interviews face-to-face at the locations of the law enforcement agencies. Prior to conducting the interviews, we informed participants about the content and purpose of the study and asked for permission to audio-record the interview. All participants signed informed consent agreements prior to being interviewed. Due to time constraints of participants at one law enforcement agency, one of the interviews was conducted in a focus group setting with three participants (one training coordinator, two instructors) at the same time. For this interview, the interview guide for training coordinators was used.

Analysis

We conducted an inductive thematic analysis following the steps described by Braun and Clarke (2006): familiarizing with the data, generating codes, constructing themes, reviewing potential themes, defining and naming themes, and producing the report. After transcription, translation of German interviews into English, and familiarization with the data, the transcripts were imported to ATLAS.ti 9 for analysis. The analysis started with open coding; we generated initial codes across the entire dataset. Initial descriptive codes were developed for any data segments that were meaningful to the researchers. In subsequent rounds of coding, we used our research questions to further specify the code labels. That is, we focused on data segments and code labels that referred to commonalities and differences of European training practices as well as signified strengths and challenges in these practices. Using thematic maps, provisional themes were explored in an iterative process to investigate the themes' relationship between each other and to the research questions. Provisional themes that captured the dataset meaningfully and informed answers to the research questions were further employed as final themes. Next, we clearly named and defined the conceptualized themes and sub themes. To ensure that the final sub themes and their labels captured relevant aspects of the main themes, we wrote theme definitions summarizing the central idea (Terry et al., 2017). For validation purposes, a second researcher reviewed the transcripts and codes to ensure that results adequately reflected the original data.

RESULTS

The thematic analysis (Braun and Clarke, 2006; Terry et al., 2017) resulted in two main themes that were evident across all six law enforcement agencies: the organization of training and the delivery of training. In the following, the two main themes and their sub themes are presented separately. The main theme of organization of training relates to more formal, institutional information from the interviews regarding the structure and organization of training. The main theme of delivery of training reflects particular experiences and opinions of police coordinators and instructors about conducting and delivering the training. **Table 2** provides an overview of the main themes, their sub themes, and the corresponding codes.

Organization of Police Training

Training Curricula

To understand the organization of formal training practices within policing, a specific look at the training curriculum of a law enforcement agency is key. A total of 33 quotations from the interviews were related to training curricula. The training curriculum outlines the components of training, as well as the frequency and duration that is spent on each of the training components. According to the interviewed law enforcement agencies, the education of a police officers is organized into two distinct phases: the basic formation of cadets at the police academy and the continued professional development of officers. At the law enforcement agencies that have been interviewed, the basic formation of cadets ranges from one to three and a half years depending on the requirements of the agency and consists of obtaining theoretical knowledge, practical knowledge, and internship-type on-duty experiences. Once graduated from the police academy, police officers continue to receive training on a yearly basis. During this continued professional development, the frequency and duration of the training is dependent on the law enforcement agencies requirements. For five of the interviewed agencies, the duration of training that patrol officers receive ranges from 16 to 48 h per year, organized into three to six training days per year. One law enforcement agency organizes their training on a weekly basis, where 2 h of training are carried out each week. A minimum of 6 h per month needs to be spent on practical training activities.

Although duration and frequency of the training differ across law enforcement agencies, similarities exist as well. All interviewed law enforcement agencies have a higher entity such as a (national) police board or (governmental) interior ministry that determines or approves training curricula. For instance, on a yearly basis the governing entity for police education provides a training focus that determines the contents that this particular law enforcement agency has to provide in their training for a particular year:

> *"Every year we get [guidelines] from the national leader for practicing policy. And that's tactics, firearms, and self-defense. And every year we get the information on what the year's focus is going to be, for instance, terrorism, deadly violence or to increase the knowledge about psychological differences. So, we'll get a document describing what kind of focus we should have during our practice for the year." (TC4)*

When we asked training coordinators to reflect on their training curricula, the development thereof, and the delivery of amount and content of training to trainees, the responses across all six interviewed law enforcement agencies were remarkably similar. Training coordinators stated that the training curricula set the framework in which training delivery can take place. This framework consists of two factors; first, the frequency, duration, and components of the training curricula that are largely determined by the responsible external entities; secondly,

TABLE 2 | Overview of main themes, sub themes, and their corresponding codes.

Main themes	Sub themes	Codes/Topics	N of total quotations	N of participants	N of agencies
Organization of training	Training curricula	Police academy training.	24	10	6
		Training frequency.	34	11	6
		Hierarchical organization structure.	21	11	5
		Curriculum development.	20	13	6
		Curriculum evaluation.	13	7	6
	Resource availability	Equipment availability.	12	8	6
		Instructor/personnel availability.	9	7	5
		Training facilities.	20	11	5
		Training time.	19	11	6
		Need to have officers on street.	6	4	3
	Training components	Practical skill components.	14	9	6
		Stress components.	19	11	6
		Decision-making components.	7	5	4
		Combined Training components.	19	10	6
		Dissatisfaction with components.	8	6	3
	Assessment	Assessment method.	15	6	6
		Assessment frequency.	8	5	4
		Assessment consequence.	15	8	6
Delivery of training	Role of the instructor	Perceived responsibility.	10	5	3
		Task description.	22	19	6
		Training preferences.	22	14	5
		Enjoyment.	22	13	5
	Didactical approaches and concepts	Linear pedagogy.	11	9	4
		Exploratory learning.	9	7	4
		Feedback.	17	10	5
		Repetition.	13	7	5
	Training environment	Importance of training environment.	10	8	4
		Tailored training environment.	11	5	4
		Realism in training environments.	10	8	5

For each code, the table provides the number of total quotations, the number of participants (training coordinators and instructors) that the quotations came from, and the number of law enforcement agencies that these participants belonged to.

the availability of resources to conduct the training prescribed in the training curricula. Training coordinators claim that what makes their training sufficient is not the development or state of the curriculum itself but what the instructors are able to achieve within the framework of the curriculum and with the resources available to them (see also training delivery):

> *"I think with the time that we have here to train, we're doing a good job, I think because everything depends. Everything is in the legislation about how many hours you can train a certain aspect of the formation and with the time that we have. If we had 2 years, it would be better, if we had a thousand rounds, it would be better." (TC2)*

> *"I think we're doing well for what we can do at the moment. It can always be better; of that I am convinced. But we do not have the means to do it the way we want to." (TC5)*

Resource Availability

With a total of 66 quotations, the availability of resources for training was a large topic for training coordinators and instructors: particularly the (limited) availability of instructors and personnel, training equipment, training facilities, training locations, and training time. For training coordinators and instructors, the shortcoming of these resources directly affects the quality of training, as well as the amount of knowledge and skills instructors are able to teach to cadets and police officers:

> *"We have a short number of trainers, so that's also something that is there. The quality of our training is under pressure." (TC1)*

> *"Due to the high number of students, it is not even possible to give every student a role-play on the respective topic. Unfortunately, that is just not doable, so [trainees] have to learn a lot by looking and watching. In terms of resources, this is unfortunately not possible any other way." (TC3)*

> *"If you come [to the training center] four times a year, then two of those times are tests, like the shooting test, the legal theory test. Then there's not much time to learn something." (I2)*

Training coordinators and instructors made clear wishes and suggestions on resources they require to improve the quality of their training:

> *"My wish is to have a group of trainers only doing training because now I borrow the trainers from regular daily [work], you know, patrolling." (TC4)*

"The [instructors] need more logistics. We have no training infrastructures. We have no buildings, and we have no weapons." (TC7)

Training Components

To ensure that police officers continue to be well prepared for any on-duty incidents, law enforcement agencies provide training content that ensures that officers have the knowledge and skill to resolve situations they encounter on duty. The common training components discussed by all six law enforcement agencies include weapon handling, shooting, self-defense, arresting skills, tactical procedures (such as tactical movements during a building search), and communication. However, the way these components are trained differs across agencies. For instance, one law enforcement agency structures their formal yearly training content into five modules (one module for each training day), where three modules focus on the training of practical skills like weapon handling and shooting, equipment handling (e.g., multi-purpose baton, taser), and tactical procedures and movements. The other two modules consist of scenario-based training relating to the yearly training focus. In contrast, within the mandatory structure of spending a minimum of 6 h per month on practical skills (e.g., handcuffing, self-defense, use of force), another agency lets the unit leader of each police unit dictate the training components based on the needs of his or her officers.

According to training coordinators and instructors, using scenario-based training is seen as the most holistic and effective form of training. Scenario-based training is implemented in the delivery of training in each of the interviewed law enforcement agencies. Instructors make use of scenario training to combine training components:

"The scenarios and role-play, everything of police training goes into it. So, you have two guns, you have knives, you have persons, cars and they have to act like they are on the street. And so that's everything. When you are on the shooting range, you only shoot. When you are in the dojo, you only fight. But in the role plays, you do everything and it's more complete." (I4)

The integration of stress inoculation training and decision-making is for most training coordinators and instructors an important part of these role-plays. Instructors use scenario trainings and role-plays to increase stress resilience of trainees and prepare them for stressful encounters on duty:

"The trainees are prepared for [stressful situation] through specific scenario trainings in which [instructors] play with the stress. [Instructors] see how the trainees feel and control the stress. For those who can take it better, you go a little higher. The instructors can do that. You can actively increase [the stress] a bit or flatten it a bit, if you notice that they are not getting further. Through this targeted scenario training, [trainees] will become familiar with these stress levels." (TC3)

While performing under stress and making appropriate decisions in high-risk situations are integrated into the role-plays that instructors conduct, training coordinators stated that there is no set training component in the curricula which separately or specifically aims at preparing trainees for stressful situations on the job or teaches them appropriate decision-making and acting skills for on-duty encounters. To this end, most law enforcement agencies look to improve the current state of practice:

"As I said, I think we're at the beginning with decision-based training, we're just getting started. So far, it has always been the case that we have provided a strict line and the solution to it was already predetermined. We are currently parting with [this approach] precisely because there is not always just one solution, there must be several solutions and several paths to reach these solutions." (TC5)

Assessment

To ensure that cadets and police officers maintain a sufficient standard of skill from the training components facilitated during the basic formation and the continued professional development, law enforcement agencies have various assessment measures in place. Across the law enforcement agencies that have been interviewed, these assessments entail written or theoretical tests of laws and regulations, shooting assessments on the shooting range, assessments of arresting and self-defense skills, the handling of certain gear such as the baton, physical fitness tests, and for some law enforcement agencies a combination of these.

Particularly during the continued professional development, not all European law enforcement agencies rely on formal assessment methods. One law enforcement agency mentioned that instead of having formal tests, police officers have evaluations with their unit leader on a yearly basis. The unit leader evaluates the officers' on-duty performance and suggests areas in which additional training is needed. Based on this evaluation, the officer in question will be assigned to training courses that address his or her specific insufficiencies.

For law enforcement agencies that require formal assessment during the continued professional development, officers have to complete testing on a yearly basis. A particular assessment focus is placed on the weapon handling and shooting testing that takes place on a shooting range, which for one of the interviewed law enforcement agencies falls outside the range of yearly testing and instead takes place every 6 months. In case a police officer fails the shooting assessment, the officer has to hand in his or her service weapon and successfully repeat the shooting assessment before the weapon is returned and the officer is allowed to patrol the streets again.

However, due to resource limitation, such as the need for officers to patrol the streets, other areas of assessment do not have the same consequences as protocol dictates:

"What happens if you fail the exam? In those areas, it is checked whether there's a need for additional training. Often that is the case, and that would also be possible [to take on] for the instructors. But the authorities don't send people because they have to be on the streets. Then that's it, the person has deficits, but oh, maybe next year [it will be better]." (TC6)

On the other hand, failing certain types of assessments may not have pre-dictated consequences at all:

"The physical test is the only thing that hasn't got consequences. You should get a positive [results], but if you don't, no problem, you can still be on the street." (TC1)

Delivery of Police Training

Role of the Instructor

According to the interviewed training coordinators and instructors, police instructors have an essential role in the conceptualization and delivery of a training session. To ensure that trainees learn effectively and efficiently, instructors have a wide range of demanding tasks to fulfill. Across the six interviewed law enforcement agencies, there are differences in tasks that instructors take on. For instance, two law enforcement agencies train their instructors to teach all components of training, whereas the other four law enforcement agencies have instructors that specialize and provide training solely in particular components such as shooting, self-defense, or tactical procedures. Similarly, some instructors specialize in the training of particular trainee groups like police recruits, regular police officers, or specialized teams such as special forces or undercover teams.

Independent of any specialization, all interviewed instructors feel a strong sense of responsibility associated with their role as a teacher. Instructors primarily felt that their responsibility in providing the training is to set up each training session with the aim to advance the knowledge and skill of the trainees and to create a safe environment in which trainees can learn:

> *"The role of teachers is to make the trainings. You're responsible for the safety in the training but also for making the good steps [in teaching]. [. . .]. You have to think about what is the purpose of my training? And what do we want to reach at the end?" (I1)*

Next to feeling a strong sense of responsibility associated with their role as instructors, the instructors we interviewed seem to thoroughly enjoy providing training to trainees, resulting in 22 quotations related to enjoyment of their profession. The source of enjoyment that instructors share differs. For instance, three instructors explicitly stated that the training session itself is what they enjoy the most; particularly, having a training environment in which the interaction with the trainees is productive yet fun:

> *"I think that it's the most important for me as a teacher to have fun in my lessons, but also to [teach] them something and have a good interaction together." (I1)*

Similarly, some instructors enjoy taking part in the learning process and witnessing the progress of their trainees the most. For yet others, the methodology of setting up a training is inherently enjoyable. For example, four instructors mentioned that the way they conceptualize the training is what brings them enjoyment in their profession as an instructor:

> *"I like the way you build up a training. So that it's useful and that it is as relevant as possible. That's what I like. To play with that in your head before the training to get it so that it is all. So that it is a good training where people really learn. That's what I enjoy most about giving training." (I2)*

Although the source of enjoyment for their profession differs amongst instructors, the sense of responsibility to teach trainees relevant knowledge and skills prevails across all interviewed instructors and is reflected at the core of what instructors enjoy about their role as police instructors.

Didactical Approaches and Concepts

Because the delivery of training across and even within law enforcement agencies is as diverse as the frequency and duration specified in the training curricula across Europe, in the following, we provide an overview of the didactical approaches and concepts that European police instructors currently rely on in their training.

Linear Pedagogy

When setting up a training program or a single training session, the interviewed law enforcement agencies[1] rely on a linear approach, building up a training in sequential stages from simple to complex. One instructor illustrated this approach using arresting techniques as an example:

> *"So far, we've set up a lot of trainings from simple to complex. That means if you now want to learn an arrest technique that is a bit more complex, you have to start with the basics first, and then you build it up piece by piece. This means that the movements are sequenced. And at the end you do a learning objective check on this skill. You build up a bit of stress and see what stuck. The reality outside is that the possible suspect [you would use the arresting technique on] may move a little. That means, I won't always be able to call on this great one technique that I have now trained for 2 h. I will have other stressors around it and maybe I will make other decisions as well." (I14)*

While this approach can be considered common practice amongst the interviewed law enforcement agencies, some instructors and training coordinators see the difficulty in this approach. As is demonstrated in the quote above, teaching skills in a linear fashion to achieve the perfect technique is seldom realistic or applicable during on-duty incidents. To this end, one law enforcement agency explicitly mentioned that they aim to part with this approach which allows for more flexibility and realism in their training programs and sessions.

Exploratory Learning

Although the linear approach of teaching appears to be common practice amongst the interviewed law enforcement agencies, a few instructors approach their training sessions by placing exploration of movements rather than perfect technique at the center. Seven of the interviewed instructors (from four different law enforcement agencies) prefer to set up their training sessions in a way that lets their trainees explore different movements and solutions to problems themselves. One instructor describes his approach to exploration in training as follows:

> *"I like to do it [this way]: I give a case and I'm not going to show you how to do it, you just do it. And then they do it. And it works out okay. But then I put in some input and say maybe like this and then they'll try again and again. Not like provide [information on] this is the way that you're always going to open a door, and this is the way you will always work an attack. If you do that, they are just going to copy me. And they might have good ideas too. So, I like to*

[1]Four law enforcement agencies explicitly described a linear approach in training, while the remaining two agencies did not explicitly discuss a linear approach to a training program or session during the interviews. Based on the reviewed training-related material from the law enforcement agencies themselves, these two agencies also use a linear approach in their training practices.

give them a chance to try. And if I see that it's not good, I try to give them hints and then they find it out by themselves." (I10)

Feedback

With 17 quotations relating to feedback, instructors described that providing effective feedback is one of the most important tasks of the instructor during a training session. Giving feedback allows instructors to review their trainees' performance, provide suggestions for improvement, and gather input from the trainees, while also ensuring that what is being learned by the trainees aligns with the purpose of the training session. Although most interviewed instructors mentioned that they utilize training time for giving feedback, the way they provide it differs from agency to agency. Some law enforcement agencies use unstructured feedback in which the role of the instructor is to debate the trainees performance and look for better solutions together, while other agencies prefer a more structured approach. For instance, one law enforcement agency has specific content that the instructors cover during a scenario-based training session:

"We have a specific way of giving feedback and we are working on four points: And that's safety, communication, movement, and treating the problem. And I think if you talk about those four aspects, you cover 90 percent of what you need to cover in a really small timeframe." (TC2)

Although the content of the feedback might be the same for instructors of the same law enforcement agency, the delivery of feedback oftentimes differs from instructor to instructor even within an agency. For instance, when using verbal feedback, four of the interviewed instructors explicitly mentioned that they prefer to have their trainees reflect on their performance themselves before the instructor provides input and recommendations. Four other instructors also noted the use of physical feedback as immensely important for their trainees to learn. For those instructors, physical feedback refers to feedback that trainees get from the training environment. To highlight this, one instructor (I2) provided the example of receiving a pain stimulus such as getting hit with non-lethal training ammunition when a trainee is not taking cover properly during a training scenario.

While the content, delivery, and type of feedback are important for instructors to consider, instructors have also mentioned that the timing of feedback is relevant in a training session. For instance, one instructor explained that he switches between providing feedback during a training scenario and providing feedback after the scenario is over:

"Sometimes in some trainings, you will stop and say, OK, look how you're standing, guys. Is that OK? Or what's a better way to stand? And then you go, OK, you stand there and go further. So, you're teaching in the moment. That's a way of teaching and sometimes you need that [. . .]. And sometimes it's better to let it go and then afterward say, OK, look what you did. What more do you see? Is there someplace better you can stand? And then they [can] think about it." (I1)

Repetition

To ensure that trainees gain experiences in training and learn from situations in a safe, practical setting, instructors let trainees repeat a variety of training scenarios within a training session. For many of the interviewed training instructors (7), implementing repetition in the set-up of a training session is a staple part of their preparation. However, the opinions of instructors regarding the approach to repetition differ. For instance, one approach involves allowing trainees to repeat the same scenario to let them learn from their mistakes, while the other approach entails creating repetitions of slightly differing scenarios to provide new situations for trainees to solve. The former approach relates to a form of drill practice where trainees repeat the same task in the same setting until they are fully capable of solving the scenario. The approach of repeating the same scenario teaches trainees to apply a particular skill in a particular context. The latter approach — varying the environment and situation context of the scenario from one repetition to the next — allows trainees to explore solutions and make decisions regarding the use of the skill taught in the lesson.

In conclusion, because the delivery of training is not as heavily regulated as the components and skills that need to be trained, a lot of variation in the didactical and methodological approaches to training exists across and within the interviewed law enforcement agencies. Due to the limited regulation of training delivery, instructors have more freedom to use their expertise and experience to design and deliver a training session. Although common practices such as linear approaches to training exist in the training programs of law enforcement agencies, instructors are still able to use their expertise to set-up and deliver a training that aligns most with their perspective on how learning takes place effectively.

Training Environment

In preparation for a training session, the interviewed instructors described the importance of creating an effective training environment to enrich the quality of learning and motivation of trainees. To this end, instructors have differing opinions on what makes a training environment effective. For example, two instructors stated that an environment that allows trainees to make mistakes without judgment from peers or instructors is the most vital part. For another instructor, creating a positive environment in which trainees can have fun and are seen for their individual qualities is what makes the training environment effective for learning to take place:

"I make very clear announcements. Definitely. But I also allow the individuality. I allow fun and joy because only in a positive learning atmosphere can you get the most out of people." (I12)

In addition, five instructors (from four different law enforcement agencies) mentioned that tailoring the training environment to the needs of the trainees is what allows for an environment to support a high quality of learning. To this end, one instructor described that the level of experience that the trainee groups have (e.g., recruits versus special forces) determines the way he sets up his training environment. The instructor explained that in a training session, he largely uses a variety of communication styles to adjust the environment to the level of the trainee groups. For instance, when training with special forces officers, his communication is more task-oriented

and deviates little from the training objective. When training with recruits, he allows them the space to ask questions and reflect on problems and solutions.

While instructors aim to provide a supportive training environment through their guidance and communication, they also consider the physical training environment as a factor in creating an effective space for trainees to learn. This includes the setting in which the training takes place such as a shooting range or other training facilities but also the equipment available to conduct a training such as FX systems (a non-lethal combat training system that allows trainees to use shooting weapons with marking cartridges). To this end, instructors expressed concern regarding the level of realism they are able to achieve with the resources available to them:

> *"For example, right now in the [training] centers that we have, we have different layouts, but they are still the same. And at one point, the person who is training is going to act like a robot. He knows the door is there. He knows he has two rooms, and I don't know how many windows." (I15)*

The familiarization with the fixed training facilities may lead trainees to dismiss important skills such as the careful scanning of a room that they would use in an unfamiliar, real-life setting. Similarly, when using FX systems, trainees are required to wear protection gear that they would not be wearing when they are patrolling the streets. Oftentimes this additional training equipment, though allowing for the safe use of shooting weapons in training, may hinder the level of realism of a training:

> *"Whenever I have to disguise myself, because I put on protection helmets or something else, then you very often have the problem that the equipment interferes, it fogs up, I can no longer see anything. Also, I have no recognition of the hits because I am wearing thick clothes." (I14)*

Instructors agree that although advances have been made, the issue of familiarization with fixed training facilities and the limited availability of current training equipment impedes the level of realism that instructors would like to achieve when designing training environments.

DISCUSSION

The organization and delivery of training practices described by training coordinators and police instructors of European law enforcement agencies reflect the diverse landscape of police training. This diversity is expressed in the training curricula, the organizational provisions of resources for training, and the didactical approaches to training delivery. In particular, the time recruits spend in basic training at the police academy highlights the diverse context of training across law enforcement agencies. While the amount of time recruits spend in the police academy is three and a half years for one law enforcement agency, police recruits at a different agency attend only for one year before assuming their position as patrol officers. This difference in education and training may be of particular concern for the increasing need of joint investigations in cross-border police cooperation (Meško, 2017). Cross-border investigations in which police officers of different agencies work together — relying on mutuality of knowledge of operational measures and investigative procedures — may prove challenging when knowledge and expertise of the officers differ tremendously across agencies.

While differences exist in police training across European law enforcement agencies, many of the current training practices share common principles. With the shared objective of providing training to develop the necessary proficiencies and improve the performance of police officers, law enforcement agencies across Europe focus on similar training components to ensure that officers are equipped with adequate knowledge and skills for duty. The interviewed agencies placed a particular focus on training of physical skills such as shooting, arresting, self-defense, and tactical procedures. The structuring of these skills into segmented training components (e.g., a training segment of the curriculum focusing only on learning to shoot, a different segment focusing only on learning self-defense skills) is a common principle in the organization of training. This finding is consistent with training practices of other European law enforcement agencies who also train particular components such as self-defense and arrest training, firearms training, and tactical training in isolated training segments (Staller et al., 2021). Similarly, the common principle in teaching of these components holds that training should be structured in a linear fashion moving from simple to complex, learning about the skill in a lecture-based setting, practicing the skill in a controlled setting such as the shooting range or the dojo, and then applying the skill in scenario-based role-plays (Renden et al., 2015). Taken together, the common principles law enforcement agencies share in the organization and delivery of training is the linear approach to learning.

The described overview of European police training practices represents the current state of training according to those who conceptualize and deliver it. Based on this current state of training, we discuss strengths and challenges of European police training with the aim to provide law enforcement agencies with examples of good practices, possible improvements, and solutions to challenges they may experience, as well as provide researchers with shortcomings in training that would benefit from further investigation.

Strengths of Current Training Practices

Five of the six interviewed law enforcement agencies structure their training content of the continued professional development of police officers on the basis of a yearly training focus determined by an administrative police board for decisions on training curricula. Having a yearly content-specific training focus provides training coordinators and police instructors with current and realistic contexts in which they can structure and deliver the training of skills and procedures. Next to providing realistic and current training contexts, a yearly training focus determined by a national or regional advisory board is assumed to reflect the specific needs of each law enforcement agency's region of operation, highlighting the necessity of training skills and procedures in the context of what has previously been an area of attention in that region. For instance, a multitude of police encounters with people with mental illnesses revealed that officers had difficulties recognizing, addressing, and interacting

with people with mental illnesses (see Morabito, 2007; Livingston, 2016). A large number of these incidents may call a national or regional police board to decide to place a yearly training focus on interaction with people with mental illnesses — as has been the case for one of the interviewed law enforcement agencies. By maintaining an overview of the most pressing national or regional matters, administrative police boards can use the yearly training focus to shape their training content to be realistic, current, and relevant.

Another strength that the interviewed law enforcement agencies share is their ability to critically evaluate the efficacy of the current state of their training practices. To this end, training coordinators and instructors aim to identify shortcomings of their current practices and look to improve the state of training of their agencies. For instance, when recognizing that teaching police officers the perfect technique in a static setting did not ensure transfer to the complex and dynamic settings that officers encounter on the street (Pinder et al., 2015; Staller et al., 2021), the instructors began looking to adjust their approach to skill learning. Current changes that the interviewed law enforcement agencies aim to implement into their training include moving away from isolated technique mastery of a single skill (Abraham and Collins, 2011), implementing decision-based training (Helsen and Starkes, 1999; Johnsen et al., 2016), and changing pedagogical approaches from strictly linear to non-linear (see Koerner and Staller, 2018, 2021), combating the common principles that are still reflected in training curricula and delivery. The ability of training instructors, coordinators, and law enforcement agencies to be self-critical and identify areas of improvements in training facilitates the development of current practices.

Current police training and its delivery benefit from the diverse expertise of police instructors. Instructors' perception of how learning takes place differs both across and within law enforcement agencies — similar to how one trainee's learning preference differs from the next (Abraham and Collins, 2011). Because of their diverse perspectives on learning, each police instructor takes a unique approach to the delivery of their training. When law enforcement agencies provide their instructors with autonomy in the delivery of training, instructors have the opportunity to use their expertise and develop an approach that fits them best, rather than adhering to a prescribed teaching style that does not align with their expertise and preference. Giving police instructors the autonomy to use their expertise to guide a training session increases the chance that instructors are fully engaged in their practice and create motivating training environments for trainees (Klusmann et al., 2008; Christenson et al., 2012). This autonomy and space for diversity may indeed also be reflected in the high levels of enjoyment and motivation of instructors found in this study.

Challenges of Current Training Practices

The overview of current training practices across European law enforcement agencies reveals numerous shared challenges that police coordinators and instructors face in the organization and delivery of police training. First, because the organization of police training — including the development and approval of training curricula — is governed by the hierarchical structure inherent to European law enforcement agencies, making modifications to the current state of training requires administrative effort (Martin et al., 2017; Shipton, 2019). For example, when instructors identify areas for improvement in their training, they have to take numerous steps to reach the level at which changes to training structures and curricula can be implemented. This process can be tedious and time-consuming, particularly if the deciding body for approval or rejection of modification to the training framework and curriculum is a governmental organization such as the internal ministry. Thus, although training coordinators and instructors may recognize room for improvement in their training practices and provide suggestions that align with developments and implementation recommendations in the scientific field (see Marenin, 2004; Koerner and Staller, 2021; Staller et al., 2021), for these suggestions to be reflected in training curricula and training delivery, numerous lengthy administrative hurdles have to be taken. Although the hierarchical structure of law enforcement agencies has the benefit of steering the content of training from an organizational position (e.g., by providing a yearly training focus), the drawback associated with this centralization is the slow and complex process for changes to take effect. While established organizational structures and processes are difficult to overcome or change — particularly in the world of policing (Chappell and Lanza-Kaduce, 2010) — law enforcement agencies may start by setting up internal "input groups" consisting of training coordinators and instructors to collect and monitor immediate challenges to the organization and delivery of training. The first function of such input group is to act as a direct link between the current state of training and the organizational entity in charge of training related decision-making. The second function of the input group is to differentiate challenges that require administrative structures and the attention of the organizational entity (e.g., changes to the training curriculum) and challenges to which solutions can be found and implemented on an immediate level [e.g., taking a learner-centered teaching approach in training sessions (Koerner and Staller, 2021)].

Another challenge that police instructors face points at the level of training delivery. When delivering a training, police instructors recognize the importance of providing realistic training to their trainees (Renden et al., 2015; Andersen et al., 2016). However, instructors are critical of the resources available to them to create realistic training environments (Cushion, 2018). For example, having to use the same training locations and facilities for scenario training allows trainees to familiarize themselves with the settings, providing a less effective low-stress and low-variance training environment (Adang, 2012; Staller and Zaiser, 2015; Staller et al., 2021). To this end, instructors wish for more flexibility in location and facilities in which they can conduct training. As availability of resources plays a part in the limited level of realism in training, an additional issue might be that instructors lack the knowledge or skill to make training sufficiently realistic with the resources available to

them. By relying solely on physical aspects of the training environment, instructors dismiss other opportunities to make training realistic; for instance, designing training tasks that allow for motor, verbal, and cognitive skills to be trained in conjunction (Di Nota and Huhta, 2019). To address the issue of limited realism in training, law enforcement agencies should consider three possible solutions. First, although unlikely in the present economic climate (Cushion, 2018), law enforcement agencies could provide instructors with the resources they need to create realistic training (Di Nota and Huhta, 2019). Second, law enforcement agencies may look for cost-effective innovations such as the use of VR for realistic training (Giessing, 2021; Murtinger et al., 2021). Lastly, law enforcement agencies can strive to elevate the knowledge and skill of instructors to create realistic training with the (limited) resources available to them (see for instance Cushion, 2018 for an alternative approach to reality-based training).

The assessment and testing of knowledge and skills of police officers, particularly during the continued professional development, is another common challenge of current practices amongst law enforcement agencies. While law enforcement agencies put assessments into place to ensure that police officers possess a certain standard of skill, our findings showed discrepancies in the consequences for underperformance during those assessments. For instance, when failing the physical competency test, there are no consequences for officers of one law enforcement agency. Further, the assessments in place are rarely representative of the on-duty work that police officers perform (Lonsway, 2003; Tipton et al., 2013; Petersen et al., 2016; Koedijk et al., 2021). Similar to the modular, segmented structure of training components in the training curricula, currently applied assessment and testing methods evaluate isolated skills such as static shooting on the shooting range or self-defense technique evaluations. Law enforcement agencies can aim to improve their assessment practices by implementing common standards for underperformance and by reevaluating the design of their assessment methods to include representative testing environments (Staller et al., 2017; Koedijk et al., 2020).

CONCLUSION

An overview of the current state of European police practices, their differences and commonalities, and strengths and challenges, depicts the landscape in which law enforcement agencies organize and deliver training. The findings emphasize the complexity of police training, including the common underlying principles that guide development and delivery of training, the administrative influence on developing and adjusting training curricula, and the wishes and needs of police coordinators and instructors for their training across law enforcement agencies.

European law enforcement agencies operate in diverse contexts and differ in the availability of resources to organize and deliver training. While the contexts and available resources differ, European law enforcement agencies face common challenges in training, such as having to undergo lengthy hierarchical, administrative processes to bring about changes to current training practices, achieving a limited level of realism in training, and having insufficient assessment standards. As each law enforcement agency has their distinct context in which they operate, a one-size-fits-all solution may not be helpful to overcome the challenges European law enforcement agencies share. To improve upon current training practices, generic recommendations, such as those provided in this paper (e.g., setting up a "input group" to influence administrative processes more concretely, providing additional training resources, alternative training systems, or trainer trainings to enhance the level of realism in training, and implementing common assessment standards and representative testing environments to enhance assessment practices), provide law enforcement agencies with initial directions for implementation of solutions. These generic recommendations can be adjusted by each law enforcement agency to encompass the wishes and needs, the distinct context of operation, and the available resources. Based on our findings on the strengths that European law enforcement agencies share, we are optimistic about improvements in police training. There is generally a solid structure by which training is organized and updated, law enforcement agencies possess self-critical and evaluative qualities at all levels involved with the daily practice of police training, and last, but certainly not least, police instructors are committed to optimizing the training environment for their trainees.

DATA AVAILABILITY STATEMENT

The datasets presented in this article are not readily available. Due to confidentiality agreements with participating law enforcement agencies and identifiable participant data in interview transcripts, the raw data obtained from the conducted interviews cannot be shared externally. Requests to access the interview guides should be directed to LK, l.kleygrewe@vu.nl.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by the Social and Societal Ethics Committee of the Katholieke Universiteit Leuven as part of the SHOTPROS project. The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

LK led the data collection and wrote the first draft of the manuscript. LK and RH performed the quantitative analysis. RH supervised the research process. RO, MK, and RH contributed to the manuscript revision. All authors contributed to the conception and design of the study and read and approved the submitted version.

FUNDING

This work was supported by the European Commission's Horizon 2020 Research and Innovation Programme (Grant No. 833672).

ACKNOWLEDGMENTS

We would like to thank the involved law enforcement agencies and their training coordinators and instructors for participating in this study.

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Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

frontiers in Psychology

ORIGINAL RESEARCH
published: 17 January 2022
doi: 10.3389/fpsyg.2021.759132

A Reasonable Officer: Examining the Relationships Among Stress, Training, and Performance in a Highly Realistic Lethal Force Scenario

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OPEN ACCESS

Edited by:
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Specialty section:
This article was submitted to Educational Psychology, a section of the journal Frontiers in Psychology

Received: 15 August 2021
Accepted: 09 November 2021
Published: 17 January 2022

Citation:
Baldwin S, Bennell C, Blaskovits B, Brown A, Jenkins B, Lawrence C, McGale H, Semple T and Andersen JP (2022) A Reasonable Officer: Examining the Relationships Among Stress, Training, and Performance in a Highly Realistic Lethal Force Scenario. Front. Psychol. 12:759132. doi: 10.3389/fpsyg.2021.759132

Under conditions of physiological stress, officers are sometimes required to make split-second life-or-death decisions, where deficits in performance can have tragic outcomes, including serious injury or death and strained police–community relations. The current study assessed the performance of 122 active-duty police officers during a realistic lethal force scenario to examine whether performance was affected by the officer's level of operational skills training, years of police service, and stress reactivity. Results demonstrated that the scenario produced elevated heart rates (i.e., 150 beats per minute), as well as perceptual and cognitive distortions, such as tunnel vision, commensurate with those observed in naturalistic use of force encounters. The average performance rating from the scenario was 59%, with 27% of participants making at least one lethal force error. Elevated stress reactivity was a predictor of poorer performance and increased lethal force errors. Level of training and years of police service had differential and complex effects on both performance and lethal force errors. Our results illustrate the need to critically reflect on police training practices and continue to make evidence-based improvements to training. The findings also highlight that while training may significantly improve outcomes, flawless performance is likely not probable, given the limits of human performance under stress. Implications for the objective reasonableness standard, which is used to assess the appropriateness of force in courts of law, are discussed.

Keywords: police, stress, training, use of force, objective reasonableness standard

INTRODUCTION

Police officers encounter critical incidents that have the hallmark characteristics of a situation that would cause a physiological stress response: namely – they are unpredictable, potentially uncontrollable, novel, and often involve time pressure (Sapolsky, 2004; Alison and Crego, 2012; Violanti, 2014). Under these circumstances, officers are occasionally required to make life-or-death decisions, often in a split-second, to preserve and protect the lives of both the public and themselves (Artwohl, 2002). Video footage of certain police–public encounters highlights deficits in officer performance, including errors in the decision to use lethal force. Such incidents

can have tragic consequences, including serious injury or death and strained police–community relations. Occasionally, such incidents can also lead to the incarceration of police officers and legal liability for law enforcement agencies (LEAs) that have not adequately prepared their officers for critical incidents (e.g., Public Prosecution Service of Canada, 2018).

Existing research and theoretical knowledge indicate that stress can adversely impact performance, but that training and experience can moderate stress reactivity and improve performance through the appraisal process (e.g., Driskell and Salas, 1996). Thus, using a sample of Canadian police officers, the aim of the current study is to examine the level of performance that can reasonably be expected under conditions that elicit high levels of stress, based on officers' years of experience and the level of training they have received. Critical reflection on training practices and evidence-based improvements to training may be called for if systemic errors or deficiencies in performance are observed in realistic scenarios. Results from this study may also provide new evidence to inform the objective reasonableness standard, which is used to assess the appropriateness of force in courts of law (Cyr, 2016; Zamoff, 2020).

Use of Force and the Objective Reasonableness Standard

The authority for police to use force in Canada is granted under section 25 of the Criminal Code (1985), whereby police officers who are acting on reasonable grounds are authorized to use as much force as necessary to enforce the law. In the case of *R. v. Nasogaluak* (McLachlin et al., 2010, p. 208), the Supreme Court of Canada further established that the "allowable degree of force is constrained by the principles of proportionality, necessity and reasonableness." Where lethal force is concerned, the force must also be necessary for the purpose of self-preservation or the protection of others from death or grievous bodily harm (Criminal Code, 1985). To assess the appropriateness of an officer's use of force, several guiding principles from international case law have become entrenched in the Canadian criminal justice system. Foremost is the U.S. Supreme Court case of *Graham v. Connor* (Rehnquist, 1989, p. 387), which established the objective reasonableness standard, instructing that the "…'reasonableness' of a particular use of force must be judged from the perspective of a reasonable officer on the scene, and its calculus must embody an allowance for the fact that police officers are often forced to make split-second decisions about the amount of force necessary in a particular situation." In essence, given the totality of the circumstances known at the time and without hindsight bias, would other reasonably prudent officers respond in the same or similar way (Alpert and Smith, 1994; International Association of Chiefs of Police, 2020)?

Scholars have provided research evidence of neurophysiological factors (e.g., cognitive and perceptual distortions) that might frame the perceptions and actions of a reasonable officer on the scene (e.g., Klinger and Brunson, 2009). However, the use of such research in court may be the exception rather than the rule (DuCharme, 2002). Indeed, critics argue that the objective reasonableness standard lacks an evidence-based foundation and that assessments of reasonableness focus too much on the general dangers and stressful nature of policing (Fagan and Campbell, 2020; Zamoff, 2020). To remedy this, Zamoff (2020) recently proposed that in determining the perspective of a reasonable officer, the courts should more heavily weigh the officer's experience and training, as well as the extent to which they adhered to or deviated from their training and the agency's policies. While valuable, this approach also lacks evidence of the extent that these factors are related to performance and errors or are influenced by stress (Engel and Smith, 2009).

Psychophysiological Threat Response

When presented with a threat, whether real or perceived, the body implicitly (i.e., below conscious awareness) engages in a series of physiological processes, colloquially known as the "fight-or-flight" response (Thayer and Sternberg, 2006; LeDoux and Pine, 2016). This evolutionary adaptive response promotes survival by immediately preparing the body's physiological and cognitive capacities to meet the demands of the situation, while suppressing unnecessary functions, such as reproduction and digestion (Kemeny, 2003; Artwohl, 2008; Anderson et al., 2019). During the fight-or-flight response, the sympatho-adrenal response is triggered, which leads to a wide-spread release of catecholamines and hormones to power the survival response (McEwen, 1998; Lovallo, 2016). Specifically, the hypothalamic–pituitary–adrenal (HPA) axis is activated, which results in the rapid release of epinephrine (i.e., adrenaline) and cortisol (De Kloet et al., 1998; Lovallo, 2016). Cortisol increases blood sugar and prepares the body for energy expenditure by stimulating glucose production and mobilizing fatty acids (Lovallo, 2016; Tsigos et al., 2020). Concurrently, the autonomic nervous system (ANS) is engaged, stimulating the sympathetic nervous system (SNS) and suppressing the parasympathetic nervous system (PNS), which is associated with modifying the sympathetic response when necessary (e.g., focused attention) and performing "rest and digest" (i.e., recovery and repair) functions (Berntson and Cacioppo, 2004; Fridman et al., 2019). When the SNS is activated, stress hormones such as norepinephrine and epinephrine are released (Lovallo, 2016).

The cascade of these catecholamines, hormones, and glucose in the bloodstream from the stress system response stimulates increased heart rate (HR), blood pressure, and respiration (Tsigos and Chrousos, 2002; Chrousos, 2009). The rapid rise in energy, oxygenation, and blood flow is directed in greatest concentration to the heart, brain, and large muscles, while they are inhibited to other areas not required to respond to a threat, such as the digestive system (Tsigos and Chrousos, 2002). Therefore, activation of this sympatho-adrenal stress response improves chances of survival in the short term, by increasing resistance, strength, and focused attention (Tsigos and Chrousos, 2002; Artwohl, 2008; Fenici et al., 2011).

While fight-or-flight is an automatic behavioral and physiological response that is engaged without the need for higher-order cognitive processing, it can be sustained and moderated through psychological processes, such as threat

appraisal, fear, and anxiety (Thayer and Sternberg, 2006; LeDoux and Pine, 2016; Chan and Andersen, 2020). The degree of SNS arousal depends primarily on the type of threat encountered and one's perception of how severe it is (Kalisch et al., 2015; LeDoux and Pine, 2016). For example, when the threat of harm during an encounter with a subject is perceived by the officer as outweighing their ability to cope with the situation (e.g., based on experience and training), then the subject may continue to be appraised as a threat, maintaining the intensity of the emotional and physiological response (Folkman et al., 1986; Driskell and Salas, 1996; Anshel et al., 1997). While there is significant evidence that the body implicitly responds to a threat, what is less clear is the extent to which this response varies as a function of experience and training, as well as the impact it has on various aspects of performance.

The Impact of Stress on Police Performance

Studies demonstrate that the impact of SNS arousal on performance is complex. The type of threat stimulus encountered, and the strength of the resulting threat response can improve or impair perceptual, cognitive, and motor performance depending on context (Arble et al., 2019; Bertilsson et al., 2019). Adaptive SNS arousal, which meets the demands of the situation, can be beneficial to performance (Yerkes and Dodson, 1908), such as shooting accuracy (e.g., Vickers and Williams, 2007), and threat-related decision-making (e.g., Akinola and Mendes, 2012). However, maladaptive stress arousal (i.e., too much or too little) is considered one of the main causes of human performance failure (Vine et al., 2016) and can result in degradation of task accuracy and increased task errors (Driskell and Salas, 1996; Nieuwenhuys et al., 2012). Growing evidence also suggests that performance deficits are related to both maladaptive SNS arousal and the suppression of the stress modulating parasympathetic influence (Saus et al., 2006; Andersen et al., 2018; Spangler et al., 2018). For example, impairments to response inhibition, resulting in more lethal force errors, can occur when the PNS is suppressed (Spangler et al., 2018).

Generally, stress-induced deficits primarily affect cognitive functions, such as perception, attention, and decision-making (Driskell and Salas, 1996; Di Nota et al., 2020). However, motor performance, in particular fine motor skills, is also affected (Staal, 2004; Nieuwenhuys and Oudejans, 2011a; Anderson et al., 2019). Since manipulating stressful real-world encounters for research purposes is unethical (Giessing et al., 2019), results from realistic scenario-based experiments form much of the existing knowledge about the impact of acute stress on performance among police officers. To date, this literature has revealed that stress inducing scenarios result in impairments to various aspects of police performance including shooting accuracy (Nieuwenhuys and Oudejans, 2010; Taverniers and De Boeck, 2014; Landman et al., 2016a), quality of skill execution (Renden et al., 2014; Nieuwenhuys et al., 2016), proportionality of force applied (Nieuwenhuys et al., 2012; Renden et al., 2017), and memory (Hope et al., 2016). The stress response also appears to have differential effects, whereby rehearsed and automated skills are influenced to a lesser degree (Vickers and Lewinski, 2012; Renden et al., 2017; Arble et al., 2019). These findings from experimental research with simulations are extremely important to draw conclusions about what *might* reasonably happen to performance in real-world stressful encounters (Giessing et al., 2019).

While few real-world studies exist, examinations of officer-involved shootings (OIS) have also uncovered stress-induced performance issues. For example, average hit rates ranging from 14 to 38% have been observed in OIS (Morrison and Vila, 1998; Morrison and Garner, 2011; Donner and Popovich, 2018), which is in stark contrast to the almost 90% hit rate reported in range-based annual firearms qualifications (Anderson and Plecas, 2000; Brown et al., 2021). In OIS incidents, officers have also reported experiencing perceptual distortions, impaired cognitive function, and reduced motor dexterity (e.g., Honig and Sultan, 2004; Artwohl, 2008; Klinger and Brunson, 2009). For example, Artwohl (2008) surveyed 157 police officers within a few weeks of being involved in an OIS. Findings demonstrated that most officers experienced perceptual narrowing, including diminished sound (84%) and tunnel vision (79%), and that the majority of officers (74%) responded on automatic pilot (i.e., with little or no conscious thought). Other studies have reported similar findings (e.g., Honig and Sultan, 2004; Klinger and Brunson, 2009).

Attentional control theory adds additional explanatory power to understanding performance impairments (Eysenck et al., 2007). This theory suggests that when exposed to a threatening stimulus, attention is drawn (or distracted) away from task relevant processes (e.g., decision-making) to the threat-related stimuli *via* psychological and neurophysiological responses (Eysenck et al., 2007; Nieuwenhuys and Oudejans, 2017; Di Nota and Huhta, 2019). Since attentional capacity is limited, it is difficult to attend to two things at the same time (Vickers, 2007). Therefore, when attention is focused on the threat, cognitive overload is more likely to occur, resulting in less attention available for mental and perceptual-motor processing (Driskell and Johnston, 1998; Eysenck et al., 2007; Hope, 2016).

These attentional, perceptual, and stress reactivity-related deficits mean that when presented with a threat, officers may be more prone to compromised performance, decision-making errors, and perceptual challenges (e.g., missing relevant cues, such as a subject pulling out a cellphone, not a gun; Easterbrook, 1959; Driskell and Salas, 1996; Vickers, 2007). Overall, the effects of stress on performance may be particularly detrimental during a critical incident, when officers are expected to demonstrate sound judgment and proficient performance. However, research in this area is limited, as studies tend to examine only narrow aspects of performance (e.g., shooting accuracy), use subjective measures of stress (e.g., self-report), or lack robust methods and measures for assessing performance.

Impact of Training and Experience on Stress Reactivity

While the body's default response to successfully deal with a threat is to stimulate the fight-or-flight response (LeDoux and Pine, 2016), training and experience are thought to moderate

TABLE 1 | Participant demographics.

	n	%	*M*	*SD*
Gender				
Female	23	18.9		
Male	99	81.1		
Age			38.2	8.2
Highest level of education completed				
High school diploma or equivalent	10	8.2		
Apprenticeship/Trade school	5	4.1		
Some college	16	13.1		
College diploma or certificate	28	23.0		
Some university	17	13.9		
Bachelor's degree	38	31.1		
Post-graduate certificate	2	1.6		
Master's degree	5	4.1		
Doctoral degree	1	0.8		
Current police rank				
Reserve constable	1	0.8		
Constable	85	69.7		
Corporal	24	19.7		
Sergeant	10	8.2		
Staff sergeant	1	0.8		
Inspector	1	0.8		
Years of police service			11.2	6.6
Previous experience with other police agency or the military				
Yes	16	13.1		
No	106	86.9		
Have you ever been involved in a lethal force encounter				
Subject officer	5	4.1		
Witness officer (i.e., officer on scene)	8	6.6		
No	109	89.3		

stress by intervening immediately following the initial autonomic stress response (Driskell and Salas, 1996; Kavanagh, 2005; Wollert et al., 2011). Theoretically, training and experience improve one's ability to cope with a threat, subsequently affecting the appraisal process, which sustains and moderates the fight-or-flight physiology (Driskell and Salas, 1996; Anshel et al., 1997; Kelley et al., 2019).

Research provides mixed evidence for this theory (Rimmele et al., 2007; Johnson et al., 2014; Landman et al., 2016b). For example, during UoF simulation studies, officers on specialized and tactical teams displayed lower HR during a high-pressure scenario as compared to general duty officers (Landman et al., 2016b; James et al., 2020). In contrast, when Baldwin et al. (2019) examined officers' level of operational skills training and years of experience, neither significantly modulated stress reactivity during general duty calls for service. Instead, stress reactivity was primarily associated with situational risk factors, such as the priority of the call and whether weapons were reported, or force was used. While the evidence is limited and mixed, greater levels of on-the-job experience and police training should, theoretically, improve coping and resilience to stressors, that is the very reason why training exists.

Impact of Training and Experience on Performance Under Stress

Research demonstrates that a wide range of training techniques can improve performance, even under stressful conditions. For example, there are many training strategies that can enhance the acquisition, retention, and application of knowledge, skills, and abilities (KSAs), such as the use of spaced practice and providing appropriate feedback (Jenkins et al., 2021; Di Nota et al., 2021a; Bennell et al., 2021b). In addition, meta-analyses and systematic reviews across many domains (e.g., sport, military, medicine, policing) consistently identify the performance benefits produced by training under pressure or threat that replicates the operational environment (Kent et al., 2018; Gröpel and Mesagno, 2019; Low et al., 2021). As a result, contemporary operational police skills training now often includes scenario-based training (SBT) that gradually exposes officers to stress-inducing simulated encounters in an attempt to develop stress-resilient skills and performance (Reaves, 2016). Meta-analyses provide empirical support for this training approach as a way of improving performance (Saunders et al., 1996; Low et al., 2021). Accordingly, we expect that officers with higher levels of operational skills training will perform better than those with less training, as they will have had greater opportunity to acquire and practice their KSAs in SBT, making the KSAs more adaptive and stress resilient.

In addition to training, operational experience may also be important to performance and decision-making under stress. For example, through the acquisition and automation of schemas, which are forms of tacit knowledge gained on-the-job or during training, experienced individuals can discern subtleties in their environment that may be imperceptible to novices (Kavanagh, 2006; Kahneman and Klein, 2009; Klein, 2015). Using this tacit knowledge, the recognition-primed decision-making (RPDM) model suggests that under dynamic and complex circumstances, experienced decision-makers can quickly assess situations and draw on their schemas to evaluate options and determine the first workable solution through satisficing (Klein, 1997, 1999; Ward et al., 2011). RPDM is resilient to stress and more adaptable to complex and dynamic situations (Klein, 2015). Accordingly, studies have found that greater levels of policing experience are related to things like flexible rather than serial decision-making (Boulton and Cole, 2016), anticipation and cue recognition (Vickers and Lewinski, 2012; Renden et al., 2015; Suss and Ward, 2018), and reduced lethal force errors (Vickers and Lewinski, 2012; Landman et al., 2016b). However, many of these studies dichotomize experience into expert (e.g., tactical officers) and novice (e.g., cadets) categories, which may not account for the broad spectrum of training that officers receive, nor do they disentangle the distinct effects of on-the-job experience compared to training.

Current Study

In the current study, active-duty police officers participated in a complex, dynamic, and realistic lethal force scenario to examine whether performance was affected by the officer's level of operational skills training, years of police service, and stress reactivity. The findings will speak to the level of performance under stress that can reasonably be expected from officers, based on their current

police training and experience. This will allow us to recommend evidence-based enhancements to training, as well as to inform the objective reasonableness standard used in courts of law.

More specifically, we hypothesized the following:

1. Officers will display elevated stress reactivity in response to the scenario, commensurate with those observed in naturalistic UoF encounters. Elevated stress reactivity is operationalized as an increase in sympathetic activity and a withdrawal of parasympathetic activity, measured by HR and HRV, as well as an increase in self-reported perceptual and cognitive distortions;
2. Stress reactivity will vary as a function of level of police training and years of police service;
3. Highly elevated stress reactivity will be associated with poorer performance, as operationalized by performance scales and lethal force errors; and
4. Higher levels of training and experience will be associated with better performance.

MATERIALS AND METHODS

Participants

In June 2018, 122 active-duty police officers from a large Canadian police agency volunteered to participate in our study. The inclusion criteria for participants were that they were considered "fit for duty"[1] by their police agency and currently on active duty. **Table 1** shows the basic sociodemographic characteristics of the sample ($N = 122$).

Materials

Demographic Questionnaire

A demographic questionnaire was used to collect age, gender, years of service, law enforcement experience, training, self-reported cardiovascular disease, and whether they were taking medication that could affect the cardiovascular system. Frequency of alcohol, tobacco, and caffeine consumption, as well as frequency of exercise, was also collected.

Stress Reactivity Monitoring Devices

Stress reactivity was measured using two Polar V800 Heart Rate Monitor Watches® and a Polar H7 Chest Strap Heart Rate Monitor® (Polar Electro Oy, Kempele, Finland). Together, these devices continuously record HR and R-R intervals (i.e., beat-to-beat intervals), with a sampling rate of 1,000 Hz for HRV analysis. These devices have been used in prior research when officers are on-shift or participating in realistic scenarios (Hope et al., 2016; Landman et al., 2016a; Baldwin et al., 2019). They have also been validated against hospital-grade electrocardiograms (ECG; Caminal et al., 2018; Gilgen-Ammann et al., 2019; Cilhoroz et al., 2020; Hernández-Vicente et al., 2021).[2]

Firearms Training System

Participants were equipped with a StressVest®, which is a non-projectile system that facilitates realistic scenario-based firearms training.[3] Participants wear the StressVest® and a StressX® PRO Belt. Duty pistols are converted to fire a laser pulse that activates the StressVest® when it strikes center mass, the side, or head (with additional side panels and face sensor baseball hat). When hit, the StressX® PRO Belt delivers either a vibration or shock to the abdomen of the participant. The system has been shown to elicit stress reactivity, as measured by HR, commensurate to training with non-lethal training ammunition (i.e., Simunition® FX marking cartridges; Condon, 2015).

Video Recording Devices

In order to code participant performance, each scenario was video recorded by three ©GoPro HERO4 Silver cameras affixed in central locations around the study area. All participants also wore an eye tracker (©Applied Science Laboratories Mobile Eye-5 Glasses) and certain participants wore body worn cameras (Axon Body2®) for purposes unrelated to the current study. The video footage was used to provide multiple angles to assess performance throughout the scenario.

Measures

Phase of the Scenario

As described in more detail in the **Supplementary Material A** (https://osf.io/qj2cg/), participants were exposed to a lethal force scenario. The scenario occurred in a building that had been designed to appear as an apartment complex in a rural setting. All participants were dispatched to a second-floor apartment for a call from a female complainant indicating

[1]Pursuant to an occupational health assessment, the individual is considered mentally and physically fit to perform the tasks and duties of a police officer. As this was not a diagnostic clinical study, we did not perform medical or psychiatric examinations of participants, however, we did examine self-reported cardiovascular disease ($n = 4$) and being on medication that affects HR ($n = 10$) in relation to the data. Several cardiovascular measures did significantly differ for the 10 participants who reported being on medication that affects HR, although they did not remain significant once Bonferroni corrected ($\alpha = 0.05/6 = 0.008$). Out of an abundance of caution, all analysis involving stress reactivity was conducted with and without participants who reported being on medication that affects HR. An examination of the results did not demonstrate a difference in level of significance or effect size. Thus, all participants were retained in the study.

[2]To reduce the likelihood of lost or corrupted data, participants were also equipped with a ©FirstBeat Bodyguard 2 Heart Rate Monitor (Firstbeat Technologies Ltd., Jyväskylä, Finland), which has also been validated against ECGs (Parak and Korhonen, 2013; Bogdány et al., 2016; Hinde et al., 2021). Data from the FirstBeat Bodyguard 2 were used to supplement HR and HRV data for 9% ($n = 11$) of participants.

[3]StressVest® does not require the use of personal protective equipment (PPE) that is typically required when training with non-lethal training ammunition (aside from range certified eye protection). This allows participants to observe facial expressions, and does not restrict peripheral vision, nor does it impede communication, hearing, or movement. SecuriBlanks® are used to maintain the fidelity of the firearm (i.e., recoil and percussion). The StressVest® can be concealed under clothing, which avoids priming the participant (i.e., actor wearing bulky PPE) and improves decision-making by safely and flexibly enabling more actors to participate in the scenario.

that a male subject had been drinking heavily and was in breach of his probation conditions. At that point, the facilitator said, "scenario on" and participants had the opportunity to ask dispatch for additional information, if they chose to do so.

Upon arriving "on scene" and knocking on the door of the residence, the participant was greeted by a bystander, who indicated that the subject had committed an assault. The bystander remained in the scenario room and demanded the participant remove the subject, who was seated at the dining room table at the other end of the room. A partially obscured knife was on the table and the subject eventually drew it and put it to his throat, threatening to die by suicide. After some time passed, regardless of how much the officer attempted to verbally de-escalate or intervene, the subject ultimately complied and threw the knife on the ground towards the participant.

The scenario was allowed to naturally unfold a little longer until the subject spontaneously pulled a firearm, stood up, and started to shoot at the participant. This resulted in a lethal force response from the participant. Once shot at by the participant, the subject feigned a gunshot wound to the chest while the bystander contemporaneously produced and pointed a cellphone, verbally indicating that they were video recording the situation. Participants were then provided the opportunity to prioritize and perform whatever actions they deemed necessary (e.g., request resources, secure weapons, physically restrain subject and/or bystander, search subject, administer first aid). The scenario was allowed to come to a natural conclusion and was ended by the facilitator when the participant failed to demonstrate any new actions or strategies.

For the purpose of analyzing cardiovascular stress reactivity, the scenario ($M = 9{:}25$ min; $SD = 2{:}32$) was broken down temporally into five phases: (1) dispatch phase – from beginning of the simulated dispatch call to the facilitator saying "scenario on" ($M = 1{:}10$ min; $SD = 0{:}53$), (2) approach phase – from the facilitator saying "scenario on" to the bystander opening the apartment door ($M = 0{:}46$ min; $SD = 0{:}26$), (3) encounter phase – from the bystander opening the apartment door to the participant recognizing the knife on the table and/or the subject grabbing the knife on the table ($M = 1{:}44$ min; $SD = 1{:}22$), (4) critical phase – from the participant recognizing the knife on the table and/or the subject grabbing the knife on the table to the participant making physical contact with the subject (e.g., arrest; $M = 3{:}08$ min; $SD = 1{:}40$), and (5) scene management and aftercare (SM&A) phase – from the participant making physical contact with the subject to the facilitator saying "scenario over" ($M = 2{:}38$ min; $SD = 1{:}04$).

Stress Reactivity

Cardiovascular Stress Reactivity

Empirical research supports the use of HRV as a noninvasive measure of psychological and physiological arousal (Berntson and Cacioppo, 2004; Appelhans and Luecken, 2006; Thayer et al., 2012). Thus, HR and HRV were captured using monitoring devices. Data were entered into ©Kubios HRV Premium Version 3.3.1. (Biomedical Signal Analysis Group, Department of Applied Physics, University of Kuopio, Finland), which is research software for the analysis of HRV. Samples were created for each phase of the scenario.

The PNS Index and SNS Index, computed in ©Kubios HRV software, were used as a measure of stress reactivity in this study (Sahoo et al., 2019). These indices have been used in other research (James et al., 2020; Giuseppe et al., 2021; Lundell et al., 2021). See **Supplementary Material B** (https://osf.io/nawhm/) for further details on the measures and methods used.

Perceptual and Cognitive Distortions

To examine whether the scenario resulted in perceptual and cognitive distortions – an indicator of stress reactivity – a 14-item questionnaire adapted from Artwohl (2008) was administered. Each perceptual and cognitive distortion during-scenario (10 items) and post-scenario (four items) was rated on a four-point Likert-type scale ranging from 0 "not at all" to 3 "to a great extent." Total scores could range from 0 to 42. Perceptual and cognitive distortion scores were expressed as a percentage of the total possible score (42). See **Supplementary Material C** (https://osf.io/hf9p6/) for a list of perceptual and cognitive distortions and descriptions.

Training

Participants' training records and the training information captured in the demographics form were used to identify and assess their level of in-service operational skills training. Eight levels of training, from basic to elite, were established based on recency, frequency, and type of training experience participants received (see **Table 2**). See **Supplementary Material D** (https://osf.io/4f8er/) for details on the agency's training and methods for categorizing the level of training.

Performance Metrics

To provide a robust assessment of performance, a combination of objective and subjective measures (Di Nota et al., 2021c) from four separate performance metrics were used: (1) the Deadly Force Judgment and Decision-Making (DFJDM), Tactical Social Interaction (TSI), and Crisis Intervention Team (CIT) metrics (Vila et al., 2018), (2) the agency's performance metric, (3) the Scenario Training Assessment and Review (STAR) scale (Wollert et al., 2011), and (4) lethal force errors.

Deadly Force Judgment and Decision-Making, Tactical Social Interaction, and Crisis Intervention Team Metric

The DFJDM metric was developed to assess performance in situations requiring the UoF, whereas the TSI and CIT metrics were developed for measuring performance during police–public interactions and encounters with people suffering from mental illness or who are in crisis, respectively. The DFJDM includes 105 performance indicators weighted from −6 (extremely negative impact on performance) to +6 (extremely positive impact on performance). The TSI has 78 performance indicators weighted from 1 (no impact on performance) to 7 (extremely positive impact on performance) and the CIT is comprised of 112 performance indicators ranging from −4 (strong negative

TABLE 2 | Level of training.

Order	Training level	Amount/type of training	*n*	%
8	Elite (level 2)	Emergency response team (i.e., tactical team)	14	11.5
7	Elite (level 1)	Use of force instructor	16	13.1
6	Advanced	Specialized (i.e., air marshal, crisis negotiator) or firearm instructor	12	9.8
5	Intermediate (level 3)	>5 Courses	10	8.2
4	Intermediate (level 2)	5 Courses	25	20.5
3	Intermediate (level 1)	4 Courses	20	16.4
2	Novice/basic (level 2)	3 Courses	17	13.9
1	Novice/basic (level 1)	2 Courses	8	6.6

impact on performance) to +4 (strong positive impact on performance).

In accordance with Vila et al.'s (2018) recommendations, the authors and a group of police trainers selected performance indicators from these three metrics that were applicable to the study scenario. This resulted in a total of 39 performance indicators from the DFJDM (20), CIT (14), and TSI (5) that were then combined into a single metric (see James et al., 2019). When rating performance, indicators were assessed as to whether they were applicable (1 – Yes; 0 – No) for each officer in the scenario. If applicable, each indicator was rated as achieved or not (1 – Yes; 0 – No; Vila et al., 2018). Weighted performance scores were then expressed as a percentage of the potential weighted score for each officer in the scenario. Where a performance indicator was not applicable, it was removed from the potential score to avoid penalizing an officer for something they could not have done (e.g., assessing ability to reload firearm, when a reload was not necessary). See **Supplementary Material E** (https://osf.io/4gzyd/) for list of performance indicators and weightings.

Agency Metric

All items contained within the agencies' performance rubrics for scenario-based training and the basic trauma equipment course were adapted into a single metric. This contained 44 items, including professionalism, law, and policy (three items), skills and techniques (five items), tactics and officer safety (28 items), and medical response (eight items). Each item was equally weighted and scored as (1 – Yes; 0 – No; Not applicable). Performance scores were expressed as a percentage of the potential applicable scores for each officer in the scenario. See **Supplementary Material F** (https://osf.io/8mfpq/) for a list of performance indicators.

Scenario Training Assessment and Review Scale

The Federal Law Enforcement Training Centre (FLETC) developed the STAR scale. The scale identifies eight factors considered essential to an officer's operational performance, including: (1) situational awareness, (2) threat identification, (3) initial response, (4) scene control after the initial response, (5) application of force, (6) arrest/processing techniques, (7) communication, and (8) articulation/after action review (Wollert et al., 2011). Each item is rated on a four-point scale (1 – Not acceptable; 2 – Least desirable; 3 – Acceptable; 4 – Desirable; Not applicable). Performance scores were expressed as a percentage of the potential applicable scores for each officer in the scenario. See **Supplementary Material G** (https://osf.io/gmpx3/) for a list of performance indicators, ratings, descriptions, and modifications.

Lethal Force Errors

To evaluate lethal force errors, participants were assessed for whether they: (1) shot the subject while they were armed with a knife and exhibiting a threat of self-harm (i.e., decision-making error), or (2) shot the bystander who quickly produced and pointed a cellphone after the subject was shot, while verbally indicating that they were video recording the situation (i.e., mistake of fact error).

Overall Performance

To develop an overall performance measure, the average of the (1) DFJDM, TSI, and CIT metric, (2) agency metric, and (3) STAR scale was calculated.

Performance Coding and Reliability

A team of eight UoF subject matter experts and trainers coded participant performance using the metrics described above. All coders had received the agencies' 3-week UoF instructor course and had extensive UoF training and/or review experience. Coders received 4 h of initial training on the use of the metrics and then completed four training assessments to confirm consistency and clarify metrics, where necessary. Coders were then randomly assigned to pairs and assigned a quarter of participants at random. Using scenario video footage, performance metrics for every participant were independently assessed by two coders to allow inter-rater reliability to be assessed.

Intraclass correlation coefficient (ICC) estimates for the total scores on each of the performance scales and their 95% CI were calculated. The resulting ICCs from the DFJDM, TSI, and CIT metric (ICC = 0.75, 95% CI [0.65–0.83]) and agency metric (ICC = 0.74, 95% CI [0.63–0.82]) were in the good–excellent (Cicchetti, 1994) or moderate–good range (Koo and Li, 2016). This indicated that coders had a relatively high degree of agreement and suggests that performance was rated similarly across coders. The STAR scale demonstrated poor-good (Cicchetti, 1994) or poor-moderate agreement (Koo and Li, 2016; ICC = 0.52, 95% CI [0.32–0.66]). To resolve discrepancies and achieve a single "most correct" assessment, independent third-party resolution was completed by another member of the coding team – neither of the original two coders (Syed and Nelson, 2015; Bakeman and Goodman, 2020). Once the independent third-party resolution was completed, the overall performance measure was calculated.

Procedure

Before beginning the study, participants reviewed and signed an informed consent form. They were then equipped with cardiovascular monitoring devices and completed the demographics questionnaire. Next, participants were outfitted

with other relevant equipment, including a StressVest™ system, eye-tracker, BWC, and all the inert tools they carry in the field. They were then exposed to the lowest shock level from the StressVest™. The shock was then increased to the highest "extreme" level, which the participants were informed they would experience, if shot, during the scenario. They then completed the scenario, which was facilitated by an expert police trainer, who remained with them throughout the entirety of the scenario to act as radio dispatch and ensure their safety and that of the role players. See **Supplementary Material A** (https://osf.io/qj2cg) for a detailed design and description of the scenario.

After the scenario, participants were de-equipped and completed the self-reported perceptual and cognitive distortions questionnaire. A random subsample of participants were recruited to wear a HR monitor to establish a true resting heart rate during sleep. Subsequently, participants were then debriefed by the researchers and a facilitator. After the debriefing, participants were compensated with a $50.00 gift card and those who volunteered to wear the heart rate monitor while sleeping, were compensated with an additional $50.00 gift card. All participants were provided the opportunity to withdraw their data, but none chose to do so.

The study was approved by the Carleton University Ethics Committee for Psychological Research (CUREB-B Clearance # 108733), as well as the Research Review Board (2018-04) of the agency from which the officers were recruited.

Data Analyses

All measures for the current study were entered into SPSS v.27 (IBM Corp, 2020) for quantitative analysis. All dependent variables were examined for expected ranges and the presence of extreme outliers. The normal distribution of dependent variables was tested using the Kolmogorov–Smirnov test, as well as an examination of histograms and Q-Q plots. All performance scales, self-reported perceptual and cognitive distortions, and heart rate measures were normally distributed. SNS and PNS indexes had nonparametric distributions.

Paired-samples *t* tests were used to test the mean difference between paired observations. Independent-samples *t* tests and Mann–Whitney U tests were used to compare parametric and nonparametric measures between independent samples, respectively. Correlations between variables were assessed using Pearson's correlation (r) for parametric distributions or Spearman's rank correlation (r_s) for nonparametric distributions.

For repeated measures with normal distributions, General Linear Model repeated measures ANOVA were used. Greenhouse–Geisser corrected value of p were reported when the assumption of sphericity was violated, as indicated by the Mauchly test. Significant main effects were further analyzed with Bonferroni-corrected *post hoc* tests. For nonparametric repeated measures, the Friedman test was used. Significant main effects from the Friedman test were further analyzed with Bonferroni-corrected Wilcoxon signed-rank tests and effect sizes calculated in accordance with Pallant (2010, p. 232). To examine the effect of training on HR, self-reported perceptual and cognitive distortions, and performance, one-way between-subjects ANOVAs were conducted. Kruskal–Wallis one-way ANOVAs were conducted to examine nonparametric HRV measures.

Multiple regression analysis was used to determine the relationships among stress reactivity, experience, and training on performance. To examine the two lethal force errors with dichotomous outcomes, logistic regression was used to model the data. All assumptions were met for regression analyses.

RESULTS

Stress Reactivity in Response to the Scenario

To measure elevated stress reactivity, we first established a true resting heart rate with a subsample ($n = 29$) who wore a HR monitor to sleep. A paired-samples *t* test was conducted to compare HR_{rest} at the lowest 1 min while completing paperwork pre-scenario to HR while the officer was sleeping. As expected, HR_{rest} ($M = 77.11$, $SD = 10.76$) was significantly higher than HR while the officer was sleeping [$M = 55.80$, $SD = 6.53$, $t(28) = 13.665$, $p < 0.001$, $d = 2.54$]. HRrest for the full sample was 75.17 bpm ($SD = 11.13$; see **Table 3**), which is in line with the resting rate found for officers (pre-scenario) in similar studies (Andersen et al., 2018), although it is 10–15 bpm higher than on-duty HRrest (Anderson and Plecas, 2000; Baldwin et al., 2019). The slight elevation may be attributed to factors such as anticipatory stress while waiting for the scenario or the officer's body positioning during the recording (e.g., sitting upright in a chair; Miles-Chan et al., 2013).

Table 3 presents cardiovascular stress reactivity data for officers across the scenario. In support of the first hypothesis, the results indicate that participants experienced elevated stress reactivity during the scenario. $HR_{mean\_scenario}$ was 129 bpm ($SD = 18.11$). Elevated SNS $Index_{scenario}$ ($M = 7.8$, $SD = 3.39$) and decreased PNS $Index_{scenario}$ ($M = -3.39$, $SD = 0.69$) were also observed throughout the scenario. Average participant $HR_{max\_critical}$ was 149.81 ($SD = 18.03$), consistent with the HR reported during real world UoF encounters (Baldwin et al., 2019).

Further supporting the first hypothesis, a repeated measures analysis ($n = 117$) demonstrated significant differences from at-rest HR and HR across the phases of the scenario [$F(3.251, 377.126) = 1091.954$, $p < 0.001$, $\eta_p^2 = 0.90$]. After a Bonferroni *post hoc* correction ($\alpha = 0.05/5 = 0.01$) was applied, it revealed that $HR_{max\_critical}$ ($M = 150.12$, $SE = 1.67$) was significantly higher than HR_{rest} ($M = 74.89$, $SE = 1.02$, $p < 0.001$, $d = 4.64$), as well as $HR_{max\_dispatch}$ ($M = 115.99$, $SE = 1.57$, $p < 0.001$, $d = 2.41$), $HR_{max\_approach}$ ($M = 139.87$, $SE = 1.51$, $p < 0.001$, $d = 0.96$), $HR_{max\_encounter}$ ($M = 142.41$, $SE = 1.67$, $p < 0.001$, $d = 0.80$), and $HR_{max\_SM\&A}$ ($M = 143.52$, $SE = 1.71$, $p < 0.001$, $d = 0.59$). See **Figure 1** for a line chart of HR during sleep, while at rest, and during the phases of the scenario.

Similarly, there was a statistically significant difference in SNS and PNS index values ($n = 111$) while at rest and across the phases of the scenario, $\chi^2(5) = 316.86$, $p < 0.001$ and $\chi^2(5) = 370.77$, $p < 0.001$, respectively. A *post hoc* analysis with Wilcoxon signed-rank tests was conducted with a Bonferroni

TABLE 3 | Cardiovascular stress reactivity during sleep, while at rest, and during the phases of the scenario.

	HR_{mean} (bpm)			HR_{max} (bpm)			SNS index			PNS index		
	M	*SD*	*n*	*M*	*SD*	*n*	*M*	*SD*	*n*	*M*	*SD*	*n*
Sleep	55.80	6.17	29	-	-	-	−0.76	1.26	29	1.43	1.59	29
Resting	75.17	11.13	122	-	-	-	1.46	1.67	122	−0.78	1.23	122
Phase of scenario												
Dispatch	103.95	16.39	122	115.94	16.68	122	5.05	2.94	119	−2.46	0.81	119
Approach	124.11	16.56	122	139.76	16.13	122	9.76	4.53	119	−3.30	0.67	119
Encounter	130.32	20.04	122	142.16	17.43	122	10.13	5.46	119	−3.40	0.79	119
Critical	132.38	19.57	121	149.81	18.03	122	9.55	4.68	116	−3.51	0.70	116
SM&A	128.93	18.28	117	143.52	18.47	117	9.16	4.64	118	−3.35	0.80	118
Overall Scenario	128.98	18.11	122	152.50	17.23	122	7.80	3.39	116	−3.39	0.69	116

bpm, beats per minute and SM&A, scene management and aftercare.

correction ($\alpha = 0.05/5 = 0.01$). There were large significant increases in SNS $Index_{critical}$ compared to SNS $Index_{rest}$ ($z = 9.347$, $p < 0.001$, $r = 0.61$) and SNS $Index_{dispatch}$ ($z = 8.294$, $p < 0.001$, $r = 0.54$). However, there were no statistically significant differences between SNS $Index_{critical}$ and SNS $Index_{approach}$, SNS $Index_{encounter}$, or SNS $Index_{SM\&A}$ ($p > 0.01$, $r = \pm 0.04$–0.09). There were small to large significant decreases in PNS $Index_{critical}$ compared to PNS $Index_{rest}$ ($z = -9.347$, $p < 0.001$, $r = -0.61$), PNS $Index_{dispatch}$ ($z = -9.199$, $p < 0.001$, $r = -0.61$), PNS $Index_{approach}$ ($z = -9.199$, $p < 0.001$, $r = -0.27$), and PNS $Index_{SM\&A}$ ($z = -2.855$, $p = 0.004$, $r = -0.19$). However, once Bonferroni-corrected, there was a small nonsignificant difference between PNS $Index_{critical}$ and PNS $Index_{encounter}$ ($z = -2.334$, $p = 0.02$, $r = -0.15$). Overall, these results provide support for our first hypothesis. See **Figure 2** for a line chart of SNS and PNS index values during sleep, while at rest, and during the phases of the scenario.

To further assess the first hypothesis, we examined perceptual and cognitive distortions experienced by participants. The majority of participants reported experiencing the sensation of being on automatic pilot (90.9%), tunnel vision (87.6%), heightened visual clarity (82.6%), and diminished sound (70.2%) during the scenario (see **Table 4**). Overall, the mean perceptual and cognitive distortion score for participants was 33.6% ($SD = 15.9$), indicating a notable presence of distortions. These results also provide support for our first hypothesis. Perceptual and cognitive distortion scores were not significantly associated with cardiovascular stress reactivity (i.e., HR, SNS, and PNS index values) during the overall scenario and during the critical phase of the scenario ($p > 0.05$).

Stress Reactivity as a Function of Training and Experience

To test the second hypothesis, a one-way between-subjects ANOVA was conducted to examine the effect of training on stress reactivity. There were small nonsignificant effects of training on HR_{rest}, $HR_{mean\_scenario}$, and $HR_{max\_critical}$. Nonsignificant results were also observed when conducting a Kruskal–Wallis one-way ANOVA for training on SNS $Index_{scenario}$, PNS $Index_{scenario}$, SNS $Index_{critical}$, and PNS $Index_{critical}$ ($p > 0.05$). These results failed to support our second hypothesis, as stress reactivity was similar across levels of training. See **Figure 3** for baseline and scenario heart rate as a function of training.

To examine whether years of police service was associated with stress reactivity, a series of nonparametric correlation tests were conducted with HR, SNS, and PNS index values at rest, during the scenario, and during the critical phase of the scenario. Once Bonferroni-corrected ($\alpha = 0.05/7 = 0.007$), years of service was significantly associated with $HR_{mean\_scenario}$ ($r_s = -0.26$, $p = 0.005$), $HR_{max\_critical}$ ($r_s = -0.35$, $p < 0.001$), and PNS $Index_{critical}$ ($r_s = 0.26$, $p = 0.005$).

A one-way between-subjects ANOVA revealed a small non-significant effect of training on perceptual and cognitive distortion scores [$F(7, 113) = 1.585$, $p = 0.147$, $\eta^2 = 0.089$]. Years of police service was also not significantly associated with perceptual and cognitive distortion scores ($r_s = -0.10$, $p = 0.258$). These mixed results regarding the effect of experience on stress reactivity provide some support for Hypothesis 2.

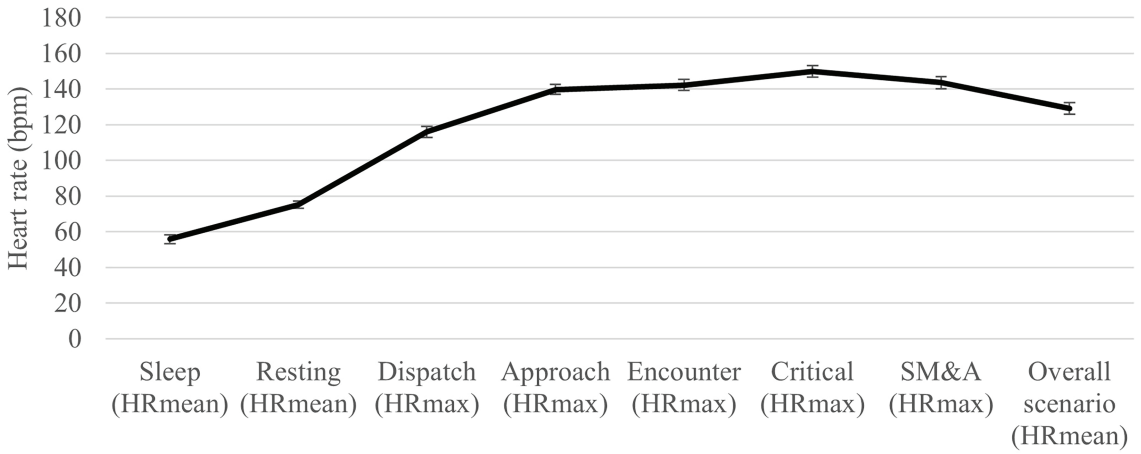

FIGURE 1 | Heart rate (HR) during sleep, while at rest, and during the phases of the scenario. bpm, beats per minute and SM&A, scene management and aftercare. 95% CI error bars displayed.

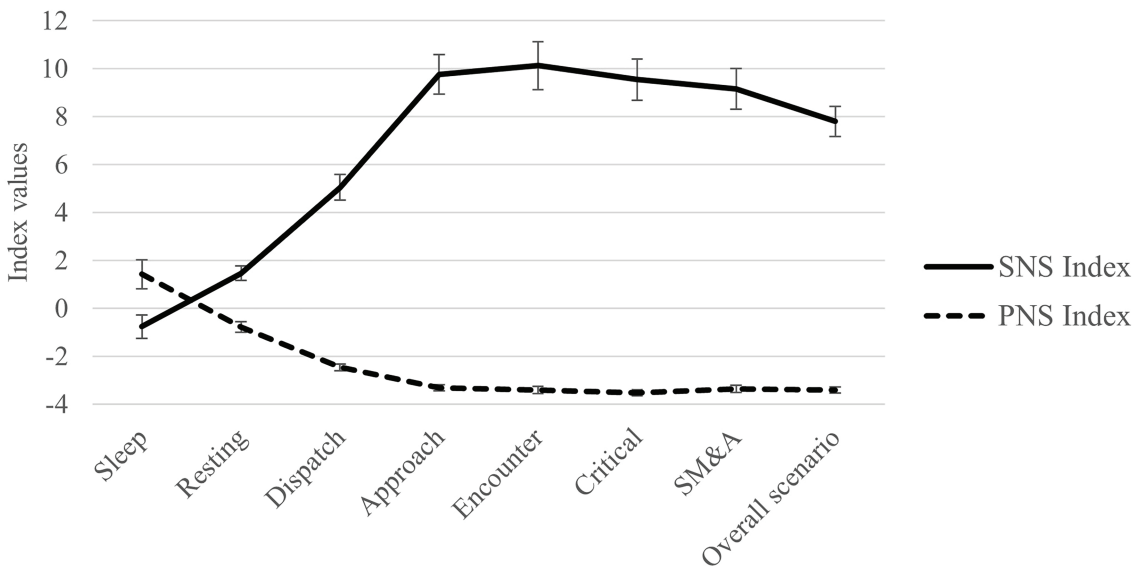

FIGURE 2 | Sympathetic nervous system (SNS) and parasympathetic nervous system (PNS) index values during sleep, while at rest, and during the phases of the scenario. SM&A, scene management and aftercare. 95% CI error bars displayed.

Performance as a Function of Stress Reactivity

All performance metrics had average scores that ranged from 50 to 66%, arguably indicating suboptimal performance under stress. Large positive correlations ($r > 0.60$, $p < 0.001$) between the three performance scales were observed. See **Supplementary Material H** (https://osf.io/73c4p/) for descriptive statistics and correlation matrix for performance metrics.

To examine our third hypothesis, a series of correlations between the performance metrics and HR, HRV, and self-reported perceptual and cognitive distortions were calculated (see **Table 5**). HR and perceptual and cognitive distortions were not significantly associated with performance metrics ($p > 0.05$). SNS $\text{Index}_{\text{scenario}}$ and SNS $\text{Index}_{\text{critical}}$ demonstrated a trend suggesting that, as participants' sympathetic activity increased, their performance decreased. Specifically, small to moderate negative correlations were found between SNS $\text{Index}_{\text{critical}}$ and all performance metrics. However, once a Bonferroni correction for multiple comparisons per dependent variable was applied ($\alpha = 0.05/7 = 0.007$), only the correlation with the STAR scale and the overall performance rating remained significant ($p < 0.001$). PNS $\text{Index}_{\text{scenario}}$ and PNS $\text{Index}_{\text{critical}}$, while not statistically significant, demonstrated small positive correlations with all performance metrics, suggesting that parasympathetic withdrawal may be associated with a deterioration in performance. Using *G*Power* (Faul et al., 2007),

TABLE 4 | Self-reported perceptual and cognitive distortions experienced by participants during- and post-scenario.

	Not at all		Very little		Somewhat		To a great extent	
	n	%	*n*	%	*n*	%	*n*	%
Diminished sound (i.e., inability to hear very loud sounds you would ordinarily hear, such as gunshots)	36	29.8	44	36.4	35	28.9	6	5.0
Intensified sounds	41	33.9	45	37.2	30	24.8	5	4.1
Heightened visual clarity	21	17.4	44	36.4	49	40.5	7	5.8
Tunnel vision (i.e., loss or narrowing of peripheral vision)	15	12.4	30	24.8	55	45.5	21	17.4
Automatic pilot (i.e., I responded with little or no conscious thought)	11	9.1	34	28.1	53	43.8	23	19.0
Slow motion time (i.e., time slowed down)	52	43.0	41	33.9	24	19.8	4	3.3
Fast motion time (i.e., time sped up)	49	40.5	30	24.8	29	24.0	13	10.7
Temporary paralysis (i.e., froze)	65	54.2	32	26.7	21	17.5	2	1.7
Dissociation (i.e., a sense of detachment or unreality)	72	60.0	22	18.3	25	20.8	1	0.8
Intrusive distracting thoughts	106	87.6	6	5.0	9	7.4	0	0.0
Memory loss for part of the event	36	30.0	49	40.8	33	27.5	2	1.7
Memory loss for some of my own behavior	33	27.3	51	42.1	35	28.9	2	1.7
Memory distortions	65	53.7	38	31.4	15	12.4	3	2.5
"Flashbulb" memories	41	33.9	29	24.0	37	30.6	14	11.6

a compromise power analysis indicated that the study sample size ($n = 116$) was considerably underpowered (16–40% power) to detect a significant effect size of that magnitude (i.e., $r = 0.09$–0.16).

Performance as a Function of Training and Experience

Our fourth hypothesis was tested with a one-way between-subjects ANOVA to compare the effects of the level of training on performance metrics. There was a significant moderate to large effect of training on DFJDM, TSI, and CIT [$F(7, 114) = 3.495$, $p = 0.002$, $\eta^2 = 0.177$], agency performance metrics [$F(7, 114) = 7.225$, $p < 0.001$, $\eta^2 = 0.307$], STAR scale [$F(7, 114) = 5.928$, $p < 0.001$, $\eta^2 = 0.267$], and overall performance rating [$F(7, 114) = 6.882$, $p < 0.001$, $\eta^2 = 0.297$]. Therefore, participants with higher levels of operational skills training displayed measurably better performance. See **Figure 4** and **Supplementary Material I** (https://osf.io/zn6mr/) for performance scores across level of training. Years of police service was not significantly associated with any performance metrics ($r_s < 0.05$, $p > 0.05$).

To examine the unique effects of training, experience, and stress reactivity on performance, multiple regression analysis was conducted. Due to high collinearity between cardiovascular measures ($r_s > \pm 0.80$), and the nonsignificant correlations between performance and both HR and the PNS Index, only SNS $\text{Index}_{\text{critical}}$ was retained in the model. In all four models (see **Table 6**), level of training had a significant effect on performance ($p < 0.001$), whereby for every increase in level of training (eight levels), there would be approximately a three unit ($B = 2.87$–3.36) increase in each of the performance metrics (%). Conversely, for every increase in years of police service, performance metrics (%) decreased by approximately 0.39 ($B = 0.28$–0.50), though this effect did not reach significance for either the DFJDM, TSI, and CIT ($p = 0.093$), or the agency performance metrics ($p = 0.054$). With regard to stress reactivity, for every one-unit increase in SNS $\text{Index}_{\text{critical}}$ ($M = 9.6$, $SD = 4.7$), performance metrics (%) decreased by approximately 0.57 ($B = 0.22$–0.99), though this effect did not reach a level of statistical significance for the DFJDM, TSI, and CIT ($p = 0.145$), or the agency performance metrics ($p = 0.304$).

Standardized coefficients indicated that the strength of the effect from the level of training ($b = 0.35$–52) on performance was approximately double that of years of police service ($b = 0.15$–18) and stress reactivity ($b = 0.09$–25). Overall, level of training, years of police service, and stress reactivity (SNS $\text{Index}_{\text{critical}}$) explained approximately one quarter ($R^2 = 0.17$–0.30) of the variance in performance in the scenario.

Lethal Force Errors

A total of 34 (27.9%) participants made one or more lethal force errors during the scenario: nine (7.4%) shot the subject while they were armed with a knife and exhibiting a threat of self-harm (i.e., decision-making error); 20 (16.4%) shot the bystander who quickly produced and pointed a cellphone after the subject was shot, while verbally indicating that they were video recording the situation (i.e., mistake of fact error); and five (4.1%) made both errors (see **Figure 5**).

To examine whether training, experience, and stress reactivity predicted lethal force errors, logistic regression analysis was conducted (see **Table 7**). All independent variables predicted ($p < 0.05$) the subject being shot while they were armed with a knife and exhibiting a threat of self-harm. Specifically, for each increase in level of training, the odds of shooting the subject while they were armed with a knife and exhibiting a threat of self-harm increased by 37% and the odds increased 12% for every additional year of police service. An increase in stress reactivity (i.e., one-unit increase in SNS $\text{Index}_{\text{critical}}$) also increased the odds of lethal force error on a subject armed with a knife and exhibiting a threat of self-harm by 25%. None of the variables significantly increased or decreased the odds of shooting the bystander who quickly produced and pointed a cellphone after the subject was shot. See **Supplementary Material J** (https://osf.io/2srpu/) for a breakdown of level of training by type of lethal force error.

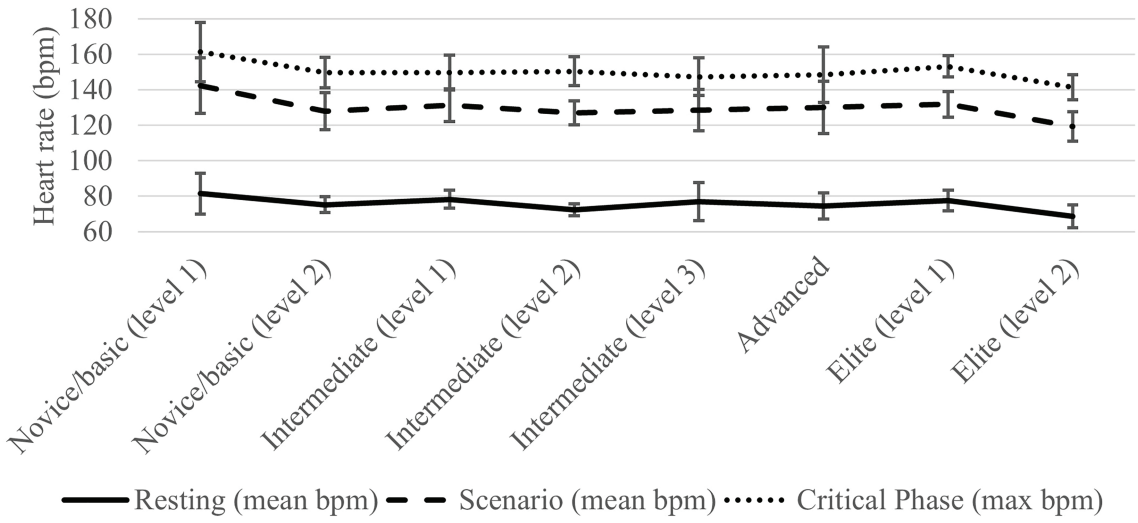

FIGURE 3 | Heart rate as a function of level of training. bpm, beats per minute. 95% CI error bars displayed.

TABLE 5 | Correlations between stress reactivity and performance metrics.

Performance scales	Overall scenario			Critical phase			Perceptual and cognitive distortions
	HR_{mean}	SNS index	PNS index	HR_{max}	SNS index	PNS index	
DFJDM, TSI, and CIT	0.00	−0.10	0.02	0.05	−0.22*	0.09	0.034
Agency metric	−0.02	−0.09	0.05	−0.03	−0.22*	0.12	−0.065
STAR scale	−0.08	−0.21*	0.13	−0.01	−0.30***	0.16	−0.004
Overall rating	−0.04	−0.16	0.08	0.01	−0.29***	0.15	−0.006

*Perceptual and cognitive distortions (n = 121), HR (n = 122), and HRV (n = 116). An independent samples t test was conducted to examine if there were differences in performance between participants with and without HRV data. No significant differences were found (p > 0.05). *Indicates p < 0.05.*
****Indicates p < 0.001.*

Exploratory Analysis of Behavioral Predictors of Performance

For an exploratory analysis of which individual behaviors were most associated with overall scores on the performance metrics, see **Supplementary Material K** (https://osf.io/vh2s6/).

DISCUSSION

Below, we briefly discuss the results related to each hypothesis and explore their implications.

Stress Reactions to the Scenario

In support of Hypothesis 1, officers displayed significantly elevated stress reactivity in response to the scenario, including large increases in SNS arousal and PNS withdrawal, consistent with a threat response (Castaldo et al., 2015; Laborde et al., 2017). Self-reported perceptual and cognitive distortions and large increases in HR were also observed, commensurate with those reported in naturalistic UoF encounters (e.g., Anderson et al., 2002; Artwohl, 2008; Andersen et al., 2016). For example, officers' cardiovascular stress reactivity during the critical phase of our scenario reached an average of 150 bpm (75 bpm higher than their pre-scenario resting rate). In comparison, Baldwin et al. (2019) reported stress reactivity in the range of 146 bpm when officers drew their firearm for the purpose of arresting a subject under threatening naturalistic conditions. Therefore, the HR produced during our scenario approximates with stress reactions to real world police encounters.

Over 70% of our participants also reported experiencing tunnel vision, heightened visual clarity, and diminished sound. These results closely correspond with the perceptual and cognitive distortions reported by others (Honig and Sultan, 2004; Artwohl, 2008; Klinger and Brunson, 2009). The high prevalence of perceptual distortions observed in this study also aligns with attentional control theory (Eysenck et al., 2007), which suggests that under stress, attention is directed toward the threatening stimuli, rather than task relevant processes (e.g., decision-making). These indications of perceptual narrowing are further supported by research showing that the perceptual field tends to shrink under stress (Vickers, 2007; Honig and Lewinski, 2008). Additionally, the majority of participants (91%) reported that they responded on automatic pilot. This corresponds with decision-making research which demonstrates that under

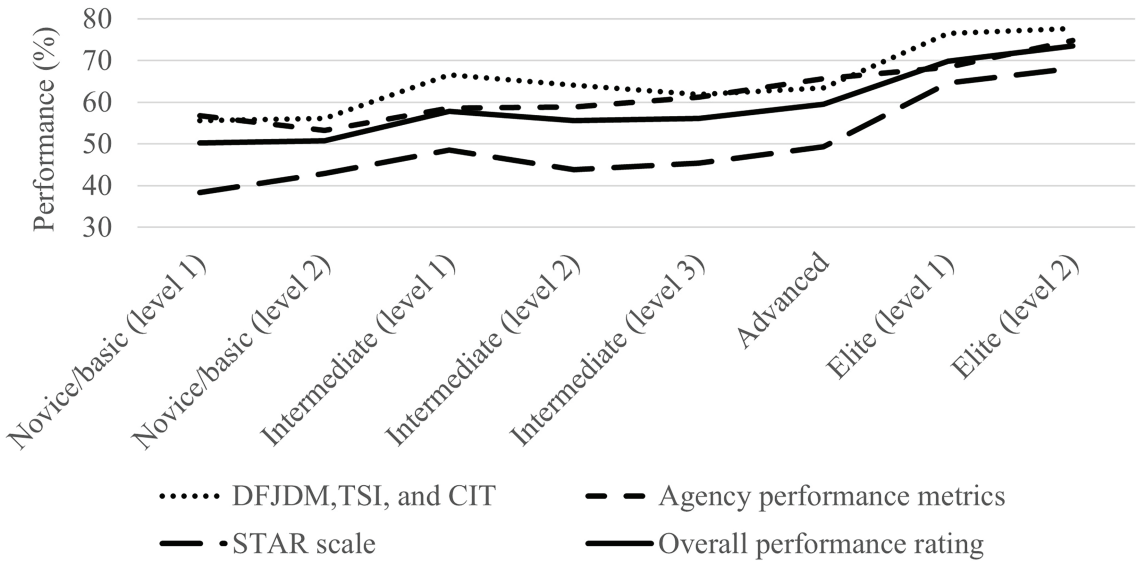

FIGURE 4 | Performance metrics (%) as a function of level of training.

dynamic and complex circumstances, responses rely heavily on intuition, which occur in an automatic manner (Kahneman and Klein, 2009; Ward et al., 2011; Klein, 2015). Our cardiovascular stress reactivity measures (i.e., HR and HRV) were not associated with self-reported perceptual and cognitive distortion scores, suggesting that self-reports of these distortions may not be a good proxy measure for stress reactivity, at least under high levels of stress. This further underscores the importance of collecting both objective and subjective measures of the phenomenon under study (Di Nota et al., 2021c).

Combined, the stress reactivity data indicate that the scenario developed for this study produced adverse physiological, attentional, and perceptual conditions. Thus, this scenario arguably provides reasonably realistic conditions under which to study and draw conclusions about what *might* happen to performance in highly stressful real-world police encounters. This is important, not only for assessing the efficacy of agency training, but also for informing the courts about how officers might reasonably perform when responding to a threat, given the current police training they have received. Further, the findings indicate how this performance and stress reactivity may be influenced by an officer's level of current police training and experience.

Impact of Training and Experience on Stress Reactivity

It is believed that training and experience can improve one's ability to cope with a threatening stimuli, subsequently affecting the threat appraisal process, which sustains and moderates the fight-or-flight physiology (Driskell and Salas, 1996; Anshel et al., 1997; Kelley et al., 2019). The current study's results provided mixed evidence for Hypothesis 2, which examined this relationship. Specifically, in contrast to what we expected, there was no effect regarding level of training on cardiovascular stress reactivity or the extent of perceptual and cognitive distortions experienced. Current findings correspond with Baldwin et al. (2019) who did not find an effect of level of training on physiological arousal when officers from the same agency as the current study responded to general duty calls for service. Together, these findings may indicate that the agency's training does not include or sufficiently embed techniques that have been shown to promote adaptive coping mechanisms (e.g., mental rehearsal, reappraisal; Anshel, 2000; Colin et al., 2014). Another possible explanation is that the agency's SBT is not currently eliciting significant enough stress reactivity to replicate the naturalistic environment and result in improved coping, advanced schemas, and stress resilient KSAs. While we are not proposing that all scenarios in SBT include high levels of stress, a progressive increase in stressful scenarios, once skills have been acquired, has shown benefits for performance that generalize across novel stressors and tasks (Driskell et al., 2001; Di Nota et al., 2021a).

Research also indicates that the threat response is malleable, with specific types of training being shown to increase one's ability to control stress reactions (Arnetz et al., 2009; McCraty and Atkinson, 2012; Andersen et al., 2018). For example, using HRV biofeedback, Andersen and Gustafsberg (2016) and Andersen et al. (2016, 2018) taught officers to modulate autonomic arousal during threat inducing SBT by evoking parasympathetic activation. This autonomic modulation training resulted in lower maximum HR and quicker recovery from critical incident stress (i.e., the time it took to return to their average resting HR) following threat exposure (a measure of PNS activation; Thayer and Sternberg, 2006). Adopting autonomic modulation training, or embedding such techniques in already existing skills training, may better equip officers to adaptively modify their stress reactivity

TABLE 6 | Multiple regressions for training, experience and stress reactivity on performance.

Predictors	Overall performance rating				DFJDM, TSI, and CIT				Agency performance metrics				STAR scale			
	B	SE B	*β*	*p*	*B*	SE B	*β*	*p*	*B*	SE B	*β*	*p*	*B*	SE B	*β*	*p*
Level of operational skills training	3.048	0.549	0.461	<0.001	2.914	0.744	0.353	<0.001	2.870	0.457	0.520	<0.001	3.359	0.742	0.386	<0.001
Years of police service	−0.393	0.175	−0.182	0.026	−0.401	0.237	−0.149	0.093	−0.282	0.145	−0.157	0.054	−0.496	0.236	−0.174	0.038
SNS $Index_{critical}$	−0.571	0.255	−0.188	0.027	−0.507	0.345	−0.134	0.145	−0.219	0.212	−0.086	0.304	−0.986	0.344	−0.246	0.005
R^2	0.30				0.17				0.30				0.26			

during real-world critical incidents, and ultimately improve performance under stress (Andersen et al., 2018; Bennell et al., 2021a).

In partial support of Hypothesis 2, we did find that more years of police service reduced parasympathetic withdrawal and HR in the critical phase and overall scenario, although no effect was observed for SNS arousal or perceptual and cognitive distortion scores. This provides some evidence that on-the-job experience may be important for parasympathetic regulation, which plays a role in forming a flexible response to environmental demands (Thayer et al., 2009; Roos et al., 2017; Andersen et al., 2018). It is unclear why this mixed effect with training and experience was observed, however, research has previously found that years of police experience influenced the extent to which officers believed they could cope with stressful events (Anshel et al., 1997). Further research exploring the role of training and experience is warranted.

Impact of Stress on Performance

Given the large positive correlations that were observed between the three performance scales used, the average of the three scales was used to create an overall performance score, which captured a more comprehensive rating of KSAs essential to police work. Under the stressful conditions produced by our scenario, average participant scores for all performance scales ranged from 50 to 66%, arguably demonstrating suboptimal performance. However, it is important to note that due to the broad scope of performance indicators used in this study, it is likely beyond the ability of any officer to perform all expected tasks on their own. For example, many officers justifiably chose to prioritize providing medical care to the subject until back-up and emergency medical services (EMS) arrived. This would have resulted in lower scores for items related to scene management, such as securing weapons and evidence, which the officer may not have assessed as a priority given the circumstances (i.e., the subject suffering from a gunshot wound to the chest).

Additionally, under stress, over a quarter of officers made one or more lethal force errors during the scenario, including decision-making errors (7%), mistake of fact errors (16%), or a combination of the two (4%). Since our study did not have a control (i.e., low stress) scenario for comparison, we cannot determine the full extent to which these performance deficits and errors were stress induced. However, our study does show that SNS arousal during the critical phase of the scenario was associated with small to moderate decreases in performance, meaning that those who had higher, more maladaptive SNS arousal during the scenario displayed poorer performance than those with lower, more adaptive SNS arousal. Additionally, while it did not reach statistical significance, small effects were observed, suggesting that parasympathetic withdrawal may also be associated with a deterioration in performance. This trend adds to the growing evidence that indicates performance deficits may not only be related to maladaptive SNS arousal, but also the suppression of the stress modulating parasympathetic influence (Saus et al., 2006; Andersen et al., 2018; Spangler et al., 2018).

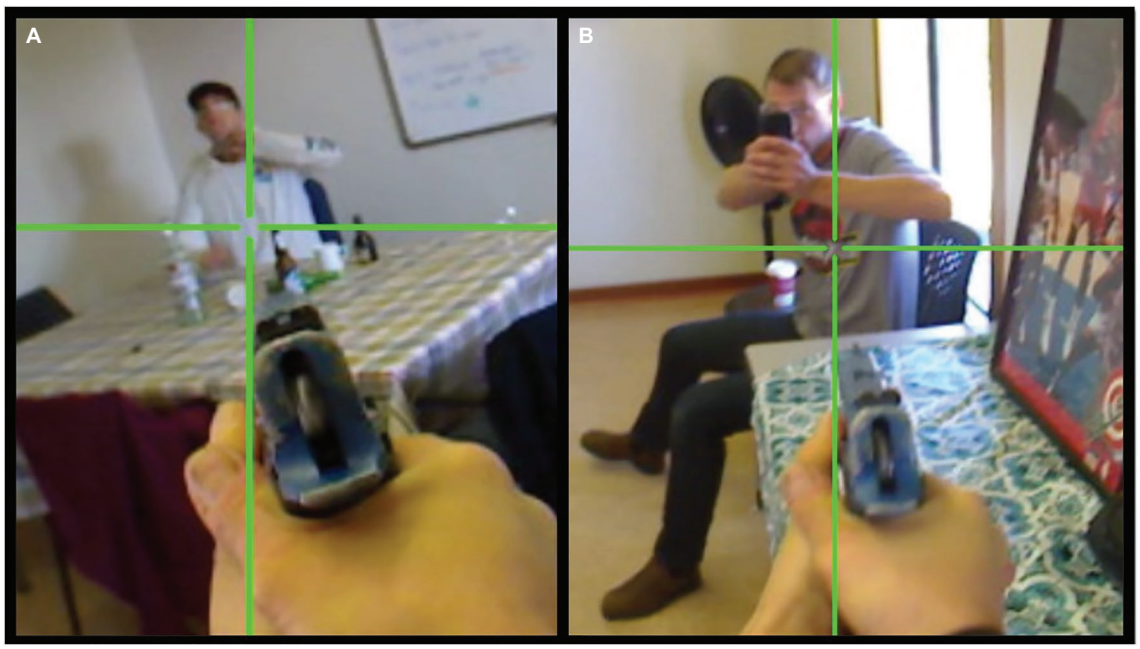

FIGURE 5 | Lethal force errors during the scenario. **(A)** Shooting the subject while they were armed with a knife and exhibiting a threat of self-harm (i.e., decision-making error); and **(B)** shooting the bystander holding a cell phone (i.e., mistake of fact error). Green crosshairs represent participant gaze (from eye-tracker) at central mass while pulling the trigger.

TABLE 7 | Logistic regressions for training, experience, and stress reactivity on lethal force errors.

Predictors	Subject[a]				Bystander[b]			
	Exp(B)	95% CI		Sig.	Exp(B)	95% CI		Sig.
		Lower	Upper			Lower	Upper	
Level of training	1.374	1.003	1.882	0.048	0.919	0.739	1.143	0.450
Years of police service	1.119	1.023	1.225	0.014	0.986	0.920	1.057	0.693
SNS index$_{critical}$	1.247	1.069	1.454	0.005	1.008	0.907	1.120	0.888

[a]*Shot the subject while they were armed with a knife and exhibiting a threat of self-harm (i.e., decision-making error).*
[b]*Shot the bystander who quickly produced and pointed a cellphone after the subject was shot, verbally indicating that they were video recording the situation (i.e., mistake of fact error).*

Even when controlling for level of training and experience, SNS arousal was still associated with performance deficits and increased odds of lethal force decision-making errors, though not mistake of fact error. With SNS Index values that ranged from 2 (low – more adaptive) to 25 (high – more maladaptive) during the critical phase of the scenario, model estimates indicate that maladaptive stress-induced deficits could decrease performance upwards of 5–23%, depending on the performance metric. Similarly, the odds of making a lethal force decision-making error would be 5.7 times higher for those with the highest SNS arousal, compared to those with the lowest SNS arousal. These findings and trends are consistent with real-world studies and scenario-based experiments, which demonstrate that maladaptive stress arousal can result in degradation of task accuracy, increased task errors, and deficits in motor skills and cognitive functions, such as perception, attention, and decision-making (e.g., Driskell and Salas, 1996; Johnston et al., 1997; Morrison and Vila, 1998). These findings provide strong evidence in support of Hypothesis 3.

Conversely, HR was not found to be associated with performance. Thus, while HR is the most easily monitored physiological proxy of stress, we must caution that this is not an absolute measure of an individual's stress reactivity, nor does it unequivocally predict individual performance under stressful conditions, as HR is influenced by a variety of factors (Meyerhoff et al., 2004; Brisinda et al., 2015; Arble et al., 2019). Additionally, self-reported perceptual and cognitive distortion scores were not associated with performance, which may indicate that while they may be maladaptive for certain aspects of performance (e.g., situational awareness), they may also

be adaptive for other aspects, such as officer safety. Therefore, caution should be used when inferring things about an individual's in-the-moment performance based on post-incident self-reported distortions, particularly given what we know about memory distortions during stress and inaccuracies in self-reports (Di Nota et al., 2020). Based on these findings, future studies examining the relationship between stress and performance should use robust measures of stress reactivity (e.g., HRV, antithrombin), which have shown predictive value (e.g., Taverniers and De Boeck, 2014; Arble et al., 2019; James et al., 2020).

Impact of Training and Experience on Performance Under Stress

In support of Hypothesis 4, there were moderate to large effects of training on all performance scales. For example, overall performance scores increased steadily from 50% for novice officers or those with basic training, to 74% for elite tactical officers. In fact, when controlling for years of police service and stress reactivity, training was the largest predictor of performance, with model estimates showing a 3% rise in performance for every increase in level of training (eight levels). This indicates that while overall performance was low, significant improvements in performance under stress can be achieved through greater levels of operational skills training.

Conversely, when controlling for training and stress reactivity, years of police service was negatively associated with performance, with model estimates showing that for every 5-year increase in years of service, performance decreased approximately 2%. This finding was somewhat unexpected as research shows that experience can improve performance, including decision-making and cue recognition (e.g., Renden et al., 2015; Boulton and Cole, 2016; Mangels et al., 2020). Since experience and training are inevitably related, our findings may be a result of using regression analysis to determine the distinct effect of on-the-job experience, while controlling for level of training. Our findings may then indicate that minimum qualifications and skills maintenance training, absent of additional or supplemental training and practice, are not sufficient to retain KSAs in the long-term (O'Neill et al., 2019). This may be particularly true for certain KSAs that are rarely used in the field, such as the UoF and medical care for a gunshot wound (Baldwin et al., 2020; Singh, 2020). Therefore, years of police service may be a crude measure of experience, as it is not necessarily indicative of exposure to critical incidents (Klein, 1999).

While greater levels of training improved global performance in the scenario, more advanced training, as well as higher years of police service, were both predictors of increased lethal force decision-making errors, even when controlling for stress reactivity. In contrast, with regard to the mistake of fact errors, neither training nor years of police service predicted shooting the bystander who quickly produced and pointed a cellphone after the subject was shot. These findings do not support Hypothesis 4, nor do they align with previous research that has shown a reduction of lethal force errors with greater levels of training and experience (Vickers and Lewinski, 2012; Landman et al., 2016b).

Research related to decision-making in naturalistic environments is helpful for understanding these unexpected results. According to this body of research, both the decision-making and mistake of fact lethal force errors observed in this study would be classified as rule-based (or misdiagnosis) errors (Reason, 2000; Taylor, 2019). This type of error involves an intended behavior (e.g., discharging a firearm at a perceived threat) that results in an unintended outcome (e.g., shooting an unarmed subject) due to a misdiagnosis of the situation and application of the wrong rule or schema (Taylor, 2019). Recall from our earlier description of RPDM that individuals rely heavily on cognitive shortcuts (e.g., satisficing) to quickly assess situations, evaluate options, and determine the first workable response (Klein, 1997, 1999; Kahneman and Klein, 2009). While this type of response is resilient to stress, requires less attentional resources, and enables a quick response to a perceived threat, it does not always result in the selection of the best response (Kahneman and Klein, 2009; Ward et al., 2011; Klein, 2015). Thus, with regard to the mistake of fact error, given the context of just being shot at by the subject, when the officers in our study saw the bystander quickly pulling an object from his pocket and raising it, this pattern was congruent with, and likely to be recognized as, a threat.

Implications for Training

Given the sub-optimal performance observed in this study, it is recommended that LEAs and their trainers reflect on their current training and further incorporate evidence-based best practices from recent reviews (e.g., Jenkins et al., 2021; Di Nota et al., 2021a; Bennell et al., 2021b), in hopes of achieving better performance. Importantly, the exploratory analysis found in the supplemental material identified several behaviors that were highly associated with positive performance. These behaviors included things like assessing the situation, recognizing threat cues, competence with intervention options, de-escalation, and maintaining tactical advantage (i.e., time, distance, cover, concealment). Thus, greater integration and focus on these behaviors in training could result in positive impacts in overall performance.

Regarding the decision-making errors observed in this study, Andersen et al. (2018) cautioned against use of force models (and associated training) that may reinforce if-then contingencies, such as relating a weapon or the threat of grievous bodily harm or death to the use of lethal force. While it is certainly important for public and police safety for an officer to *draw* their firearm in response to a weapon or lethal threat in relevant instances, if use of force models do promote if-then thinking, maladaptive heuristics may be relied on that are inappropriate in certain circumstances. For instance, in our study, we observed a significant number of officers discharge their firearm at a subject who was armed with a knife but was exhibiting a threat of suicide. The odds of doing so also increased with more training and experience. Therefore, it is possible that the

current UoF model and related training, are inadvertently creating and reinforcing inappropriate mental shortcuts that may be used under dynamic and highly stressful situations. Thus, LEAs should examine evidence-based training and models that target decision-making (e.g., Vickers, 2007; Klein and Borders, 2016; Engel et al., 2020) and problem-solving abilities (e.g., Rajakaruna et al., 2017; Belur et al., 2019; Blumberg et al., 2019).

Lastly, agencies need to ensure adequate amounts and frequency of training are provided to achieve mastery and retention of evidence-based KSAs (e.g., O'Neill et al., 2019; Bennell et al., 2021b; Di Nota et al., 2021b), as rehearsed and automated skills are influenced to a lesser degree by stress (Vickers and Lewinski, 2012; Renden et al., 2017; Arble et al., 2019). Training should also include appropriate amounts of representative practice that is commensurate with real-world settings, to allow officers the opportunity to practice and integrate a wide-range of KSAs under stressful conditions (e.g., tactics, de-escalation, decision-making, perceptual-motor movement, medical aftercare). Several studies have demonstrated that training under stress can improve police performance, enhance officer safety, and reduce use of force errors (e.g., Nieuwenhuys and Oudejans, 2011b; Taverniers and De Boeck, 2014; Andersen et al., 2018).

Implications for the Objective Reasonableness Standard

Critics have argued that the objective reasonableness standard lacks an evidence-based foundation and focuses too much on the general dangers and stressful nature of policing (Fagan and Campbell, 2020; Zamoff, 2020). As the courts' interpretation of what is reasonable is not static, research of the type reported here can advance the standard by "injecting a consistent dose of evidentiary rigor" (Zamoff, 2020, p. 585).

Performance under high levels of stress in this study was sub-optimal, with overall performance scores of 59% and over a quarter of officers making one or more lethal force errors during the scenario. While proper training may significantly improve performance, threat-induced performance deficits and lethal force errors in police officers are persistent, even with training (Nieuwenhuys et al., 2015). For example, even the sample of highly trained tactical officers in this study had performance scores of 74, and 14% made lethal force errors under stressful conditions, despite a quarter of their shift time being devoted to training (Cyr et al., 2020). These findings suggest that a reasonable officer, regardless of the amount of training and experience they have received, will likely not perform flawlessly under the unpredictable, novel, and potentially uncontrollable circumstances of a critical incident.

While this information is necessary to inform judgments concerning the reasonableness of an officer's actions, the purpose of this research is not to excuse sub-optimal performance or errors by the police. Instead, the aim is to paint a realistic picture of human performance under stress, identify the extent to which current police training and experience can improve performance, and promote police accountability. Accordingly, the results suggest that unless there is a significant investment in more frequent and evidence-based training, police officers are likely not sufficiently prepared to deliver optimal performance in critical incidents, which can impact both public and police safety. Thus, absent of evidence of bias, malice, or gross incompetence on the part of an officer, responsibility for poor performance or lethal force errors lies with LEAs and governments who are responsible for setting evidence-based training standards and ensuring that they can be met. Currently, many police services identify significant barriers to providing training, such as limited funding, resources, and facilities (Rojek et al., 2020). At this critical juncture in time, when trust and confidence in policing are being significantly tested (e.g., Leger, 2021), a concerted effort is required to address these challenges.

Study Limitations

While we are optimistic that our research findings can improve police training and inform the courts understanding of reasonable performance under stress, we caution readers to interpret and use the findings with consideration to various study limitations presented.

While the results of this study paint a stark picture of performance under stress, which may cause some alarm, these results must be considered within the context of what is *actually* occurring in the agency's operational environment. For example, with over 16,000 officers policing approximately 8 million people, the agency's OIS are relatively rare, with an average of 21 per year; accounting for 0.0008% of their police occurrences or one OIS in approximately 130,000 occurrences. These incidents also make up less than 1% of the number of times officers from the participating agency displayed or pointed their firearm at a subject, demonstrating that the vast majority of these high-risk situations are resolved without lethal force. Thus, while we can draw conclusions about what *might* happen to performance in highly stressful real-world police encounters, we must caution that it does not necessarily mean that it is occurring in naturalistic settings.

This study also involved only a single scenario, which was specifically designed to be complex and dynamic, and left the officer to respond on their own without backup. Such scenarios are known to elicit significant cognitive load (Mugford et al., 2013; Hope, 2016), which could inflate the sort of performance deficits we observed. While the scenario was designed to be as realistic as possible to cause high levels of stress in participants, it is also important to note that even a realistic scenario does not completely mirror the stress induced by a critical incident. For instance, in a training or research scenario, officers are aware they will not be seriously injured or killed, nor be subjected to post-OIS stressors (e.g., external civilian oversight investigations, risk of criminal liability, job loss). Therefore, we caution that no scenario-based study can truly replicate the naturalistic police environment or officer performance within it.

The current assessment of performance was also based on a single snapshot in time with one sample of officers

from a specific agency. Consequently, the results may not generalize to other scenarios, other officers, or other agencies. On average, officers from the participating agency receive in-service training that aligns with other LEAs (i.e., 40 h annually; Reaves, 2010), their pre-service and supervised field training are significantly longer (i.e., 6 months each). Additionally, the agency is known to provide high quality training according to industry standards, as exemplified by its dedicated teams of experienced and expert learning designers (civilian and police), standardized training, centralized oversight of instructor training, and collaboration with academics to embed best training practices. Therefore, the results of this study may be reflective of performance with above-average quality training.

Lastly, measurements of HRV can be influenced by respiration and physical activity, which may obscure linkages between psychological and physiological processes (Laborde et al., 2017). However, to increase confidence in the study findings, the current study used measures which are relatively free of respiratory influences, reported baseline measures, used a scenario room with confined space to restrict movement, and followed recently proposed HRV reporting guidelines (Quintana et al., 2016; Laborde et al., 2017). As cardiovascular stress reactivity is only one aspect of the stress response system, future research should include as much biological sampling (e.g., HPA activity, blood markers) as is logistically and ethically possible (**Supplementary Material L** (https://osf.io/egkf6/)).

CONCLUSION

Based on the robust methodology and relatively large sample of active-duty police officers used in this study, the results provide important insights into the general relationships between stress, training, experience, and performance in critical police incidents. The findings provide LEAs the opportunity to critically reflect on current training practices and offers a roadmap for making evidence-based improvements to training. The results also provide important evidence which may inform the reasonableness standard used in courts of law and paint a more realistic picture of police performance under stress given the current training available to officers. However, perhaps most importantly, we identify a need for a concerted effort to increase police training standards and ensure the necessary infrastructure is in place to achieve them. In this way, we should be able to enhance police performance in stressful police–citizen encounters and significantly reduce critical lethal force errors.

DATA AVAILABILITY STATEMENT

The datasets presented in this article are not readily available because of privacy and ethical restrictions. Requests to access the datasets should be directed to SB (simonbaldwin@cmail.carleton.ca).

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by the Carleton University Ethics Committee for Psychological Research (CUREB-B Clearance # 108733), as well as the Research Review Board (2018-04) of the agency from which the officers were recruited. The patients/participants provided their written informed consent to participate in this study. Written informed consent was obtained from the individual(s) for the publication of any potentially identifiable images or data included in this article.

AUTHOR CONTRIBUTIONS

SB, CB, and BB conceptualized the study and JA advised on stress measures during conceptualization. SB, BB, AB, BJ, CL, HM, and TS completed the data collection. SB performed the data analysis and interpretation with guidance from JA and under the supervision of CB. SB drafted the manuscript. CB, JA, BB, AB, BJ, CL, HM, and TS provided critical revisions. All authors contributed to the article and approved the submitted version.

FUNDING

This research was funded by a Social Sciences and Humanities Research Council Insight grant awarded to CB (SSHRC# 435-2017-1354). The participating agency also provided funds to facilitate data collection, along with in-kind contributions to support the research.

ACKNOWLEDGMENTS

The authors would like to express their sincerest thanks to all the police officers who participated in the study and the agency who collaborated with us to make the data collection possible. The agency's openness to collaborating with academics to assess their training and make evidence-based improvements is commendable. We also thank the scenario facilitators, including Cst. Blake Manning, Cst. Tyler Folz, Cst. Nick Fleming, Cst. Sean Willimott, Cst. Jeff Shanks, Cpl. Matt Janssens, Cpl. Nick Widdershoven, and Chris Lawrence, for volunteering their time to ensure the success of the study and the safety of participants. In addition, the authors would like to express special thanks to the expert reviewers, including Cpl. Nick Widdershoven, Cpl. Colin Kaiser, Cpl. Brent Halm, Cpl. Shaun Marchant, Sgt. Mirza Karimullah, Supt. Thomas Walker, and Supt. (ret.) Troy Lightfoot, who ensured the performance assessments were underpinned by strong expertise.

SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpsyg.2021.759132/full#supplementary-material

SUPPLEMENTARY MATERIAL INDEX | https://doi.org/10.17605/OSF.IO/PKJNV.

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frontiers in Education

ORIGINAL RESEARCH
published: 19 January 2022
doi: 10.3389/feduc.2021.777040

"The Situation is Quite Different." Perceptions of Violent Conflicts and Training Among German Police Officers

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Being a police officer bears the inherent risk of encountering violent conflicts while on duty. Federal reports on violence against German police officers document an increase in registered acts since 2011. However, apart from statistical data, little is known about the *qualitive specifics* of violent encounters within police operations. At the same time, national and international data point to problems of transfer between training and the field. Against this background, the following study presents the expert views of 29 German Federal police officers which have been interviewed about qualitative specifics of conflict dynamics they had experienced during operations and the extent to which they felt prepared for these situations by means of professional training. Results of the study reveal that violent encounters are perceived as complex, dynamic and ambiguous in nature, in turn demanding high standards of police officers' awareness, decision-making and interaction skills, ranging from de-escalation to fighting. Moreover, the majority of police officers reported that police training lacked adequate preparation. The findings are discussed through the lenses of professional policing and police training in Germany. For the further empowerment of police organisations, police trainers and police trainer education, we argue that a solid and methodically controlled knowledge base on situational parameters of violent encounters is key.

Keywords: violence against police officers, police training, qualitative parameters of conflict, professionalisation, qualitative research

OPEN ACCESS

Edited by:
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Reviewed by:
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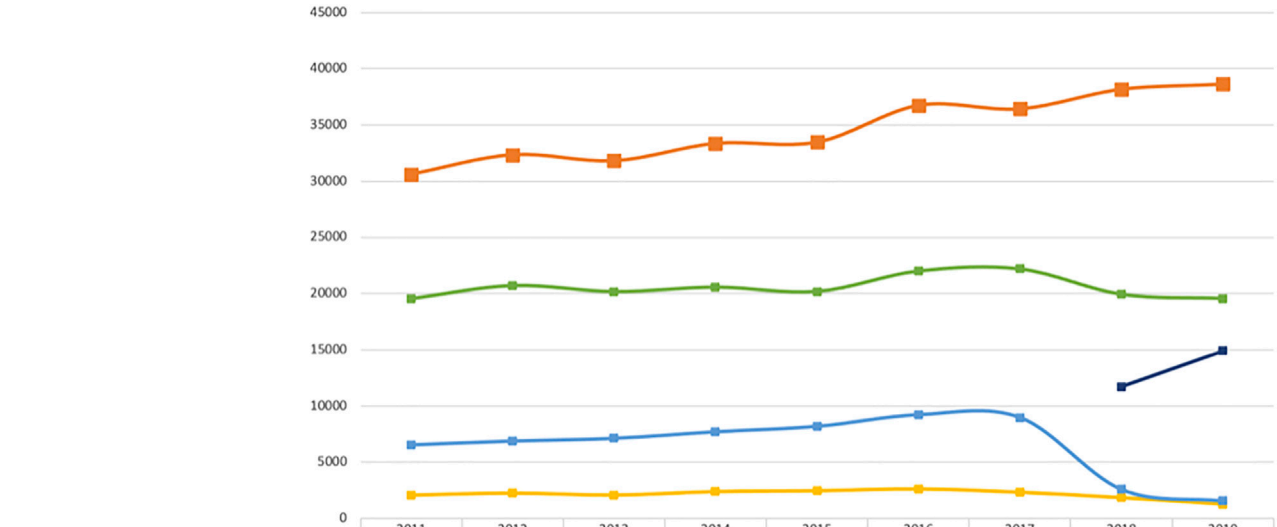
Specialty section:
This article was submitted to Educational Psychology, a section of the journal Frontiers in Education

Received: *14 September 2021*
Accepted: *21 December 2021*
Published: *19 January 2022*

Citation:
Koerner S and Staller MS (2022) "The Situation is Quite Different." Perceptions of Violent Conflicts and Training Among German Police Officers. Front. Educ. 6:777040. doi: 10.3389/feduc.2021.777040

INTRODUCTION

Police officers are exposed to a variety of demanding situations associated with the specific tasks of the job. Depending on the chosen career path (e.g., office service, riot police, cyber officer, special unit) professionals within the policing domain are likely to experience different types of violence in the course of their work. This is especially true for front-line policing, for example in the context of safety monitoring at airports or train stations. In the field, everyday police situations can take an unexpected turn from one moment to the next. A passport check, for example, can be amicable, but it can also escalate. The situation may return to normality and resolve peacefully, but it can also turn violent and endanger the physical integrity of police officers (Jager et al., 2013; Ellrich et al., 2011; Renden, et al., 2015b). To understand these differing outcomes of police-citizen interactions, researchers regularly point out the interactional dynamics of police-citizen encounters (Alpert



	2011	2012	2013	2014	2015	2016	2017	2018	2019
Accumulated Acts Of Violence Against Police Officers	30628	32355	31820	33368	33479	36755	36441	38190	38635
Grievous Bodily Harm	2092	2277	2098	2416	2491	2651	2357	1865	1276
Deliberate Simple Bodily Harm	6561	6894	7137	7716	8196	9229	8974	2611	1589
Resistance Against Police Officers	19541	20712	20168	20570	20187	22014	22191	19925	19559
Assaults								11704	14919

FIGURE 1 | Violence against police officers in Germany by year (data from BKA, 2012–2020, own graphic).

2004; Dai et al., 2011; White 2015; Todak and James 2018; Lee 2021). For example, using data from social observations Dai et al. (2011) found that police demeanour and their consideration of citizen voice significantly reduced citizen disrespect and noncompliance. In a similar vein, the results of an observational study by Todak and James (2018) indicate, that when police officers keep their emotions in check and interact with the citizen in a way that reduces the power differential predicted a calm citizen at the end of the encounter. In contrast, the concept of officer-created jeopardy (Lee 2021; Stein et al., 2021) explicitly points towards problematic tactical behaviours of police officers that deoptionalize officer behaviour beyond a certain point leaving very few behavioural options. In sum, these indicate the need for employing an interactional lense concerning qualitative specifics of police-citizen encounters. However, this lens is in need of interactional data in order to be employed. Those respective data are widely lacking for the German context.

Instead, the German discussion within the public-media and scientific sphere focuses on statistical data on the frequency of violence against police officers. Annual reports of the German Federal Criminal Police Office regularly provide incidence-based empirical insights. Since 2011 the reports provide detailed information on the prevalence of violence against police officers, that is regularly present and debated with the media. **Figure 1** shows the number of police officers having experienced violence in various forms in 1 year. From 2011 to 2019 the total number of violent encounters has increased by 21%, which is predominantly due to the increase in *deliberate simple bodily harm*, *grievous bodily harm* and *resistance* against police officers. In addition, since the introduction of the offence of *assaults* in 2018, the number of victims of *deliberate simple bodily harm* has decreased in comparison to the years before. In the case of *grievous bodily harm*, there was a significant increase in the period from 2011 to 2017, although the number of victimized police officers has decreased in recent years as well.

Regardless of the question whether violence against police officers increases or decreases in statistical numbers (Derin and Singelnstein, 2019), police operations inherently bear the risk of being exposed to violence. However, while annual reports of the German Federal Criminal Police Office (BKA, 2020) provide important information on the frequency of deployment-related violence, the collected data do not provide *qualitative information* about the specifics of the reported violent acts, for instance about situational dynamics (Ellrich et al., 2014) or their impact on the police officers' state and behaviour. Beyond statistical data, for Germany there are only few reliable findings which shed light into the emergence, dynamics and impacts of violent encounters experienced during frontline police work.

Ellrich et al. (2011) provided important insights into the characteristics of the situation in a study comprised of nearly 2,700 police officers from ten German state police forces who experienced violence on duty. In addition to temporal (day of the week, time of day), local (urban area, location), and perpetrator-related aspects (e.g., intoxicated), the study identified a high influence of communicative factors on the (non)occurrence of violence. From the perspective of the police officers, more than half of the assaults occurred during the phase of establishing contact, e.g., during arrests or the examination of suspects, as well as in the course of attempts at communicative de-escalation (Ellrich et al., 2011).

To date, there is little empirical evidence on the extent to which police training in Germany meets the preparatory demands for these real-world operational requirements. Police training pursues the goal of effectively preparing said officers for operational demands, especially for the professional handling of conflict and violence. However, the study of Jager, Klatt and Bliesener (2013) points out discrepancies between training and the field. Summarizing the qualitative part of their investigation, the authors state: "Overall, the interviewed PVB [police officers] said that the training and further education they have received does not lead to them feeling adequately prepared for attacks directed against them." (p. 351). From the point of view of the police officers interviewed, the "techniques" covered in training do not transfer to the operational context in the desired way, which in turn can lead to a "feeling of helplessness" (ibid.).

The doubts expressed here about the effectiveness of police training and the accompanying desire for a more realistic approach by referencing characteristics of real-world violence dynamics are supported by findings from a recent study of Staller et al. (2021a) investigating perceptions of German police recruits. In the recruits' point of view, police training lacks key informational variables which are present in the field. For example, they perceive it as problematic, that the role of the citizen in frontline policing is not as clear as in the training setting: "[. . .] you don' know the other person, you are uncertain from the beginning whether it is the perpetrator, whether it is the victim [. . .]. I know that nothing can happen to me in here, maybe a little injury, I have to expect worse things outside." (TN12; Staller et al., 2021b).

Geared towards the German situation, the following qualitative case study aims to further explore this constellation by investigating police officers' experiences of violent conflicts, qualitative characteristics of those conflicts and their respective views on preparatory police training. It is the first study explicitly focusing on 1) qualitative aspects of violent situations in duty as experienced by German federal police officers and 2) their assessment of the preparatory function of police training related to these experiences. Thereby, this study is underpinned by the assumption that a profound knowledge on the qualitative specifics of violent encounters in duty provides a key prerequisite for the empowering of police training, so that it can achieve its declared intention and function: to adequately prepare police officers for professionally coping with conflict and violence. For the content and pedagogical design of police training, data on qualitative specifics of police violence dynamics provide a central basis and orientation. As training for frontline work, knowledge about contextual factors, situational features, and typical interaction dynamics is essential for the professional planning, implementation, and evaluation of police training and police trainer education in Germany (Koerner and Staller, 2020a).

In this respect, the expansion of operational knowledge, especially focusing on qualitative aspects in the context of violent conflicts, is an urgent issue of concern. A sample of 29 German Federal police officers have been interviewed about conflict dynamics they had experienced during operations and to what extent police training had prepared them for coping with the respective demands. Since violence within the context of policing manifests itself in numerous forms of social interaction, the study's perspective on violent conflicts covers a broad range of social interaction, including verbal, non-verbal and physical conflicts during police-citizen encounters (Buss and Arnold, 1961; Tedeschi and Felson 1994).

MATERIALS AND METHODS

Method Selection

The course of violent police-citizen interactions could be properly analysed by using video data from body-worn cameras (Nassauer and Legewie 2019). However, in contrast to countries such as the US (Chapman, U. S. Department of Justice, 2019; Koen and Mathna 2019), in Germany material from body-worn cameras has not yet been considered as a source for systematically generating operational knowledge on qualitative aspects of violent encounters. Instead, the use of self-recorded video data by the police is currently limited to legal purposes. In line with said national constraints for the use of data from body-worn cameras, the study attempts a different approach.

Due to the access to the German federal police within the broader context of research projects related to police training, the study has been conducted as a qualitative case study utilizing semi-structured interviews with police officers. As a prominent part of qualitative research methods, interviews have their strength especially in delivering insights on issues of interest, using subjective perspectives and interpretations (Flick, 2018). Generally, police officers are deemed experts by value of their profession. Since experts own "technical, process and interpretative knowledge that relates to his or her specific professional or occupational field of action" (Bogner and Menz 2005), p. 46), police officers appear to be a promising source in the attempt to identify situational features and qualitative aspects of violent encounters during deployment. This may include specific contextual factors of police-citizen encounters as well as the unfolding dynamics of these situations. In contrast to statistical and video data, interview data has the advantage of also capturing how a single police officer subjectively experienced the violent situation. In addition, the interviews provide insights into the police officers' perception of police training as a preparatory measure that all police officers in Germany have undergone. While we fully acknowledge the subjective interactional perspectivity of their accounts, we find value in this subjectivity in so far, that the police officers' perspective may provide important insights of how police training is currently designed and delivered in Germany.

Data Collection

Within the literature on qualitative research, for single case studies a sample-size of 15–30 participants is recommended for data saturation (Francis et al., 2010; Marshall et al., 2015). The final sample of the following study consisted of 29 German Federal police officers (m = 26; f = 3), suggesting adequate information power (Malterud et al., 2016) for the research question posed. The officers had a mean age of 38 (SD = 7.35)

and a minimum of 3 years of working experience in-service (M = 17.14; SD = 7.91).

The interview-guide comprised questions on the topics of violent experiences in duty as well as questions on the respective role of police training which had been derived from the review of relevant literature (see discussion above). After an opening question about their personal background and individual career-path, police officers were asked to comment on the following points (translated from German to English):

1) Please tell me what conflict situations have you experienced in the field.
2) Please describe one or two situations in further detail.
3) Please explain to what extent police training had prepared you to deal with the experienced conflicts.

The semi-structured regime ensured orientation along the topical domains, at the same time enabling flexible follow-up questions of the interviewer concerning the statements of the police officers. This structured sensitivity to participants' views, as well as the individually varying level of experience, memory and detail in the reports, led to interviews of between 10 and 34 min of length (M = 19.86; SD = 6.81). Ahead of each interview, informed consent was obtained from all police officers, including the assurance of anonymity. The study was approved by the ethics committee of the German Sport University Cologne. The interviews were conducted and audio-recorded by both authors (SK, MS) and subsequently transcribed verbatim by trained research assistants (Kuckartz 2014). For the purpose of publication, quoted passages were translated from German to English.

Data Analysis

In order to support scientific rigor and credibility of the findings (Tracy 2010), the data analysis followed procedures of qualitative thematic analysis (Braun and Clarke 2006), utilizing MAXQDA software (Kuckartz 2014). The analytical strategy was chosen according to the objectives of the study, thus employing *concept-led* (deductive) and *data-driven* (inductive) approaches for the systematic development of themes (Graneheim et al., 2017). The deductive coding of meaning units was based on the research question; that is 1) experiences of violent encounters and 2) perception of the preparatory function of police training (Braun and Clarke 2006).

Due to the open approach to this rather unexplored field of interest, we additionally utilized inductive coding. Using the inductive approach, further meaning units relevant to the overall research question were identified and then assigned to further (sub-)themes (Biddle et al., 2001; Braun and Clarke 2006; Graneheim et al., 2017). Within both coding strategies, the database was analyzed and clustered into *raw-data*, *lower-order*, and *higher-order themes*. Raw-data themes were derived from the coding of relevant meaning units within the database. Identity in focal meaning (e.g., "hit in the face with the backhand", police officer 07/"got fist punched in the face, so to speak", police officer 10) led to the creation of raw-data themes by paraphrase comprising the generalized meaning (e.g., "punched") and in turn allowing for the further subsumption of similar units under the existing theme, whilst difference in meaning led to the creation of a new theme (e.g., "spit", derived from "one [person] spit", police officer 23). The coding guide created after a first turn of fully coding the whole set of data, was then applied to the entire dataset for a second time in order to ensure a comprehensive analysis (see **Table 1**).

In a next step, raw-data themes were coherently built-up into lower-order themes by generalising their focal meaning (e.g., "spit" and "punched" to "physical conflict" due to their *physical* nature). The set of lower-order themes had been re-examined by the second author beforehand, and both researchers had reached a consent on said themes by using questions and debates (Abraham et al., 2006). Subsequently, the sub-themes were generalised on a further abstraction level of meaning and built-up to higher-order themes (e.g., "physical conflict" and "verbal conflict" to "types of conflict" due to their *difference* in mode but *similarity* in being conflictual). Higher-order themes were again critically evaluated by the second author before eventually being set. At the level of raw-data themes, meaning units providing qualitative information on violent encounters and assessments of the effectiveness of preparatory training were quantified according to the frequency of their mentioning by single participants. At the level of lower-order and higher-order themes, meaning units have been quantified according to their overall occurrence. Although "the "keyness" of a theme is not necessarily dependent on quantifiable measures" (Braun and Clarke 2006, p. 82), the total number of mentions provides important insight into the subjectively perceived relevance of individual themes within the study sample and thus "captures something important in relation to the overall research question" (ibid.).

RESULTS

Experienced Conflicts

With regards to police officers' personal experiences of violent encounters in duty (issues 1 and 2, see *Data Collection*), data analysis revealed five higher-order themes that are presented in **Table 2**: 1) frequency of conflicts; 2) working context of conflict; 3) type of conflict; 4) parameters of conflict; and 5) operational demands.

We are aware that theses higher-order themes are interrelated. Given the rather open focus on experiences of conflict situations and on implicitly what the interviewees ascribed relevance to it (throught mentioning it), we place the higher order-themes in the foreground individually and in sequence. However, this separation is purely analytical in nature. In reality, the higher-order themes of conflict situations, which are presented in excerpts based on quotations, are inextricably linked. Thus, the exemplary presentation of, for instance, the working context of a violent conflict also provides insight into the dynamics or type of conflict. Notwithstanding this, we have decided to reproduce longer quotes from the police officers' descriptions in order to give the reader a denser and more

TABLE 1 | Coding examples of building up process of raw-data, lower-order themes and higher-order themes.

Quote (raw-data theme)	Paraphrase (raw-data theme)	Lower-order theme	Definition	Application rule	Higher-order theme	Definition	Application rule
"The atmosphere was loaded with aggression" P011	Aggressive atmosphere	Situational parameters	General specifying aspects of the situation at hand (in difference to person related aspects, e.g., the citizen involved)	Subsumption of raw-data themes referring to general specifying aspects of the situation at hand under lower-order theme	Parameters of conflict	Specifying parameters of conflict comprising situational, officer and citizen related aspects (e.g., in difference to the working context of conflict)	Building-up of lower-order themes referring to specifying parameters of conflicts into higher-order theme
"High potential for aggression" PO14 "This potential for aggression, which that we are facing there" PO26	High potential for aggression	Citizen's behavior	Specifying aspects of the citizen involved (e.g. in difference to general specifying aspects of the situation at hand)	Subsumption of raw-data themes referring to specifying aspects of the citizen involved under lower-order theme			
"So really this conditioning to put away the first thing, to overcome chock and immediately go into attack mode" PO12	Overcoming chock and taking physical action	Physical demands	Specifying demands of physical action (in difference to e.g. verbal and non-verbal demands)	Subsumption of raw-data themes referring to demands physical action under lower-order theme	Operational demands	Specifying aspects of conflict covering operational demands for the dealing with conflicts (e.g. in difference to the type of conflict)	Building-up lower-order themes referring to operational demands for the dealing with conflicts into higher-order theme
"You start shaking like hell, because the adrenaline wants to get out somewhere and then you have to control yourself" PO19	Control oneself under adrenaline	Self-regulation	Specifying demands for inner mental processes of action regulation (in difference to other demands, e.g. physical demands)	Subsumption of raw-data themes referring to demands for inner mental process of action regulation under lower-order theme			
"then the citizen stood in front of me at ultra-close distance and I got hit in the face with the backhand" PO7	Punched (Specific physical attack)	Physical attacks	Conflictual actions of physical nature comprising bodily means (in difference to other means, e.g., verbal means)	Subsumption of raw-data themes referring to conflictual actions of physical nature under lower-order theme	Type of conflict	Specifying aspects of conflict related to the specific mode and type of conflict (e.g., in difference to the working context of conflict)	Building-up lower-order themes referring to the specific mode and type of conflict into higher-order theme

vivid insight into the conflict situation experienced. The respective higher-order theme merely represents the chosen focus of the analytical view.

At this point, it is important to note that the higher-order themes identified within the sample do not allow for further generalisation, but rather have their value within the sample and within the issue the German federal police officers were asked to comment on ("Please describe one or two situations in further detail"). The cases of the sample stand for themselves.

Frequency of Conflicts

The frequency of conflict describes the perceived frequency of conflictual situations while on duty. When asked about violent situations experienced in the line of duty, all police officers elaborated on at least one (12) or two (17) concrete incidents in further detail, leading to a report of a total of $n = 46$ conflict situations. Many (but not all) of them began their reflection with an estimation of the frequency of violent encounters in general. Police officer 05 represents the group of colleagues ($n = 12$) that reported already having been confronted with violence on duty *many* times.

> *"There are many. Be it violence from the crowd, be it violence three against one or three against two, group dynamics, violence from the group. I have experienced a lot, because I am in the riot police's arrest squad, which is deployed in these hot spots. Or sometimes house searches, even one to one." (PO 05)*

However, not all police officers reflecting on the frequency of violent experiences during operations stated that "conflicts are an everyday appearance" (PO 12). For instance, the perception of police officer 02 represents the group of interviewees who reported having experienced only a *few* conflictual situations in duty so far:

> *"So, I've actually only had real resistances like that twice. Twice. Otherwise, I always got along quite well while policing." (PO 02)*

Type of Conflict

Police officers reported different types of conflict within their accounts of experienced conflictual situations. The *type of conflict* comprised a total of $n = 82$ meaning units. The theme is made-up

TABLE 2 | Results of qualitative analysis of conflicts experienced by German federal police officers (Numbers in column "*n*" denote the number of participants contributing to the raw-data theme; within the columns of lower-order and higher-order themes, numbers in brackets denote the total number of meaning units).

Higher-order theme	Lower-order theme	Raw-data theme	n
Frequency of conflict (19)	Frequency of conflict (19)	Few	7
		Many	12
Type of conflict (82)	Weapons involved (17)	Assumed existence of a weapon	2
		Iron bar	1
		Bottle throws	5
		Stone throws	2
		Getting hit with a stick to the neck	1
		Firecrackers	2
		Attacked with all sorts of objects	3
		Citizen grabbing service weapon	1
	Verbal assaults (21)	Verbal disputes	9
		Insults	12
	Physical attacks (44)	Physical attacks (not specified)	11
		Physical attacks specified	33
		• Pushed (5)	
		• Grabbed (1)	
		• Spit (2)	
		• Bitten (5)	
		• Scratched (1)	
		• Punched (12)	
		• Kicked (5)	
		• Clinched (2)	
Working context of conflict (46)	Major and special situations (13)	Fan escort	8
		Mass demonstration	3
		Riot on new-year's eve	1
		Mass looting in supermarket	1
	Safety monitoring rail traffic (15)	Ticket control	3
		Identity control	1
		Mass brawl	2
		Riot in the train	1
		Knife attack at station	1
		Youth fighting	1
		Firearm at station	1
		Armed robbery at station	1
		Person suffering Heroin addicton	1
		Violent couple during patrol	2
		Resistance at platform	1
	Safety monitoring aviation (7)	Document control	6
		Resistance during repatriation	1
	Border police security (2)	Traffic control	2
	Other (9)	House search	1
		Detention in police office	1
		Drunk at bar	1
		Intrusion into office	1
		Aggressive citizen in office	2
		Identity check at the Harbour	1
		Offender at football match	1
		Freak-out in flat	1
Parameters of conflict (72)	Situational parameters (25)	Chaotic and complex	7
		Without rules today	1
		Aggressive atmosphere	2
		Highly dynamic	13
		Ended upon the ground	1
		Pushed into the public eye	1
	Police officers' state and behaviour (27)	Excited	2
		Exhausted afterwards	2
		No sense of time	1
		Respect for superior numbers and objects	1
		Situation stuck for a long time	1
		Overwhelmed	4
		Surprised	6
		Stressed	4
		Panicked	2

(Continued on following page)

TABLE 2 | (*Continued*) Results of qualitative analysis of conflicts experienced by German federal police officers (Numbers in column "*n*" denote the number of participants contributing to the raw-data theme; within the columns of lower-order and higher-order themes, numbers in brackets denote the total number of meaning units).

Higher-order theme	Lower-order theme	Raw-data theme	n
		Switched to professional mode	4
	Citizen's behaviour (20)	Incomprehension for applied measures	1
		High potential for aggression	13
		Strong resistance	1
		Drunk	5
Operational demands (49)	Self-regulation (3)	Control oneself under adrenaline	2
		Keep yourself together	1
	Perceptual-cognitive demands (16)	Being aware, alert	7
		Decide quickly	8
		Being flexible in the situation	1
	Physical demands (9)	Retrieve technique under real load	2
		Overcoming chock and taking physical action	4
		Behaviour/fighting on the ground	1
		Adhere to principles, not techniques	1
		Deal with uncontrolled movements	1
	Mindset (7)	Less inhibitions or fears	1
		Ready for violence	3
		Role perception: being a police officer, not a street thug	1
		Mental preparation in general	1
		Self-esteem	1
	Verbal and nonverbal demands (11)	Ability to de-escalate	8
		Self-confident demeanour	5
	Tactical demands (3)	Barricading	1
		Tactical approach in a team	1
		Taking action first	1

of *physical attacks* (n = 44), *verbal assaults* (n = 21) and the *involvement of weapons* (n = 17), displaying the broad range in which violence had been experienced during deployment. For instance, police officers 07, 08, 09, 11, and 16 recalled having bottles thrown at them as improvised weapons on several occasions, representing a special type of attack, because

> *"when bottles are thrown at you, you don't always have direct access to who did it, because you don't really notice where it came from." (PO 09)*

This is somehow different to the type of *physical attacks,* in which the violent interaction is based on direct contact between the police officers and citizens. Within this lower-order theme, many police officers reported being punched, kicked, bitten and pushed. Typically, the different types of attacks used to follow each other and alternated, as experienced by police officer 07 at a demonstration during the G20 summit in Hamburg:

> *"We just got out of the car to prevent it and then an offender jumped into my colleague with a jumping knee, I would call it, bounced off him a bit, stood in front of me at ultra-close range and hit me in the face with his backhand. That was an attack that is still very present in my mind because it was launched from such a close distance." (PO 07)*

In many cases, especially within the reported control situations, physical conflicts were preceded or accompanied by verbal assaults. During a patrol at the railway station, one of the interviewees recalled a situation in which

> *"a person, who was apparently completely against the police, began to insult us in passing with such insults as "You fucking cops", "Get out of here", "You have no business here", "We don't want you here". Then we wanted to make an identity check in line with the protocol and file a report for insults. He then went completely berserk, stormed towards us and wanted to hit us. We had to bring him to the ground and restrain him. Even when he was tied up he continued to resist in such a way." (PO 06)*

On the other hand, several of the reported experiences of violent encounters were limited to verbal offences, such as the following insult, experienced by police officer 23 during a passport control at the airport:

> *"There was a very interesting situation for me. At the very beginning I came to the airport and I was checking in the passengers. And there was a citizen standing in front of me pointing at my epaulettes and saying to me in English that I'm "a nothing". And first I thought, okay what is this? What is he doing? What does he want from me now?" (PO 23)*

Working Context of Conflict

Within the data, the experienced conflicts had been specified by *contextual* information, displaying a localisation of

encounters that can be expected in the area of use of German federal police officers. Even if the contexts mentioned do not provide any representative information on the operational contexts of German federal police officers, they nevertheless give valuable indications as to which operational contexts are considered newsworthy and thus relevant by the police officers surveyed. Most of the reported incidents took place within the context of *safety monitoring rail traffic* (n = 15), *safety monitoring aviation* (n = 13) and *major and special situations* (n = 13). Within the latter, *fan escorts* on the periphery of football matches (n = 8) provide the most frequent contextual frame of violent encounters reported by the interviewed German federal police officers, followed by deployments alongside of *mass demonstrations* (n = 3), such as those around the Gorleben nuclear waste repository. For instance, PT 13 recalls an incident during which a protester almost removed the officer's firearm from his holster without him noticing as follows:

> *"That was also a drastic experience, where you thought: OK, that happened during the scuffle. We had those other holsters back then, not these safety holsters that we have now. At that time, we were at the nuclear waste repository in Gorleben. It must have been the mid-nineties. The blockades were first secured with a police cordon. Usually, the water cannon came and then the protester were surrounded and carried away from the site. Then I noticed that someone had already reached for the gun." (PT 13)*

The encounter of a group of violent football fans alongside a premiere league match as reported by PT 04 provides a detailed insight into the situation he and his colleagues were in:

> *"If we want to talk about football, we were deployed here in Gelsenkirchen once. We simply closed off the lower area from the upper area at the train station to the Christmas market. There, in the public area there were fans, who were pursued by, I don't know, about 50 hooligans came towards us. Then the space became narrower, funnel-shaped narrower and we closed it down, then we had to retreat. Everyone fled into the stands, also the passers-by and then it was channeled a bit. That slowed down everything that was happening. Then, full blast, so with sticks and fists we simply drove the crowd back. That was very explosive, because it was getting tighter, it was a mess, some people crashed, so also to keep the people together or to look for themselves, but then you were more or less on your own to find yourself again." (PT 04)*

In the context of *safety monitoring* at German airports and rail stations, *control situations* (ticket control, passport check) attracted the highest number of reported conflicts within the sample. As an example of this working context, the following experience of police officer 06 is presented here, in which he had to track and secure a single suspicious person:

> *"The second situation I can remember relatively well was during a document inspection at the aircraft. A person presented me the passport. I noticed that something was wrong with the passport, then I looked at his height and noticed that it said 1.65 m, but he was clearly taller than me, which was the first indication that something was wrong. I then made it relatively clear to him that he would now accompany us to the police station because we would have to take him back to check his document, which he then immediately took advantage of and out of reflex practically passed us and fled. And of course we, that is a colleague and myself, immediately followed him and I then tried to hold him by the shoulder. He then broke away twice and in the end I was the only one who managed to stop him after I approached him from behind and was able to grab him by the leg. Then we both fell forward head-on and the colleague joined us. He was half a metre to a metre behind me and we were able to fixate him on the ground, but we did not have his arms yet. We had to use a lot of force and a few nerve pressure techniques to force him to give up his arms, because he had always blocked them under his body and then, thank God, he accepted his fate relatively quickly and allowed himself to be tied up and transported to the police station without any further situation arising." (PO 06)*

Parameters of Conflict

Within the retrospective views of the interviewed police officers, *parameters of conflict* (n = 72) are of high relevance. Those parameters could be subdivided into *parameters* related to the *overall situation* (n = 25), to the *citizens involved* (n = 20) and finally to the *state and behaviour of the police officers* themselves (n = 27). Within the experienced conflicts a high potential for *aggressive* behaviour (n = 13) among citizens had been perceived. The relevance of this parameter was for example articulated by police officer 17. During an operation at a train station where several young men had been involved, his colleague had to be taken to a hospital after "the aggressiveness of the police counterpart, (who) immediately struck my colleague and also brutally started to punch" (PO 17).

According to many police officers, aggression is seen as a potential that can unfold "spontaneously" (e.g., PO 06). It was also stated that "nowadays" (PO 26, PO 28) there is a generally lowered inhibition threshold for violence against police officers. In several cases, however, the aggressive behaviour of the citizen was accompanied by an alcoholic state (n = 5), as for example during this riot in a train reported here:

> *"There was a person who was rioting in the ICE, so he was very drunk and very aggressive and also insulted the people. And he was already sitting in his seat again and was actually just supposed to get off the train. We talked to him, the situation got out of hand. A colleague was standing in front of me. I was standing behind the person. Then the person got up and wanted to hit my colleague in the face and I took advantage of the moment, because I don't think he noticed that I was*

standing behind him because he was so drunk, and I intercepted his arm and was able to immediately put him in a restraining grip and basically stopped him from hitting me. Then I had him quite safely. Then we took him out of the train, and at that moment a unit from the police force of Hesse joined us and supported us again because he put up a lot of resistance, so we brought him to the ground with several colleagues, tied him up and carried him to the police station." (PO 29)

Next to the citizens behaviour, *situational parameters* of conflicts had been mentioned, forming a significant lower-order theme within the police officers' perception (n = 25). Conflictual situations are perceived as being inherently *complex, chaotic* (n = 7) and foremost: *highly dynamic* (n = 13). In many reported cases, conflict situations altered in a split second, turned literally "from zero to one hundred" (PO 16), evolved practically "out of nothing" (PO 21) and lacked clarity. Looking back on the situations he experienced, interviewee 10 describes the situational quality as follows:

"It happens relatively unexpected sometimes as well. It is a normal search and he launches a headbutt directly, or it is a normal document search and he runs away, where you could say that sometimes it is difficult to recognise that something is about to happen. If you don't really have an affinity for it and you're not prepared for it, it's really, really hard to recognise that the situation is about to get dicey." (PO 10)

Finally, the *police officers' state and behaviour* (n = 32) completes the qualitative parameters of conflict. In coherence with the already highlighted key themes, police officers denote their own mental state during violent conflicts as being *stressed* (n = 4), *surprised* (n = 6) and *overwhelmed* (n = 4) throughout the situation, "not knowing how to deal" (PO 10) with it. At the same time, some interviewees report that they were shifted into *professional mode* (n = 4), being much more alert and made ready for the use of violence.

Operational Demands

Finally, *operational demands* (n = 49) emerged as a higher-order theme displaying a certain relevance in the police officers' reflection of conflicts that they had experienced. Within this thematic complex, *perceptual-cognitive demands* (n = 16) were mentioned the most, followed by *verbal and nonverbal demands* (n = 11), *physical demands* (n = 9) and *mindset* (n = 7). The perceived qualitative specifics of conflictual situations and portraying them as inherently complex, dynamic and shaped by the citizens' aggressiveness, aligns with the enumeration of significant demands on police officers which are based on those qualities. Within an unclear situation

"incidents don't always announce themselves. People just stand in front of you at a short distance and decide to attack all at once . . . you have to focus on what is really important at that moment, e.g., how is the person behaving, how is his or her state mood or what is happening here right now? That's what you really need in practice, namely the right reaction within the shortest possible amount of time." (PO 01)

This perception of police officer 01 had been confirmed by several colleagues pointing to operational demands which address the perceptual and cognitive domain: Conflict situations call for *quick decisions* (n = 8) and a heightened *awareness* (n = 6) for the selection of action guiding cues. As police officer 12 puts it:

"I have to recognise that there is a danger. I have to decide how to react to the danger. And then I have to do something, which does not have to be technically perfect, but it has to work." (PO 12)

According to the data-driven typology of conflicts comprising physical and verbal encounters, the interviewees stated that conflict situations demand sound action capabilities in the respective domain. The police officers' ability to *de-escalate* in an atmosphere of aggression, for instance, is mentioned frequently (n = 8), thereby showcasing even more thematic relevance than the physical ability for *overcoming the shock and taking action* (n = 4) or the correlated *mindset* of being *ready for violence* (n = 3) in situations that have already escalated. Furthermore, within the non-verbal domain, *self-confident* demeanour (n = 5) is deemed important. To the mind of police officer 16, displaying self-confidence during conflict situations is linked to de-escalation: "So if one has the right demeanour, this can already have a de-escalating effect." (PO 16)

In this regard, one of his colleagues points out that for purposes of de-escalation, the fine line between displaying self-confidence and displaying arrogance has to be acknowledged, since the latter can provoke opposition and create resistance. The officer states:

"That doesn't have much to do with ego, so nothing to do with ego or overestimation but simply with a certain kind of self-confidence and security that I have to have towards the person... I don't want to provoke any resistance." (PO 03)

This kind of perception is reinforced by police officer 02, who emphasises the reciprocity of behavioural outcomes, an effect that especially the police officers involved in the interaction should be aware of: "Many things are based on how one behaves oneself: What goes around comes around." (PO 02) The practical relevance of de-escalating behaviour in critical moments becomes clear in the following conflict situation reported by police officer 23. The situation was about to escalate into a physical conflict when she had to deal with an indignant citizen who could not be calmed down by any other colleague:

"We were called in, it was about, I think it was [anonymized], who was behaving very aggressively with several colleagues. Yes, he had already had a verbal altercation, he was shouting and we just got

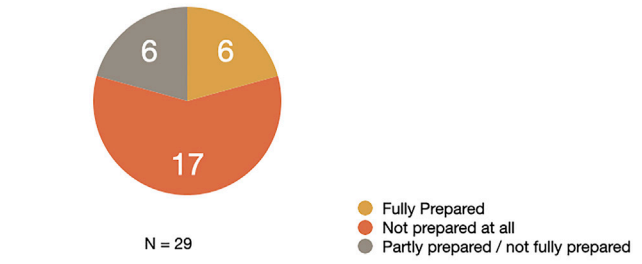


FIGURE 2 | Police officers' perception on whether police training had prepared them for the conflicts they had experienced.

involved and he saw me and fixated on me, but not in a negative way, but in a positive way. That means that in the end I was the only one who could direct and control him a bit, because he reacted to me. And it was a situation that was very tense. He was also difficult to calm down. But through this verbal communication and for whatever reason he had chosen me at that moment, we actually managed to calm him down to such an extent that we were able to get him out of the masses, out of this room. We took him to the office and did everything else there ... He didn't let anyone touch him, he didn't let anyone get close to him, and in the end, we were able to take him with us in a really sensible way." (PO 23)

While in this case it was the verbally de-escalating behaviour of the police officer that led to the citizen focusing on her and letting her calm him down, the second situation described by the same officer shows that things can always turn out differently in the field. In this case, the solution to the situation at hand required an adaptive use of resources:

"A fare dodger was discovered by the DB [the railway company]. He refused to talk to them. We then came to take his personal details and he did not act normally. He wasn't agitated, he was just very, very calm. We asked him to give up his personal details and out of nowhere he lashed out and wanted to hit me first and then run away. And then I grabbed him by the arm, he was wearing a thick winter jacket, and he wriggled out of it. Then the colleague came and folded him up on the floor, (laughs) like a jack-knife. Yes, and then it actually happened very quickly. So we lay on him like that. We actually did everything without thinking." (PO 23)

Experienced Conflicts and Police Training

With regard to the question as to what extent police training prepared them for the violent conflicts they had experienced (question 3), six out of 29 police officers confirmed that they had been prepared adequately, whereas 17 interviewees stated that the training did not serve this purpose at all (see **Figure 2**). In another six cases, police officers gave a differentiated assessment in which both functional and dysfunctional aspects were mentioned (partly prepared/not fully prepared). For instance, one officer reported that in front-line situations "the tear-back technique, practised thousands of times in training, worked fairly well" (PO 26), while mental preparation for operational requirements "was almost non-existent" (ibid.).

Furthermore, data analysis revealed that a significant number of raw-data themes contribute to *not prepared through training* (n = 65), as compared to *prepared through training* (n = 23), as shown in **Table 3**.

Prepared Through Training

Six out of 29 police officers assessed that training had prepared them for the conflicts they had experienced. A further six stated that this had at least partially been the case. For the thematic complex of *prepared through training*, aspects of *content* (n = 11) were deemed relevant. More specifically, police officers stated that police training had offered the *basics* (n = 4) for dealing with real-world conflicts. While police officer 11 stated that police training "actually had not prepared me at all" (PO 11), he subsequently puts the assessment into perspective. With regard to arrest situations he experienced in the line of duty, which differed from the situations experienced during training, he still states that the training has taught him/her the basics for a successful handling of said arrests:

"Although arrests were trained, in the context of this chaos, I was only a functioning, clearly with basics that I had received from the police training. Taking down somebody was automatised." (PO 11)

Like police officer 11, another three colleagues also emphasised that the police training had given them the necessary basics for dealing with the experienced conflict situations. In the perception of police officer 04, for instance,

"jujutsu, the system we basically trained back in the days, was sufficient for the time being. It wasn't particularly spectacular, but you had your basic tools." (PO 04)

More specifically, several police officers mentioned the value of techniques learned in police training: "There are already techniques that you use, which give you a certain amount of safety" (PO 26), as one interviewee states. However, the same officer continues by acknowledging that he had experienced limits for the use of those techniques in real-world situations: "The fact that they don't work like that in reality, those are experiences that you only make in reality." (ibid.) Interviewee 15 arrives at a similar assessment, on the one hand emphasising the usefulness of learned techniques and on the other hand pointing out the limits of their applicability in real-world settings. He states:

"Of course, all the joint locks we've trained were good. It also helped me a lot, but it was rather secondary. When

TABLE 3 | Results of qualitative analysis whether training prepared for experienced conflicts (Numbers in column after raw-data theme denote number of participants contributing to the raw-data theme; numbers in brackets denote total number of meaning units for lower-order and higher-order theme).

Higher-order theme	Lower-order	Raw data theme	n
Prepared through training (23)	Prepared through training (12)	Fully Prepared	6
		Partially prepared	6
	Prepared through content of training (11)	Had offered basic	4
		Had made me/us mentally strong	1
		Provided physical preparation	1
		Prepared through techniques	5
Not prepared through training (65)	Not prepared through training (23)	Not prepared at all	17
		Not fully prepared	6
	Not prepared through content of training (16)	Not prepared because of a focus on technique	4
		Not prepared for situational dynamics	1
		Mentally not prepared	1
		Not prepared for violence	1
		Ju Jutsu not purposeful	1
		Not close to reality	7
		Neglected combat option due to focus on de-escalation	1
	Not prepared through pedagogical aspects of training (9)	Preparation for technical examination ("acting") is not enough	4
		Training of techniques was linear/out of context	4
		Shooting training was a catastrophe	1
	Prepared through experience of previous operations (2)	Prepared through experience of previous operations	2
	Prepared through private martial arts experience (14)	Prepared through private martial arts experience	14
	Prepared through childhood (1)	Learned to fight in early childhood	1

> *you have someone on the ground. Then you do a little bit here and a little bit there, but that you really do a sophisticated arm bar or a finger lever, that rarely happened. It's always this mishmash...". (PO 15)*

The techniques learned in training were good, they had helped. However, when put into the context of front-line policing, its quality, which has been parametrized before in great detail and is coded here as "mishmash", forced the officers to adapt said techniques. Along with this, a perceived difference between training and field comes into play. Police officer 14 puts it this way:

> *"Police training always offers only a partial basis. The rest, which you then acquire in reality, is then, in my opinion, flexibility, and in some cases, you cannot train this at all, because the situation is quite different." (PO 14)*

The quote "*the situation is quite different*" condenses a view of major relevance within the police officers' perception, articulating that *training had not prepared* them adequately for competently dealing with conflictual situations in front-line policing.

Not Prepared Through Training

17 out of 29 police officers stated that their former police training had not prepared them for the conflict situations they reported at all. Police officer 07 puts it this way:

> *"Well, I hate seeing things negative, but if I'm honest, I have to say that the police training didn't help me at all." (PO 07)*

With regards to police officers' personal assessment of not having been prepared, data analysis revealed a significant number of raw-data themes referring to the *content of training* (n = 16) and to *pedagogical aspects of training* (n = 9). Finally, another thematic category emerged from a number of the officers' statements, which explicitly attributes the preparation for the experienced conflict situations not to police training, but to a private origin: The fact of having a biographical *background in martial arts* provided the main resource for feeling able to competently deal with conflicts in deployment. A fact that was stated by n = 14 police officers.

Within *content of training* a number of police officers pointed to remarkable differences between the field and training, stating that the latter was not *close to the reality* of the field (n = 7) and suggesting a lack of realism in police training. This point is, for example, made clear by police officer 20 as he describes one of the conflicts he experienced at the airport in further detail:

> *"In the transit area, the US demanded a ten percent follow-up check from us at random. And our task was actually only to pull out those who wanted to go to the US or who were coming back from the US and then hand them over to a team from [anonymised] Security, who checked them again. A couple came, and he let himself be checked normally. He didn't question it. But she completely lost it during the check, not because of our search, but because of the [anonymized] security. So without any indication, at least we didn't recognized any, she completely unleashed, head-locked one of the officers and kicked a second one. We joined in and had to restrain her. She was like in such a frenzy. She was completely out of control. It was the first resistant*

behaviour for me where I realised that it doesn't work like on the mat." (PO 20)

In this retrospection of an experienced front-line conflict, the difference between "the mat" and the dynamic quality of real-world violence leads to the important conclusion: In the context of dealing with the sudden release of physical resistance and chaotic attacks, the police officer realised that reality differs from training. Despite that, to the mind of several other interviewees, training was not geared towards realism. On the contrary:

"That was the mat, you had more of a feeling as if you were preparing for a competition. That was a dojo, with a [martial arts] suit, and all that had nothing to do with the street . . . And otherwise it was just all so stiff ju-jutsu ... There was this, yes, I don't know how to describe it, this street-like thing, it was not in there." (PO 08)

When seen through the lens of the qualitative specifics of the experienced conflict situations described above, police training is depicted as being rather stiff and oriented towards traditional codes of the martial arts, therefore not being very 'street-like'. On the other hand, fast decision-making and spontaneous eruptions of violence, as well as the application of de-escalation skills when dealing with aggressive citizens in dynamic, complex and chaotic situations characterise the process of dealing with conflicts during frontline work:

"Well, police training was absolutely not geared in this direction. And that is still not the case today". (PO 06)

According to this view, police training lacks realism. Within the domain of issues related to the content of training, foremost *techniques* have been problematised. In $n = 4$ cases, the deficit in preparation is seen as being related to dysfunctional techniques that had been practised in police training. Police officer 13 clarifies:

"The police training that was done, generally what we did in this ju-jutsu. It was actually not effective. The techniques always failed in reality . . . these techniques with arm bar that existed were actually rather ineffective." (PO 13)

Police officer 05 also attributes the lack of preparation for real conflict situations to a focus on techniques that largely lacked a functional application in reality. In this case, impacted by conflict parameters and operational demands, the technique failed during the specified situation as well, that is why

"you can't say I was prepared. Because the techniques we learned in the old curriculum, I rarely applied them until now, when I experienced it outside. The only thing we were sure of was the procedure when it came to restraints. So, the hand locks, they worked. But these techniques to get to the ground always ended up in wrestling (laughs). No matter how, the main thing is that we go to the ground." (PO 05)

In addition to the content issues, there were a considerable number of raw data themes that contributed to the cluster of *pedagogical aspects of the training* ($n = 9$), which were also viewed as being responsible for the circumstance that the police training did not prepare adequately for deployment. Within this thematic complex, the repetitive learning of single *techniques out of their context* of relevant parameters of conflict, is held responsible. Police officer 20 provides a detailed insight into this issue, which is related to the pedagogical design of training:

"In principle, we were asked to repeat techniques over and over again in a calm atmosphere, in a laboratory situation, so to speak. There were few or no surprises, neither in normal training nor in the situational training. Because even in situational training, where you don't actually know beforehand how exactly the situation will unfold, you already knew the intensity levels beforehand. Yes, you were told, 'Watch out, you're going to be in a situation, but it's going to be very relaxed. Just be communicative.' So, we were already prepared for it and that's how it happened. It would have been better to have said 'Take it easy, it's probably going to be a calm thing.' And all of a sudden, (claps) two intensity levels on top of that there is a surprise from the side. Because then I would say in hindsight after such a training, that I would have gotten to know myself better. I would have understood better how I react in such a situation. Am I capable of acting or am I paralyzed at first? Am I in a kind of shock state where I can't really sort out my thoughts at all? I had to wait for these experiences until I was in frontline police work. Also that's why, in answer to your initial question, no, I did not feel well prepared." (PO 20)

The repetitive practicing of techniques is foremost seen as problematic due to the missing connection to the relevant parameters that are representative of conflict dynamics in the field, such as surprise and uncertainty. Instead

"a lot of blunt movement sequences were simply trained with the same input over and over again. But this does not reflect what might happen on the street or in the field. I had the feeling that there was always a certain prompt in the training, that is, for example, attack with the right hand now and then please do this and then use that specific defence technique. But that doesn't really reflect reality." (PO 01)

The linear technical approach to solve a known problem (e.g., "attack with the right hand") with a prescribed technique ("that defence"), underpinned by the linear teaching model of "if x, then y", is also problematized within the context of testing and evaluation, in which

> *"the technique had to be performed correctly and that it is not so much the outcome that counts in the end, but rather that the technique was beautiful. Then, of course, it always becomes acting. Of course, I can show a much more beautiful technique with a partner who is acting nicely, than when someone really resists. And our whole examination system, which is still the same, is designed more for the correct showcasing of a technique, so more for a spectacle than for the realistic fight outside, because of course we all know if it is a fight, what it will be outside, then it always looks messy and you won't see much technique in it." (PO 03)*

As in normal training, the problem with examinations is that a demonstration of beautiful techniques, while excluding realistic constraints, is considered more important than a proper check of the ability to act "when real resistance comes into play" (PO 05). Whilst reality is messy, training and examinations on the other hand stage a well scripted choreography:

> *"I always call it acting. That such a training takes place, the techniques are shown, the aspirant has understood the technique, he also knows the technique, but he has never used it when real resistance exists. That's what happens with us. And that's what happened to me at the time." (PO 05)*

Finally, a further lower-order theme deserving attention when analysing the question on whether and to what extent police training had prepared them for conflict emerged from the data set. A total of $n = 14$ police officers reported that not professional police training, but having a private *martial arts background* provided the main resource for the ability to competently deal with conflict situations. Police officer 07 states:

> *"But if I'm honest, I have to say that the police training didn't help me much at all, so for almost all situations ... through the skills that I acquired in martial arts I was able to solve quite a lot... I have drawn a lot from that. But not much, if anything, from the pure police training." (PO 07)*

Police officer 09, who has practised ju-jutsu and kickboxing in private, emphasises the impact of private martial arts as a key preparatory means for successful policing:

> *"Actually, police training itself didn't really prepare me for this. I relied more on my private background. But the pure police training itself, I rather don't rely on it." (PO 09)*

DISCUSSION

For Germany, the results shed light onto so far under-researched *qualitive specifics* of violent conflicts as experienced by German federal police officers. Furthermore, the findings reveal valuable information concerning the significance of police training as a preparatory means in this regard.

Although not every interviewee gave an estimate on the *frequency* of personally experienced violent conflicts, all of them reported at least one specific. As such, it can be assumed that violent experiences related to their job are an issue of concern within the sample of this study. The result is in accordance with statistical data of the past decade (Bundeskriminalamt 2015; Bundeskriminalamt 2020), indicating an inherent and case-by-case risk of German police officers being exposed to violence in the field, while acknowledging that the question of causality within the development of violence cannot be answered at this point (Ellrich and Baier, 2021).

Within the reported cases, different *types* of violent conflicts were deemed as relevant by the interviewees, showcasing a major focus on *physical attacks*, followed by *verbal assaults*. The dominance of physical violence is in line with current data on the prevalence of violence against police officers (Bundeskriminalamt 2020). However, at this point it has to be considered that e.g., the annual reports of the German Federal Criminal Police Office are mainly focused on physical violence. As a consequence, this may lead to the perception that violent conflicts in policing are basically physical in nature. In light of the research on violence and aggression, it becomes clear that this is not the case. Instead, the micro-social interaction of violence in policing encompasses a broad range of types (Tedeschi and Felson 1994; Collins 2009). In this study, the experts' reports on violent conflicts support this finding: In the context of control situations for instance, data indicated both that conflict dynamics were limited to verbal means, as well as that they were preceded by verbal confrontations and eventually result in physical violence. One way or another, communication plays a major role in violent encounters of German federal police officers.

Furthermore, study data yielded valuable information about the *working context* in which said violent conflicts had been experienced. Although violent encounters do have a contextual index per se (they take place somewhere), for Germany, there is less empirical knowledge on their context-specificity (Ellrich et al., 2011; Reuter, 2014)—for federal police officers, which were the subject of this study, there is even none at all. In this vein, mainly control situations at the airport or at train stations, e.g., during passport checks involving individual citizens were mentioned. On the other hand, *fan escorts* on the periphery of football matches turned out to be another frequent context of violent encounters, involving a mass of people on both sides. The range of identified contexts is influenced by the use of a sample group consisting purely of German federal police officers, which are primarily tasked with border protection and security in the context of major events.

The potential of different types of conflicts, including the involvement of improvised weapons, account for a distinct quality that is inherent to violence itself. Therefore, *parameters of conflict* that have been identified within the data are of special interest. On the side of the *citizens* involved, a high potential for aggressiveness, occasionally unfolding into brutal violence in a spontaneous manner, has been pointed out. The data additionally addressed the fact that this process is sometimes accompanied by

an alcoholic state of said citizens. Furthermore, qualitative parameters specifying the overall *situation* were deemed important, such as complexity, chaos and high dynamics, which for instance refers to conflict situations in deployment that altered in a split second and went "from zero to one hundred". In view of these parameters involved, the *police officer's state and behaviour* are affected, leading to feelings of stress, surprise and overload. These findings are in line with other current research, indicating that violent encounters in policing are accompanied by the element of surprise and high levels of aggressiveness (Jager et al., 2013; Giessing et al., 2020; Renden, et al., 2015b). Importantly, according to psychological (Groves and Anderson 2018; Lansford 2018; Parrott and Eckhardt 2018) and sociological (Collins 2009) explanations of violence, the parameters of conflict are likely to interact and affect each other in rapid succession.

In light of these conflict parameters, it seems plausible that the data reflect another topic–highlighting important *demands* on the side of police officers. In the interviewees' point of view, dealing with conflicts such as those that were reported, calls for awareness and quick decision-making in the domain of perceptual-cognitive skills, as well as for the ability to de-escalate situations in an atmosphere of aggression, or for taking physical action. These aspects represent the domain of verbal and physical demands. Finally, the value of a self-confident demeanour during conflict situations is emphasised by the experts. These results align with existing research, touching on the question of how performance under pressure (Nieuwenhuys et al., 2015; Frenkel et al., 2021) and decision-making in stressful situations (Baldwin et al., 2019; Jenkins et al., 2020a) can be optimized in light of the demanding tasks police officers are confronted with during deployment. For instance, as Jenkins et al. (Jenkins et al., 2020b) recently investigated, applying the use-of-force option in conflict situations impacts the physiological stress response of police officers, which may in turn be associated with further performance impairment. Interestingly, the reciprocity of behavioural outcomes, and more specifically the issue of police officers' demeanor in police-citizen interactions, has rarely been the subject of research yet (Alpert 2004; Dai et al., 2011; White 2015; Todak and James 2018; Lee 2021). For Germany, research on qualitative aspects, such as situational parameters, of police-citizen encounters is still in its infancy (Jager et al., 2013; Ellrich et al., 2011). The data provided here underline the important role of future studies by shedding more light upon qualitative specifics of conflict interactions in policing.

The ability to professionally cope with conflict situations requires *training*. However, according to the majority of police officers interviewed in this study, police training had lacked crucial input when it came to serving this purpose. When asked to reflect on the functionality of police training in reference to a concrete conflict situation they had experienced, a vast number of police officers pointed to problems during training that limited its function. This finding is of high interest, since for police training in Germany, little is known in regards to its effectiveness (Staller et al., 2021a; Koerner et al., 2021b). The experts' opinions point to problems of content and pedagogical aspects related to the design of training, which were mainly identified as an overall poor relationship between training and application in reality, putting an emphasis on dysfunctional techniques and isolated exercises. Although programmatically serving as training for the field, the training lacked key contextual parameters of the field, e.g. surprise, mental stress and ambiguity. It is noteworthy that a large number of police officers stated that they had been better prepared for the conflict situation by their private martial arts background than through the use of mandatory training programs. While national and international data already pointed to issues of problematic content as likely causes for the disintegration between training and the field (Jager et al., 2013; Renden, et al., 2015a), pedagogical issues came into focus only recently (Staller et al., 2021b; Koerner, 2021).

In conclusion, the findings of this study support the need for future research on 1) issues related to the qualitative specifics of conflict situations in police operations, as well as on 2) the functionality of police training, especially in Germany, where related research is scarce (Koerner, 2021). In this regard, the following aspects call for more scientific attention:

1) *First*, in order to broaden the scope on conflict situations a continuous analysis on a micro-level of police-citizen interaction is needed, specifically with regard to the question of how exactly violence arises and under what conditions it develops or is avoided. Statistical data available in Germany do not provide any information about this. For this purpose and in order to circumvent biases of perspectivity, as caused by interview-studies like the paper on hand, in-depth analysis of video data (Koen and Mathna 2019; Longridge et al., 2020) seems to be a fruitful avenue for more (and different) objective (but still perspective-driven) data.
2) *Second*, data on qualitative specifics of conflict dynamics is of high importance, especially for police training, which is, one way or another, based on knowledge about "the field". The more empirical knowledge on qualitative specifics of conflict situations we have, the more systematically evidence-based (Bennell et al., 2021) and functional in terms of its purpose the police training and police trainer education could be.
3) *Third*, data gathered here and elsewhere (Jager et al., 2013; Renden et al., 2015a; Boulton and Cole 2016; Preddy et al., 2019) clearly indicate a *nonlinear nature* of real-world conflict dynamics. This in turn calls for a reflection on whether the existing predominantly linear police training in Germany based on techniques and emphasising isolated exercises out of context (Staller et al., 2021a) can meet the demands displayed in front-line policing. In contemporary police training settings in Germany, firearms training, self-defence training and tactical training are offered in a separate manner (Staller et al., 2021b) following a linear fashion of delivery. While such training models have previously been problematized and are related to questions of effective coaching in police training in general (Cushion 2020,

Cushion, 2021; Koerner and Staller 2018), current questions concerning the optimization of German police training revolve partly around how police training could be delivered more effectively. As such, paradigmatic alternatives emphasising nonlinearity in training (Koerner and Staller 2020a) have to be explored. Training that is designed according to principles of *nonlinear pedagogy* for instance allows officers to pick up relevant information similar to those in the field (e.g., those that would otherwise induce the element of surprise), in turn allowing them to make decisions in training as they will have to make in the field 1 day; as well as to act in training as they will have to act in the field 1 day. As such, the nonlinear approach to police training heavily relies on knowledge about qualitative interactional data of front-line policing. The effects of these data-driven pedagogical approaches in general have to be empirically evaluated (Koerner et al., 2020b).

4) *Fourth,* the impact of biographical backgrounds on professional performance in police operation and its training deserves more scientific attention. How does a background like being socialised in martial arts impact the thinking or the actions taken on several levels of police work (operation, training, organisational decision-making)?
5) *Fifth*, all requirements and future perspectives mentioned here lead up to the point that German police organisations are well-advised to continuously revise their educational structure and knowledge base, as well as to create a certain mindset and a procedure of second order observation on all levels: As we train, what are the guiding assumptions of content and design? On which knowledge is the practice based? The same reflexive mechanism applies to necessary organisational reform, e.g. comprising changes in the curriculum in terms of content and pedagogical approaches. Research can help to base decisions on all levels on the best current available evidence (Bennell et al., 2021), as well as enable their reflection. Thus, methodically controlled organisational knowledge is key for the further professionalisation and empowerment of police operation and police training in Germany (Koerner et al., 2021b).

LIMITATIONS

Whilst interview-based case studies serve the purpose of exploring so far untouched fields of interest and allow for an in-depth reconstruction of subjective experiences and views, the validity of the results is subject to important limitations on different levels. *First*, on an epistemological level, expert-interviews deliver ex-post narratives on the issue at hand containing personal experiences, views and attitudes (Smith 1992). As such, they depict neither an accurate portrayal of real-world violent encounters nor of police training. Instead, interview data are subject to *perspectivity* in three ways: They are 1) perspectively biased due to the officer's selection of content, 2) perspectively biased due to his or her retrospective narration, and 3) perspectively biased due to the analysis and interpretation of the researchers. In this way, they are re-*constructions*. *Second*, on a methodological level, as an instrument of qualitative research expert interviews have their strength in delivering insights from subjective perspectives and interpretations of a chosen sample (Flick, 2018). As such, the qualitative data gathered in this study does not provide any representative information. General statements or conclusions regarding qualitative specifics of conflict situations or the (dys-)function of police training lay beyond the scope of this study. The results have their meaning and value within the sample and within the issues of concern. In this respect, the study`s results are explorative in nature, context-specific and must be critically reflected upon in terms of their scope. Provided there is a willingness within police authorities to be further open to research, future studies have to provide further insights on qualitative aspects of violent conflicts and related aspects of preparatory training.

CONCLUSION

For Germany, annual reports of the German Federal Criminal Police Office provide important empirical data which shed light upon the prevalence of violence against police officers. More specifically, the quantitative data allow for the assessment of longitudinal trends, as well as for changes in the focus of single types of offences. However, information on qualitative aspects of violent conflicts as experienced in policing remains vague. Also, geared towards the German situation, there is poor empirical evidence on the question whether police trainings serves as an *integrative mechanism* between training and the field, and if it does, then the question of how much of an asset it really is, remains (Staller et al., 2021a; Koerner, 2021).

In this study, 1) experts' views on qualitative specifics of conflict dynamics during their field work and 2) the extent to which police training had prepared them to meet the respective demands have been explored. Concerning the quality of the reported violent encounters, German federal police officers perceived them as complex, dynamic and ambiguous in nature. In order to cope with these demands, police officers reported that they needed awareness for situational cues that are relevant for the interaction at-hand, as well as fast decision-making and sound interaction skills ranging from de-escalation to hands-on-fighting skills. Concerning the preparation, the majority of police officers reported that police training did not provide adequate preparation, thereby pointing towards problems concerning the content of training (focus on technique), its representativeness (lack of realism) and its delivery and testing methods (linear approach).

While we acknowledge the subjectivity of the police officers' reports (and our analysis), in turn leading to biases in perspectivity, we identify this perspectivity as a major problem

that has to be addressed by implementing structural mechanisms that provide police training with a solid and methodically controlled knowledge base in the field of situational parameters of violent encounters. In our view, a solid and continuous growing knowledge on qualitative aspects of violent encounters as well as corresponding procedures of systematic data collection and evaluation are an urgent task and challenge for the further professionalization of contemporary police training in Germany.

DATA AVAILABILITY STATEMENT

The data supporting the conclusions of this article can be requested from the authors.

ETHICS STATEMENT

The study has been approved by the German Sport University Cologne, Ethics Committee. The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

SK and MS equally contributed to the current study and the final manuscript. The study was designed by SK and MS. Data was collected and analyzed by SK and MS. SK wrote the first draft of the manuscript. MS revised the draft and helped to reach the manuscript its final form.

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Conflict of Interest: The remaining author declares that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

The handling editor is currently organizing a Research Topic with one of the authors SK and MS.

frontiers in Education

ORIGINAL RESEARCH
published: 10 February 2022
doi: 10.3389/feduc.2022.730791

Topics, Sources and Applicability of Coaching Knowledge in Police Training

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The current study explored police trainers' perceptions of their actual and preferred methods of acquiring new coaching knowledge; the types of knowledge they currently require and/or desire; and how they apply new knowledge. A total of 163 police trainers from Germany and Austria participated in the study. The responses were analysed using an inductive approach. The results showed that police trainers thought they needed knowledge of pedagogy, policing, and self-development, with reasons being centred around a need to optimise learning, training content and the engagement of learners within the training sessions. Preferred methods of learning focused predominantly around informal and non-formal opportunities, the reasons for which were social interaction, the reality-based focus of the content and the perceived quality. Finally, police trainers identified technical or tactical policing knowledge, or knowledge specific to the delivery of police training as useful, recently acquired coaching knowledge, mainly because it was perceived to have direct application to their working practices. Based on these findings, it is suggested police trainers are in need of context-specific knowledge and support to develop the declarative knowledge structures that afford critical reflection of new information.

Keywords: police training, coaching knowledge, coach learning, coach development, police conflict management training

OPEN ACCESS

Edited by:
Konstantinos Papazoglou, Pro Wellness Inc., Canada

Reviewed by:
Nashwa Ismail, Durham University, United Kingdom
Simon Baldwin, Carleton University, Canada

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Specialty section:
This article was submitted to Educational Psychology, a section of the journal Frontiers in Education

Received: *25 June 2021*
Accepted: *14 January 2022*
Published: *10 February 2022*

Citation:
Staller MS, Koerner S, Abraham A and Poolton JM (2022) Topics, Sources and Applicability of Coaching Knowledge in Police Training. Front. Educ. 7:730791. doi: 10.3389/feduc.2022.730791

INTRODUCTION

In most police departments, institutions, academies and agencies, police training is considered an essential training setting for recruits and sworn officers to develop and refine their practical front-line skills, such as self-defence and arrest skills, firearms, tactical skills and communication (Staller M. and Körner, 2019b; Isaieva, 2019), in order to safely and effectively cope with operational and conflictual scenarios that are a regularly part of police work (Ellrich and Baier, 2016). Within this context—sometimes also referred to as police use of force or conflict management training—the police trainer facilitates the development of recruits through the achievement of learning outcomes (Birzer, 2003; Cushion, 2020; Staller et al., 2021b). However, research from observational and interview studies has identified problematic issues with the current delivery of police training in some quarters. For instance, training might not lead to the achievement of the intended outcomes (Rajakaruna et al., 2017; Nota and Huhta, 2019; Cushion, 2020; Staller et al., 2021a; Staller et al., 2021b). Furthermore, there is evidence of outdated pedagogical approaches in practice (Birzer, 2003; Cushion, 2020; Staller et al., 2021b), and a shortfall in knowledge required by police trainers for purposeful planning and reflection on training sessions (Cushion, 2020; Staller et al., 2021a). Such

observations bring the structure of how police trainers are educated and developed into question. For the purpose of this paper, we consider the practice of police trainers as *coaching* (Staller et al., 2020) and therefore refer to police trainer development as *coach development* or *coach education*. There is anecdotal evidence from Germany that police trainers are assigned to coach other police officers often without formal coach education (Staller M. and Körner, 2019b). Taken in combination with evidence displaying that when coach education in police training is offered it varies in content, depth and duration (Staller et al., 2020), questions about the type, source and application of knowledge by these coaches arise.

In light of this scarcity of research in the domain of coach development in police training, the closely aligned field of sport coaching offers insights. An increasing body of research has investigated how coaches learn how to coach (Cushion et al., 2010; Stoszkowski and Collins, 2015). The acquisition of coaching knowledge takes place in a variety of settings, extending beyond formal coach education environments encompassing non-formal and informal self-directed learning situations (Cassidy and Rossi, 2006; Lemyre et al., 2007; Wright et al., 2007; Stoszkowski and Collins, 2015). Whereas *formal* coach education is considered as a highly institutionalised setting that is formally recognized with diplomas and certificates, *non-formal* coach education encompasses organised learning opportunities outside the formal educational settings, whereas *informal* education reflects self-driven searches for knowledge and reflection (Mallett and Dickens, 2009). In the context of police training, national regulations provide the framework for the formal coach education for police trainers. For example, in Germany, the police regulation 211 (PDV211, 2014) describes the obligation of a police force to adequately equip their coaches with the knowledge and competencies needed to deliver a police training curriculum. These formal coach education courses differ from state to state (Körner et al., 2019a). Nonformal coach education settings typically comprise of workshops, seminars and conferences that police trainers attend. Opportunities for *informal* coach education can arise within formal and nonformal coach education settings. Informal learning is primarily controlled by the learner and is not typically classroom based or highly structured (Mallett and Dickens, 2009). For example, police trainers discussing new operational tactics over lunch would be considered an informal learning experience. Finally, informal opportunities exist in everyday life through job experience, or personally directed searches on online and offline sources of information.

The different formats of learning seem to have a unique role in the development of coaches (Lemyre et al., 2007; Wright et al., 2007). For example, Wright et al. (2007) identified seven different learning situations accessed by ice hockey coaches as sources for their coaching knowledge, encompassing formal (large-scale coach education programs, formal mentoring), non-formal (coaching clinics and seminars) and informal learning settings (books and videotapes, personal experiences, face-to-face interactions with other coaches, the internet). Stoszkowski and Collins (2015) recruited some 320 participants for an online survey. They found that coaches prefer to acquire coaching knowledge from informal learning activities, especially when activities allow for social interaction, such as talking to other coaches. Furthermore, the data revealed that coaches employed knowledge acquired from formal coach education settings, even though this learning setting was not mentioned as the preferred source of knowledge acquisition by the majority of coaches (Stoszkowski and Collins, 2015).

Abraham et al. (2010) used self-determination theory to explain why informal learning opportunities are valued by coaches; "Firstly, the coaches have autonomy of choice when they decide about what to engage with and when. Secondly, the coaches gain feelings of competence by deciding what ideas and knowledge they find useful and can work with while choosing to ignore those they don't (especially as no one is looking over their shoulder to check understanding). Finally, by making these choices, they are more likely to gain ideas and knowledge of how to relate better to their athletes, other coaches, parents and officials. In essence, self-driven learning is by its very nature intrinsically motivating" (p.53).

That being said, Abraham et al. (2010) acknowledge that a self-determined approach to coach development inevitably leaves gaps in a coach's repertoire of skills and knowledge (Abraham and Collins, 2011). because in the absence of conscious programme design and evaluative processes, most coaches acquire knowledge that is limited in scope, depth, breadth and interconnectivity (Gilbert and Trudel, 2001; Mallett and Dickens, 2009; Cushion et al., 2012).

It has been argued that coaches need well developed declarative knowledge structures (conceptual knowledge) to check and challenge the value of new knowledge acquired from informal learning situations (Abraham et al., 2006; Abraham and Collins, 2011). An advanced declarative knowledge base guards against coaches mindlessly mimicking the practice of other coaches (Grecic and Collins, 2013). Similarly, a heavy or even sole focus on procedural knowledge (how knowledge) limits the coach's ability to adequately adapt to changes in the training environment and the individual needs of trainees (Staller et al., 2020). Declarative knowledge about the pros and cons of a wide range of coaching approaches is needed to make informed decisions and judgements about how best to navigate the dynamics of police training (Abraham and Collins, 2011; Staller et al., 2020). In short, knowing what to do and how to do it (procedural) is clearly important to police trainers. However, it is knowing why they are doing something (declarative), and indeed why they are not doing something else, that facilitates adaptability and criticality in coaching.

Results from Stoszkowski and Collins (2015) indicated that critical reflection and justification of the application of acquired coaching knowledge was mostly absent within sport coaches. Based on these results, the authors infer the "necessity of some element of "up front" formal learning, in order to equip coaches with the structures to ensure their informal development is sufficiently open-minded, reflective and critical" (p. 8). Indeed, appropriate formal learning may actually be crucial for the majority of coaches at different stages of their development. This may be particularly true as coaches come to understand the "relative" nature of knowledge and practice (Collins et al.,

TABLE 1 | Demographic details of participants.

-		Number of coaches	-	Number of coaches	-	Number of coaches
Gender						
-	Male	158	Female	4	w/o specification	1
Age range						
-	25–29	7	30–39	63	40–49	53
	50–59	37	60 or more	2	w/o specification	2
Country where participants are based						
-	Germany	104	Austria	59	-	-
Police Agencies of the n = 104 German police officers						
-	Saxony	48	Hesse	46	Customs	3
	Federal Police	3	Bavaria	1	North Rhine-Westphalia	1
	Rhineland-Palatinate	1	Lower Saxony	1	-	-
Number of years coaching experience in police training						
-	0–2 years	13	3–5 years	30	6–9 years	33
	10–15 years	42	16–20 years	29	21–30 years	29
	30 and more	2	w/o specification	2	-	-
Number or years police officer experience						
-	0–2 years	13	3–5 years	30	6–9 years	33
	10–15 years	42	16–20 years	29	21–30 years	12
	30 and more	2	w/o specification	2	-	-

2012). With regard to police training, the potential lack of evidence-based knowledge structures for police coaches to reflect informally acquired knowledge against, may provide an explanation for the manifestation of traditional pedagogies within this specific domain (Birzer, 2003; Cushion, 2020). However, since there is no empirical data on where police trainers get their knowledge from (the sources), what knowledge domains are relevant to them (the topics) and what they deem to be applicable to them, it would be speculative to generalise the conclusions arising from sport coaching education to the police training domain. As such, the purpose of this study was to capture police trainers' perceptions related to the following questions:

- What they need to know more about to be a better police trainer, and why?
- Preferred source and methods of acquiring new coaching knowledge, and why?
- Examples of useful, recently acquired coaching knowledge, how it was acquired and how it was applied.

MATERIALS AND METHODS

Participants

Police trainers from German speaking countries—Germany and Austria—volunteered to participate (N = 163). The German and Austrian police training programmes are collaborative in terms of knowledge exchange and take a similar view on the content and delivery of police training, which is informed by the same police training literature. Demographic details of participants are displayed in **Table 1**. Police trainers from Austria, Saxony and Hesse were particularly well-represented.

Online Survey

An online survey was constructed in SoSci Survey (www.soscisurvey.de) that comprised demographic questions and seven open-ended questions taken and translated from Stoszkowski and Collins (2015) who systematically developed the questions for their highly-relevant study on the knowledge acquisition of sports coaches. The online survey afforded data collection from police trainers across German speaking countries. The seven open ended-questions listed in **Table 2** elicited qualitative responses about the sources the participants consult for coaching knowledge (questions 4, 6, 7), the topics of coaching knowledge they seek and acquire (questions 1, 2, 3), and the ways they use and apply the acquired knowledge (question 5). While questions 1, 2, 6 and 7 aimed at eliciting the general knowledge needs and sources of police trainers, questions 3 to 5 were aimed at their last learning experience.

Procedures

The questionnaire was distributed using opportunity sampling (Brady, 2006). The survey was initially distributed by email to a professional network of police training coaches and to gatekeepers of police trainer networks. The landing page of the survey contained detailed information about the purpose and procedure of the study and how responses to the survey would be handled. Participants were informed that they should only continue if they were active police training coaches.

TABLE 2 | Questions posed about sources, topics and application of coaching knowledge.

Number	Question	Aim
1	State the main thing you feel you need to know more about in order to be a better coach	Topics
2	Why do you feel that is the case?	Topics
3	State the last thing you learned which you found useful for your coaching	Topics
4	Where did this idea or information come from?	Sources
5	How have you used the idea or information since you got it?	Application
6	What would you say is your most preferred way to gain coaching knowledge?	Sources
7	Give 3 reasons why you prefer this method of gaining coaching knowledge	Sources

Participants were also informed that submitting a response would constitute consent to use the data and that they could not withdraw their data once it was submitted as no identifying information was tracked at any stage of data collection. Recruitment of participants took place over a 10-week period before the web link was deactivated.

Data Analysis

The open-ended responses consisted of a mixture of short statements and longer, more structured sentences and were subjected to an inductive content analysis (Patton, 2002) using MAXQDA 2018. The analysis followed a two-stage protocol (Nelson et al., 2013; Stoszkowski and Collins, 2015). First, the survey answers were treated as stand-alone meaning units. If they contained more than one self-definable point, for example, "visiting conferences *and* talking with peers", they were separated accordingly. The meaning units for each item were listed and labelled, before they were compared for similarities and organised into raw data themes. Meanings units were treated as similar, when they conveyed the same idea; for example, "will boost motivation of trainees" and "officers will be more motivated". In the second stage, the analysis proceeded to a higher level of abstraction. The raw data themes were built up into larger and more general themes and categories to form higher-order concepts (Côté et al., 1993). In order to enhance the validity of the data analysis, two researchers (MS and SK) independently familiarised themselves with the data before discussing meaning units, categories and themes to reach a consensus. If consensus was not reached initially, the researchers debated the issue of contention until consensus was achieved. Having used inductive content analysis to interpret the data into raw, lower and higher order themes, the final phase of analysis involved gaining triangular consensus between the lead (MS) and second researcher (SK) along with two additional researchers (AA and JP) who acted as a "critical friend" (Faulkner and Biddle, 2002; Kelly et al., 2018). The additional researchers were not involved with the data collection or analysis and were required to confirm, or otherwise, the placement of raw data themes into lower and higher order themes.

Enhancing Trustworthiness of the Analysis

Using guidelines relating to qualitative methods (Tracy, 2010; Tracy and Hinrichs, 2017), checks were made to ensure eight criteria of high-quality qualitative research (worthy topic, rich rigour, sincerity, credibility, resonance, significant contribution, ethics and meaningful coherence) were met. Investigating the sources, topics and application of coaching knowledge in police training was perceived to be a worthy topic. Data collection and analysis procedures were carried out systematically following established guidelines to enhance the rigour of the methodology and data analysis is described in detail for increased transparency. Sincerity was observed via two "critical friends" who checked and challenged the coherence between the data and the presented raw data themes and higher order themes. This helped maximise the trustworthiness of the analysis process. To ensure credibility, we ensured that higher order and raw themes were traced back to the participant's statements. Furthermore, we highlighted direct quotations to support findings, which we argue demonstrated resonance as it allowed for visual representations of participants thoughts. In terms of contributing to the literature, we argue the study has theoretical (e.g., conceptual understanding) and practical (e.g., professional training programmes and applied practice) implications that will further develop this area of study. Institutional ethical clearance was obtained. We also adhered to situational (e.g., reflectively discussing the analysis process with the research team and reflect on data worth exposing), relational (e.g., reflection on researcher actions and potential consequences of data analysis) and exiting (e.g., avoiding unjust or unintended consequences of findings presented) obligations. Finally, in terms of meaningful coherence, the study used methods consistent with earlier studies of coaching knowledge.

RESULTS

Topics of Coaching Knowledge

The topics that participants felt they needed to know more about to be a better coach tended to be associated with policing knowledge (47.20%) or related to coaching pedagogy (29.44%—see **Table 3**). Specifically, participants felt the need to know more about past operations and incidents (12.15%) and the criterion environment, like statistics and current modes of operandi (10.57%). Regarding pedagogy, the group articulated a need to know more about coaching methodology and didactics, such as teaching methods for firearms training or learning approaches (10.28%); and coaching tools, including frameworks for periodisation or training principles (9.35%). The topics of coaching knowledge specified (see **Table 4**) were deemed by participants to be needed mainly for personal development (26.49%); to optimize learning environments (23.78%); and to optimize the taught police-specific training content (20.54%).

TABLE 3 | Participants' perception of what they need to know more about to be a better coach.

Raw data theme	Frequency	%	Higher order theme	Frequency	%
Methodology/didactics	22	10.28	Pedagogy	63	29.44
Coaching tools	20	9.35			
Motivation of participants	7	3.27			
Perspective/needs of participants	6	2.80			
"Pedagogy"	5	2.34			
Communication as a coach	3	1.40			
Data from past operations/incidents	26	12.15	Policing Knowledge	101	47.20
Knowledge about the criterion environment	23	10.75			
Tactical knowledge	17	7.94			
Knowledge about police training	16	7.48			
Technical knowledge	9	4.21			
Legal knowledge	5	2.34			
Firearms/Non-lethal weapons	5	2.34			
Own learning/further education	15	7.01	Self development	28	13.08
Own operational experiences	8	3.74			
Self-reflection	5	2.34			
Physiology	3	1.40	"Ologies"	10	4.67
Psychology	7	3.27			
Experiences from other coaches	8	3.74	Experiences from other coaches	8	3.74
Nothing	4	1.87	Nothing	4	1.87

TABLE 4 | Participants' perception of why they need to know the knowledge reported in **Table 3**.

Raw data theme	Frequency	%	Higher order theme	Frequency	%
Desire for personal improvement	21	11.3	Personal improvement	49	26.49
Eliminating of own deficits/uncertainties	16	8.6			
Perceived as basic prerequisite	6	3.24			
Is needed to stay "up-to-date"	6	3.24			
Would make coaching sessions more effective	35	18.92	Optimizing of learning environments	44	23.78
Would help to design training in a more practical way	9	4.86			
Optimization of taught training content	26	14.05	Optimization of police-specific training content	38	20.54
Would help to adapt content to current needs	10	5.41			
Better preparation for future missions	2	1.08			
Would help to increase the motivation of the participants	9	4.86	Optimization of individualization and motivation	29	15.68
Would help answer questions from participants	7	3.78			
Would help with the individualization of training	6	3.24			
Would help to identify the needs of participants	5	2.70			
Would help for additional explanations	2	1.08			
Increases credibility/acceptance as coach	9	4.86	Social reasons	14	7.57
Feedback/exchange with others	5	2.70			
Would help to standardize teaching	5	2.70	Organisational reasons	7	3.78
Would help break up old training structures	1	0.54			
Would help limit "copy and paste" coaching	1	0.54			
Education/CPD is sufficient	1	0.54	Reasons for no reported need of knowledge	3	1.62
Informed enough by own commitment	1	0.54			
Dealt enough with coaching	1	0.54			
No answer	1	0.54	No answer	1	0.54

Sources of Coaching Knowledge

Table 5 indicates that the majority of police trainers preferred to acquire knowledge by informal means (69.29%), particularly from conversations with and observation of their peers (32.86%). Fewer police trainers referenced nonformal continuing professional development (CPD) learning activities (e.g., seminars, workshops, conferences) as their preferred learning source (28.21%). Formal learning activities were the

TABLE 5 | Participants' preferred method of acquiring coaching knowledge.

Raw data theme	Frequency	%	Lower order theme	Frequency	%	Higher order theme	Frequency	%
Coaching course	3	1.07	Formal coach education	3	1.07	Formal learning	3	1.07
Seminar/workshop/course	76	27.14	Attending CPD activities	79	28.21	Nonformal learning	79	28.21
Conferences	2	0.71						
Trade shows	1	0.36						
Discussion with other coaches	70	25.00	Other coaches/colleagues	92	32.86	Informal learning	194	69.29
Discussion with other officers	13	4.64						
Observing in the learning environment	6	2.14						
Observing in the criterion environment	3	1.07						
Books	12	4.29	Reading	22	7.86			
"Reading"	4	1.43						
Academic journals	3	1.07						
Operation reports	2	0.71						
Magazines	1	0.36						
Internet	20	7.14	Internet/Intranet	30	10.71			
Youtube/Videos	5	1.79						
Online social networks	2	0.71						
Intranet	2	0.71						
Share point/Cloud storage	1	0.36						
Theory	2	0.71	Theory	2	0.71			
Experience as practitioner in training settings	21	7.50	Practical experience	40	14.29			
Experience as officer	7	2.50						
Reflection	7	2.50						
Experience as coach	4	1.43						
Other sport	1	0.36						
Self-study	8	2.86	Self-study	8	2.86			
No answer	1	0.36	Reasons for no preferred method	4	1.43	Reasons for no preferred method	4	1.43
Learned nothing in the past	1	0.36						
Every way is right	2	0.71						

least favoured source. Three police trainers (1.07%) preferred to acquire knowledge from formal coach education programmes. The reasons reported for why coaches prefer particular methods of acquiring coaching knowledge were wide ranging (see **Table 6**); however, perceived quality of the source (31.63%), social interaction (24.82%) and the preference of knowledge that is grounded in reality (19.46%) were most common.

Topics, Sources and Application of Recently Acquired Knowledge

Concerning the last topic police trainers found they had learned or found useful, the results tended to be either content specific to police training (57.54%), particularly technical or tactical knowledge, or specific to the delivery of police training, that is pedagogy (29.61%—see **Table 7**). Police trainers indicated that knowledge was mainly gained from accessing a variety of nonformal (46.33%) and informal learning opportunities (44.63%; see **Table 8**). CPD seminars, workshops and/or courses either organised by the police force or privately attended were the primary source of knowledge identified. Concerning the application of that knowledge (see **Table 9**), police trainers primarily reported that they immediately utilised the knowledge to inform their own coaching practice (78.36%). Police trainers also reported to have further considered the newly acquired knowledge to reflect on and/or adapt their practice (9.36%); although, in nearly 10% of the cases police trainers acknowledged that the knowledge had not been used at all.

DISCUSSION

Given recent concerns about the quality of police training delivery and the lack of empirical data about how police trainers learn to coach, the current study was designed to shed light on the acquisition of knowledge by police trainers. Structured around three main research questions, the results provide insight into what knowledge police trainers think they need, where they prefer to get it from, and how they apply their recently acquired knowledge.

Context-specificity of Police Training Knowledge

For this sample of police trainers police training specific knowledge about *what* to teach was commonly identified as a development need. Most frequent was the need to know more about past operations and incidents, as well as statistics and

TABLE 6 | Participants' reasons for preferring particular methods of acquiring coaching knowledge.

Raw data theme	Frequency	%	Higher order theme	Frequency	%
Too few/no officers on duty	22	5.35	Official obstacles	27	6.57
Official information is too slow	4	0.97			
Only official knowledge is permitted	1	0.24			
Contributes to safety of colleagues	1	0.24	Contribution to safety	2	0.49
Contributes to own safety	1	0.24			
Makes fun/is enjoyable	4	0.97	Fun/joy	4	0.97
Can gain own experience	26	6.33	Grounded in reality	80	19.46
Works in reality	26	6.33			
Includes practical training	19	4.62			
Allows for reviewing one's own knowledge base	9	2.19			
Information is not filtered	8	1.95	Filtering function	14	3.41
Information is pre-selected	6	1.46			
Food for thought	5	1.22	Food for thought	5	1.22
Fast and easy access	31	7.54	Logistics	39	9.49
No distraction	4	0.97			
Expenses	2	0.49			
Autonomy in terms of what is attended	1	0.24			
Plannable	1	0.24			
Exchange of experiences	41	9.98	Social interaction	102	24.82
Perspectives from other coaches	16	3.89			
Questions can be asked directly	15	3.65			
Social relatedness	9	2.19			
Contributes to a uniform perspective	8	1.95			
Enables change of perspective (participant view)	5	1.22			
Own experience can be brought in	4	0.97			
Internationality	4	0.97			
Good for knowledge expansion	34	8.27	Perceived quality	130	31.63
Good for learning	26	6.33			
New ides/Information	25	6.08			
Up-to-date	18	4.38			
Competent personnel/experts/professionals	16	3.89			
Officially verified knowledge	6	1.46			
Evaluation of the source is possible	3	0.73			
More suitable than CPD on duty	2	0.49			
Own licensing	1	0.24	Own licensing	1	0.24
Not specified	5	1.22	Reasons for no specific answer	7	1.70
Can only be learned from own experience	1	0.24			
No preferred way	1	0.24			

further information about the current situation on the street. The importance of domain specific content knowledge for coaches has been identified in sport (Nash and Collins, 2006; Abraham and Collins, 2011). In the distinct domain of police training, the focus on specific content knowledge may reflect the need to better understand the criterion environment and uncertainty of how to best cope with (un-)armed conflict situations in the field; and may explain the observed failure of skills learned in readily transfering to the field (Jager et al., 2013; Renden et al., 2015). Identification of the technical or tactical skill set needed on the front-line will help trainers develop a more comprehensive police training curriculum (Renden et al., 2016; Körner and Staller, 2018).

CPD activities in police training, like workshops and seminars, mainly involve police training specific content, like technical or tactical behaviour. As such it is not surprising, that this domain specific content knowledge is actually picked up by coaches from this source as the current data showed. Also, within these settings, information of past operations or incidents is disseminated via case studies and anecdotal accounts of the personal leading the CPD activities (coach developers), which satisfies the need of police trainers for further knowledge within these areas. Such educational settings also afford social interaction with other coaches and colleagues, which were a preferred knowledge source for many police trainers.

Besides the need for specific content knowledge, the findings of the current study also support the interpretation that police trainers long for police training specific pedagogical knowledge, since police trainers reported that (a) they generally wanted to know more about pedagogical aspects and (b) they prefer nonformal and in-formal sources to acquire their knowledge.

Research has consistently highlighted the importance of gaining coaching knowledge through informal, self-directed

TABLE 7 | Last thing participants' perceived they had found useful for their coaching.

Raw data theme	Frequency	%	Higher order theme	Frequency	%
Specific coaching method/technique	11	6.15	Pedagogy	53	29.61
Specific training activities	10	5.59			
Skill acquisition	10	5.59			
Pedagogy	8	4.47			
Effective planning	7	3.91			
Communication as coach	7	3.91			
Technical knowledge	60	33.52	Policing knowledge	103	57.54
Tactical knowledge	30	16.76			
Data from past operations/incidents	4	2.23			
Coping with stress	4	2.23			
Attitude/Mindset	4	2.23			
Legal knowledge	1	0.56			
Self-awareness as coach	5	2.79	Own development	7	3.91
Self-awareness as practitioner	2	1.12			
Psychology	3	1.68	"Ologies"	4	2.23
Physiology	1	0.56			
Social interaction/discussion with other coaches	3	1.68	Social interaction/discussion with other coaches	3	1.68
Not specified	9	5.03	Not specified	9	5.03

TABLE 8 | The source of the last thing that participants perceived they had learned or found useful.

Raw data theme	Frequency	%	Lower order theme	Frequency	%	Higher order theme	Frequency	%
Coaching course—attended as part of duty	11	6.21	Formal coach education	16	9.04	Formal learning	16	9.04
University course	4	2.26						
Coaching course—attended privately	1	0.56						
Seminar/workshop/course—attended as part of duty	61	34.46	Attending CPD activities	82	46.33	Nonformal learning	82	46.33
Seminar/workshop/course—attended privately	16	9.04						
Conference/Symposium	3	1.69						
Lecture	2	1.13						
Internet	3	1.69	Internet/intranet	6	3.39	Informal learning	79	44.63
YouTube	2	1.13						
Intranet	1	0.56						
Books/Magazines	6	3.39	Reading	6	3.39			
Experience as practitioner in training settings	15	8.47	Practical experience	25	14.12			
Experience as coach	6	3.39						
Reflection	4	2.26						
Another coach	27	15.25	Other coaches/ colleagues	42	23.73			
Another officer	11	6.21						
Feedback from observers	2	1.13						
Feedback from participants	1	0.56						
Observing another coach	1	0.56						

learning situations (Lemyre et al., 2007; Erickson et al., 2008; Mallett et al., 2009), which is also in line with findings from Stoszkowski and Collins (2015) who identified other coaches and colleagues as important sources of coaching knowledge. Interactions among coaches can provide valuable learning situations, in which coaching issues are discussed and strategies are developed, experimented upon and evaluated to resolve these issues (Gilbert and Trudel, 2001; Lemyre et al., 2007). Therefore, self-directed learning activities allow police trainers to tackle their specific coaching issues, an aspect that is more difficult to focus on in formal learning settings, where the agenda is somewhat fixed by the ones delivering the program. The limited impact of formal coaching courses has been documented throughout the coaching literature (Abraham et al., 2006; Lemyre et al., 2007; Jones et al., 2010). A possible explanation is that coach-education programs fail to cover complex contextual factors in the specific coaching environment (Lemyre et al., 2007; Jones et al., 2010). This is also supported by the reported need for police trainers to know more about police training specific content knowledge and pedagogical aspects. An

TABLE 9 | How participants perceive they used the acquired knowledge.

Raw data theme	Frequency	%	Higher order theme	Frequency	%
Applied/used in practice as coach	119	69.59	Direct application in role	134	78.36
Applied/used on operational duty	12	7.02			
Applied/used in own training as practitioner	3	1.75			
Base for further thought/reflection	7	4.09	Stimulated reflection and sensemaking	16	9.36
Reflected and adapted for own context	5	2.92			
Experimented and adapted	4	2.34			
Not used	14	8.19	Not used	17	9.94
Application is forbidden	2	1.17			
Application has to be agreed upon	1	0.58			
No answer	4	2.34	No answer	4	2.34

aspect that was also reported by police trainers in in-depth interviews about the importance of pedagogy in police training (Körner et al., 2019a). The 30 police trainers interviewed highlighted a lack of context specificity of content as a limitation of formal coaching courses.

The reported reasons for preferring specific sources provide an indication of what police trainers want in terms of the quality of the knowledge and how it is delivered. Specifically, this group of police trainers identified a need for knowledge that was credible, current and expanded their knowledge base. References to sources being preferred because they were grounded in reality (being reality-based) suggests the need of some police trainers for a practical focus to the delivery of knowledge, whether it is experiential or has credibility in that it is known to work in practice. Furthermore, many police trainers value the exchange of experiences, perspectives of colleagues and opportunities to directly ask questions afforded by the social interaction facilitated by some sources. The three main reasons for preferring certain knowledge sources all appear to point toward the accepted need of police trainers to acquire coaching solutions that tackle the specific issues of police trainers.

While the criteria of a source being high in quality and grounded in reality provide a functional reference point for what knowledge is needed and where to get it from, there is a problem attached to that argument. In the self-defence domain, a reference to reality has been identified as a major selling point for technical and tactical behaviour advocated by different self-defence systems (Staller, 2016). However, research indicates that the conception of what works in self-defence situations differs between individuals (Heil et al., 2017; Heil et al., 2019). This may provide a rationale for the reported need of coaches to acquire further knowledge about the criterion environment ("the reality"). However, if anecdotes of colleagues are used as a primary source for information about the criterion environment compared to relying on sound and rigorous analyses of operational situations (Staller M. and Körner, 2019b), police trainers perception of reality might not accurately reflect reality.

The surveyed police trainers predominately reported police-specific content knowledge, like tactics and techniques, as nearly twice as often as pedagogical knowledge compared to the topic of knowledge they last acquired that they found useful. The reported knowledge was predominantly acquired by accessing non-formal and informal learning settings. Specifically, the source for pedagogical knowledge were mainly informal learning settings, whereas domain-specific content knowledge was mainly acquired though non-formal learning settings. All knowledge topics could be applied in practice in nearly 80% of the cases. These findings show two things: First, police trainers mainly find and use context-specific content and pedagogical knowledge in non-formal and informal learnings settings compared to formal learning settings like formal coaching courses. Second, informal learning settings are the main sources for pedagogical knowledge, whereas non-formal learning settings are the primary source for domain-specific content knowledge. This adds to the current data from coaches' preferred sources and topics, suggesting formal coaching courses may lack context specificity and as such direct applicability for police trainers.

The dominant difference between reports of police-specific content and pedagogical knowledge in the last meaningful learning experience indicates a shortfall of pedagogical knowledge compared to police-specific knowledge. This might explain a observed prevalence of out-dated pedagogical approaches in police training (Birzer, 2003; Cushion, 2020; Cushion, 2022; Staller et al., 2021b). Recent studies advocate for strengthening the focus on pedagogical aspects of police training centred coach education (Staller and Zaiser, 2015; Staller MS. and Körner S, 2019a; Nota and Huhta, 2019; Cushion, 2020). Knowledge of pedagogy is considered an attribute of coaching excellence (Nash and Collins, 2006; Abraham and Collins, 2011), which is widely acknowledged by sport coaches (Stoszkowski and Collins, 2015). While some police trainers acknowledged the need for pedagogical knowledge, many more reported the need for police training specific content knowledge. Such views may reflect the "shadowy existence" the topic of pedagogy has in the German police training domain (Körner et al., 2019a; Staller M. and Körner, 2019b). While police training specific content (e.g., tactical behaviour and use of force) and "ologies" (e.g., psychology) are explicitly referenced in the official regulations about how police training coaches in Germany should be qualified for their work (PDV211, 2014), there is no direct mention of the need of pedagogical knowledge.

When asked about their last learning experience, police trainers reported that they primarily acquired pedagogical knowledge through self-directed informal learning settings. This further supports the notion that finding and tapping into the sources of such knowledge primarily rests in the hands of police trainers. This adds to evidence from interview data from police trainers reporting that the potential for pedagogy for police training has not been recognised comprehensively within policing (Körner et al., 2019a). As such, it may be fruitful to further strengthen and communicate the value of pedagogy for effective coaching in police training (Körner and Staller, 2018).

Need for Knowledge Structures for Reflection

The synthesis of the results indicate that police trainers are in need of knowledge structures that allow for reflection, especially when they come in contact with new information. The findings yield that police trainers prefer police-specific content knowledge more than pedagogical knowledge and draw mainly from informal learnings settings, especially from interactions and observations of other coaches. Also, related to their last meaningful learning experience, police trainers reported that other coaches and colleagues are a useful source and that pedagogical knowledge is primarily acquired through self-directed informal learning activities. Finally, the vast majority of recently acquired knowledge has been directly applied.

While these findings do not directly indicate a need of knowledge structures that allow for the filtering and reflection of new information, they may serve as an explanation for results reported in other studies (Birzer, 2003; Cushion, 2020; Staller et al., 2021a; Staller et al., 2021b) indicating that police trainers use outdated pedagogical approaches and that declarative knowledge structures are missing allowing for a critical reflection of police training delivery (Körner and Staller, 2018; Staller et al., 2021a). In order to tackle out-dated pedagogical approaches, police trainers need to be aware of what approach they are using and what assumptions about learning governs their behaviour as a coach. They also need alternative approaches with the underlying knowledge of why a specific approach might be useful in a given situation. Acquiring this knowledge and being able to reflect on it seems hard to achieve through self-directed learning activities, which was predominately reported as the main source for pedagogical knowledge. Instead, it seems more likely that coaches stick to the pedagogical approach they know, which seems to be a traditional approach to learning (Birzer, 2003; Cushion, 2020; Staller et al., 2021a; Staller et al., 2021b). This traditional model of police training heavily relies on a linear approach to training, with large amounts of repetitive practice of isolated skills, that are later put together in complex training scenarios. Without the knowledge structures about pedagogical approaches, and without guidance for what and where to look for new information, self-directed learning activities may become a self-reinforcing mechanism for traditional pedagogical approaches (Hoy and Murphy, 2001).

This potential lack of reflecting capacity also becomes problematic when police trainers draw knowledge from social interactions with peers and observation. The main purpose of the coaching environment is coaching the trainees—and not coach learning (Trudel et al., 2010; Stoszkowski and Collins, 2015). For coaches it is hard to know how appropriate or relevant information by other coaches is, particularly considering the differing needs of both coaches and participants and the differing contexts within which coaches coach (Stoszkowski and Collins, 2015). Just because a "successful" coach applies a specific method or uses a specific drill, does not necessarily mean that it will be appropriate or effective for another coach in another context (Abraham and Collins, 2011; Cushion et al., 2012). Likewise, this argument holds true for police training specific content, like technical or tactical behaviour. Just because on operator successfully applies a specific technique in a specific situation does not necessarily mean that the application of the same technique will be effective for another officer and/or in another situation (Staller and Körner, 2020). Moreover, there is evidence from the sport coaching domain that the social milieu of coaches encourages perceiving aspects of training as relevant that actually are not (Nelson et al., 2013), and that much of the coaching practice that coaches observe and discuss in the coaching environment is more influenced by tradition (Abraham et al., 2006; Lemyre et al., 2007; Jones et al., 2010) than the critical consideration of current research (Stoszkowski and Collins, 2015). The precedence of traditional knowledge has also been identified in observational studies of police training (Staller et al., 2021). In sum, even though when reflected against the current literature the coaches in the current study seem aware of what they need, it seems that they do not seek this in a sufficiently critical and reflective way and via the best routes.

In order to engage in meaningful discussion with other coaches and colleagues, a declarative knowledge base is needed to allow coaches to reflect new information against (Nash and Collins, 2006; Abraham and Collins, 2011; Staller et al., 2020). However, the current results indicate that newly acquired knowledge is directly applied, suggesting that the knowledge has been critically reflected upon before application or that it has been uncritically applied. In the case of an uncritical application of newly acquired knowledge this would suggest that many participants may lack an overall knowledge structure against which they can compare, contrast, and reflect new knowledge against. Evidence from recent studies investigating the planning, delivery and reflection of police training (Cushion, 2020; Staller et al., 2021a; Staller et al., 2021b) indicate that this might be the case. The lack of declarative knowledge has been pointed out as problematic in sport (Martindale and Collins, 2013; Stoszkowski and Collins, 2014; Stoszkowski and Collins, 2015) and martial arts domains (Staller et al., 2020). The need for such knowledge structures, providing clear and justifiable criteria against which questions, practice, habits, standards, values and beliefs can be reflected against have been continuously highlighted as being important with regards to coaching practice (Gilbert and Trudel, 2001; Abraham et al., 2006; Abraham and Collins, 2011). As such, without these structures, there is potential for police training coaches (a) to uncritically adopt information from the dominant culture, especially if the main source of learning is another coach

or someone who is perceived as an expert without necessarily being one (Staller and Koerner, 2021), and (b) to incorporate information through self-directed learning settings without appropriate filters. Strengthening the acquisition of declarative knowledge structures within police trainers would prevent the implementation of potentially undesired, ineffective and/or dangerous practices that are otherwise simply being accepted at face value (Rynne and Mallett, 2014).

Furthermore, the need for knowledge structures for reflection also concerns the choice of where police trainers look for new information and knowledge. When asked to identify the source of the last thing learned that they found useful, it is notably that a portion of the CPD activities from which knowledge was drawn were privately attended seminars, workshops or courses. This adds to findings indicating that police trainers do what they do because they like it and are privately invested in it and as such are influenced by their personal background stories, especially with regards to martial arts or self-defence systems (Körner et al., 2019b). On the one hand, the finding might suggest that police trainers are highly engaged in their subject matter; however, on the other hand, it might suggest that there are perceived gaps in content and/or knowledge provided by police programmes that motivated trainers may be seeking out. Especially in the light of a lack of higher levels of reflection concerning the assumptions governing their behaviour this may become problematic. For example, communicative and de-escalative conflict resolution strategies in police training have been identified as blind spots in the delivery of police training (Rajakaruna et al., 2017; Staller, 2019; Staller et al., 2021b). As such, a police trainer who attends a physical combat and fighting workshop needs to be aware if the taught content is needed to become a better coach for. It may be advisable, that police trainers remain self-reflexive about that issue.

Practical Implications

The context a police trainer operates within may differ widely (Staller and Koerner, 2021) from teaching recruits at the academy over a period of time, to isolated CPD activities for officers, to the training of special operators. Each context differs with regards to the wants and needs of the learners, the curriculum, the learning environment and the organisational context. Police trainers seek out knowledge to tackle specific problems they face in their coaching practice. As such, coach education in police training needs to be mindful of who, what and how police trainers are required to coach in order to provide access to an appropriate suite of resources for support and coach development.

Second, police trainers have to be aware that coaching in the law enforcement domain is a pedagogical endeavour (Basham, 2014; Körner and Staller, 2018). The current data implies that police trainers want a better understanding of pedagogy. This is reassuring given that police training coaching is essentially a pedagogical endeavour. As such, it is important that nonformal coaching activities are built around pedagogical knowledge and are reflected upon from this perspective. A strong focus on pedagogical aspects in nonformal (and formal) learning settings, may result in pedagogical issues becoming the topic of informal activities as well. It is important to note that this does not call for downsizing the importance of police training specific content knowledge. However, valuing coaching as a decision-making process (Abraham and Collins, 2011) and as such a focus on knowledge structures allowing for the effective plan, implementation and review of police training sessions, may be beneficial for formal coach courses as well as for nonformal and informal learning situations. Thinking and reflecting tools such as the Coaching Practice Planning and Reflecting Framework (Muir et al., 2011; Muir et al., 2015) or reflective cards (Hughes et al., 2009) may help coaches with the demands of this ongoing, dynamic and adaptive process of coaching. Consequently, regulations about the qualifications and the development of police training coaches should acknowledge the importance of a sound pedagogical knowledge base; police training coach development courses should be designed to cover these aspects and facilitate the development of the needed knowledge structures.

Since social interactions with other trainers and colleagues and in self-directed learning settings seem to provide valuable context-specific knowledge for the police trainers, the need to be wary, critical and open minded to make the best use of these interactions. Preparing police trainers for continuously making the best out of informal and nonformal learning opportunities may be one of the main goals of formal coaching education in police training. In order to achieve this, formal coach education in police training has to be fundamentally changed. Stoszkowski and Collins (2015) suggest that a primary purpose of formal learning is to equip coaches with the knowledge structures that promote critical and reflective thinking in informal and nonformal learning settings. Coach learning "episodes" should be designed to expose and challenge pre-existing values and beliefs that coaches may have formed about a certain topic (Stoszkowski and Collins, 2015). Based on these experiences, context specific theoretical knowledge could be introduced to provoke, stimulate debate and to raise awareness of alternative and potentially more effective ideas about what to coach and/or how to coach it (Werthner and Trudel, 2006). Planned learning episodes used to check, re-visit and monitor the appropriateness of new beliefs and knowledge and regular interactions in the coaching context could then be interspersed and periodically implemented. This would allow coaches to move forward towards a more critical understanding of their thinking, reasoning and behaviour (Cushion et al., 2003; Abraham et al., 2010; Stoszkowski and Collins, 2015), and reduce the copy and paste mentality of some coaches.

Limitations

There are limitations inherent to the survey approach employed by this study. Since police trainers answered the survey questions independently, there remains the potential for response biases due to participants' interpretation of the questions (Evans and Mathur, 2005). Hence, future studies in police training could incorporate more interactive approaches (e.g., interviews) to further illicit how knowledge structures are developed in police training. Furthermore, participants in this survey were mainly recruited from three police agencies (Saxony, Hesse and Austria). Although no differences in patterns of responses were detected between the three main communities during the analysis, caution is warranted

with regards to the generalisation of the results, especially if states fundamentally differ with regards to coach education in police training. Future studies should therefore incorporate other states and federal agencies as well.

CONCLUSION

The current study focused on coaching knowledge in police training. Specifically, it aimed at answering questions about (a) the types of knowledge they currently require and/or desire (the topics), (b) their actual and preferred methods of acquiring new coaching knowledge (the sources), and (c) how they apply the acquired knowledge (the applicability). Many of the police trainers surveyed indicated a need for knowledge about what to coach and the criterion environment, as well as pedagogical knowledge about how to coach. In light of the out-dated pedagogical approaches observed in police training (Cushion, 2020) and the lack of focus on pedagogy within coach education, the development of police trainers pedagogical knowledge should be prioritised. Finally, the findings show that nonformal and informal learnings settings are a prevalent and preferred source for police trainers to acquire new coaching knowledge. In order to make best use of these settings, police trainers need the declarative knowledge structures that allow them to be wary, open-minded and critically reflective about any new topic knowledge, received from any source, before it is applied to their coaching practice.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusion of this article will be made available by the authors, without undue reservation.

AUTHOR CONTRIBUTIONS

All authors substantially contributed to the current study and the final manuscript. The study was designed by MS and AA. Data was collected and analysed by MS. MS wrote the first draft of the manuscript. SK, AA, and JP provided substantial feedback to the manuscript and helped the manuscript to reach its final form.

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Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

frontiers in Psychology

ORIGINAL RESEARCH
published: 10 February 2022
doi: 10.3389/fpsyg.2022.806163

Deep-Breathing Biofeedback Trainability in a Virtual-Reality Action Game: A Single-Case Design Study With Police Trainers

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OPEN ACCESS

Edited by:
Craig Bennell, Carleton University, Canada

Reviewed by:
Paula Maria Di Nota, University of Toronto Mississauga, Canada
Jolie Baumann Wormwood, University of New Hampshire, United States

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Specialty section:
This article was submitted to Educational Psychology, a section of the journal Frontiers in Psychology

Received: *31 October 2021*
Accepted: *03 January 2022*
Published: *10 February 2022*

Citation:
Michela A, van Peer JM, Brammer JC, Nies A, van Rooij MMJW, Oostenveld R, Dorrestijn W, Smit AS, Roelofs K, Klumpers F and Granic I (2022) Deep-Breathing Biofeedback Trainability in a Virtual-Reality Action Game: A Single-Case Design Study With Police Trainers. Front. Psychol. 13:806163. doi: 10.3389/fpsyg.2022.806163

It is widely recognized that police performance may be hindered by psychophysiological state changes during acute stress. To address the need for awareness and control of these physiological changes, police academies in many countries have implemented Heart-Rate Variability (HRV) biofeedback training. Despite these trainings now being widely delivered in classroom setups, they typically lack the arousing action context needed for successful transfer to the operational field, where officers must apply learned skills, particularly when stress levels rise. The study presented here aimed to address this gap by training physiological control skills in an arousing decision-making context. We developed a Virtual-Reality (VR) breathing-based biofeedback training in which police officers perform deep and slow diaphragmatic breathing in an engaging game-like action context. This VR game consisted of a selective shoot/don't shoot game designed to assess response inhibition, an impaired capacity in high arousal situations. Biofeedback was provided based on adherence to a slow breathing pace: the slower and deeper the breathing, the less constrained peripheral vision became, facilitating accurate responses to the in-game demands. A total of nine male police trainers completed 10 sessions over a 4-week period as part of a single-case experimental ABAB study-design (i.e., alternating sessions with and without biofeedback). Results showed that eight out of nine participants showed improved breathing control in action, with a positive effect on breathing-induced low frequency HRV, while also improving their in-game behavioral performance. Critically, the breathing-based skill learning transferred to subsequent sessions in which biofeedback was not presented. Importantly, all participants remained highly engaged throughout the training. Altogether, our study showed that our VR environment can be used to train breathing regulation in an arousing and active decision-making context.

Keywords: police education, police training, virtual-reality, stress management, autonomic arousal, heart rate variability, biofeedback

INTRODUCTION

The work of a police officer can be seen as an evolutionary paradox: in places and situations where most people would fall prey to survival instincts of self-preservation, police officers ought to act calm, with proportionality and benevolence. As a result, working as a police officer can elicit considerable stress, with high prevalence of work-related physical injuries (West et al., 2017) and stress-related symptoms (Leppma et al., 2017) which can lead to mental disorder (Carleton et al., 2018) and suicidal ideation (Di Nota et al., 2020). Additionally, police officers are under constant scrutiny from both internal and external sources, including the public display of mistakes to ensure accountability (Skolnick and McCoy, 1984). The nature of their dangerous work as well as being under ongoing surveillance puts a great deal of pressure on police officers.

A large body of literature has shown that, besides affecting physical and mental wellbeing (Stetz et al., 2007), stress can impair decision-making aspects which are crucial to the policing job. Experimental studies have consistently shown that under high levels of arousal, decision-making becomes more impulsive and less goal-directed (Porcelli and Delgado, 2017), which is related to impaired control by prefrontal brain regions under stress (Arnsten, 2015; Maier et al., 2015). The detrimental effects of arousal have also been demonstrated in police, where high arousal has been associated with impaired shooting accuracy, as well as decreased inhibitory control (Nieuwenhuys et al., 2015; Hashemi et al., 2019). It is essential that police officers manage their stress while on the job to avoid costly mistakes such as the inappropriate use of force.

To train coping under stress in police officers, recent studies investigated the training of behavioral skills under pressure, which improved basic perceptuomotor skills such as shooting accuracy under threat (Nieuwenhuys and Oudejans, 2011) or spatial orientation (Driskell et al., 2001). However, this type of training may not always improve relevant higher-level decision-making under stress, such as when asked to make shoot/don't shoot decisions (Nieuwenhuys et al., 2015). To counter this stress-induced performance drop and improve decision-making under threat, training efforts have moved beyond the focus on performance, by adding in police education elements to help officers directly manipulate the bodily stress response itself (Bouchard et al., 2012a; Mccraty and Atkinson, 2012; Andersen and Gustafsberg, 2016). In some cases, this opportunity for physiological modulation was even delivered intermixed with action in realistic scenario-based environments (Andersen and Gustafsberg, 2016; Andersen et al., 2018; Di Nota et al., 2021). This type of biofeedback training mainly focuses on promoting emotional regulation by helping the officer control their physiological arousal by giving feedback on their objective physical stress level (e.g., indexed by heart rate parameters, see below) to improve physiological awareness and gain more voluntary control over their physiology (Weerdmeester et al., 2020).

After studies showed the usefulness of biofeedback to enhance stress regulation (McCraty et al., 2009; Bouchard et al., 2012b) several police forces worldwide have implemented training programs in which a biofeedback training component is included. However, according to a recent survey in Netherlands, this type of training was generally negatively appraised by police officers and did not result in substantial improvements in reported stress regulation (van der Meulen et al., 2018). These disappointing results might be attributable to the fact that in current practice, biofeedback is often delivered in a passive classroom setup, which may not feel relevant to police officers and thereby affect their engagement. Yet, engagement is a key prerequisite for behavioral change (Holzinger et al., 2006). To promote both engagement and generalization to real-life stressful situations (skill-transfer), it is important to train stress regulation within a progressively more active and thereby more representative action context (Seifert et al., 2018; Staller and Körner, 2019). Indeed, just as the current biofeedback applications often lack elements to make the learning process engaging and relatable, excessive stress might also prevent learning (Di Nota and Huhta, 2019). To better reappraise stress into challenge and to improve performance under stress (Jamieson et al., 2010), it seems necessary to design a training context in which stress is kept at a moderate, optimal level that is not too low, but also not overwhelming and excessive.

One way to address previous shortcomings in classroom-based training is by creating engaging environments in Virtual-Reality (VR) where physiological control must be exerted while performing decision-making actions in an arousing context. VR is a useful tool to create controlled—yet representative—environments, allowing to elicit high levels of arousal and engagement (Parsons, 2015; Miller et al., 2019). However, re-creating a highly realistic virtual police environment in VR can also have negative consequences on subjects' experiences due to slight mismatches with reality (Wilson and Soranzo, 2015) and the challenges in recreating genuine verbal and tactile interactions (Michela et al., 2019). To remedy this, the use of game mechanics (a set of rules and events defining the game experience) inspired by commercial videogames offers the possibility to re-create a genuine feeling of threat and immersion, moderate enough for learning to take place while at the same time boosting engagement (Allcoat et al., 2015; Cummings and Bailenson, 2016; Lin, 2017; Slater, 2018; Schoneveld et al., 2019). Game mechanics also present another advantage over realistic environments in VR, which is the ease of emotional elicitation and repeatability of the experience (Lobel et al., 2016; Michela et al., 2019; Scholten and Granic, 2019). Ultimately, gaming contexts also alleviate the emotional impact that poor performance could have on feelings of professional self-efficacy, reduces the chance of overtraining motor responses that may be less adequate in real-life and limits reactivation of potentially traumatic experiences, since the actual action is rather far removed from real policing contexts (Michela et al., 2019). Evidence-based VR trainings are, however, currently scarcely available (Di Nota and Huhta, 2019) and to the best of our knowledge, no training has been described that makes use of the aforementioned VR and gaming assets. Therefore, we developed a VR environment that offers the player the possibility to train breathing-based biofeedback skills in real-time while immersed in an engaging active decision-making game (Brammer et al., 2021).

For the physiological training component, our VR application aligns with previous training practices in Dutch Police. Specifically, biofeedback training applied to police officers has mainly focused on abdominal deep breathing (van der Meulen et al., 2018; Bennell et al., 2021), which has been shown to increase heart-rate variability (HRV) by respiratory sinus arrythmia (RSA; Hirsch and Bishop, 1981) reflecting parasympathetic nervous system dominance (Russo et al., 2017). The influence of deep breathing on the parasympathetic nervous system can be measured in both the low frequency and high frequency spectrum of HRV (Shaffer and Ginsberg, 2017; Kromenacker et al., 2018), as well as the coherence between breathing and HRV (Shaffer et al., 2014; Schwerdtfeger et al., 2020). This type of biofeedback has proven useful in a variety of training applications, from performance training for athletes (Jiménez Morgan and Molina Mora, 2017) to stress and anxiety management (Goessl et al., 2017). Importantly for police applications, an elevated HRV is also related to better performance under threat (Hansen et al., 2009), and was shown to be effectively modulated by biofeedback, hence reducing stress in contexts related to police realities (Bouchard et al., 2012a; Andersen et al., 2015, 2018; Andersen and Gustafsberg, 2016) and also improving cognitive control (Laborde et al., 2021). In our VR environment, biofeedback was provided by modulating the width of the field of view according to breathing rate and depth, thus making real-time physiological regulation key to being able to perform well in the game.

For the behavioral assessment components during the training in our VR environment, we focused on one of the key decision-making processes that is affected by stress and related to police-relevant go/nogo decisions, namely shoot/don't shoot decisions (Nieuwenhuys et al., 2015; Gladwin et al., 2016). Impairments in response inhibition are known to be especially high when individuals are primed to believe that they will need to take action and the stakes are high (Johnson et al., 2018; Taylor, 2019). Thus, we designed our game mechanic around these processes of response inhibition under stress and the impact of priming. Having those metrics imbedded in the same environment as the physiological training allows for direct measurement of the impact that physiological training has on performance.

The first overarching goal of the current study was design validation. First, we tested if the VR environment was, as hypothesized, successful in creating a challenging environment that elicits clear increases in levels of arousal (assessed *via* heart rate) and self-reported engagement. Second, we tested if our biofeedback (a) increases slow and deep breathing and HRV, and (b) raises physiological awareness for the participants. Third we explored whether our setup allowed extraction of meaningful behavioral metrics concerning response inhibition and priming. Behavioral measurements were all extracted from the VR environment, with the auxiliary aim of documenting interactions between behavioral metrices and physiology.

The second main goal of the current study was to perform a preliminary evaluation of the game's potential to train breathing-based biofeedback in an active decision-making context. We hypothesized that breathing biofeedback score would improve over the training, along with HRV. Moreover, biofeedback-driven physiological regulation skills should transfer to the same action context, when experienced without biofeedback. This preliminary proof-of-concept was performed by means of a withdrawal single-case experimental design (SCED), applied to a sample of nine trainers from the Dutch police, a difficult population to get access to and test due to their usual work load, yet highly valuable given that they contain all the critical insight in both the required skills for dealing with stress and the challenges surrounding teaching those skills to police recruits. These trainers took part in a ten-session training program. Withdrawal SCED has already been successfully used in investigating the potential of biofeedback (e.g., Bossenbroek et al., 2020). This design has the advantage of providing rich datasets to investigate the dynamical evolution of skill acquisition within and across sessions (Smith and Little, 2018), and inform future research about the often overlooked aspect of minimal training length required for efficient training (Di Nota et al., 2021).

MATERIALS AND METHODS

Participants

Participants were nine male police trainers with an average age of 43.2 years (SD = 6.45) and with an average of 18.4 years (SD = 8.6) of operational background as a police officer. Their average trait anxiety was 27 (range 23–34 on a scale of 20–80), which indicates participants in our sample to be non-anxious. Only three participants reported playing video games in their free time, to a maximum of 4 h a day during weekends. Participants were recruited from a Police skill training center, in Netherlands, hereafter referred to as IBT center ("Integraal Beroepsvaardigheids Training centrum"). Given that this was a proof-of-concept study, the number of participants was based on earlier studies using similar SCED methodologies (Ebbinghaus, 2005; Smith, 2012; Smith and Little, 2018; Bossenbroek et al., 2020). Participation was voluntary and handled by the coordinator at the IBT center. According to the rules of the Dutch Police, financial compensation of the police officers functioning as participants was not allowed. Therefore, for each participant a donation of 50 euros was allocated to a fund for the training of "PTSD dogs" (Actie ZeeHond, n.d.). The research procedures were approved by the ethical committee of the Faculty of Social Sciences of Radboud University Nijmegen (ECSW-2020-112). All participants provided informed consent in writing prior to participating in the study, in line with the guidelines of the Declaration of Helsinki (WMA, 2018).

Materials

Physiological Recordings

Participants' breathing rate was measured using a respiratory inductance plethysmography (RIP) belt from Plux S.A. and a BITalino (r)evolution board (Batista et al., 2017). The heart rate of the participant was recorded by a Polar H10 chest strap, which extracts R–R intervals (i.e., the time between consecutive R-waves of the QRS electro cardiac signal). Both physiological recording units broadcasted their data to a Raspberry Pi 4 Model B, which was also used to calculate the breathing biofeedback scores with custom-made python software, based on the open

source EEGsynth library (Brammer et al., 2021; Oostenveld, n.d.).

Virtual-Reality Material, Model, and Task

An HTC Vive setup was used to immerse the participants in a virtual environment that consisted of a poorly lit underground parking garage. The VR trackers were set 3–4 m apart, giving the player a minimal play area of 4 square meters. One of the two VR controllers was wrapped by a 3D printed case, giving the controller the weight and shape of a gun. The second VR controller was attached to the vest of the participant and used as a dispatch-radio in the game.

Operationalization

The VR environment was designed to incorporate game mechanics based on existing experimental laboratory tasks, as shown in **Table 1**. The paradigms listed were incorporated as they represent specific behavioral aspects known to be affected by stress and relevant in the decision-making processes. The first paradigm is emotional regulation, in our case physiologically influenced through breathing-based biofeedback presentation. Its implementation as a modulation of the width of the field of vision makes the biofeedback relevant for the player, since in active contexts it is easy to ignore the biofeedback if it does not interfere with action. Modulating the peripheral view directly impacts the difficulty of detecting approaching enemies in the VR environment.

The second and third paradigms were selected based on existing literature investigating police performance in decision making contexts. Specifically, response inhibition under stress, operationalized as go/nogo (shoot/don't shoot) decision-making, has been linked to increased error-rates with increased threat level (Nieuwenhuys et al., 2015; Hashemi et al., 2019, 2021). Similarly, priming has been shown to increase wrong shooting decisions in police officers primed with a radio dispatch indicating that an upcoming opponent was armed (Taylor, 2019). These two paradigms were implemented in the game in the form of a zombie shooting task (see below).

TABLE 1 | Operationalization of in-game tasks.

Experimental paradigm	In-game operationalization	In-game mechanic	Game output / proximal measure	Training outcome
Emotion regulation	Biofeedback	Width of the field of view linked to breathing pace	Breathing control and HRV scores	Physiological control
Response inhibition (Go/NoGo)	Shoot/don't shoot	Shooting at targets matching dispatch information	Accuracy	Response control
Priming	Dispatch bias task	Targets' (mis)match with dispatch information (body shape; eye color)	Accuracy based on body type of the target	Bias resistance

Model for the incorporation of experimental paradigms in the game environment; HRV, heart-rate variability.

The Virtual-Reality Game

The game scenario unfolded as follows: Participants found themselves in a dimly lit parking garage, received dispatch information about hostile targets with a description of their features, were approached by (friendly and hostile) targets, and decided whether to shoot or not. Each game session lasted approximately 15 min. Targets were coming toward the participants from all directions, in fourteen waves. During each wave, the participant would receive dispatch information over the walkie-talkie to shoot the hostile but not the friendly targets, including a description of the hostile targets. All targets had two identifying features that made them recognizable as friendly or hostile. The *large identifier* was their body type (tall male, small male, tall female, or small female). During the game this identifier became less reliable to identify a target, as hostile targets had increasingly more varying body types (starting with 100% targets matching the description and decreasing to 50% in the last waves). The *small identifier* was their eye color (red, blue, or yellow); this was always 100% reliable. To summarize: The dispatch information for the eye color of hostile targets would always be correct, but the dispatch information for their body types was not completely accurate. The body type was visible from a far distance, while eye color was only visible when the target had approached to a close distance. Hence, identifying targets with the correct eye color and shooting at them on time was our implementation of the go/nogo task component, while the radio dispatch announcing suspected body types associated with the targeted eye-color was our implementation of the priming component.

Each time the player shot, the game recorded if the shot was a hit or a miss. In case of a hit (i.e., hostile target with correct eye color), the game logged the body type of the target and the distance between the target and the player. Shooting a friendly target (i.e., wrong eye color) was punished by a loud burst of noise. Each time a target reached the player without being shot, the game logged the body type of the target, whether it was hostile and the time that it had spent in the line of sight of the player. Hostile targets would then stay next to the player and attack them until shot. The player was notified of the attack by sound, and a red halo appeared framing their field of view. Players could not "lose" the game in the sense that they reached game-over, the hostile targets had to be all shot before the next wave would start. Please note, in contrast to more traditional laboratory assessments of go/nogo performance, different trial types were here presented at the same time (i.e., multiple targets approached the player at the same time). Hence, time pressure was created by the fact that multiple choices had to be made concomitantly, to simulate a short response window, required to maximize false alarm rates (Young et al., 2017). The maximization of false alarms was needed to provide enough improvement margin to the player and benefited from the non-realistic environment to mitigate risks in terms of professional self-efficacy in players.

At the end of each session, the participant was presented with scores ranging from 0 to 100%, summarizing their performance on three metrics commonly used to describe police performance in the field: Control over the situation, control over the suspect and control over the self (Binder and Scharf, 1980; Huhta et al., 2021; see **Supplementary Material 1** for the formulas used to calculate these scores). While the first two scores represented behavioral elements, the last one was a summary of the breathing pace performance rewarded by the biofeedback. The scores were calculated to make the scores of "control of the situation" and "control of the suspect" relatively easy: Participants could achieve high scores without excessive effort. On the other hand, the "control of the self" score directly represented the physiological control score, thus helping to nudge the players toward focusing on physiological control more in the following sessions.

Biofeedback Parameter and Implementation

In sessions in which the biofeedback was displayed to the player (ABBABABABA withdrawal design; A = without biofeedback: session 1, 4, 6, 8, and 10; B = with biofeedback: session 2, 3, 5, 7, and 9), a breathing pace of eight breaths per minute was rewarded by having optimal vision, with faster or slower breathing paces being progressively punished by reduced (tunneled) vision (see **Figure 1**).

The visual feedback on participants' breathing pace was implemented by reducing the vision of the player in the VR task proportionally to their non-adherence to the rewarded breathing pace. This "tunneled" vision served to help the player control their breathing pace in the heat of the moment, when task demand reduced awareness of their own physiological processes. Specifically, the biofeedback value rewarded slow and deep breathing by promoting high amplitudes of breathing paces in the 6–10 breath per minute range. It was calculated by performing spectral density estimation on the incoming breathing signal and then calculating the power of the signal within the target frequency range divided by the power outside the target frequency range (c.f., Brammer et al., 2021; **Supplementary Figure 2**). Please note that the power was calculated as area under the curve, thus reflecting the amplitude (depth of breathing) within the target range. This value was updated at a rate of 0.5 Hz, and ranges between 0 and 1. Hence, every 2 s, a breathing segment of the last 30 s of breathing data was analyzed, resulting in an overlap of 28 s between consecutive segments. It rewarded diaphragmatic breathing at a pace of eight breaths per minute. This target is faster than the six breaths per minute pace recommended by the literature to increase HRV (Hirsch and Bishop, 1981; Brown et al., 1993; Ben-Tal et al., 2014), as piloting revealed that such a low pace was too hard to achieve in action. The exact signal processing pipeline and data extraction can be found in the **Supplementary Material** of our previous article, detailing the development of the biofeedback parameter (Brammer et al., 2021). Importantly, the visual presentation of the biofeedback could be switched off, in which case the player would always have a full vision, independently from their breathing biofeedback score. This parameter was experimentally manipulated between training sessions to test the impact of biofeedback presentation (see section "Procedure").

Questionnaires

All questionnaires were administered in a paper and pencil form. The following questionnaire data were collected.

Trait-Assessments of Anxiety

Participants' trait anxiety was assessed in the first session using the Dutch State-Trait Anxiety Inventory with twenty items and four response options (1 = "almost never" to 4 = "almost always"; van der Ploeg, 1984). An example of a statement is "I feel satisfied with myself." A total score was calculated by calculating the sum of all item scores (range 20–80), with higher scores corresponding to less anxiety.

Prior Gaming Experience

Participants' prior gaming experience was assessed in the first session using two self-constructed questions. Participants were asked how many hours a day they played video games on a weekday and how many hours during a day on the weekend. Response options were: (1) I do not play video games; (2) less than 1 h per day; (3) one to 2 h a day; (4) two to 3 h a day; (5) three to 4 h a day; (6) more than 4 h a day.

Pre-test Questionnaire

The pre-test questionnaire (target approach analysis, see **Supplementary Material 2**) is a short self-constructed questionnaire inspired by questionnaires used to investigate plan-making in real-life policing situations (Adang and Timmer, 2005), administered before each VR session to the players. They were asked to indicate which one of the three control scores mentioned above they would focus on, what scores they expected to achieve as well as the scores they expected their colleagues to achieve. An open question concluded the questionnaire, to ask the player if they had a specific strategy in mind for the upcoming session. The aim of this questionnaire was twofold: Measuring the participants' training intentions and prime them to keep in mind the policing goals of the training endeavor.

Post-test Questionnaire

After each session, the post-test questionnaire (after action report, see **Supplementary Material 2**), a short self-constructed questionnaire, was administered to the participants. The players were asked to indicate which score they thought they had achieved, on a scale from 0 to 100%, for each one of the 3 control scores (control of the situation, of the suspect and of self) and several open-ended questions to make them think about their performance. The aim of this questionnaire was twofold: Measuring the participants' performance estimates, and maintain awareness of the policing goals of the training endeavor. Of the three self-rated control scores, only the "control of the self" score was used for further analyses, where it was contrasted to the actual "control of the self" score achieved by the participant.

Threat and Challenge Appraisal

Participants' appraisal of threat and challenge during the game was assessed after each session on an eleven-item scale developed by Mendes et al. (2007), with seven response options per item (1 = "totally disagree" to 7 = "totally agree"). Six items were indicative of the threat aspect (i.e., "this task is demanding," "... is stressful," "... is distressing," "... is threatening"; "I am

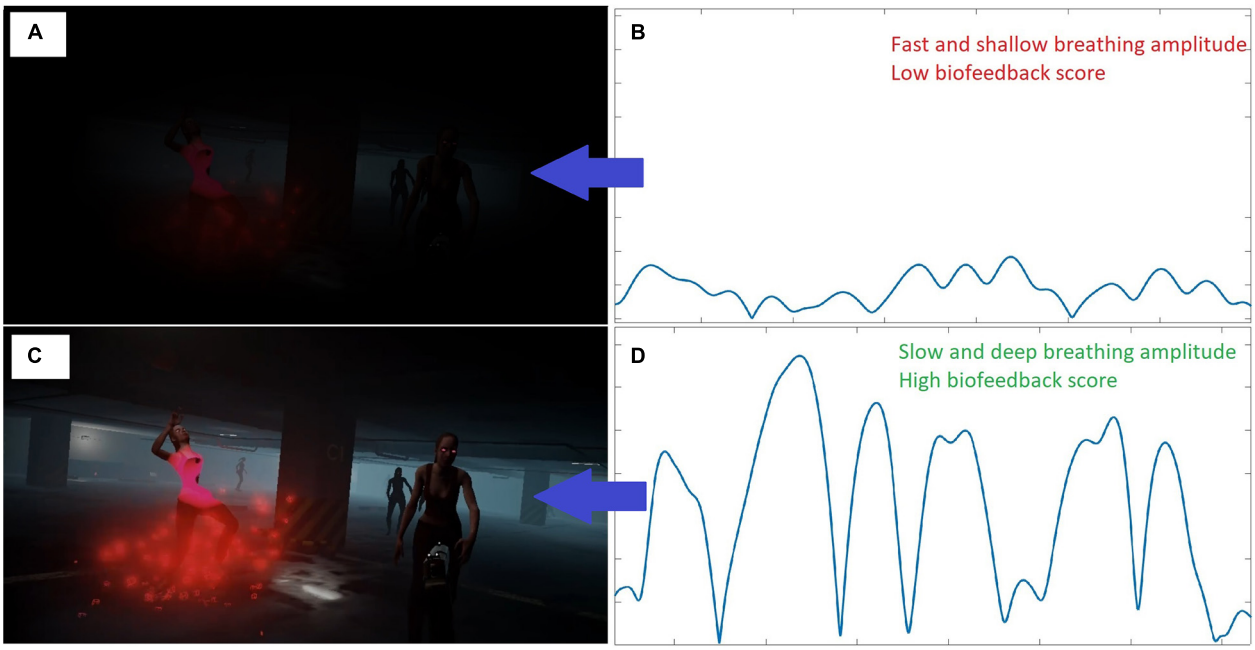

FIGURE 1 | Implementation of the biofeedback as peripheral vision modulation. The quality of the vision (on the left) was linked to the biofeedback score, calculated from the breathing speed and amplitude (on the right); **(A)** Vision with a biofeedback score equal to 0 (the player is not breathing at the rewarded pace); **(B)** example of fast and shallow breathing amplitude, corresponding to a breathing biofeedback score of 0; **(C)** Vision with a biofeedback score equal to 1 (maximum adherence to rewarded breathing pace) or in A-phase sessions in which online biofeedback was not presented to the player; **(D)** example of slow and deep breathing amplitude, corresponding to a breathing biofeedback score of 1.

uncertain how I will perform"; "this task requires a lot of effort"). In addition, five items were indicative of perceived positive challenge (i.e., "I have the abilities to perform well," "I have the expectations to perform well," "performing well is important to me," "this task is a positive challenge," and "I am the type of person who does well on these tasks"). Two distinct scores (ranging from 1 to 7) were calculated for the threat and the challenge aspect, by averaging the related item scores.

Engagement

Participants' engagement was assessed after each session using seven items from the Intrinsic Motivation Inventory with seven response options (1 = "totally disagree" to 7 = "totally agree") (McAuley et al., 1989). An example statement is: "I would describe this activity as very interesting." The negatively formulated statements ("I thought this was a boring activity" and "This activity did not hold my attention at all") were recoded. A total score was calculated by averaging the scores on all items (range 1–7). The higher the score, the higher participants' engagement during the training.

Procedure

After giving written informed consent and filling in the questionnaire about gaming experience as well as the trait anxiety questionnaire on the first session, each session consisted of participants putting on the respiration belt and the heart-rate belt, receiving a police vest, the controllers (radio and gun in the VR environment), headphone, and VR headset. Next, participants filled in the pre-test questionnaire, standing, while their physiological baseline was measured. The participants then performed the VR task for around 15 min until they completed all the waves of the game. In the first session, participants first played a tutorial in which they were instructed about processes such as confirming a radio message, followed by the actual VR task. The tutorial was also present in the second session, with additional information about biofeedback control and a breathing pace training. From session two onward, participants were instructed to breathe 5 s in and 5 s out while playing. After playing each session, participants filled in the rest of the questionnaires regarding their appraisals of the game. When the participant finished all questionnaires, they were presented with their average session scores of control over the situation, suspect and self.

To allow statistical inferences in small sample sizes, in this single case experimental design (SCED) study participants were invited ten times to the training sessions. A withdrawal ABAB design was used in which the experimentally withdrawn variable was the presence of online biofeedback on the participant's breathing pace, where slow and deep breathing was rewarded. The online biofeedback was presented to the participants by means of vision impairment while performing the VR task. Over the course of 1 month (September 2020), all participants completed the ten sessions (phases) following a withdrawal design (ABBABABABA). The majority of the sessions were separated from each other by one to 5 days. Due to participant scheduling limitations, some sessions had, however, to be done in the same day. In such a case, the first session always was an

A phase, to prevent short term carry-over from the biofeedback presentation, displayed in B phases. In other words, we wanted to prevent the risk that players would apply the breathing technique in an A phase just because they had to apply it in the B phase that happened only minutes before. This security measure was implemented to ensure that looking at contrasts between a biofeedback B phase and a subsequent A phase would reflect as much as possible learning transfer and not mere short-term habituation. Continuous breathing-based biofeedback was added in the B-phases and withdrawn in the A-phases. The design is in line with the guidelines for small-N designs, by allowing a minimum of four repetitions of the addition-withdrawal procedure (Kratochwill et al., 2013).

Data Preparation

Any identification information was removed from participant data and the data were securely stored on password-protected servers hosted by the Radboud University. The data was only accessible for approved members of the research team. The research data was not shared with the police organization, nor with the IBT center from which participants were recruited.

Physiological Recordings

The physiological data (breathing biofeedback score and inter-beat "R-R" intervals) were automatically saved at a rate of 0.5 Hz. The data points were then synchronized with the game events and averaged before the start of the game to constitute the baseline. Since the baselines were inconsistent in length, the shortest recording (29 samples = 56 s) was used as a length reference, hence we only considered the last 29 samples portion for longer baselines. Per session, the inter-beat (R–R) intervals were interpolated to extract low (0.04–0.15 Hz) and high (0.15–0.4 Hz) frequency HRV, the low/high frequency ratio of HRV, and the coherence between the low frequency HRV and breathing. The coherence score was calculated by quantifying the similarity of the breathing and inter-beat interval time-series (Shaffer and Ginsberg, 2017). This quantification, bound between 0 and 1, is frequency specific. We therefore only considered the low-frequency HRV range as it is the range at which paced breathing would happen. The low frequency coherence metric is extracted as an index of relaxation, as Hayano and Yuda (2019) suggested that breathing induced fluctuations in the low frequency spectra of HRV reflects the presence of resting function. The scripts used to extract those HRV metrics can be found on GitHub (Brammer, 2020) and were taken from the guidelines proposed by Shaffer and Ginsberg (2017).

Decision-Making and Response Inhibition Behavior

In-game events and actions were summed within a session to compute accuracy and signal detection measures. Hit scores were calculated by adding events where the participant shoots at an incoming hostile target before it reaches the player. Similarly, miss scores were the sums of hostile targets reaching the player before being shot, correct rejection scores were the sums of friendly targets reaching the player unharmed and finally false alarm scores were the sums of friendly targets being shot by the player. For each of those scores, we also recorded if the target involved in the event had the primed large identifier (body type announced by the radio dispatch as potentially hostile).

Data Analysis

Missing and Excluded Data

Due to a technical issue with the heart rate belt recordings, the HR data of session 1 was missing for participants 3 and 5, although the participants did complete the training session. Moreover, due to material failure with the breathing belt used for biofeedback, the breathing data of session 8 was missing for participant 4, although the participant completed the full training session. Subject 9 was excluded from HRV-related analyses, since his high frequency component of HRV was more than 3 standard deviations higher than the rest of the group, for several sessions; this was due to a lack of accuracy in the R peak detection from the heart rate belt. This problem did not affect biofeedback measurements.

Environment Design Validation

Due to the small sample size, this section of the results is purely descriptive, as only the biofeedback data allowed to make meaningful statistical inferences thanks to the withdrawal (ABBABABABA) design.

Game Arousal, Challenge, and Engagement

To descriptively assess, for each subject, the evolution of the level of arousal, challenge and engagement, individual trajectories were plotted alongside group average. For the HR, average baseline and in-game session scores were obtained. The in-game scores were obtained by subtracting the average baseline score from the in-game scores.

Biofeedback Relevance

To assess whether our biofeedback manipulation was successful in influencing HRV, the average breathing biofeedback score within a session was correlated with the low and high frequency components of HRV and with the coherence between the breathing and low frequency HRV. The latter correlation is used to measure the extent to which low frequency HRV is influenced by slow and deep breathing, an indicator of resting function rather than sympathetic dominance (Hayano and Yuda, 2019). Since correlations were based on all 10 sessions of eight participants in total, where each session is a data point, we used a repeated measure correlation approach using the R package "rmcorr" (Bakdash and Marusich, 2017, 2021). Subject 9 had to be excluded from those analyses due to a measurement error.

To measure how awareness of the breathing control performance evolved over the course of the 10 sessions, we computed for each session the difference between participants' self-rating in breathing performance (an auto evaluation ranging from 0 to 100%) and the actual session score of "control of the self" (the percentage of the session that the player spent with a breathing biofeedback score of at least 0.8 over 1). Thus, the awareness score was calculated as: real "self-control" score—self rating "of self-control" score.

To further investigate the relevance of biofeedback, we looked at how often players mentioned breathing (e.g., "I need to focus more on the breathing"), biofeedback visual impairment (e.g.,

"Too much tunnel vision") and self-control score (e.g., "Focus on self-control") in the open-ended questions asked to the player before and after the VR task. Mentions of action-related elements (e.g., "Reload more often" or "Monitor 360") were scored as well.

Decision-Making Behavior

To measure decision-making (shoot/don't shoot) performance, we calculated the amount of hits, misses, correct rejection and false alarms per subject and session. Additionally, sensitivity $\{d' = [z(\text{Hit rate}) - z(\text{False alarm rate})]\}$ and response bias $\{\text{criterion} = -[z(\text{Hit rate}) - z(\text{False alarm rate})]/2\}$ were computed according to signal detection theory (McFall and Treat, 1999). Since some participants managed to avoid false alarms for an entire session, a loglinear correction was applied to the data to avoid infinite values (Hautus, 1995; Stanislaw and Todorov, 1999). To describe the effect of the priming, we calculated per session and subject the difference in false alarm rate between targets that had the body type primed by radio dispatch and those who did not[1].

Training Efficiency: Physiological Control

Next, we tested the link between the presentation of online biofeedback in B-phases and the improvement in breathing control in action witnessed in all subjects. In this methodology, the goal is to search for the effect of repeatedly adding and removing a variable. Evidence for a causal effect is then gathered through multiple analyses to ensure that the found effect is genuine. In our case, the experimentally added and removed variable is the presence of biofeedback, implemented as the tunneled vision described above. According to the requirements, of the SCED methodology (Kratochwill et al., 2013), multiple datapoints have to be extracted per session, which allows this section of the study to perform inferential statistics. The biofeedback values of a session were separated in 15 s bins and averaged for each bin. The biofeedback scores of individual participants were analyzed within and between sessions (A-sessions, B-sessions, B-A-sessions, and A-B sessions). The six features of the SCED visual analysis were level, trend, variability, immediacy of effect, consistency of data patterns across similar phases and degree of overlap of data (Kratochwill et al., 2013). A change of the data-patterns when there was a change in condition (addition or removal of biofeedback) indicates the biofeedback had an effect. To determine whether there was a significant intervention effect for a participant, a minimum of three such changes was needed for at least three of the six features (Horner et al., 2005; Kratochwill et al., 2013; Lane and Gast, 2014). Additional descriptive representations of HRV parameters were included in this section, since the main goal of breathing-based biofeedback was to calm participants by regaining parasympathetic dominance through HRV increase.

Single-Case Experimental Design Analysis

To illustrate the within and between session dynamics, the evolution of the biofeedback scores, evaluated at the 15 s bin level throughout the entire training, were plotted for each subject along with separated fitted trend lines for the A and the B phases. The trend lines were obtained with the MATLAB function "polfit.m." To increase visibility of the data, the lines were smoothed with the moving average option of the MATLAB function "smooth.m." Since the biofeedback score was measured on a time window of 30 s, the first two data bins of each session were discarded to avoid analyzing data from the baseline period.

Of the six SCED features used to test the role of biofeedback, data overlap is the one presented in the result section as it is most relevant to our design. For completeness, we report other aspects in the **Supplementary Material 3**. To test whether vision impairment was a salient enough way of providing biofeedback in B-sessions, and causally influenced the player's behavior, data overlap of the biofeedback values of consecutive sessions was calculated by using the Kendall's tau ranked correlation coefficient (Kendall, 1938). For each subject, the tau scores were then aggregated into two distinct scores (addition and removal) by combining effects of single contrasts (Manolov et al., 2015; Tarlow, 2017a, 2018). The addition score encompasses the tau scores for A-to-B phases contrasts, hence when comparing consecutive sessions where the first is played without online biofeedback and the second with biofeedback. Conversely, the removal score encompasses the tau scores for B-to-A phases (transition from with to without biofeedback). Kendall's tau was extracted by using an edited version of the R code by Tarlow (2017b). The editing consisted in removing Theil–Sen estimator used for baseline trend correction (Tarlow, 2017b). Baseline trend correction was not used for this dataset, as trend analysis revealed that a within session trend was often present but negative, hence correcting for it would lead to false positive results.

RESULTS

Goal 1: Environment Design Validation

Does the Virtual-Reality-Game Environment Evoke Arousal and Engagement?

The VR-game elicited psychophysiological arousal and was experienced as challenging and engaging in the small sample at our disposition. This is indicated by the self-reported threat and challenge appraisals, the increase in HR and the self-reported engagement score (see **Figures 2A–C**). As expected, police officers reported consistently low levels of experienced threat, with an average of 2.39 on a 7 point scale (SD = 0.86; see **Supplementary Material 4**) over all sessions and participants. However, challenge scores were consistently high (**Figure 2A**) indicating that the participants experienced the game as positively stimulating ($M = 5.36$, SD = 0.65). In terms of absolute HR during the sessions, the average was 79 BPM. There was a marked peak in HR during the first session ($M = 99$ BPM) with substantial variation between subjects from $M = 78$ BPM (for subject 4) to $M = 176$ BPM (for subject 1). This strong variability was only witnessed for the first session. Relative to the baseline period immediately preceding the game start, an average increase of HR from baseline of approximately 10 BPM was observed (**Figure 2C**), similar to increases witnessed in established stress induction protocols (e.g., see Vogel et al., 2015). As shown in

[1]Individual trajectories were plotted alongside the average of all participants, with standard error.

Figure 2B also participants' reported engagement (scale 1–7) was generally high (M = 5.65, *SD* = 0.66), steadily decreasing until session seven, where the average engagement was still 5.3, corresponding to a moderately high level of engagement.

Does the Biofeedback Implementation Influence Heart-Rate Variability and Facilitate Physiological Awareness?

In our limited sample, a strong and significant positive relation was found between the average biofeedback score and the coherence between low-frequency HRV and respiration in a session [r(68) = 0.72, $p < 0.001$]. A smaller positive correlation was also found for low frequency HRV [$r_s(68) = 0.47$, $p > 0.001$] but not for high frequency HRV [$r_s(68) = 0.15$, $p = 0.212$]. Hence, biofeedback scores correlated strongly with breathing induced fluctuations in HRV, a resting function index (Shaffer et al., 2014; Hayano and Yuda, 2019).

To evaluate the participants' self-awareness of physiological control during the training process, the differences between the self-rating of physiological control and the objective biofeedback score are plotted in **Figure 2D**. A fast reduction in differences (overestimation) can be seen in the first half of the training process, with a notable yet short-lived increase in difference once online biofeedback was removed for the first time in session 4. Thus, subjects became considerably more accurate in their assessment of their physiological control over the course of the training.

Additionally, the answers given to the pre- and post-questionnaires (see **Supplementary Material 5**), indicated that the participants mentioned breathing more after biofeedback sessions, both in the pre-test phase before the session (from five subjects in session 1 to all nine subjects in session 3) and in the post-test phase when debriefing (from four subjects in session 1 to eight subjects after sessions 2 and 3). Thus, biofeedback sessions successfully increased attention to breathing control.

Does the Behavior in Our Application Follow Expected Patterns Relating to Response Inhibition Under Stress?

The distribution of correct and incorrect decisions in the game is presented in **Figure 3** (see **Supplementary Table 6.1** in **Supplementary Material 6** for details). Results showed that misses were by far the most likely type of mistake and police trainers avoided to make false alarm responses (**Figure 3A**). Over time, participants steadily increased in accuracy (sensitivity) as assessed by d prime (d'; **Figure 3B**), while their response bias (criterion) remained stable and conservative (**Figure 3C**). Interestingly, d' tended to be lower in sessions with biofeedback. Lastly, we investigated dispatch priming. As shown in **Figure 3D**, a higher proportion of friendly targets being shot (FA) was composed of targets whose large identifier (body type) was announced as presumably hostile in radio dispatch.

Goal 2: Training Validation

Biofeedback Score

The average biofeedback scores per participant are depicted in **Figure 4A**. The overall biofeedback score was $M = 0.077$ (SD = 0.16) in the first session (A_1), increasing to $M = 0.497$ (SD = 0.279) across all sessions with online biofeedback (B phases) and to $M = 0.460$ (SD = 0.266) across the subsequent sessions without online biofeedback (A_{2-5} phases). Six participants (2,4,6,7,8 and 9) showed higher biofeedback scores in B-phases (sessions with online-biofeedback), whereas three participants (1,3 and 5) had a higher average biofeedback score in A-phases (see **Supplementary Material 3** for details).

Evolution of Heart-Rate Variability

We here illustrate how beneficial the breathing-based biofeedback training is to influence HRV through RSA modulations. In **Figures 4B–D** the evolution of the low and high frequency components of HRV, and the coherence between low frequency HRV and the breathing pace are presented. While the low frequency HRV-breathing coherence (**Figure 4C**) parallels the increase over time shown by the breathing biofeedback score, displayed in **Figure 4A**, quite accurately, this pattern is less apparent for low (**Figure 4D**) or high (**Figure 4B**) frequency HRV. This indicates that our operationalization of the biofeedback parameter as a paced breathing reward successfully promoted higher coherence between the breathing and the HR (Shaffer et al., 2014; Schwerdtfeger et al., 2020), an index of resting function (Hayano and Yuda, 2019).

Single-Case Experimental Design Analysis

The within and between session evolution of each participant's breathing biofeedback score (indicative of breathing control) is presented in **Figure 5**. Trend lines revealed that every subject showed a positive trend with increasing breathing biofeedback scores over time for both A and B phases, except subject 4 who showed no improvement in the B phases (red lines). Subjects 1, 3 and 5 displayed a particularly steep learning pace. Interestingly, those are also the subjects with a higher biofeedback average in A-phase sessions than in the B-phase ones.

Data Overlap

To assess the influence of the breathing biofeedback presence (on or off), changes in breathing biofeedback score were related to the addition or removal of biofeedback by means of Kendall's tau (**Table 2**). Results indicated a consistent positive effect of the addition of online biofeedback across subjects (A to B phase). Out of 36 individual transitions where biofeedback was added, 25 transitions were found to be positive and significant, with four subjects (2, 5, 8, and 9) each having three significant effects of non-overlap and a significant meta-effect when all A-to-B contrasts were merged, thus reaching formal criteria for a significant intervention effect. Importantly however, all nine subjects showed an effect in the same positive direction (**Table 2**). This suggests that, while there was a difference in the robustness of learning, participants generally improved in physiological control when online biofeedback was presented. Upon removal of biofeedback (B to A-phase), the pattern was more mixed. Out of 36 removal transitions, 14 transitions were found to be significantly negative. Only subjects 8 and 9 showed three significant repetitions of non-overlap, and only subject 9 had a significant meta-effect of withdrawal with in total six out of nine subjects showing a negative effect. Overall, the

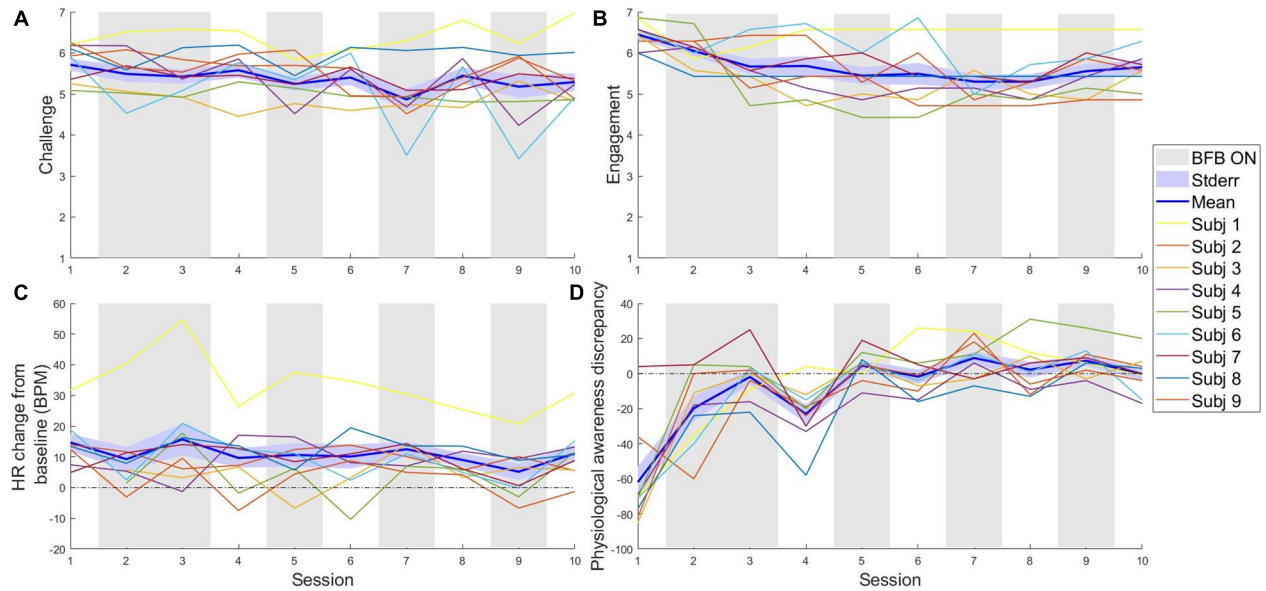

FIGURE 2 | Stability of arousal and engagement during the course of the training. Changes across the whole training in: **(A)** self-reported challenge (1 = very low to 7 = very high); **(B)** mean engagement (1 = very low to 7 = very high); **(C)** HR change, in BMP, from the 30 s pre-test baseline (the dashed line represents a null change); **(D)** Difference between the self-reported estimation of biofeedback control score after the VR task and the real score (range 0–100%; plotted value = real score—reported score). Stderr, standard error of the mean; BFB ON, Sessions in which online biofeedback was presented to the participants.

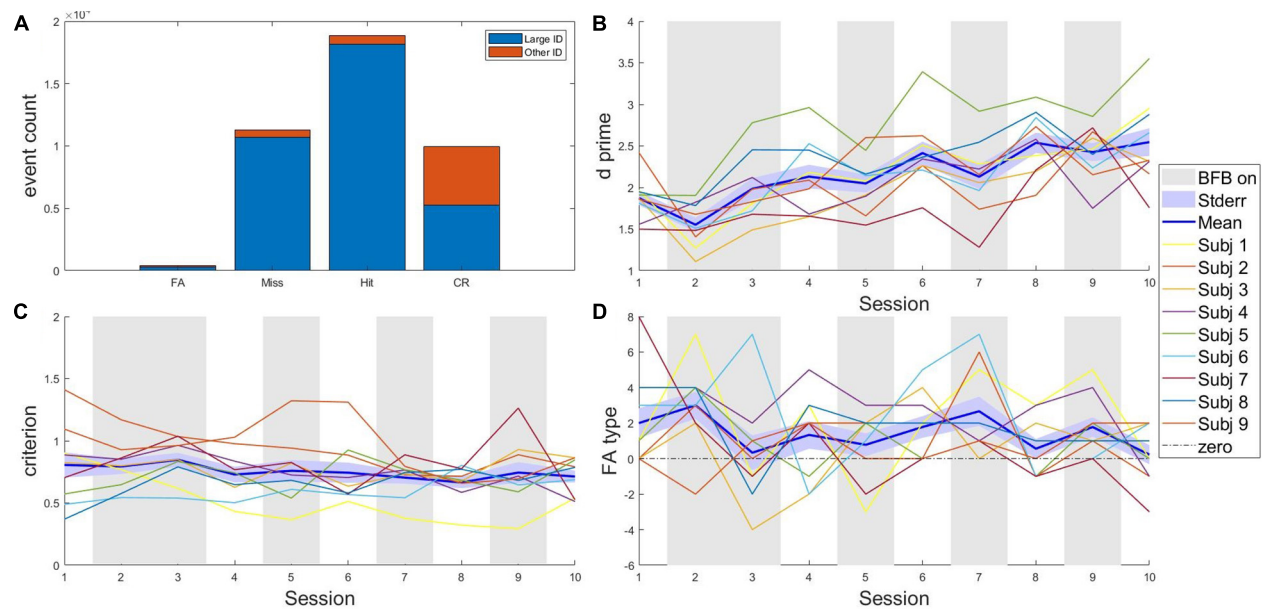

FIGURE 3 | Behavioral metrics (in-game). **(A)** Go/nogo action distributions across sessions and subjects. Columns are sub-divided according to the large identifier of the target related to the trial. **(B)** *d'* from signal detection theory indicating sensitivity to target type (hostile/friendly); **(C)** criterion from signal detection theory indicating potential changes in strategy **(D)** Difference score of false alarm depending on the body type (primed body type—unprimed body type); Hit, hit; CR, correct rejection; FA, false alarm; Miss, misses; large ID, has the primed body type, announced as presumably hostile in radio dispatch; other ID, does not have a body type announced as presumably hostile in radio dispatch; BFB on, Sessions in which online biofeedback was presented to the participants; Stderr, standard error.

results support a causal effect of the biofeedback experimental manipulation, with seven participants (1, 2, 5, 6, 7, 8, and 9) showing a minimum of three significant non-overlap effects in the expected direction (Kratochwill et al., 2013). More elaborate SCED analyses can be found in the **Supplementary Material 3**, which according to formal SCED guidelines together indicated a moderate positive effect of our training procedure (Kratochwill et al., 2013).

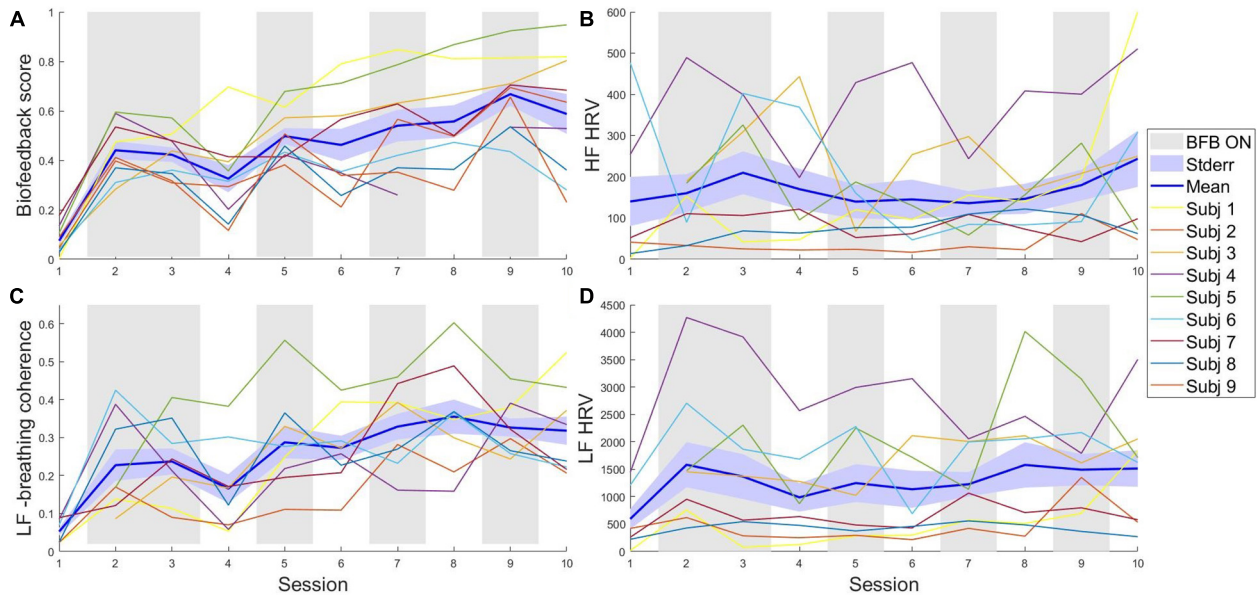

FIGURE 4 | Evolution of the breathing biofeedback score and the HRV indexes. Changes across the whole training in panel **(A)** the average biofeedback score; **(B)** the high frequency component of HRV (0.15–0.4 Hz); **(C)** the coherence between the low frequency HRV and breathing; **(D)** the low frequency component of HRV (0.04–0.15 Hz). BFB ON, B phases, where online biofeedback was presented; Stderr, Standard Error; LF-breathing coherence, coherence between the low frequency component of HRV and breathing; LF HRF, low frequency HRV.

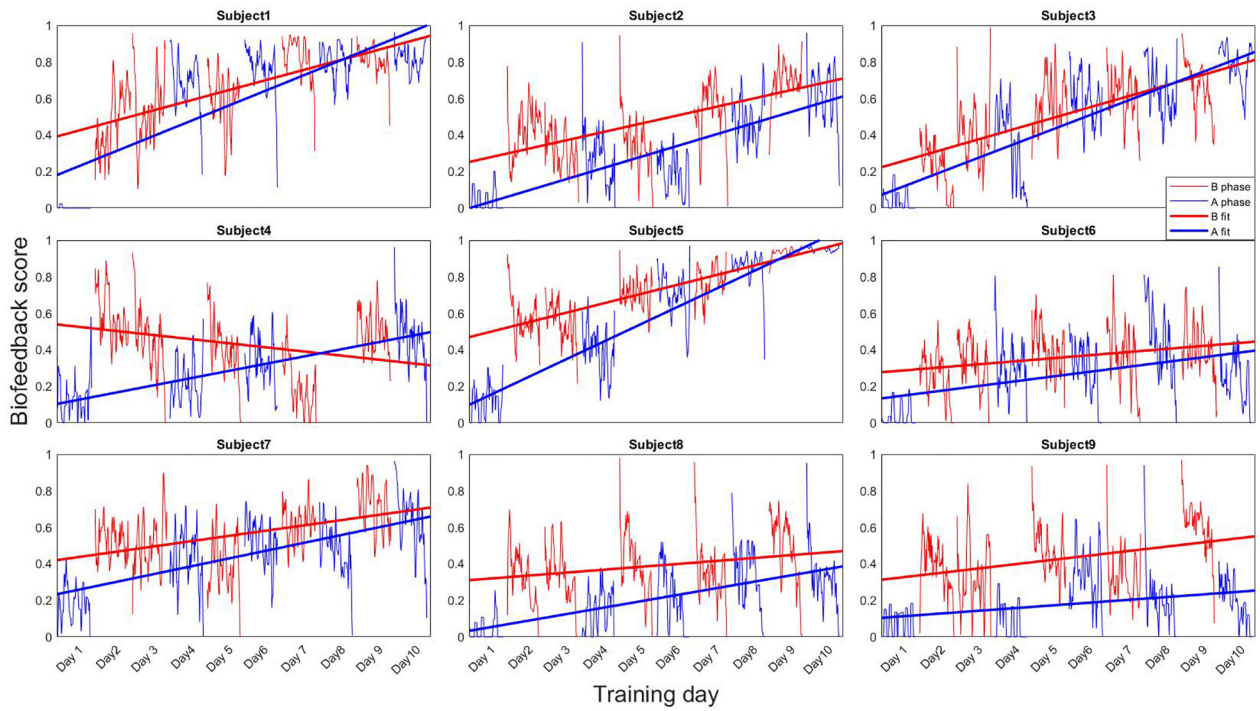

FIGURE 5 | Evolution of the breathing biofeedback score across the entire training period. Each datapoint represents the average biofeedback value for a 15 s epoch. Scores range from 0 (no adherence to the rewarded breathing pace) to 1 (perfect adherence to the rewarded breathing pace). B phase, breathing score for B phase sessions (Session 2, 3, 5, 7 and 9); A phase, breathing score for A phase sessions (Session 1, 4, 6, 8 and 10); B fit, fitted line for the B phase sessions; A fit, fitted line for the A phase sessions.

TABLE 2 | Kendall's tau non-overlap indices for consecutive sessions.

Subject	Kendall's tau									
	Addition (A-to-B phase contrast)					Removal (B-to-A phase contrast)				
	S1-S2	S4-S5	S6-S7	S8-S9	Meta	S3-S4	S5-S6	S7-S8	S9-S10	Meta
1	0.8***	−0.13	0.21**	−0.01	0.26	0.21**	0.27***	−0.16*	0.03	0.09
2	0.67***	0.16*	0.47***	0.29***	0.42*	−0.09	−0.3***	−0.12	−0.1	−0.15
3	0.53***	0.25***	0.08	0.06	0.25	−0.04	0.02	0	0.17*	0.04
4	0.6***	0.35***	−0.23**	*NaN*	0.26	−0.4***	−0.12	*NaN*	−0.05	−0.19
5	0.62***	0.37***	0.17*	0.35***	0.40*	−0.26***	−0.01	0.1	0.17*	0.004
6	0.52***	0.14*	0.11	0	0.21	−0.04	−0.17*	0.06	−0.24**	−0.09
7	0.47***	−0.03	0.12	0.29***	0.22	−0.05	0.13	−0.17*	−0.09	−0.04
8	0.62***	0.39***	0.25***	0.22**	0.39*	−0.34***	−0.3***	−0.02	−0.24**	−0.22
9	0.56***	0.61***	−0.02	0.49***	0.43**	−0.43***	−0.19*	−0.23**	−0.55***	−0.35*

*$p < 0.05$; **$p < 0.01$; and ***$p < 0.001$.

Gray cells indicate significant non-overlap between two consecutive sessions; i.e., S1-S2 = contrast between the first and the second session (the same applies for the other headings).

Meta, Overall effect, obtained by merging the effect-sizes of the single contrasts.

DISCUSSION

We aimed to validate the design of a novel biofeedback training tool for in-action physiological regulation in police. Our first goal was design validation. We found that the VR game was successful in creating an engaging, challenging, and arousing environment. Our in-game biofeedback implementation succeeded in improving physiological awareness. Moreover, behavioral metrics of performance indicated suitability for probing response inhibition and priming effects under stress. For our second goal, investigating the training effectiveness, we additionally found support for the trainability of deep-breathing by presenting biofeedback in-action. These results, while preliminary given the small sample, suggest the feasibility and promise of influencing physiological control in an active decision-making context with tools like our new VR biofeedback application.

One of the rationales for using a VR context to train physiological control was the possibility to evoke strong emotions (Parsons, 2015). As expected, self-reports indicated a high sense of positive challenge (see **Figure 2A** and **Supplementary Material 4**), but a low sense of threat. This result indicates that the game is a good learning environment as it is not perceived as too threatening (Jamieson et al., 2013), although this interpretation should be cautious given the tendency of police officers to underreport socially undesirable emotions (McCanlies et al., 2014; Habersaat et al., 2021). One additional possible explanation for the low threat score, as pointed out by Weerdmeester et al. (2020), is that the high level of challenge experienced by the participants throughout the training could partially be explained by the effect of biofeedback, which has been theorized to help participants better appraise threat into challenge since interoceptive signals of stress are dampened.

In terms of arousal, elicitation was successful in our VR environment as in-game HR increases from baseline were comparable to established stress induction protocols (see **Figure 2C**; Boesch et al., 2014; Vogel et al., 2015). However, we cannot establish the extent to which this arousal is of emotional nature or due to movement, as players were moving more during the game than at baseline. Yet, research by Gorini et al. (2011) showed effects of similar magnitude from exposure to a VR environment without participant movement.

We used VR to maximize the sense of engagement experienced by the participants, as it has been highlighted as an important non-specific factor fostering behavioral change (Holzinger et al., 2006). Engagement also helps with accurate recollection of the participant's physiological arousal (McCall et al., 2015), thus improving biofeedback learning. The high and lasting engagement in our sample (see **Figure 2B**) may be ascribed to the advantages of VR (Riva et al., 2007), but could also be partially explained by peer pressure to perform, as our participants were, on their own initiative, actively comparing their performance scores with each other, a common practice in the police forces (Chen et al., 2013). This behavior provides support to the idea that reporting police-relevant scores at the end of each session helps strengthen engagement.

Just as the scores helped the participants to engage in the training, it also helped them to better estimate their performance and enhance physiological awareness, as illustrated by the improvements in physiological scores estimation (see **Figure 2D**). Similarly, the integration of biofeedback as peripheral view modulation was successful in eliciting awareness of breathing, when evaluated by self-report in open-ended questions (see **Supplementary Material 5**). This "tunneled vision" is known to be a relatable phenomenon for police officers (Dirkin, 1983; Klinger and Brunson, 2009). Indeed, as shown by the participant's written reports before and after action, mentions of breathing-related elements increased throughout the training.

Regarding the behavioral metrics, despite the small sample, we could show preliminary evidence that behavioral measurements were suitable for individual performance indexes to be extracted, per session (see **Figure 3**). It is worth noticing

that decision-making stably improved throughout the training. Analyses of the mistakes showed preliminary evidence that priming the participants for certain targets' body types increased the chance for friendly targets to get shot when their body type partially matched the description, which is in line with priming tests performed in more realistic setups on police officers (Taylor, 2019). The game environment may therefore be suitable to investigate, in future studies, the *in-action* relation between physiology and response inhibition, as well as the effect of biofeedback on performance (Caballero Sánchez et al., 2016). Ideally, associations between in-game behavior and external measures of response inhibition under stress should be demonstrated in a larger sample, with a police relevant transfer condition, to further establish the validity of the in-game behavioral assessments. Importantly, in this game performance was affected by the biofeedback. Indeed, biofeedback was implemented as vision manipulation and thus could impair shooting and target recognition. A visual impairment linked to physiological measures created an artificial link between physiological control and behavioral performance. An illustration of this effect can be shown by fact that the sensitivity *d'* index tended to reduce in sessions with biofeedback. The artificial strengthening of the relation between physiology and behavior is a confound which, together with the changes in game difficulty during a session and the small sample available, made it difficult to investigate links between physiology and performance as have been previously reported (Hashemi et al., 2019). It is, however, anecdotally worth noticing that subject 5, the participant with the highest behavioral performance scores, was also the one with the highest biofeedback score in sessions without biofeedback. This transfer of physiological control skill to sessions where no online feedback on physiology was given suggests that successful transfer of breathing control skill may not come at the cost of reduced performance.

One of the main contributions of the current study was to investigate the proof-of-concept trainability of breathing biofeedback in an active context. Our results suggest that despite the fact that our subjects all received breathing-biofeedback in a classroom setup in the years preceding our experiment, no subject seemed able to control their breathing to satisfying levels prior to the introduction of biofeedback (see **Figures 4A**, **5**). Additionally, our results show support for the trainability in active contexts of deep breathing, thus extending previous evidence showing deep breathing trainability in passive VR contexts (Rockstroh et al., 2019), but also in breaks during real-life police training scenarios (Andersen et al., 2018). Trying to apply emotion regulation techniques *in-action* is not a new idea, and has been implemented with techniques like neurofeedback (Schoneveld et al., 2016), and even breathing biofeedback (Bossenbroek et al., 2020), albeit in a rather meditative VR context. To the best of our knowledge, this is the first attempt at rewarding deep breathing in real-time while immersed in an arousing and active decision-making context. Additionally, only a few participants reached a plateau in biofeedback training after ten sessions. It is therefore unclear when the training benefits of such technique would stop. This issue should be investigated in future research, since there are institutional pressures to shorten training for police officers, sometimes to the point of rendering them useless (Di Nota et al., 2021).

Importantly, although the deep breathing in an active context was shown to reliably increase due to biofeedback, one limitation of this study is that a positive effect of the training on parasympathetic dominance indices could not be demonstrated and should be further investigated in future studies. While no claim can be made regarding parasympathetic control of the heart due to the fact that the heart is controlled by many systems simultaneously (see Hayano and Yuda, 2019, for an overview), we did identify a potentially strong link between adherence to the required breathing pace and a resting function index (the coherence between breathing and low-frequency HRV), as well as with an index of low-frequency HRV. We found no association for high-frequency HRV, which has been linked to increased performance in decision tasks (Gamble et al., 2018) and is usually seen as an index of parasympathetic dominance. The lack of results in high-frequency HRV might have a methodological explanation, as standing has been reported to dampen this HRV metric (Srinivasan et al., 2002). Additionally, training deep breathing transfers the breathing-induced HRV fluctuations from the higher to the lower part of the spectrum, hence increasing low-frequency HRV, possibly at the cost of high-frequency HRV (Hayano and Yuda, 2019). While low-frequency HRV may in fact be driven by parasympathetic nervous system activity during slow breathing (Kromenacker et al., 2018; Schwerdtfeger et al., 2020) it does not allow claims about the influence of the parasympathetic nervous system. Moreover, we found no consistent increase in either low or high frequency HRV across training, only in coherence. While coherence has been linked to improved cognitive and emotional function (Mather and Thayer, 2018; Schwerdtfeger et al., 2020), it is not possible, with the current dataset, to assess if the specific effect we report here is effective in producing such cognitive and emotional improvements.

The present study has other limitations, like the lack of a dedicated breathing pace baseline recording. Mostly, this study is limited due to the small sample size, which prevents not only inquiries on efficiency and training output (Smith and Little, 2018), but also on the interaction between behavior and physiology. A larger and more diverse sample, combined with a non-VR transfer task, would allow us to test the extent to which the training in VR transfers to physiological and behavioral patterns observed in real life, which is a critical test to evaluate the generalizability of the VR measures (Miller et al., 2019). A last limitation is the fact that our sample was, years prior to our training, exposed to a stress reduction course containing psychoeducational material and a short biofeedback session, as part of the mandatory training of all police officers in Netherlands. However, the lack of evidence that the previous training and exposition to psychoeducational theories (that have a high prevalence in police curricula) had any effect in session 1 made us consider it as a non-confounding factor.

In terms of future work, our VR game could also be used to investigate the dynamical interaction between physiological

state and decision-making in a more complex and engaging environment than traditional laboratory assessments. Indeed, little is known about the effectiveness of physiological control in the variety of phases through which police action evolves. While a fully realistic VR setup would contain too much variability and dimensions to measure performance reliably (Brehmer, 1992; Michela et al., 2019), testing well-known scientific measurements of decision-making in dynamical interactions could prove invaluable to relate performance and physiological control, but also to further investigate the external validity of those paradigms (Flake et al., 2017). Additionally, we recommend future studies to individualize the biofeedback target to the player, thus rewarding the breathing frequency and associated strategy that more efficiently raises HRV, rather than a fixed target like in the present study. Lastly, the output data includes positional tracking, and could be used to investigate potential movement confounds in the HRV measurement. More information on the ways movement can perturbate HRV biofeedback can be found in our implementation oriented publication (Brammer et al., 2021).

To conclude, while the generalizability of the results presented here needs to be assessed in future studies with larger samples, the present study showed the promise of a VR game to train physiological regulation in an arousing, police-relevant decision-making context. In addition, there seems to be support for targeting the behavioral action mechanisms that were included in the VR game. Our VR design opens new potential avenues for testing the impact of priming, arousal, and physiological control on (police-relevant) behavior in a more naturalistic context than traditional laboratory experiments. It will be important to design future studies to not only assess whether the VR game impacts decision-making under stress for police officers, but also if the physiological mediators of these effects are indeed the same that are targeted in the training.

DATA AVAILABILITY STATEMENT

The datasets presented in this article are not readily available due to privacy concerns, since the dataset contains performance indexes of police officers. Requests to access the datasets should be directed to the corresponding author, abele.michela@gmail.com.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by Ethics Committee Social Science, Behavioral Sciences Institute Nijmegen, Thomas van Aquinostraat 4, ecsw@ru.nl. The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

AM, AN, FK, and IG wrote the first draft of the manuscript. AM, JB, JP, MR, WD, KR, FK, and IG conceptualized the VR environment and experiment. WD provided the theoretical policing framework. WD and AS coordinated data collection. JB, JP, and RO conceptualized and implemented the biofeedback. AM, AN, and JB collected the data. AM, AN, JB, MR, and FK analyzed the data. All authors reviewed and contributed to the manuscript. KR, IG, and FK recruited funding for the project.

FUNDING

This work was supported by the NWO Creative Industry grant #055.16.139 2795 and CbusineZ. The funders were not involved in the study design, collection, analysis, interpretation of data, the writing of this article or the decision to submit it for publication.

ACKNOWLEDGMENTS

We would like to thank the police trainers from the Sevenum IBT center for their time and dedication. We would also like to thank Ken Koontz (https://www.kenkoontz.com), Erik van den Berge and Thijs Doornbos for their design and implementation work for the VR environment.

SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpsyg.2022.806163/full#supplementary-material

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Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

frontiers in Education

ORIGINAL RESEARCH
published: 10 February 2022
doi: 10.3389/feduc.2021.771629

"It has Changed, Quite Clearly." Exploring Perceptions of German Police Trainers on Police Recruits

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The individual views and attitudes of trainers responsible for equipping police officers for operational demands have rarely been subject to international research. Geared toward the German situation, the following *case study* focuses on the particular question of how police trainers at a German state police training site perceive police recruits as the target group of their coaching. The data set consisted of $n = 8$ interviews with police trainers who were originally conducted with the aim to investigate their expert opinions on pedagogical, training-related issues. Within the process of inductive coding, the perceived recruit condition emerged as a high-order theme, displaying a predominantly deficit-oriented view among police trainers. The findings are discussed through the lens of the concept of *critically reflective practice*, in which the reflection of the views and guiding assumptions of the police trainers is seen as a key ingredient for a further professionalization of the police trainer education and its respective research.

Keywords: police training, police recruits, reflective policing, subjective theories, professionalization

OPEN ACCESS

Edited by:
Craig Bennell,
Carleton University, Canada

Reviewed by:
Christopher Cushion,
Loughborough University, United Kingdom
Peter Shipley,
Kinetic Defense Systems, Inc., Canada

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Specialty section:
This article was submitted to Educational Psychology, a section of the journal Frontiers in Education

Received: *06 September 2021*
Accepted: *14 December 2021*
Published: *10 February 2022*

Citation:
Koerner S and Staller MS (2022) "It has Changed, Quite Clearly." Exploring Perceptions of German Police Trainers on Police Recruits. Front. Educ. 6:771629. doi: 10.3389/feduc.2021.771629

INTRODUCTION

For police training, institutionalized within police organizations around the world, police trainers play a decisive role (Staller, 2021). Their role-specific actions are supposed to prepare police officers for the complex demands of front-line policing (Birzer and Ronald, 2001; Blumberg et al., 2019). While police training has recently attracted a remarkable amount of scientific attention (Birzer and Ronald, 2001; Andersen et al., 2015; Renden et al., 2015; Nota, 2019; Mcneeley and Donley, 2020; Bennell et al., 2021), the pedagogy of police training, the role of police trainers, and more specifically their views on police training and related pedagogical issues have received only marginal attention so far (Cushion, 2020; Koerner, 2021; Staller, 2021).

Staller, et al. (2021a) investigated sources and types of knowledge of 163 police trainers from Germany and Austria, identifying a perceived need for pedagogical knowledge and a preference for nonformal and informal sources of knowledge acquisition. For the United States, Preddy et al. (2020) have examined the views of 317 police trainers on cognitive readiness in the context of violent police-citizen interactions. Data indicate a perceived lack between the capabilities and operational demands of the officers during violent encounters.

In the course of engaging with data from an interview study with police trainers in Germany, which was originally aimed at exploring pedagogical issues of training through the lenses of the persons in charge, using an open methodological approach (Körner et al., 2019), the analysis revealed an unexpected thematic focus on the perceived condition of police recruits: Within the reconstructed perceptions of the trainers, a deficit-oriented view on learners emerged, which was in turn comprised

of the categories of "social," "psychological," and "physical" aspects. In addition, the views of the trainers on female recruits revealed a gender bias.

Based on this unexpected thematic focus in the existing data set, we present the results as they relate to the perceived condition of police recruits in more detail. We then discuss these within the broader framework of the *critically reflective practice* of Brookfield (Brookfield, 1998, Brookfield, 2017), arguing for the decisive role of police trainers and their views play within the context of a further professionalization of police training as an institution of professional teaching and learning. Due to their specific origin, we start by outlining the methodological context from which said findings on the perception of the trainer of police recruits emerged.

MATERIALS AND METHODS

Method Selection

Similar to the international situation (Basham, 2014; Cushion, 2020; Preddy et al., 2020), the research on German police training using the perspective of pedagogical issues is still in its infancy (Koerner, 2021; Staller, 2021). Methodologically, for the purpose of exploring and mapping presumably important issues of a given field of interest, qualitative research has proven functionality (Flick, 2018), delivering insights form subjective perspectives and interpretations. In our case and due to the initial access to police trainers at a central state police training-site, semi-structured expert interviews have been conducted (Bogner et al., 2014) to serve the aim of qualitative exploration. Since experts are associated with professional role play and (are said to) possess "technical, process and interpretative knowledge that relates to his or her specific professional or occupational field of action" (Bogner and Menz, 2005, p. 46), police trainers represent a valuable knowledge resource for the exploration of central aspects in the field of police training. For the case study, two preliminary guiding assumptions were made: First, as an institutionalized teaching and learning setting, police training is of pedagogical relevance (Cushion, 2020). Second, within this setting and its function, the role and views of trainers form the basis for the exploration of this specific field of interest (Preddy et al., 2020).

Data Collection

Due to the initial character of our research, along with organizational matters (time available during duty), the sample size was determined by accessibility rather than by information power (Malterud et al., 2016). A total of eight police trainers (m = 7; f = 1) teaching police recruits within the bachelor degree program at a central training site of a German state police had been interviewed. The number of interviewed police trainers represented the total of police trainers we were granted access to. Based on the strong dialogue developed by the researchers with the police trainers, it was deemed that a small sample size would hold sufficient information power (Guest et al., 2006). Taking into account the fact that police training in Germany has hardly any connections to scientific research yet, as well as the fact that there is a documented skepticism in police to take part in scientific studies (Jasch, 2019), the sample size was deemed satisfactory.

The trainers had a mean age of 39 (SD = 5.95) and an average of 7 years (SD = 3.45) of experience as a trainer. The interview guide was comprised of 24 questions, aiming to gather biographical background data on the police trainers, as well as to create an opportunity for them to provide information about different aspects of training, e.g., with regard to their favorite methods of delivery, including instruction and feedback, or their understanding of their own role as police trainers. The semi-structured regime ensured orientation along the topical domains, at the same time enabling flexible follow-ups and probes of the interviewer to statements of the police officers. The interviews lasted between 35 and 65 min. Informed consent was obtained from all trainers before each interview. The interviews were conducted in German, audio-recorded, and subsequently transcribed verbatim (Kuckartz, 2014). For the purpose of publication, quoted passages were translated to English.

Data Analysis

In order to support scientific rigor and credibility of the findings (Tracy, 2010), the data analysis followed procedures of qualitative thematic analysis (Braun and Clarke, 2006; Graneheim, 2017) utilizing MAXQDA software (Kuckartz, 2014). The analytical strategy was chosen according to the objectives of the study. Due to the rather open approach to the field of interest, which served as a first qualitative exploration of pedagogically relevant aspects of police training from the perspective of trainers, the data-set was subjected to a data-driven, inductive thematic coding (Biddle et al., 2001; Graneheim, 2017), allowing for emergent information and had been "irritation through data." Inductively, meaning units relevant to the topical issue were identified and assigned to further (sub-) themes (Biddle et al., 2001; Braun and Clarke, 2006; Graneheim, 2017).

Within the inductive coding strategy, the database had been analyzed and clustered into *raw-data*, *lower-order*, and *higher-order themes*. Raw-data themes were derived from the coding of relevant meaning units within the database. Identity in focal meaning (e.g., "basic *coordination* is *not* present," police officer 01/"You *can't* challenge them anymore, so *coordination*, for example gymnastic elements," police officer 06) led to the creation of raw-data themes comprising the generalized meaning (e.g., "lack of coordinative skills") allowing for the further subsumption of similar units under the existing theme, while the difference in meaning led to the creation of a new theme (e.g., "lack of motivation," derived from "people are not motivated," police officer 05). The coding guide created after a first coding pass of the whole data set was applied to the entire dataset in a second pass in order to ensure complete analysis.

In a next step, raw-data themes were coherently built-up into lower-order themes by generalization of their focal meaning (e.g., "lack of coordinative skills" to "physical deficiency" due to its *physical* nature). The set of lower-order themes had been re-examined by the second author and consented between both researchers using question and debate (Abraham et al., 2006). Subsequently, the sub-themes were generalized on a further

TABLE 1 | The perception of the police trainers of the condition of the police recruits (numbers in column after raw-data theme denote number of participants contributing to the raw-data theme; within lower-order and higher-order theme, numbers in brackets denote the total number of meaning units).

Higher-order	Lower-order	Raw data theme	*n*
Deficit (27)	Physical deficiency (14)	Snivelling	1
		Lack of coordinative skills	5
		Lack of conditional skills	2
		Women disadvantaged	6
	Psychological deficiency (8)	Lack of motivation	4
		Lack of concentration	2
		Lack of attitude	1
		Indifference	1
	Social deficiency (5)	Lack of discipline	3
		Like little children	1
		Do not take training seriously	1
Cause (5)	Social change (4)	Situation has changed	1
	Education (1)	Media impact	3
		Soft approach	1
Potential (8)	Engagement (5)	Motivated in training	1
		Mostly interested	1
		Fun in training	3
	Ability to learn (2)	Surprise with qualities	1
		Interest in exploring boundaries	1
	Social competence (1)	There for each other	1

abstraction level of meaning and built-up to higher-order themes (e.g., "physical deficiency" and "psychological deficiency" to "deficit" due to their *difference* in mode but *similarity* in being deficit oriented). High-order themes were again critically evaluated by the second author and finally set.

At the level of raw-data, the themes were quantitatively numbered according to the frequency of their mentioning by single participants, respectively, according to the overall prevalence of meaning units at the level of lower-and higher-order theme. Although "the 'keyness' of a theme is not necessarily dependent on quantifiable measures" (Braun and Clarke, 2006, p. 82), the number of mentions is key in those cases, in that it "captures something important in relation to the overall research question" (ibid.).

RESULTS

When asked to examine 1) what they as police trainers like and like less about police training and 2) which situations in training they perceive as pleasant or as difficult, issues related to the *recipients* (n = 31 meaning units) of the training gathered by far the greatest number of thematic appearances, even more than the problematic issues of resources (n = 16 meaning units) and working conditions (n = 7). Interestingly, 27 out of the 31 meaning units were grouped around the deficient constitution of police recruits. In view of this dominance of deficit aspects, we reinvestigated the entire data set looking for meaning units referring to the condition of police recruits.

Three higher-order themes emerged from the data analysis that are presented in **Table 1**: 1) deficits of police recruits, 2) causes for perceived deficits, and 3) potential of police recruits.

In the perception of trainers, the *engagement*, *learning ability*, and *social competence* of the recruits denote their potential. As a *higher-order theme*, however, the potential of recruits (n = 8) appears in qualitatively significantly lower differentiation and quantitative expression within the interview data compared with the deficit theme (n = 27).

While the view of the coaches on police recruits seems to be less associated with their potential, their deficits dominate the perception of their trainers. Within this complex, *physical deficiency* represents the largest thematic unit, mainly seen in a lack of coordination and condition/fitness in police recruits. As one police trainer puts it:

> Or take the area of self-defense, coordinative things, of course injuries often occur here because this basic coordination, which one actually assumes that every police applicant should have, is actually not there. Many things are missing. Of course, that's because you've never climbed anywhere in your life or done other physical things. Maybe you just sat at home in front of a computer game and tried to master something, but you didn't/weren't whistling through the forest, jumping from tree to tree. It has changed, you have to say that, quite clearly (I: Mh.) And then, of course, there are more and more injuries, because things that you assume should be there are not there (PT 01).

In the perception of this police trainer, contemporary recruits fail to meet the expected physical standards for police training. According to this point of view, the negative condition is *caused* by modern times and the according lifestyle, consisting of the use of modern media and a decline of playful natural movement in childhood, eventually leading to consequences of injury in training and the need to implement basic coordination exercises, e.g., "running backward up the stairs" (PT 01). Recruits do not have what they should have and used to have

back in the days: "*It has changed, . . . quite clearly.*" This change in condition is also reported by another trainer, a prerequisite which, for instance, is making the teaching of appropriate restraint techniques challenging.

> And it's not getting better because the material is getting worse. So, I say the students (I: Ok.) You can no longer demand as much of them like that and you have to pick them up where they are. And then you have to cut back. Because you simply can't do these exercises, for example, coordination, gymnastic elements. We always do the TKF, this hold in the floor position, but if you have no coordination and if you have no strength and no assertiveness, then even the technique is of no use (PT 06).

In the view of trainers, recruits appear as deficient modes of their ideal version. This perception is reinforced by deficits in motivation and concentration during police training, building the theme of psychological deficiency (see **Table 1**). The lack of motivation and attention of the recruits within the teaching process are perceived as burdensome, for instance negatively effecting the emotional state of the trainers. One police trainer states as follows:

> When you notice that some of the people are not motivated, they don't listen to you at all. You say something now and then at some point I'm also not motivated. You quickly notice my mood then (PT 05).

Additionally, and related to motivational issues, deficits in the domain of social behavior contribute to the negative complex, as it can be viewed in this statement of a police trainer:

> Sometimes there's an admonition if someone doesn't really want to run on track. The discipline among the young colleagues is different in contrast to my training back then, basic training. . . We didn't have to salute any more, that used to be the case with the police, but then there was silence. When in the frontline the announcement was made and then they all stepped away. There is a lack of discipline. I don't know what the reason is, it may be the generations that now come to the police. Maybe it's a tougher approach, in my eyes that could be helpful, here and there (PT 03)

The lack of discipline in young trainees, which is stated here appears as a recurring theme within the data-set, and again, the deficit is compared with its better version, which once more is located in past times of a more disciplined generation of apprentices. Furthermore, in accordance with the point of view of the trainers, a sensible cause of action to deal with inappropriate social behavior would be a tougher approach to teaching and learning within police training, which might in turn fix the problem of discipline.

Additionally, within the thematic complex of the deficiency of the recruits, a gender bias emerged within the data.

> Yes, and what we try to pass on to the students, who come to us completely clueless, who have never had anything to do with anything, especially the girls, who have never had anything to do with this kind of contact, is to make it clear to them that it is really important to defend oneself outside or to effectively support a colleague during an arrest (PT 08).

Female police officers are seen as "supporters" in the context of deployment, compared with their male colleagues who supposedly carry out the actual work. Labeled as "girls," the overall condition of females and suitability for operational requirements, especially when it comes to physical confrontations, are called into question by the trainer. In this point of view, female police recruits are perceived as rather incapable and as inexperienced learners. They appear to be deficient beings with special needs that have to be met in a compensational manner through training:

> Especially women, who are considered the weaker sex here or so. They cannot always hide behind it . . .of course they are physically disadvantaged, but eh there are simply certain things that you can train and that you also have to train. (PT 08)

According to this view, female police recruits are considered as members of the "weaker" sex within the domain of police training. Interestingly, it is not this depiction itself that is further problematized here. On the contrary, in this statement the image of a weaker sex is reinforced by referring to generalized physical disadvantages of women. Even more importantly, the statement suggests that this view appears to be a shared opinion among police trainers and police organizations, and that it is seen as an excuse for female police recruits to hide behind.

In conclusion, initial qualitative interview data led to unexpected explorative findings broadening the perspective of pedagogically relevant issues in police training. The analysis of expert views provided by police trainers at a central German training site for police recruits revealed a predominant perception of physical, psychological, and social deficiency, which is linked to changes in society as a whole, presenting pressing concerns in police training. In contrast, the potential of said students was less emphasized.

DISCUSSION

The findings on the perceptions of the police trainers of their clientèle can be contextualized and discussed on several different levels.

First, the deficit themes that emerged from the data could be interpreted as a more or less representative depiction of reality and objective conditions. Taking this *objective* approach, the deficiency of police recruits in physical, psychological, and social areas regard has to be met in training and become the subject of compensatory education (Luhmann ans Schorr, 1979a). According to this perspective, issues of appropriate teaching and the design of learning environments according to

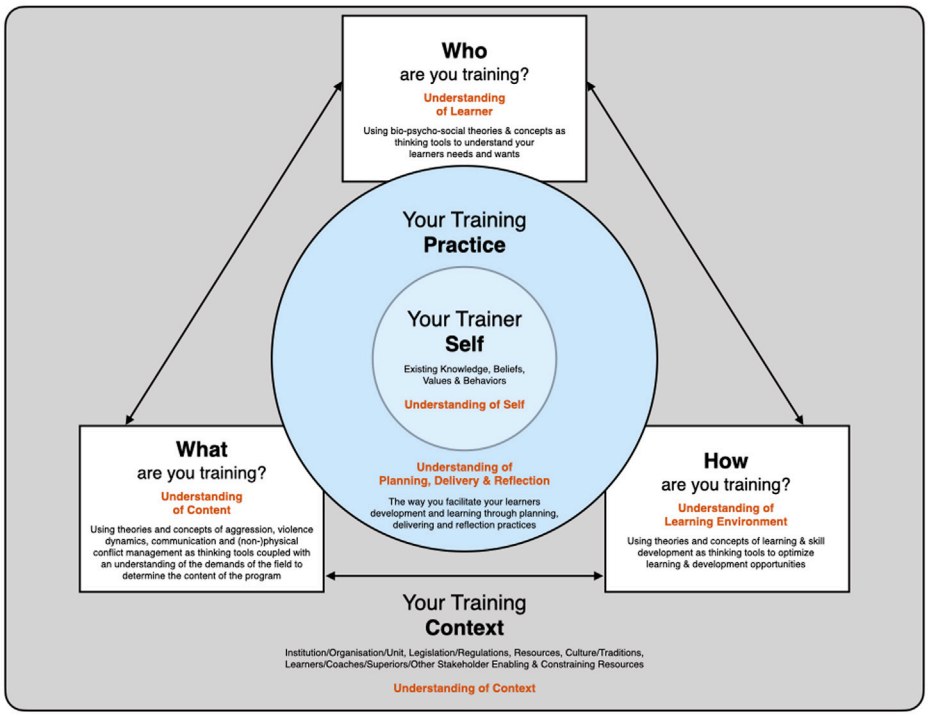

FIGURE 1 | Professional coaching model (Staller, 2021).

the model of professional coaching (Staller, 2021) are deemed relevant (see **Figure 1**). If, for instance, police recruits lack the ability of running up stairs backward, or to perform mandatory restraint techniques (see quote above), structured coordination exercises and fitness programs must be implemented in training as compensatory measures for the creation of a motor-related baseline to work with (Blumberg et al., 2019). In a similar vein, compensatory attention and education must then be given to female police recruits because of their "physical disadvantages."

According to the model in **Figure 1**, problematic and heterogeneous prerequisites within the learners (*Who-Dimension*) affect and determine the selection of contents (*What-Dimension*) that meet the demands of the learners. Furthermore, deficits in motor skills, motivation, or discipline also have an influence on the decisions of the trainers on how to teach (*How-Dimension*). For instance, heterogeneity of physical pre-conditions in the learning group may call for the within-differentiation of exercises along with individualized instruction and feedback strategies, as applied in physical education (Ruiz-Pérez et al., 2018). Moreover, disciplinary problems as perceived by the trainers may raise the question of whether more (or less) authority (Omer et al., 2010), and which kind of authority (Reichenbach, 2009) within the personal teaching style, is appropriate and serves as a possible solution (or as the problem). Within the objective approach, general recruits' as well as specific gender-based deficits are taken for granted. They are perceived as entities at hand, and as such, they call for action.

Second, the deficit themes that emerged from the data could be observed through the lenses of pedagogical paradigms. In this *conceptual* approach, the pre-dominant orientation toward deficits could be confronted by implementing an alternative: a *pedagogy of potential*. In this perspective, declarative knowledge as well as the ability to distance oneself from one's views is the basic prerequisite trainers have to fulfil. The practice and reflection on education is historically grounded in a semantic of human deficits (Luhmann and Schorr, 1979b; Valencia, 1997), especially within the history of physical education (Koerner, 2020). Pedagogical endeavors, even nowadays, do not seldom start with the deficit premise—that something is not yet as it should be (Paschen, 1973, 1988). If children do not partake in enough physical activity (Finger and Lange, 2018), the resulting deficits should be resolved, for instance through physical education (Koerner, 2008a).

However, the traditional pedagogical premise of deficits is neither without alternatives nor unchallenged. Looking at learners in a different way, the *pedagogy of potential* turns the perspective around (Oelkers, 2001). In large parts of modern pedagogy, a potential-oriented view has prevailed, even when the initial conditions deviate from a socially constructed normality, as is the case in the field of special needs education (Kozulin, 2015). At the same time, this orientation toward potential is by no means exclusively the expression of normative hopes that miss the mark.

The call for potential is empirically supported. On the one hand, learners are inherently endowed with a broad range of hard-wired potential. These are for example grounded in neurobiological degeneracy (Orth et al., 2019), allowing to yield the same goal and output in different behavioral ways. In the area of movement coordination, learners have an incredible

number of degrees of freedom at their disposal when it comes to the use of joints and muscles in a targeted manner (Schoellhorn et al., 2012). On a social level, concerning the German situation, it is evident that never before have so many people been engaged in organized sports (DOSB, 2020). In addition, the area of informal sport culture, popular especially with younger people, has grown remarkably in recent decades (Gugutzer, 2004). So, it may be true that nowadays more people, and even police recruits, have not "jumped from trees" (see quote above) as much as their predecessors did in their childhood days, but as a matter of fact, the new generation does different things differently—what can be viewed either as deficit or as a potential. On the other hand, pedagogical research indicates that deficit-oriented views on learners, as well as certain pedagogical practices, can both lead to negative consequences (García and Guerra, 2016; Smit, 2012; Valencia, 1997).

The orientation toward either deficits or potential is a crucial part of the professional action and reflection of a trainer. The respective conceptualization of the learners is a difference that makes a difference: a difference in view, a difference in the chosen course of action, and eventually, a difference in outcome (Koerner, 2008b). If two police trainers are teaching the same recruit, depending on their pedagogical orientation, they are likely to set a different focus of attention and are likely to evaluate the observed aspects in different ways. For the potential view, this may include the opportunity to evaluate deficits, e.g., in motor performance or discipline, as a potential for personal growth and development. The question of basic pedagogical attitudes is paradigmatic, referring to the dimension of self-reflection within the model of professional coaching (*Dimension of Trainer-Self*). The self-dimension advocates for the reflection of the very premises that underpin the model of the learner and the learning process of a trainer (Chow et al., 2016). This leads to a additional view on the empirical findings.

Third, the deficit themes that emerged from the data could be interpreted through the lenses of *subjective theories*. Subjective theories refer to implicit and explicit beliefs about the world, including its people (Nespor, 1987). As filters of perception (Weinstein, 1990), subjective theories are of high functionality for the reduction of real-world complexity, which serves as a premise for dealing with it: They structure the relationships of the subject to the world by shaping his or her perception and interpretation of situations and persons (Borko and Putnam, 1996). As school research has shown, subjective theories act as key agents of teachers' professional actions (Baumert and Kunter, 2013; Mandl and Huber, 1983). Empirical data indicate that subjective theories about the subject as well as the learners affect the actions of the teachers and, thus, also indirectly the learning process of the students. They are of considerable significance for lesson planning (Bromme, 1986), control the perception of teaching processes, especially of critical teaching situations (Wahl, 1981), and have substantial effects on classroom management (Stipek et al., 2001).

In line with scientific theories, subjective theories serve to predict, explain, justify, and evaluate one's own as well as the actions of others. In contrast to scientific theories, subjective theories do not have to meet scientific criteria (Eynde et al., 2002). They are rather the result of socialization (Calderhead and Robson, 1991) than of methodically controlled observations. Being foremost derived from one's own learning biography in school as well as other learning institutions, subjective theories are believed to be true (Nespor, 1987) and resistant to change (Lasley and Thomas, 1980). As such, subjective theories mostly contain implicit assumptions (Mandl and Huber, 1983) that in a professional scientific manner need to be acknowledged as the axioms of the trainer-self, guiding his or her practice of planning, delivery, and evaluation of training (see **Figure 1**).

In terms of professional trainer action, subjective theories and their underlying assumptions have to be aligned with scientific knowledge and corrected if necessary. Within the framework of *subjective theories*, the perceived deficits of police recruits are not taken for granted, as is the case in the objective approach. Rather, the views of the trainers are analyzed by referring to the underlying assumptions that (may) guide those views. By doing so, subjective theories literally call for a *reflective turn* within the professional action of police trainers.

In summary, all three approaches are based on declarative knowledge structures. The *objective approach* requires solution-knowledge since the perceived problem itself is not problematized, but set. If recruits show physical deficiencies, structured fitness exercises are needed for compensation. The approaches of *conceptual orientation* and *subjective theories* call for higher-order declarative knowledge. Both perspectives do not start from the object of perception, but focus on perception itself and relate it to its *guiding premises and assumptions* (Brookfield, 2017). The pedagogy of potential makes different assumptions about the learner and the learning process than deficit-orientation does. Additionally, both approaches contain different expectations on delivery and outcome: Whereas deficit-orientation leads to a practice of compensation, potential-orientation leads to a practice of growth and development in police training.

The approach of *subjective theories* starts at an even more fundamental level and investigates all the assumptions that guide the actions of the trainer. This is analogous to our recent proposal for *reflective policing* (Staller et al., 2021b), in which we introduced the uncovering of individual paradigmatic, prescriptive and causal assumptions as a part of professionalism based on Brookfield's *critically reflective practice* (Brookfield, 2013). The conceptual, as well as the approach of subjective theories, are both components of a reflective practice of trainer action. The reflective practice focuses on action and reflects on their consequences (future direction) and premises (past direction). Thereby, reflective practice is based on the assumption that—analogous to findings in school research (Hattie, 2011)—in police training, the *trainer matters*, including his or her views on the learner.

The pedagogical views, orientations, and guiding assumptions of police trainers do not exist in a vacuum. They are, among other things, embedded within a police culture (see context-dimension, **Figure 1**) that reproduces

itself in applying them (Behr, 2006; Chapell and Lanza-Kaduce, 2010; Behr, 2017; Gutschmidt and Vera, 2020). Through a reflexive analysis of pedagogical approaches and assumptions, this cycle can be made visible and, if necessary, interrupted; especially at points where adopted perspectives contain assumptions in need of correction, for example about a supposedly weak gender (Rawski and Workman-Stark, 2018; Seidensticker, 2021).

LIMITATIONS

The validity of the results is subject to important limitations on several levels. First, from a *methodical* point of view, the study had only limited access to police trainers in Germany due to the cooperation with a single central training site. In this respect, the results of the study are explorative in nature, context-specific and must be critically reflected upon in terms of their scope. Provided there is a willingness within police authorities to further open up police training to pedagogical research, future studies at other training sites across the country will have to provide further insights on police trainers perception on their recruits. Second, while research on subjective theories of teacher action in particular suggests that these influence classroom action in many ways, the findings of this study do not allow this *causal* conclusion and transfer to police trainers. The views and attitudes of police trainers were re-constructed selectively, but not their influence on the practical level of coaching. The latter issue requires further studies as well as alternative methodological approaches, such as training observations (Cushion, 2020). Third, limitations on an *epistemological* level have to be acknowledged. Although qualitative research in general and expert interviews especially have their strength in delivering insights form subjective perspectives and interpretations (Flick, 2018), the qualitative data are subject to perspectivity and bias due to the retrospective narration by the police trainers and the analysis and interpretation of the researchers. In this way, they are re-*constructions*.

CONCLUSION

Pedagogical issues of police training have rarely been the subject of international and national research yet. Police trainers, as the agents in charge of police training, are offering a relevant access to this special field of interest. In the context of our explorative interview study on the German police trainer's expert views on pedagogical implications of their training, a predominantly deficit-oriented perception of police recruits occurred as a rather random finding. When asked about different aspects of the training, the interviewed trainers reported a deficiency of their clientèle within the realms of physical fitness, motivation and discipline.

In this article, it has been argued that this view, in particular, as well as the trainers' perception, in general, is of great importance for pedagogical research, as well as for the reflection of police training itself. Through the lenses of a professional coaching model and (critically) reflective practice, the deficit-oriented view has been discussed on different levels: 1) as an objective depiction of real conditions, which have to be effectively met in training in a compensatory manner; 2) a conceptual orientation that has a deep foundation within the history of education and can be contrasted with the alternative approach of a pedagogy of potential; and 3) as an issue relevant to the reflection of believed subjective theories, which in turn guide trainers' actions.

Especially the approaches of conceptual orientation and subjective theories contribute to the paradigm of reflective practice in police training. They refocus the process of reflection back on the generating mechanism of the point of view of the trainer, and advocate for analytical deliberations on the underlying premises and assumptions. By doing so, they make an important contribution to elucidating the police culture that forms the breeding ground of those action-guiding assumptions and practically reproduces itself through it.

Although the key finding of a deficit orientation in German police trainers regarding police recruits has to be considered as limited due to the small sample size, it stresses the relevance for further research on the role of police trainers and their perceptions of training. In view of the hypothetical impact within the context of practical police training, further insights into the spread and impact of objective views, conceptual orientations, subjective theories and their underlying assumptions are of great interest for future research.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusion of this article will be made available by the authors, without undue reservation.

ETHICS STATEMENT

The study has been approved by the German Sport University Cologne, Ethics Committee. The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

SK and MS equally contributed to the current study and the final manuscript. The study was designed by SK and MS. The data were collected by SK and analyzed by SK and MS. SK wrote the first draft of the manuscript. MS revised the draft and helped to reach the manuscript to its final form.

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Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

The handling editor is currently organizing a research topic with the authors.

frontiers in Psychology

ORIGINAL RESEARCH
published: 23 February 2022
doi: 10.3389/fpsyg.2022.798766

Shoot or Don't Shoot? Tactical Gaze Control and Visual Attention Training Improves Police Cadets' Decision-Making Performance in Live-Fire Scenarios

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Police officers often encounter potentially dangerous situations in which they strongly rely on their ability to identify threats quickly and react accordingly. Previous studies have shown that practical experience and targeted training significantly improve threat detection time and decision-making performance in law enforcement situations. We applied 90-min traditional firearms training as a control condition (35 participants) and a specifically developed intervention training (25 participants) to police cadets. The intervention training contained theoretical and practical training on tactical gaze control, situational awareness, and visual attention, while the control training focused on precision and speed. In a pre- and posttest, we measured decision-making performance as well as (tactical) response preparation and execution to evaluate the training. Concerning cognitive performance training (i.e., decision-making), the number of correct decisions increased from pre- to posttest. In shoot scenarios, correct decisions improved significantly more in the intervention group than in the control group. In don't-shoot scenarios, there were no considerable differences. Concerning the training of response preparation and execution in shoot scenarios, the intervention group's response time (time until participants first shot at an armed attacker), but not hit time, decreased significantly from pre- to posttest. The control group was significantly faster than the intervention group, with their response and hit time remaining constant across pre- and posttest. Concerning the training of tactical action control, the intervention group performed significantly better than the control group. Moreover, the intervention group improved the tactical handling of muzzle position significantly. The results indicate that a single 90-min session of targeted gaze control and visual attention training improves decision-making performance, response time, and tactical handling of muzzle position in shoot scenarios. However, these faster response times do not necessarily translate to faster hit times – presumably due to the motor complexity of hitting an armed attacker with live ammunition. We conclude that theory-based training on tactical gaze control and visual attention has a higher impact on police officers' decision-making performance than traditional firearms training. Therefore, we recommend law enforcement agencies include perception-based shoot/don't-shoot exercises in training and regular tests for officers' annual firearm requalification.

Keywords: police, law enforcement, gaze control, training, visual attention, decision-making

OPEN ACCESS

Edited by:
Joel Suss,
Wichita State University, United States

Reviewed by:
David Harris,
University of Exeter, United Kingdom
Gregory Huffman,
Naval Health Research Center,
United States

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Specialty section:
This article was submitted to Educational Psychology, a section of the journal Frontiers in Psychology

Received: *20 October 2021*
Accepted: *31 January 2022*
Published: *23 February 2022*

Citation:
Heusler B and Sutter C (2022) Shoot or Don't Shoot? Tactical Gaze Control and Visual Attention Training Improves Police Cadets' Decision-Making Performance in Live-Fire Scenarios. Front. Psychol. 13:798766. doi: 10.3389/fpsyg.2022.798766

INTRODUCTION

Law enforcement plays a vital role in providing communities with general security, preventing crimes, and detaining suspects. Although police officers often face potentially dangerous situations on duty, lethal encounters are fortunately isolated. However, attacks aimed at police officers' lives can still happen at any time and without apparent indicators that allow officers to prepare for an escalating situation. Therefore, law enforcement personnel often find themselves in a challenging position between pursuing a community-oriented policing approach while also knowing that they may have to face deadly confrontations in an instant. Patrol officers, especially, are expected to manage the balancing act of being approachable helpers to their community and highly specialized tactical officers at the same time. To be prepared, police officers must rely on their situational awareness, ability to assess threats, and ability to react under stress (Helsen and Starkes, 1999; Vickers and Lewinski, 2012; Martaindale, 2021).

Situations in which a police officer shoots a citizen usually attract considerable public attention – especially if the citizen was unarmed. Therefore, it should be in everyone's interest to identify and implement measures to avoid these incidents and reduce harm on both sides. One important factor that negatively influences police officers' performance in use-of-force situations is stress (Nieuwenhuys et al., 2009, 2012; Akinola and Mendes, 2012). High levels of anxiety critically reduce perception capability and situational awareness. Biggs et al. (2021) showed that military personnel, who undergo stress-inoculation training, are less likely to shoot at an unarmed person. Another aspect worth mentioning is tactical considerations. Taylor (2020) demonstrated in an experimental setting with a firearms simulator that police officers can reduce the risk of mistakenly shooting an unarmed suspect without sacrificing a considerable amount of time by taking a lower muzzle position.

Police officers' and military personnel's primary source of information is visual perception – especially when identifying objects and assessing threats. With more than one-third of the human brain being affiliated with visual perception, this primary system of sensory information processing far outweighs other senses in potentially lethal law enforcement situations (Findlay and Gilchrist, 2003; Alt and Darken, 2008; Sutter and Ladwig, 2012; Ladwig et al., 2013; Körber, 2016; Heusler and Sutter, 2020a). Studies showed that law enforcement expertise and training facilitate performance in visual search tasks related to potential threats (Körber et al., 2007; Vickers and Lewinski, 2012; Martaindale, 2021). Moreover, Körber (2016) showed that visual priming can positively influence the identification and visual search of dangerous objects and weapons.

However, human visual perception has its limitations on multiple levels. For one, there are physical limitations, like the narrow sharp corridor within our field of vision (foveal vision; about 2°) and the fact that new visual information cannot be processed between fixations (Yarbus, 1967; Irwin, 1992; Hoffman, 1998; Salvucci and Goldberg, 2000; Castelhano et al., 2009; Carrasco, 2011). Another crucial aspect in this context is attention. Although visual information may be obtained and processed by the visual system, further cognitive processing depends on stimulus salience (i.e., prominence of stimulus features to attract attention) and locus of attention (i.e., where attention is focused). Vice versa, attention can actively influence gaze and visual perception (Groner and Groner, 1989; Findlay and Gilchrist, 2003; Henderson et al., 2007; Carrasco, 2011). Therefore, visual perception is not merely passive but an active process, which Findlay and Gilchrist (2003) described as "active vision."

These physical limitations, a lack of attention, anxiety, inexperience, and other factors may seriously hamper threat assessment in law enforcement situations. Taking this into consideration, it becomes apparent how important awareness and practical training are (Ho, 1994; Dewhurst and Crundall, 2008; Nieuwenhuys and Oudejans, 2010, 2011; Nieuwenhuys et al., 2012; Biggs et al., 2015, 2021; Donner et al., 2017; Donner and Popovich, 2019). Therefore, it is essential to teach law enforcement officers what to expect, what to focus on (both gaze and attention), and what factors to base shoot decisions on.

Amini and Vaezmousavi (2020) found that an external-relevant attentional focus improved the performance of elite military shooters. They claim that this attentional focus strategy was more effective in this context than other attentional focus strategies. Hamilton et al. (2019) showed that cognitive training can improve shooting performance in law enforcement situations. These findings are consistent with Preddy et al. (2019), who suggested that cognitive readiness in the context of critical encounters in a law enforcement context should be supported by skill training in the areas of domain and prerequisite knowledge, pattern recognition, and situational awareness.

One of police officers' hardest decisions is whether to shoot and risk shooting an unarmed person or to hold fire and risk being killed by an armed person. This dilemma is already challenging enough; however, officers might have to make such decisions in a split second and while under extraordinary levels of anxiety. Additionally, environmental circumstances (e.g., dim light or distractions) can make it hard or even impossible for an officer to detect a deadly threat and react before it is too late. Kruke and Henriksen (2020) found that Norwegian police officers showed a tendency to hold their fire in real confrontations until life-threatening situations materialized into actual attacks – resulting in potentially avoidable, imminent danger. In an experiment, Blair et al. (2011) showed that even under near-perfect conditions, it may not be possible for police officers to shoot at an armed attacker in time. It took suspects, pointing a gun to the ground, on average 360 ms to raise the firearms, aim, and shoot at a police officer. Even though the officers started with their guns already aimed at the attacker, they still needed 380 ms after the suspect's initial movement to return fire (not necessarily hitting the attacker). These response times reveal the importance for law enforcement personnel to anticipate potential attacks and identify threats quickly. Suss and Raushel (2019) experimented using video scenarios in which actors either pulled a revolver or a wallet. Participants were relatively unbiased in their anticipation during the first part of the drawing motion. However, they tended to anticipate a

weapon more frequently than a non-weapon as more of the draw motion was revealed.

The decision to shoot or not to shoot must be made consciously – even under elevated anxiety levels. Simply being frightened or surprised by a complex situation is not a legitimate reason to shoot when the decision is not based on a valid threat assessment. Vice versa, being overwhelmed and choking under pressure should not be the reason for not shooting. Biggs and Pettijohn (2021) showed in realistic military scenarios that inhibitory control plays a considerable role in shoot/don't-shoot decision-making.

The goal of training police officers must be to increase the probability of correct decision-making in real-world situations by training under comparable conditions. Moreover, handgun qualification tests for police officers should involve more than marksmanship elements. Law enforcement situations are complex and unpredictable and cannot be simulated by merely having officers shoot at predefined, static targets (Morrison and Vila, 1998; Helsen and Starkes, 1999).

Most previous studies examining law enforcement personnel's shoot/don't-shoot performance (e.g., Akinola and Mendes, 2012; Nieuwenhuys et al., 2012; Davies, 2015) used non-lethal training equipment, response boxes, or static targets to measure decisions and performance. As a result, empirically sound data of police officers reacting to dynamic video scenarios using live ammunition in experimental settings are scarce.

Based on the results of previous studies and the current theoretical framework, we designed an intervention training focusing on the following key elements.

- Realism (using pictograms and photographs as targets instead of abstract geometrical shapes);
- Situational awareness (raising awareness toward the need to assess threat-levels, e.g., "are the suspect's hands visible?");
- Tactical gaze control (training participants to actively shift their gaze on tactically crucial regions, like a suspect's hand- and hip region); and
- Visual attention (training participants to be vigilant toward critical visual stimuli, e.g., weapons).

We expected this targeted training to improve police officers' shoot/don't-shoot performance. We also expected this type of training to raise officers' awareness of the importance of visual perception, causing them to keep their eyes open longer and raise their weapons later into their line of sight. Therefore, we formulated the following six hypotheses.

Compared to police cadets who receive active control training, we hypothesized that police cadets who complete 90-min firearms training on tactical gaze control and visual attention improve their performance from pre- to posttest by

- More often making the correct decision to shoot in shoot scenarios (hypothesis 1);
- More often making the correct decision not to shoot in don't-shoot scenarios (hypothesis 2);
- Shooting faster in shoot scenarios (hypothesis 3);
- Hitting the attacker faster in shoot scenarios (hypothesis 4);
- Bringing their gun later up to eyesight level before shooting (hypothesis 5); and
- Keeping their eyes open longer right before shooting (hypothesis 6).

MATERIALS AND METHODS

The personnel responsible for conducting the experiment consisted of three people. The main instructor and the supporting instructor (the primary author of the current study) were in charge of operating the firing range, ensuring compliance to safety regulations at all times, and providing the training. Both instructors were experienced police trainers and licensed firearms instructors. In addition, a research assistant oversaw the timing of sequences, supervised the participants, and supported setting up the pre- and posttest material.

Participants

A total of 95 police cadets volunteered for the study. All participants were students of the 3-year bachelor's degree course "Polizeivollzugsdienst – Schutzpolizei" (Law Enforcement – Uniformed Police) at a German State Police Academy. All participants were in their third semester and had already received basic firearms training and lectures in fundamental police tactics. The study's training was applied to eight classes with about 12 persons each. Although the study was part of the regular (and mandatory) firearms training, the students were not obliged to participate in the experimental part of the training. However, all cadets volunteered and gave their written consent after being handed a comprehensive information sheet. The study was reviewed and approved by the German Police University's ethical review committee and the University of Applied Sciences for Police and Administration. Except for the participants' genders, no personal data were gathered for the study. The results were stored anonymously using random three-digit identification numbers assigned to the participants.

We randomly assigned four classes (49 participants) to the intervention training and four classes (46 participants) to the control training. All participants received either the intervention or control training. Due to high occupancy of the firing range and the resulting time limitations, only a random 69 out of the 95 participants could be considered for both the pre- and posttest. Even though all of these 69 participants completed both test parts, technical issues resulted in improper data recording, so that the posttest data of nine participants were not available. This left us with a total of 60 participants (N = 60; 15 female; 45 male), whose pre- and posttest data were evaluable. **Table 1** provides the group characteristics. The intervention group consisted of 35 participants (10 female; 25 male), while the control group consisted of 25 participants (5 female; 20 male).

Since we created a new research design for the current study, we could not use a power analysis to estimate the necessary sample size. However, we oriented ourselves by comparable studies with between-subject designs (e.g., Nieuwenhuys et al., 2012; Vickers and Lewinski, 2012), that investigated 24–36 participants with 11–18 participants per group. Considering that

TABLE 1 | Group characteristics.

N = 60	Intervention group	Control group
Number of participants	35	25
Gender (female/male)	10/25	5/20

FIGURE 1 | The experimental setup of the pre- and posttest.

these studies generated effect sizes up to 0.77 and 1.52, we expected our sample size to be sufficient.

Pre- and Posttest

The pre- and posttests were conducted in an indoor firing range (with an integrated digital target-projection system) of a German State Police Academy. The range's target canvas consisted of two backlit layers of continuous paper sheets that could be moved in opposite directions to reset the visible hits. **Figure 1** depicts the experimental setup for the pre- and posttest. The participants stood on a marked spot 6 m from the paper target canvas. A mobile projector (Casio XJ-A255V) and two stereo audio speakers (Logitech Z200) were placed on the floor between the participant and the canvas. The speakers and the projector were connected to a laptop computer that controlled the stimuli presentation. The firing range was dimly lit to allow for better visibility of the projected targets on the canvas.

The participants used a Heckler & Koch P30 V2 handgun, their standard-issue 9 mm service pistol, and were given a choice of two grip sizes. The pistol was loaded with a magazine containing 15 rounds of live ammunition. For the recording of eyelid movements and first-person videos, participants wore the "Pupil Invisible" glasses by Pupil Labs – a lightweight (46.9 g) mobile device with individual eye cameras (resolution: 192 × 192 pixels) and a front camera (resolution: 1,088 × 1,080 pixels; field of vision: 82°) attached to the left temple. The Pupil Invisible glasses also served as eye protection and substituted the regular shooting safety glasses. In addition, all participants wore earmuffs (3M Peltor) and earplugs (Bilsom 303L) for hearing protection. The double hearing protection was introduced because the temple tips of the Pupil Invisible glasses were slightly thicker than the temple tips of regular shooting safety glasses and we could not entirely rule out that this might have reduced the effectiveness of the earmuffs. The Pupil Invisible glasses were connected to a OnePlus 6 mobile phone in a radio pouch attached to the back of the participants' standard issue ballistic vests. The two experimenters, both licensed firearms instructors, wore standard-issue ballistic vests and earmuffs like the participants.

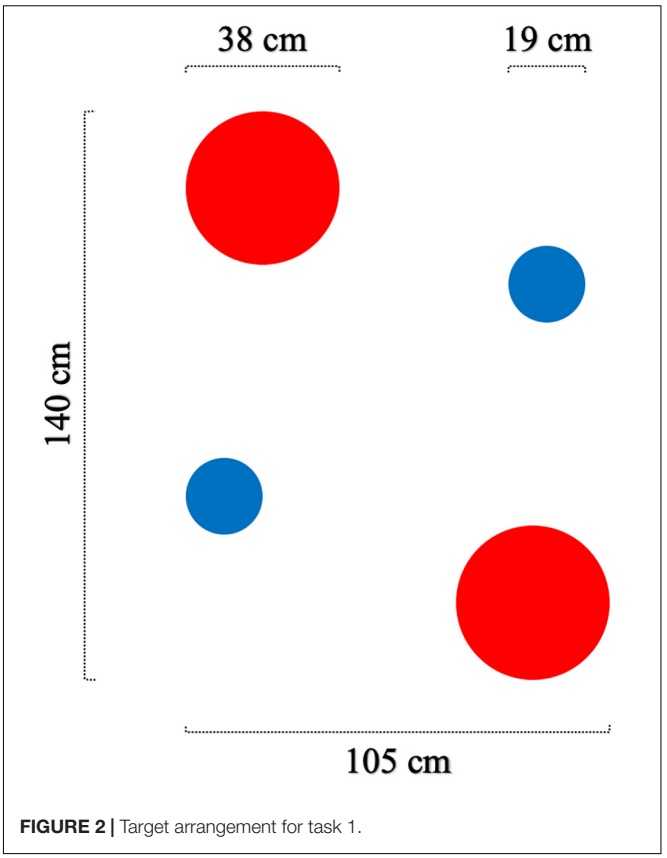

FIGURE 2 | Target arrangement for task 1.

Tasks and stimuli were the same for pre- and posttest. The dependent variables for each task are described in the section Design and Statistical Analyses. Task 1 served as a manipulation check to see whether the two types of training affect "traditional" firearms proficiency and improve the participants' ability to cope with the speed–accuracy tradeoff. The goal was to hit as many static targets as possible in the least amount of time. **Figure 2** depicts the stimuli for task 1: the targets were two red circles (⌀ 38 cm) and two blue circles (⌀ 19 cm). Participants were instructed to first shoot at two red circles and then at two smaller blue circles as accurately and fast as possible. They had to fire at each circle once and then move on to the next one – even if they missed. This task resembles the most common tests used by German law enforcement agencies for annual firearm requalification.

Task 2 tested the participants' shoot/don't-shoot performance in video scenarios. At the outset, a briefing sheet provided the background story to the video scenarios. Participants were informed that they were on patrol duty when they identified a wanted fugitive. This male fugitive was a suspect in an armed robbery of a jewelry store that had taken place a couple of hours earlier. They were also informed that the fugitive was most likely

armed and unpredictable. Next, the information sheet provided current mug shots for the participants to recognize the fugitive in the scenarios. Furthermore, the participants were instructed that they would have to complete multiple video scenarios that were all based on the background story. Every participant approached each scenario as a single officer; no backup officers were present. They were instructed to deal with the situation as realistically as possible, including talking to the fugitive. Tactical choices, like verbal communication or the muzzle position of their service pistol, were up to the participants. The dependent variables for each task are described in the section Design and Statistical Analyses.

Figure 3 depicts the six experimental scenarios (the actor's face is blurred for publication but was visible to the participants during the study). Task 2 included two shoot scenarios (**Figure 3**, upper), two don't-shoot scenarios (**Figure 3**, middle), and two dummy scenarios (**Figure 3**, lower). The video scenarios always showed the same male suspect from the instruction sheet in front of a neutral concrete wall. In the shoot scenarios, the suspect drew a gun and pointed it at the participant. In the don't-shoot scenarios, the suspect drew a harmless object (e.g., passport) and pointed it at the participant. The pre- and posttest each comprised three scenarios. The first and second scenario were either shoot and don't-shoot, or don't-shoot and shoot, respectively. The third scenario was always a dummy scenario (i.e., either a shoot or a don't-shoot scenario, selected at random). The inclusion of the dummy scenario was designed to prevent participants from knowing exactly how many shoot scenarios and how many don't-shoot scenarios they would encounter within each three-scenario test. Therefore, within each test, participants could encounter one shoot scenario and two don't-shoot scenarios, or two shoot scenarios and one don't-shoot scenario—in any order. The scenarios were comparable regarding the suspect's drawing speed and general behavior.

In shoot scenario 1 (S1) and don't-shoot scenario 1 (D1), the suspect held a mobile phone to his ear with his right hand throughout the scenario to simulate a phone conversation. His left hand remained at waist level until he drew an object after about 13 s and pointed it toward the camera. In S1, the object was a silver pistol and in D1 a red passport.

In shoot scenario 2 (S2) and don't-shoot scenario 2 (D2), the suspect's hands were initially empty and visible. After about 10 s, he reached diagonally into his jacket's inside pocket, drew an object with his left hand, and pointed it toward the camera. In S2, the object was a silver pistol and in D2 a wallet.

In dummy scenario 1 and dummy scenario 2, the suspect's hands were initially empty and visible. He then reached behind his back with his left hand, drew an object from his back pocket, and pointed it toward the camera. In dummy scenario 1, the object was a silver pistol and in dummy scenario 2 a mobile phone.

The scenarios were designed in close cooperation with experienced police trainers to ensure realism and tactical unambiguity. The shoot scenarios left no room for vagueness or hesitation, as the suspect posed an immediate threat to the participant's life by drawing a pistol and aiming it at them. Therefore, participants had to shoot their service pistol at the suspect in the shoot scenarios. On the other hand, in the don't-shoot scenarios, shooting at the unarmed suspect was an apparent mistake. For video production, a single-lens reflex camera (Canon EOS 550D) on a tripod was used. We set up the camera approximating its position to human eyesight level (165 cm above ground) and filmed from the same distance (6 m) that the participants later stood in front of the canvas. This allowed us to project the videos in life-size (suspect's height: approximately 180 cm) while also simulating a natural visual perspective. The suspect's dark clothes contrasted sharply with the light-colored background. This allowed participants to see the subject's movements and the objects clearly.

Training

As described above, we assigned eight classes to receive one of the two types of training. Both the control and intervention training were conducted in groups, lasted 90 min, and focused on visual perception. Although both forms of training included elements of visual perception and decision making, the theory-based intervention training focused on teaching the aforementioned aspects of attention and tactical gaze control. Each participant fired 30 live rounds and stood 8 m from the target canvas, regardless of the type of training they received. All exercises in the training were static and did not include any video scenarios, ensuring comparability by not favoring any group in preparation for the posttest. **Table 2** provides a comparison of both training concepts.

The training took place in the same indoor firing range as the pre- and posttest. The weapons and safety equipment were the same as in the pre- and posttest except that the participants wore standard-issue shooting safety glasses and earmuffs without additional earplugs. We used the firing ranges' integrated ceiling-mounted projectors and computer to project the targets. All participants were given direct feedback on their performance (e.g., correct/wrong decisions, weapon handling, and shooting technique) after each practical exercise.

Control Training

The active control training resembled traditional law enforcement firearms training, in which the focus is set on identifying and hitting targets as fast as possible. These training goals match the requirements of the regular tests that police officers usually have to pass during annual firearm requalification. Additionally, the training aimed to improve the participants' visual perception and decision-making performance in abstract and static shooting exercises.

The theoretical part of the control training focused on educating the participants about the speed–accuracy tradeoff and the most effective ways to ensure maximum precision in the least amount of response time possible. Thus, the instruction can be described as a conventional approach toward theoretical police firearms tactics.

In the practical part of the control training, the participants performed shooting exercises that gradually increased in complexity and difficulty. The targets were initially large and predefined but later shrunk in size and had to be identified by the participants. Some targets had to be shot in a given order

FIGURE 3 | The six different scenarios of task 2. **(a)** The initial situation, **(b)** the drawing motion, **(c)** the suspect's final position with the drawn object.

while others had to be avoided, thus forcing the participants to actively search for the targets, identify them and make conscious decisions on whether to shoot or not. Even though the exercises increased in complexity, and decision-making tasks (based on shapes, numbers, and colors) became increasingly challenging, the participants were not confronted with threat-based decisions.

Intervention Training

The theory-based intervention training was newly designed and focused on tactical gaze control, attention, and situational awareness for detecting weapons on a suspect. It aimed at improving visual perception strategies and decision-making performance in realistic law enforcement scenarios.

In the theoretical part of the intervention training, participants were instructed to focus both gaze and visual attention on tactically crucial regions. For example, although a suspect's face is very salient and may be a good indicator of their emotional state in most cases, it does not necessarily predict an upcoming attack or the actual danger level that a person poses. Therefore, police officers have higher chances of detecting and correctly identifying

TABLE 2 | Comparison of both training concepts.

	Intervention training	Control training
Context	• Realism	• Abstract visual stimuli
Content	• Situational awareness • Tactical gaze control • Visual attention	• Precision • Speed
Training goals	• Participants' increase shoot/don't-shoot decision-making proficiency • Participants keep both eyes open while using their service pistol • Participants maintain a low muzzle position longer before firing	• Participants increase their proficiency in dealing with the speed–accuracy tradeoff • Participants decrease response time after a visual "go" signal
Theoretical input (30 min)	• Safety protocol • Basics of human visual perception • Theoretical introduction to tactical gaze control (where to look) • Importance of attention (what to be vigilant about) • Situational awareness (what to expect)	• Safety protocol • Theoretical introduction to the speed–accuracy tradeoff • Proper use of the pistol's sights for maximum accuracy • Proper movement of the pistol to ensure maximum speed
Practical exercises (60 min)	• Exercise 1 (warm-up): Six rounds on a torso-sized rectangle. • Exercise 2: Six rounds on circles after small visual impulse. First introduction to visual target recognition. • Exercise 3: Nine rounds on indicated human silhouettes with pictogram hands holding various objects. First introduction to threat-based shoot/don't-shoot decisions. Participants are encouraged to focus gaze and attention on the hands and give verbal orders. • Exercise 4: Nine rounds on life-sized photographs of persons in various situations holding different objects. Same objective as in exercise 3 but increased realism.	• Exercise 1 (warm-up): Five rounds on squares of different sizes. • Exercise 2: Four rounds on colored circles with a finishing round on a smaller circle. Participants were encouraged to focus on the correct use of their gun's sights. • Exercise 3: Ten rounds on shrinking squares. Practical introduction to the effects of the speed–accuracy tradeoff. • Exercise 4: Five rounds on the same circles as in exercise 2. This time the order of the targets is indicated by their color. First introduction to visual target recognition. • Exercise 5: Five rounds on a static bullseye target. Participants were encouraged to find their "sweet spot" between firing as fast and accurately as possible.

drawn objects by focusing both gaze and attention on a suspect's hands and hip region (Heusler and Sutter, 2020a,b).

Furthermore, the theoretical intervention training taught the participants about situational awareness as a crucial factor in reducing risk in potentially lethal situations. Situational awareness in this context describes the ability to distinguish routine situations from situations with elevated risk potential. Nonetheless, situational awareness also encompasses the understanding that even seemingly harmless law enforcement situations can escalate. Thus, a vital element of the intervention training was to teach participants about the potential dangers of direct interaction with suspects while also sensitizing them to the possible adverse effects of being too expectant of attacks. Police officers can escalate situations unnecessarily if they solely focus on potential attacks rather than trying to de-escalate.

The practical part of the training started with abstract targets (rectangles and circles), then progressed to semi-realistic targets (torso silhouettes with pictogram hands and objects) and ended with photographs of persons. As the targets became increasingly realistic with each new exercise, the participants were instructed to actively shift their attention and gaze toward the hands and hip region of the silhouettes and the photographs. Although the participants were not given instructions on which stance to take in any given situation, they were advised to take a compressed ready position with their service pistol's muzzle pointing to the ground (**Figure 4**) when they assumed an elevated threat level. This advice was based on the previously described findings of Taylor (2020). The participants were also advised to keep both eyes open while shooting, ensuring maximum visibility of the suspect's hands and hip region at all times.

Another aspect of the practical intervention training was to teach proper communication in law enforcement situations with elevated risk levels. Professional verbal communication is crucial for de-escalating situations, as is giving suspects clear orders before, during, and after an attack. The instructors demonstrated appropriate verbal communication tactics and reinforced the use of such tactics during the training. Although communication was neither documented nor analyzed in the study, it added to the workload and overall realism.

Procedure

The procedure was the same for each class, regardless of whether they were assigned to the control group or the intervention group. We started by welcoming each class and introducing the research personnel. Then the participants were handed a comprehensive information sheet informing them about the study's anonymous, voluntary, and confidential (information was not to be shared with fellow cadets) nature. Although the participants knew they were about to be part of an experiment, they were not yet told about the study's focus on visual perception and decision-making. We only recorded and used the data of participants who gave their written consent after reading the information sheet. As all potential participants agreed to take part in the study, no data had to be excluded. The participants then did a 5-min written test on basic police firearms tactics, putting them in a tactical mindset without revealing the focus of the study. The participants did the subsequent pretest individually, taking about 4 min per person (8 min including the introduction).

Both the pre- and the posttest took about 60 min and required the participants to follow a predefined sequence of actions: one participant prepared for the upcoming practical shooting

by reading the introductions for tasks 1 and 2, while another participant did the shooting at the range. During this time, the remainder of the class worked on a class assignment unrelated to the experiment. A research assistant oversaw the group exercise to ensure that no information about the study was exchanged between officers who had completed the experimental tasks and those who had not yet completed them.

In preparation for the upcoming practical shooting, participants first received a playing card, which they were asked to keep until the end of the experiment. The playing cards allowed us to match the participants to their corresponding data sets later without identifying them through personal data. Then, after reading the instructions for the shooting tests, the participants entered the shooting range and were equipped with hearing protection, the Pupil Invisible glasses, the mobile phone with the radio pouch, and a pistol with a fully loaded magazine (15 rounds). Participants had the choice between two different pistol grip sizes, depending on personal preferences.

All the instructions inside the shooting range were presented visually to ensure equal treatment of the participants. However, questions were answered if necessary. The presentations of the testing tasks 1 and 2 (for details, see section "Pre- and Posttest") were preceded by a 3-s visual countdown to ensure that participants were ready. Before the scenarios in task 2, we presented a picture of the suspect to ensure that participants recognized him as the fugitive introduced in the instructions. The participants were also reminded that they could pick a stance and muzzle position of their choice.

To guarantee maximum variety and reduce confounding variables, we constructed 16 counterbalanced orders of the shoot and don't-shoot scenarios (**Table 3**). Participants in each group were randomly assigned to one of these 16 orders.

After completing the pretest tasks, the participant returned the experimental equipment to the experimenters and joined the rest of the class to continue working on the class assignment. After sanitizing the equipment, the experimenters welcomed the next participant and proceeded with the following pretest.

The following 90 min consisted of the training, which comprised approximately 30 min of theory and 60 min of practical shooting exercises. The practical exercises were conducted simultaneously on two firing lanes with two firearms instructors, giving individual and instant feedback on the participants' performances. While awaiting their turn to complete the practical exercises, participants were encouraged to work on weapon handling and run "dry" exercises at the rear of the shooting range.

The posttest was similar to the pretest and lasted another 60 min. Afterward, the participants tidied up the range and debriefed with the experimenters. During the debriefing, participants were encouraged to ask questions and give feedback.

In total, the experiment lasted about 4 h per group. Data were collected on 4 days (two groups per day) in October and November 2020.

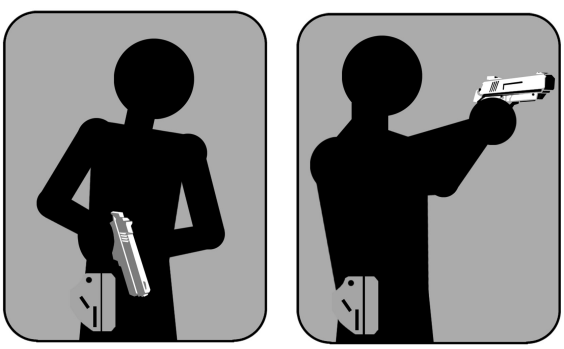

FIGURE 4 | The compressed ready position **(left)** and the final shooting stance **(right)**.

Design and Statistical Analyses

The current study followed a quasi-experimental, counterbalanced, controlled, repeated-measures design. We used the simplified term "experiment" to facilitate readability throughout the paper. The first measure took place in the form of a pretest before the intervention, while the second measure took place in the form of a posttest after the intervention. We used a control group, which received traditional training and an intervention group that received the new, specially designed training.

As described above, task 2 of the pre- and posttest comprised a shoot scenario and a don't-shoot scenario (not necessarily in that order) with a dummy scenario at the end. The dummy scenario's sole purpose was to prevent participants from recognizing patterns and anticipating upcoming tasks. Therefore, the dummy scenarios were not considered in the statistical analysis.

TABLE 3 | The 16 possible variations of scenario orders (S1/2 = shoot scenario; D1/2 = don't-shoot scenario; SD/DD = shoot and don't-shoot dummy).

Counterbalanced order	Pretest scenario order			Posttest scenario order		
	First	Second	Third	First	Second	Third
1	S1	D1	SD	S2	D2	DD
2	S1	D1	DD	D2	S2	SD
3	S1	D2	SD	D1	S2	DD
4	S1	D2	DD	S2	D1	SD
5	D1	S1	SD	S2	D2	DD
6	D1	S1	DD	D2	S2	SD
7	D1	S2	SD	S1	D2	DD
8	D1	S2	DD	D2	S1	SD
9	S2	D1	SD	S1	D2	DD
10	S2	D1	DD	D2	S1	SD
11	S2	D2	SD	S1	D1	DD
12	S2	D2	DD	D1	S1	SD
13	D2	S1	SD	D1	S2	DD
14	D2	S1	DD	S2	D1	SD
15	D2	S2	SD	S1	D1	DD
16	D2	S2	DD	D1	S1	SD

The dummy scenarios served to prevent participants from recognizing patterns and were not included in the data analysis.

Hit Factor: The *Hit Factor* is a quotient commonly used in evaluating police officers' shooting performance. In the present experiment, it serves as a manipulation check to evaluate participants' performance in the traditional firearms exercise (task 1). The *Hit Factor* was calculated by dividing the number of hits (maximum one hit per target; maximum four hits total) by the time taken to complete the task. It describes the participant's performance in task 1 based on accuracy and time (from the start of the exercise until the last shot). The higher the *Hit Factor*, the better the participant's performance. Note that the quotient could exceed 1.0 if participants completed the task in less than 4 s. One control group participant was excluded from the analysis since they did not follow the instructions and shot twice at every circle instead of once (both in the pre- and posttest).

For the statistical analysis, we first calculated a repeated-measures ANOVA with the between-subject factor Group and the within-subject factor Time. We then calculated separate repeated-measures ANOVAs for each group to investigate their respective pre- to posttest development.

Decisions: This variable aimed to investigate the two hypotheses on decision-making and was documented separately for the shoot (hypothesis 1) and don't-shoot scenarios (hypothesis 2). It describes the participants' decision progress from pre- to posttest.

When a participant shot in a don't-shoot scenario or before the drawn object was first identifiable, it was automatically considered a wrong decision (false positive). When a participant did not shoot at an armed attacker after the drawn pistol had been identifiable for 2 s, the decision was also automatically considered wrong (i.e., false negative or miss). We set 2 s as the maximum response time in consultation with active police trainers and firearms experts. After 2 s elapsed following the presentation of a clear threat, it is safe to assume that the officer either failed to detect the threat or mistakenly decided not to shoot despite the threat. Two seconds are sufficient for an armed attacker to fire multiple deadly shots at an officer in a real-life scenario. Correct decisions will be referred to as "correct positive" (participant shot in a shoot scenario) and "correct negative" (participant did not shoot in a don't-shoot scenario) hereafter. The data of all 60 participants were considered for the analysis.

Every incorrect decision (i.e., false positive and false negative) was given the value "0." In contrast, every correct decision (shooting in a shoot scenario or not shooting in a don't-shoot scenario) was given the value "1." By subtracting the pretest score from the posttest score, we produced a value that indicated each participant's progress ("−1" = deteriorated, "0" = constant, "1" = improved). We then calculated non-parametric Mann–Whitney *U* tests for the decision-making progress in the shoot and don't-shoot scenarios, respectively.

Response Time: This variable aimed to investigate the time of the initial motor response (firing the service pistol) after detecting the threat in shoot scenarios (hypothesis 3). We timestamped the moment in every shoot scenario when the drawn pistol was first identifiable for the participant and the moment of the first shot hitting the canvas. *Response Time* describes the time between these timestamps in milliseconds (regardless of whether the shot hit the suspect or not). To avoid distorted results in the analysis, we excluded 19 participants who did not shoot in at least one of the two shoot scenarios.

For the statistical analysis, we first calculated a repeated-measures ANOVA with the between-subject factor Group and the within-subject factor Time. We then calculated separate repeated-measures ANOVAs for each group to investigate their respective pre- to posttest development.

First Hit: This variable describes the time it took participants to engage the attacker with effective fire (hypothesis 4). For every shoot scenario, we calculated the time between when the attacker's pistol was first clearly visible to the officer and the time of the first shot to hit the attacker's torso or head. Shots outside these hit zones, which active police trainers had defined, were disregarded. We excluded 22 participants who failed to hit the target zone in at least one of the shoot scenarios.

For the statistical analysis, we first calculated a repeated-measures ANOVA with the between-subject factor Group and the within-subject factor Time. We then calculated separate repeated-measures ANOVAs for each group to investigate their respective pre- to posttest development.

Muzzle Position: This variable describes the time that the service pistol was held at eyesight level and pointed at the suspect before the first shot (hypothesis 5). A tactical "high ready position," where the weapon is held slightly below eyesight level and is not yet aimed, was not considered eyesight level. We excluded the same 19 participants as in the calculation of *Response Time* since they did not shoot in at least one of the two shoot scenarios.

For the statistical analysis, we first calculated a repeated-measures ANOVA with the between-subject factor Group and the within-subject factor Time. We then calculated separate repeated-measures ANOVAs for each group to investigate their respective pre- to posttest development.

Closed Eye(s): This variable aimed to show whether participants kept both eyes open when using their service pistol. More specifically, it describes the time a participant had at least one eye closed right before their first shot in milliseconds (hypothesis 6). If a participant had both eyes open while aiming and firing, the value of this variable was set to "0 ms." Again, we excluded the same 19 participants as in the calculation of *Response Time* since they did not shoot in at least one of the two shoot scenarios.

For the statistical analysis, we first calculated a repeated-measures ANOVA with the between-subject factor Group and the within-subject factor Time. We then calculated separate repeated-measures ANOVAs for each group to investigate their respective pre- to posttest development.

RESULTS

Hit Factor

We had 59 evaluable data sets (intervention group = 35; control group = 24) for the *Hit Factor* analysis. The repeated-measures ANOVA with the within-subject factor Time and the between-subject factor Group revealed a significant effect with a medium effect size for the factor Time [$F(1,57) = 8.094$; $p = 0.006$;

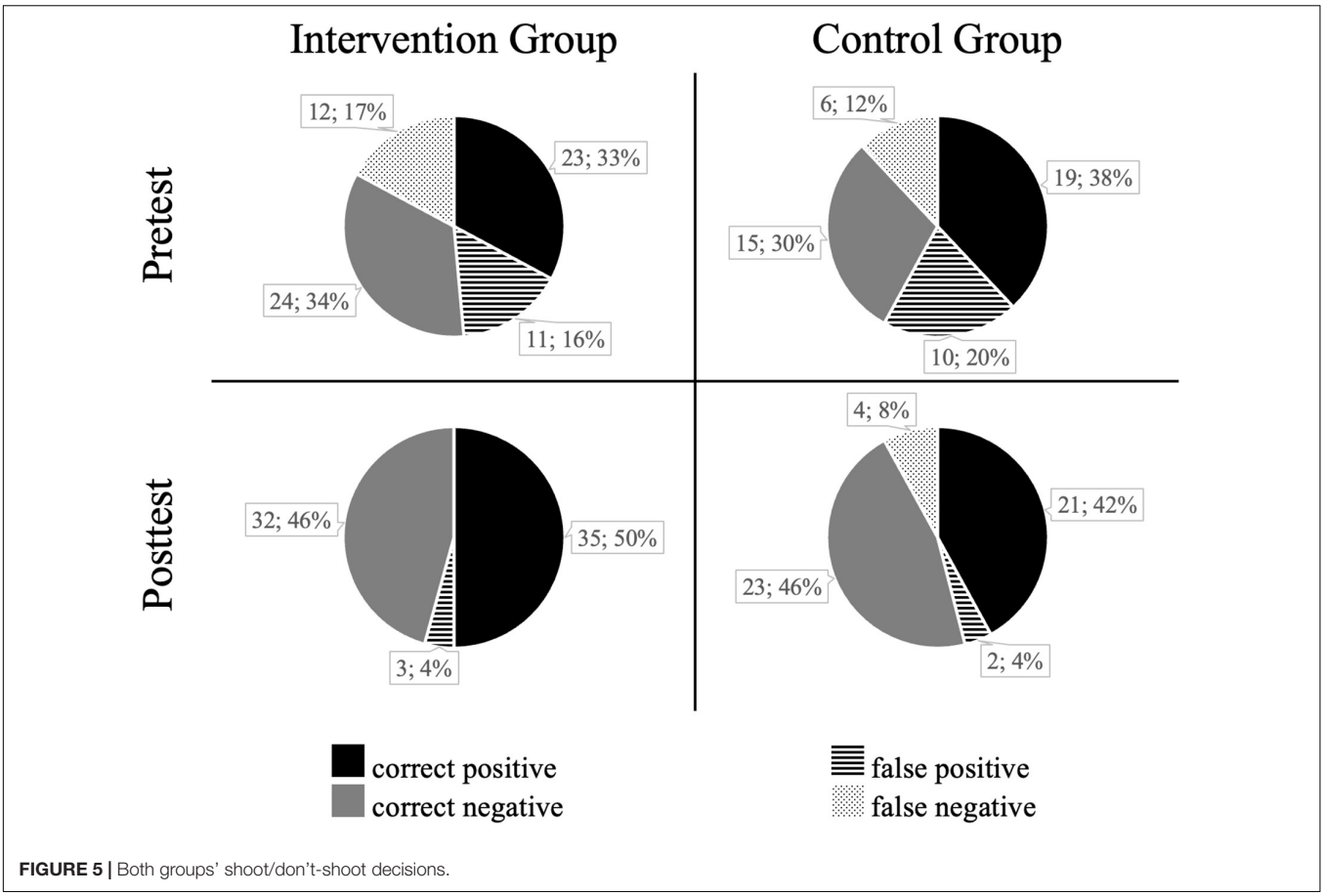

FIGURE 5 | Both groups' shoot/don't-shoot decisions.

$\eta_p^2 = 0.124$] and a significant effect with a medium effect size for the interaction of the factors Time × Group [$F(1,57) = 4.169$; $p = 0.046$; $\eta_p^2 = 0.068$]. The test of between-subject effects revealed a non-significant effect with a negligible effect size for the factor Group [$F(1,57) = 0.009$; $p = 0.924$; $\eta_p^2 = 0.001$].

The separately calculated repeated-measures ANOVAs showed a significant main effect of the factor time with a large effect size for the control group [$F(1,23) = 9.932$; $p = 0.004$; $\eta_p^2 = 0.302$] and a non-significant main effect of the factor time with a small effect size for the intervention group [$F(1,34) = 0.400$; $p = 0.531$; $\eta_p^2 = 0.012$]. The results show that the control group significantly increased their *Hit Factor* from pre- to posttest (0.56 vs. 0.72), while the intervention group did not improve significantly (0.62 vs. 0.65).

Decisions

Figure 5 provides the number of correct positive and false negative decisions (shoot scenarios) and correct negative and false positive decisions (don't-shoot scenarios) for the intervention and control group. Both groups started with comparable performances in the pretest (**Figure 5**, top), making 67–68% correct decisions (**Figure 5**, gray and black solid). In the posttest (**Figure 5**, bottom), the intervention group made 96% correct decisions (with no false negatives) while the control group made 88% correct decisions.

The statistical analyses (non-parametric Mann–Whitney *U* tests) showed that the intervention group improved their decision-making performance in the shoot scenarios (hypothesis 1) from pre- to posttest more than the control group (mean progress for intervention group = 0.34 and control group = 0.08; $U = 393.5$; $p = 0.033$). For the progress variable on decisions in don't-shoot scenarios (hypothesis 2), the Mann–Whitney *U* test did not reveal a significant difference between the groups (mean progress for intervention group = 0.23 and control group = 0.32; $U = 546.5$; $p = 0.435$).

Table 4 provides an overview of both groups' *Decisions*. It also shows the number of individual improvements, consistencies, and deteriorations for the shoot- and don't-shoot scenarios, respectively.

Response Time

For the analysis of the participants' response times (hypothesis 3), we had 41 evaluable data sets (intervention group = 23; control group = 18). **Figure 6** shows the groups' response times in shoot scenarios. The repeated-measures ANOVA with the within-subject factor Time and the between-subject factor Group revealed a significant effect with a medium effect size for the factor Time [$F(1,39) = 5.680$; $p = 0.022$; $\eta_p^2 = 0.127$] and a significant effect with a medium effect size for the factor Group [$F(1,39) = 4.791$; $p = 0.035$; $\eta_p^2 = 0.109$]. The interaction between

TABLE 4 | Overview of the decision progress from pre- to posttest in the intervention and control group (N = 60).

	Shoot scenarios		don't-shoot scenarios	
	Intervention	**Control**	**Intervention**	**Control**
Improved (+1)	12	3	9	10
Consistent (0)	23	21	25	13
Deteriorated (−1)	0	1	1	2
Mean progress	0.34 (SD = 0.482)	0.08 (SD = 0.4)	0.23 (SD = 0.490)	0.32 (SD = 0.627)
Mann–Whitney U	U = 393.5 (p = 0.033)		U = 546.5 (p = 0.435)	

the factors Time × Group was non-significant with a medium effect size [$F(1,39) = 3.248$; $p = 0.079$; $\eta_p^2 = 0.077$].

The separately calculated repeated-measures ANOVAs showed a significant main effect of the factor time with a large effect size for the intervention group [$F(1,22) = 9.260$; $p = 0.006$; $\eta_p^2 = 0.296$] and a non-significant main effect of the factor time with a small effect size for the control group [$F(1,17) = 0.167$; $p = 0.688$; $\eta_p^2 = 0.01$]. The results confirm that the intervention group significantly reduced their response time from pre- to posttest (1,083 vs. 820 ms), while the control group did not improve significantly (780 vs. 743 ms).

First Hit

For the analysis of the participants' *First Hit* on the predefined target zone (hypothesis 4), we had 38 evaluable data sets (intervention group = 21; control group = 17). **Figure 7** shows the groups' hit times in shoot scenarios. The repeated-measures ANOVA with the within-subject factor Time and the between-subject factor Group revealed a significant effect with a medium effect size for the factor Group [$F(1,36) = 4.607$; $p = 0.039$; $\eta_p^2 = 0.113$] and a non-significant effect with a small effect size for the factor Time [$F(1,36) = 0.984$; $p = 0.328$; $\eta_p^2 = 0.027$]. The interaction between the factors Time × Group was non-significant with a negligible effect size [$F(1,36) = 0.140$; $p = 0.710$; $\eta_p^2 = 0.004$].

The separately calculated repeated-measures ANOVAs showed a non-significant main effect of the factor time with a small effect size for the intervention group [$F(1,20) = 0.802$; $p = 0.381$; $\eta_p^2 = 0.039$] and control group [$F(1,16) = 0.276$; $p = 0.606$; $\eta_p^2 = 0.017$], respectively. The results show that the intervention group (1,330 vs. 1,155 ms) and control group (961 vs. 882 ms) did not reduce their mean times until the first hit significantly from pre- to posttest.

Muzzle Position

For the analysis of the time that participants had their weapons up to eyesight level before shooting (hypothesis 5), we had the same 41 evaluable data sets as for *Response Time* (intervention group = 23; control group = 18). **Figure 8** shows both groups' results for *Muzzle Position* in ms. The repeated-measures ANOVA with the within-subject factor Time and the between-subject factor Group revealed a significant effect with a large effect size for the factor Group [$F(1,39) = 13.230$; $p < 0.001$; $\eta_p^2 = 0.253$] and a non-significant effect with a small effect size for the factor Time [$F(1,39) = 0.520$; $p = 0.475$; $\eta_p^2 = 0.013$]. The interaction between the factors Time × Group was significant with a medium effect size [$F(1,39) = 5.114$; $p = 0.029$; $\eta_p^2 = 0.116$].

The separately calculated repeated-measures ANOVAs showed a significant main effect of the factor time with a large effect size for the intervention group [$F(1,22) = 5.778$; $p = 0.025$; $\eta_p^2 = 0.208$] and a non-significant main effect of the factor time with a small effect size for the control group [$F(1,17) = 0.912$; $p = 0.353$; $\eta_p^2 = 0.051$]. The results confirm that the intervention group significantly reduced the time of holding their service

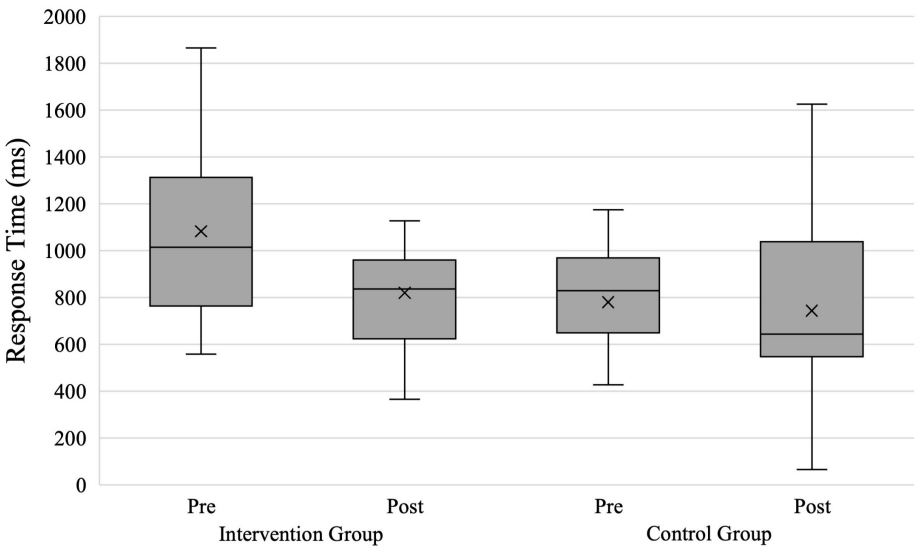

FIGURE 6 | *Response Time* in shoot scenarios for both groups. X, mean marker.

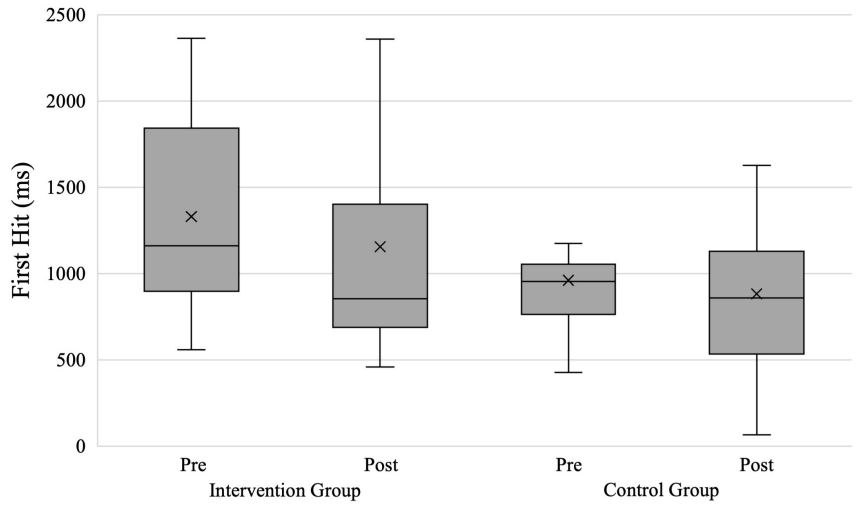

FIGURE 7 | *First Hit* in shoot scenarios for both groups. X, mean marker.

weapons at eyesight level before firing from pre- to posttest (2,250 vs. 247 ms), while the control group did not improve significantly (5,066 vs. 6,100 ms).

Closed Eye(s)

For the analysis of the time that participants had one eye closed immediate before shooting (hypothesis 6), we had the same 41 evaluable data sets as for *Response Time* (intervention group = 23; control group = 18). **Figure 9** shows both groups' results for *Closed Eye(s)* in ms. The repeated-measures ANOVA with the within-subject factor Time and the between-subject factor Group approached significance with a medium effect size for the factor Group [$F(1,39) = 4.051$; $p = 0.051$; $\eta_p^2 = 0.094$] and a non-significant effect with a small effect size for the factor Time [$F(1,39) = 0.886$; $p = 0.352$; $\eta_p^2 = 0.022$]. The interaction between the factors Time × Group was not significant and showed a small effect size [$F(1,39) = 0.543$; $p = 0.466$; $\eta_p^2 = 0.014$].

The separately calculated repeated-measures ANOVAs showed a non-significant main effect of the factor time with a medium effect size for the intervention group [$F(1,22) = 2.366$; $p = 0.138$; $\eta_p^2 = 0.097$] and a non-significant main effect of the factor time with a small effect size for the control group [$F(1,17) = 0.550$; $p = 0.468$; $\eta_p^2 = 0.031$]. The results show that neither group significantly reduced their *Closed Eye(s)* time from pretest to posttest (intervention group = 190 vs. 113 ms; control group = 1,202 vs. 571 ms).

DISCUSSION

The present study took place in an indoor firing range using live ammunition. The aim was to examine police cadets' shoot/don't-shoot performances in video scenarios before and after two different types of firearms training. The control group received traditional firearms training, while the intervention group received specifically developed firearms training based on state-of-the-art empirical findings in cognitive psychology. The study investigated whether training focused on tactical gaze control and visual attention tactics improves decision-making performance and (tactical) response preparation and execution more than traditional firearms training. Both the control group and intervention group completed a pretest before—and a posttest after—their respective training. Throughout the study, it was notable that the use of live ammunition offered a considerable level of realism and caused the participants to behave more cautiously and alertly than they typically do when they use non-lethal training equipment.

The results of the manipulation check *Hit Factor* show that only the control group improved their performance from pre- to posttest in this static and abstract task, while the performance of the intervention group stayed consistent. This outcome is reasonable since the control training aimed to improve the traditional aspects of firearms proficiency: hitting a geometrical shape in the least amount of time possible. On the other hand, the intervention training focused on training participants to make conscious shoot decisions based on threat assessments. This illustrates that one cannot assume that decision-making and threat-assessment training will automatically improve traditional marksmanship performance.

As long as police academies base their evaluations of officers' firearms proficiency on "how many predefined targets were hit in what time?" traditional training will seem to generate the best shooters. However, it must be considered that these tasks are highly abstract and do not resemble real-life scenarios. Training officers to hit targets 10 mm closer to the bullseye or reducing response time by 10 ms must not be considered more important than training officers to make correct shoot decisions in the first place.

This study's intervention training aimed to improve police officers' decision-making performances in shoot/don't-shoot scenarios by implementing theory-based aspects of tactical gaze control, visual attention tactics, and situational awareness.

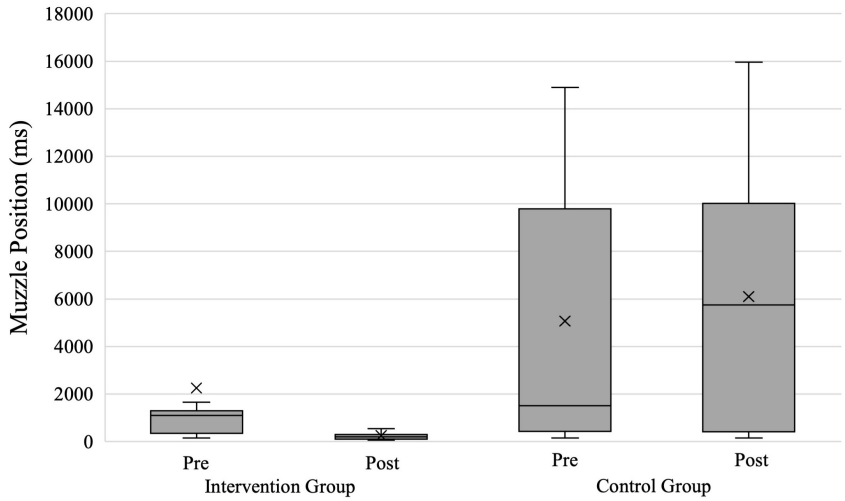

FIGURE 8 | *Muzzle Position* in shoot scenarios for both groups. X, mean marker.

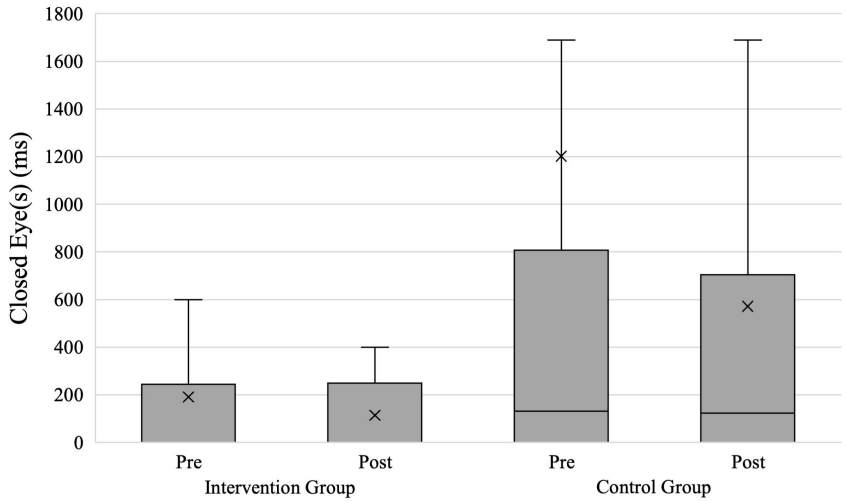

FIGURE 9 | *Closed Eye(s)* in shoot scenarios for both groups. X, mean marker.

Participants were encouraged to prioritize the underlying processes of making a shoot decision (visual perception, threat assessment, and conscious decision-making) over sports-like factors such as shooting as fast and accurately as possible.

Concerning our hypotheses, we found that the intervention group improved their number of correct decisions to shoot in shoot scenarios to a greater extent than the control group (hypothesis 1): while 34% of the intervention group improved their pre- to posttest performance, only 12% of the control group improved. Furthermore, one control group participant even scored lower after the training than before.

We also assumed that the intervention group would shoot faster (hypothesis 3) in shoot scenarios than the control group. Our results showed that the intervention group reduced their *Response Time* significantly by 263 ms, while the control group did not reduce it to a degree of statistical significance. At this point, the groups' differing baseline performances must be taken into consideration. The intervention group started with a higher mean response time, which may have amplified the observed effect.

Moreover, we hypothesized that the intervention group would bring their gun up to eyesight level later (hypothesis 5) before shooting than the control group. Our analysis revealed that only the intervention group reduced their *Muzzle Position* significantly (by 2,003 ms). This leads us to conclude that the intervention group participants understood the value of keeping a clear line of sight toward the suspect. Therefore, they may have waited longer until they raised their weapon as this tends to block the vision of the suspect's hand and hip region. This result matches the intervention's training goals and aligns with findings suggesting that a lower muzzle position improves shoot/don't-shoot decision-making (Taylor, 2020).

Furthermore, we hypothesized that the intervention group would make the correct decision not to shoot in don't-shoot scenarios more often than the control group (hypothesis 2). However, our analysis of *Decisions* did not reveal a significant difference in both groups' decision-making progresses in don't-shoot scenarios. Therefore, hypothesis 2 was not confirmed. However, both groups improved their decision-making performance in don't-shoot scenarios from pre- to posttest. This indicates an unspecific training effect, potentially caused by the pretest scenarios.

We also assumed that the intervention group would hit the attacker faster than the control group (hypothesis 4). However, neither group reduced their *First Hit* significantly from pre- to posttest, thus not confirming hypothesis 4. We suspect that this can be explained by the participants' still rather basic levels of firearms proficiency. Thus, even though the intervention group may have identified threats quicker and decided to shoot faster, their underdeveloped skill levels may have prevented them from reliably hitting the attacker with their fast first shots. This could be explained by a speed–accuracy tradeoff or the assumption that the intervention group spent more mental resources on active vision and verbal communication.

For *Closed Eye(s)*, our analysis showed a tendency that the intervention group keep both eyes open longer right before shooting than the control group. This observed tendency aligns with hypothesis 6 and matches the intervention's training goals.

Considering the overall results, it is noteworthy that although the intervention training had a noticeable positive impact on decision-making performance in shoot scenarios, performance in don't-shoot scenarios did not differ by training type. Both groups improved their decision-making performance in don't-shoot scenarios from pre- to posttest. The 90 min of intervention training were apparently enough to improve the participants' ability to detect and identify the firearms drawn by the attacker. However, the 90 min of intervention training did not affect the participants' ability to distinguish harmless from dangerous objects or suppress the shooting motion (inhibition) under stress. Another point worth considering is that the intervention group were encouraged to use verbal communication tactics when interacting with a potentially armed suspect. In contrast, the control group's traditional firearms training did not include verbal aspects. Although all participants have had previous training on basic verbal communication tactics, it became apparent that the workload was already very high in the scenarios and the use of verbal communication tactics became even more demanding. Therefore, the workload of the intervention group – who were reminded of the importance of verbal communication tactics in their intervention training just before the posttest – was probably higher when addressing the suspect correctly than the control group's, who in some cases did not communicate verbally at all. Just reacting is less challenging than reacting while actively communicating.

Limitations and Future Studies

The current study was conducted at a police academy using live ammunition, official equipment, and a very selective sample: police cadets. Therefore, the results of this job-related intervention are highly targeted and do not necessarily translate to a more general population. On a methodological level, we faced the limitation that we could not randomly assign the participants to the groups as we had to work with intact classes. This quasi-experimental design could have generated distortions caused by different skill levels between the groups. However, we expected these effects to level out due to the number of groups.

Due to the previously described technical issues, nine datasets of the control group were not recorded during the posttest. This left us with uneven group sizes (intervention group = 35; control group = 25), possibly causing a loss of power in the statistical analysis.

During the study, it became apparent that the learning effects from the pretest were considerable. A third group omitting the pretest could have been helpful to distinguish learning effects caused by the pretest from effects linked to the actual training. Another valuable addition for future studies would be introducing a retention test. Including a retention test—for example, 4 weeks after the posttest—would make it possible to evaluate the sustainability of the intervention.

Future studies could also focus on more experienced officers and investigate whether the participants' overall levels of firearms proficiency correlate with their ability to benefit from theory-based shoot/don't-shoot decision training. Another point worth looking into deeper is the relationship of muzzle position, response time, and shoot/don't-shoot decision-making. For example, finding practical ways to benefit from a lower muzzle position while keeping the extra response time to a minimum could lead to promising new training approaches. Furthermore, we believe that signal detection theory offers promising opportunities to investigate the underlying processes of shoot/don't-shoot decision-making in law enforcement.

Conclusion and Practical Implementation

During the pre- and posttest, it was noticeable that using service weapons with live ammunition added a considerable degree of realism and stress to the experiment. Even participants who were generally comfortable with weapon handling and basic firearms tactics showed apparent signs of stress-related limitations during the video scenarios. We assume that most participants would be less stressed in experiments using non-lethal training equipment like marking rounds (special weapons shooting soft colored projectiles that leave visible marks) or laser weapons with simulated recoil. However, non-lethal training equipment can provide other aspects of realism, like face-to-face scenarios with actors and complex 360° scenarios in real-world locations. Therefore, we recommend a balanced mix of theory-based training both with live ammunition and non-lethal alternatives.

Another crucial aspect of a professional police force is the trainers' and trainees' awareness that regular practice is vital. Fundamental "dry drills" without the use of live ammunition (for example, drawing, reloading, holstering, and clearing malfunctions) can be practiced virtually anywhere and anytime to automatize sequences of movements.

Just understanding tactical concepts is not enough to be prepared for highly complex and stressful real-life situations. Only a combination of theory, well-designed basic training, and further regular training provides law enforcement personnel with the necessary tools to handle potentially deadly situations with a maximum degree of professionalism. Officers must not only train to reduce the risk of losing their own life but also to reduce the risk of taking an innocent life.

The 90 min of theory-based firearms training showed considerable positive effects on participants' shoot/don't-shoot performance and weapon handling. These effects, however, seem to have been hampered by the still basic level of the participants' firearms proficiency and the brief nature of this one-time intervention. We surmise that regular training of this sort – not only with cadets but also with experienced officers – could further increase the observed effects. In particular, the shoot/don't-shoot scenarios seemed to have had a considerable "Aha effect" on the participants, which led them to better understand the nature of the split-second decisions they may have to make while performing their operational duties.

Law enforcement agencies need to further focus their firearms training on decision-making and tactical perception. Police officers, who shoot fast and accurately, are only good shooters if they base their shoot decisions on valid threat assessments. Making the correct decision to shoot or not shoot under stress and with limited time is an incredibly demanding task. Therefore, law enforcement agencies should be obliged to regularly renew their officers' firearms competency licenses based on well-designed tests. The tests for this renewal process must comprise not only aiming tasks but also perception-based shoot/don't-shoot tasks. Law enforcement firearms proficiency must not be confused with proficiency in competitive shooting sports.

Police officers should understand the tactical importance of a potential attacker's hands and hip region (cf., Heusler and Sutter, 2020a). In almost all cases, an attacker will have to use their hands to pose an immediate deadly threat. Although a suspect's face is a salient stimulus and may reveal some observable emotions, neglecting tactically more important regions could potentially be fatal. Faces do not operate firearms and knives – hands do!

In the current study, it was notable that some participants lowered their weapons immediately after the first shot and relaxed noticeably. However, police officers must understand that a single shot at an armed attacker might not instantly stop the immediate threat, even if the shot is well placed. Therefore, shoot/don't-shoot training should also train officers to reassess critical situations continually. Proper reassessment of an ongoing attack may result in the realization that further actions must be taken to stop the imminent threat.

The scientific investigation of police de-escalation tactics and their effectiveness is a relatively young field of study and has produced somewhat inconclusive results so far (Oliva et al., 2010; Todak, 2017; Todak and James, 2018; Todak and White, 2019; Bennell et al., 2020; Engel et al., 2020). However, as studies become more mature and findings accumulate, this field of research may provide valuable insights into equipping officers with more tools to find peaceful solutions for potentially deadly encounters – especially when combined with situational awareness, gaze control, and tactical attention strategies.

Li et al. (2020) found that non-stress law enforcement training is associated with significant reductions in police officers' use of deadly force. This approach may facilitate a citizen-oriented "guardian-mindset" as opposed to a militarized "warrior-mindset" in law enforcement (cf., Stoughton, 2016). Other research, however, suggests that training under elevated levels of anxiety is vital for police officers to perform in real-life threat scenarios (Oudejans, 2008; Nieuwenhuys and Oudejans, 2011; Liu et al., 2018). Instead of focusing too much on creating either guardians or warriors, we strongly advise giving officers the necessary tools (material, education, and training) to fulfill both roles. We believe that situational awareness and mental preparedness are the keys to a citizen-oriented police force that is also capable of withstanding robust confrontations.

A step toward modernizing police use-of-force training could be introducing a theory-based multidimensional model of law enforcement firearms competency. Traditional and outdated ways of evaluating firearms proficiency (like only relying on the previously described Hit Factor) should be complemented with aspects such as perception, decision-making, weapon handling, verbal communication, etc. This could substantially improve individual law enforcement agencies' abilities to evaluate their personnel's firearms proficiencies. Shooting quickly and accurately on predefined geometrical shapes is not as crucial for police officers as basing shoot decisions on valid threat assessments.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by the Ethical Review Committee of the German Police University. The patients/participants provided their written informed consent to participate in this study. Written informed consent was obtained from the individual(s) for the publication of any potentially identifiable images or data included in this article.

AUTHOR CONTRIBUTIONS

Both authors listed have made a substantial, direct, and intellectual contribution to the work, and approved it for publication.

ACKNOWLEDGMENTS

We wish to thank Petra Kohlleppel, Pia Willeke, and Christiane Spiegel for their research support. Many thanks are also given to Schahin Yasin, Jörg Schmidt, and Erik Egold for their practical contributions to the study.

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frontiers in Psychology

REVIEW
published: 07 March 2022
doi: 10.3389/fpsyg.2022.818009

Knowledge, Skills, and Abilities for Managing Potentially Volatile Police–Public Interactions: A Narrative Review

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OPEN ACCESS

Edited by:
Aloysius Henry Sequeira, National Institute of Technology, Karnataka, India

Reviewed by:
Vinitha Cabral, St. Agnes College (Autonomous), India
Arjun R., VIT University, India
Andra Diaconescu, Politehnica University of Timişoara, Romania

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Specialty section:
This article was submitted to Educational Psychology, a section of the journal Frontiers in Psychology

Received: *18 November 2021*
Accepted: *03 February 2022*
Published: *07 March 2022*

Citation:
Bennell C, Jenkins B, Blaskovits B, Semple T, Khanizadeh A-J, Brown AS and Jones NJ (2022) Knowledge, Skills, and Abilities for Managing Potentially Volatile Police–Public Interactions: A Narrative Review. Front. Psychol. 13:818009. doi: 10.3389/fpsyg.2022.818009

We conducted a narrative review of existing literature to identify the knowledge, skills, and abilities (KSAs) necessary for officers who police in democratic societies to successfully manage potentially volatile police–public interactions. This review revealed 10 such KSAs that are frequently discussed in the literature. These KSAs include: (1) knowledge of policies and laws; (2) an understanding of mental health-related issues; (3) an ability to interact effectively with, and show respect for, individuals from diverse community groups; (4) awareness and management of stress effects; (5) communication skills; (6) decision-making and problem-solving skills; (7) perceptual skills; (8) motor skills related to use-of-force; (9) emotion and behavior regulation; and (10) an ability to treat people in a procedurally just manner. Following our review, we conducted semi-structured interviews ($N = 7$) with researchers who specialize in police training and adult education, interactions with individuals in crisis, and racialized policing, as well as two police trainers with expertise in de-escalation and use-of-force training. These interviews confirmed the importance of the 10 KSAs and highlighted two additional KSAs that are likely to be critical: understanding the role of policing in a free and democratic society and tactical knowledge and skills. To ensure that police–public interactions are managed effectively, police trainers may want to focus on the development and evaluation of these KSAs—something that is not always done currently.

Keywords: competencies, use-of-force, de-escalation, law enforcement, police training, public safety, non-escalation

INTRODUCTION

Police officers are frequently involved in potentially volatile interactions with the public (Baldwin et al., 2016; Shjarback and White, 2016). A primary goal in such interactions should always be to minimize the potential for harm, which will often involve the use of non-escalation and de-escalation strategies by officers (Engel et al., 2020). When force is necessary to control these situations, the level of force used must be appropriate, given the totality of circumstances

faced by the officer (Cyr, 2016), and the application of that force should never be based on extraneous factors that are unrelated to risk (e.g., citizen race).[1]

In addition to being able to apply a range of skills in a competent manner, police officers must consider a range of other issues when managing police–public interactions. These complexities are captured to some extent in models that officers are taught to draw on when making critical decisions. For example, in Canada, police officers are often trained to apply "NRA principles" during their interactions with the public (e.g., Peel Regional Police, 2015). This encourages officers to think about whether their decisions are *necessary* (e.g., to address the threat), *risk effective* (e.g., avoiding unnecessary harm to the individual, officer, and others), and *acceptable* (e.g., legally, publicly, and ethically). Thus, in jurisdictions where NRA principles are relied on, an optimal outcome in potentially volatile police–public interactions is one that is defensible across these multiple elements.

Training is provided to police officers in many countries to increase the likelihood that these sorts of outcomes can be achieved during challenging interactions with the public. For this training to be effective, not only must it adhere to principles of training and learning, but also it must arguably target relevant knowledge, skills, and abilities (KSAs).[2] While some attempts have been made by researchers to articulate principles of training effectiveness and learning within the policing context (e.g., Angel et al., 2012; Andersen et al., 2017; Bennell et al., 2021; Jenkins et al., 2021), less effort has been invested in identifying exactly what KSAs to prioritize during police training.

The primary goals of this paper, therefore, are: (1) to begin the process of identifying the core KSAs that are relevant to the effective management of potentially volatile police–public interactions and (2) to determine the degree to which these KSAs have been empirically studied and supported. While we draw on international research to accomplish these goals, we are interested specifically in the implications of this review for policing in democratic societies, such as Australia, Canada, the United Kingdom (UK), and the United States (US). While we believe that the value of the identified KSAs, and the training that targets them, likely generalizes to other settings, the research and examples we draw on throughout this paper are heavily biased toward policing in these contexts.

[1]There is a lot of disagreement on how to define some of the terms highlighted in this paragraph (e.g., Todak, 2017). However, for the purpose of this report, *non-escalation* will refer to attempts by a police officer to prevent the escalation of conflict, tension, or harm in a police–citizen encounter. *De-escalation* will refer to attempts by a police officer to reduce conflict, tension, or harm in an encounter that has already escalated. Finally, *use-of-force* will refer to the use of any intervention by a police officer to compel compliance in an individual.

[2]By *knowledge*, we are referring to a theoretical or practical understanding of an issue, whereas we treat *skills* as specific proficiencies that are developed through experience or training and *abilities* as innate qualities that allow officers to successfully complete a relevant task.

METHODOLOGY

To accomplish our goals of identifying relevant KSAs and determining the degree to which they have been studied and supported, we adopted a two-stage methodological approach, each of which will be described in this section.

Narrative Literature Review

The first stage of our study was to conduct a narrative review of relevant literature using a two-step process. The first step of the narrative review involved an attempt to identify core KSAs highlighted in existing literature as being relevant to the management of potentially volatile police–public interactions in democratic policing contexts. In this first step, we conducted broad searches of 12 different databases (e.g., PsycINFO, Web of Science, and Scopus) using various keywords, as well as combinations of these keywords (e.g., knowledge/skills/abilities + non-escalation/de-escalation/use-of-force). The second step of the literature search involved a more targeted attempt to determine the degree to which the identified KSAs from the first step were supported by empirical evidence. In these more targeted searches, specific KSAs identified in the first step were used as key words (e.g., communication skills + de-escalation) so that empirical research related to these KSAs could be identified. For an article to be considered relevant to our review, it had to focus on a clearly defined KSA that may be relevant for managing police–public interactions, and it had to be examined within the context of public policing in a democratic society.

Given the lack of previous comprehensive reviews of such KSAs, a narrative literature review was deemed suitable. While less structured and comprehensive than a systematic literature review, narrative reviews not only allow researchers to gain an appreciation for the research landscape in an area, but they also lay the foundation for later systematic reviews. Narrative reviews, which are typically defined simply as a summary and critique of existing research, are common in the published literature, especially in fields like medicine (Baethge et al., 2019), and arguments have been made that they are valuable (Greenhalgh et al., 2018; Furley and Goldschmeid, 2021). However, there is also a danger that narrative reviews can be biased (e.g., cherry-picking studies to include in the review). To minimize this possibility, we paid particular attention to systematic reviews and meta-analyses when selecting literature to inform this paper.

Subject Matter Expert Interviews

The second stage of our study involved semi-structured interviews with a small sample ($N = 7$) of subject matter experts (SMEs) following the completion of our review to determine: (1) whether they thought the KSAs we identified were important and (2) whether we missed important KSAs when conducting our review. The SMEs included researchers who had published extensively on training and education, police interactions with individuals in crisis, and racialized policing, as well as two police trainers with expertise in non-escalation, de-escalation,

and the use of force. Interviews with these SMEs were completed either in person or *via* Skype by at least two interviewers, ranged from 90 to 180 min, and were audio-recorded so that we could refer to the conversation if required.

The basic structure for each interview was the same. Key terms were defined for the SME, such as non-escalation, de-escalation, and use-of-force, and then, each of the KSAs identified from the narrative literature review was presented one at a time. The SME was asked to speak to the relevance, or not, of each KSA for managing potentially volatile police–public interactions. The SMEs with expertise in responding to individuals in crisis and racialized community members were also specifically asked to reflect on the KSAs from that perspective. At the end of the interview, the SMEs were asked if they thought the list of KSAs was complete. If they did not, they were asked to provide additional KSAs that they felt were important. All SMEs agreed that the identified KSAs were important. However, the interviewees identified two additional KSAs that did not emerge from our review.

Each of the 10 KSAs that were identified in the narrative literature review are briefly described below and we highlight the state of empirical research surrounding each KSA, focusing as much as possible on previous systematic reviews and meta-analyses. Where systematic reviews and meta-analyses are not available, we draw from other types of research, including qualitative analyses, experimental studies, and randomized controlled trials. Following this, we discuss the two additional KSAs that emerged from the SME interviews. Beyond highlighting the complex nature of police–public interactions, and the competencies that are likely necessary to navigate the myriad challenges that might be encountered during these interactions, the KSAs identified in this study speak to issues that should arguably be targeted in training and help to clarify where current training gaps might exist. Accordingly, we conclude the paper by discussing the implications of our findings for police training and its evaluation.

OFFICER KSAS IDENTIFIED IN THE LITERATURE

The broad KSAs that emerged from our literature review include: (1) knowledge of organizational policies and laws; (2) an understanding of mental health-related issues; (3) an ability to interact effectively with, and show respect for, individuals from diverse community groups; (4) awareness and management of stress effects; (5) communication skills; (6) decision-making and problem-solving skills; (7) perceptual skills; (8) motor skills, especially as they relate to the application of use-of-force; (9) emotion and behavior regulation; and (10) an ability to treat people in a procedurally just manner.

Knowledge of Organizational Policies and Laws

Knowledge of relevant organizational policies and laws, and an understanding of how to apply this knowledge in operational settings, has been highlighted as critical for officers (e.g., Prenzler et al., 2013; Rajakaruna et al., 2017). It is beyond the scope of this paper to cover the full range of policies and laws that police professionals and academic researchers have highlighted as being important for effectively managing potentially volatile interactions between the police and the public. Instead, we provide several pertinent examples to clarify the content of this domain and to illustrate why this knowledge and understanding may be critical.

One example of why knowledge of organizational policies is important is that these policies typically dictate the courses of action available to officers working in a particular police service and the conditions under which certain response options are appropriate. For example, consider the use of conducted energy weapons (CEWs), which have been shown to be an effective use-of-force intervention option (e.g., Baldwin et al., 2017) and a useful de-escalation tool in some settings (e.g., Ho et al., 2011). Police services have different policies regarding the use of CEWs, such as whether using CEWs is permitted at all, who can use CEWs, under what conditions CEWs are allowed to be used, and so on. To ensure that the use of CEWs is congruent with expectations within any given police service, and to make sure they are used appropriately, researchers have suggested that officers need to be fully aware of, and understand, their organization's CEW policies (e.g., Alpert and Dunham, 2010).

It has also been stressed that officers must understand the laws that dictate their policing authorities if they are to effectively manage potentially volatile situations. Laws governing the appropriate use of force are seen as being particularly important for officers to understand (e.g., Cyr, 2016). Contributors to this literature have also argued that officers should be familiar with significant pieces of legislation in the jurisdictions within which they operate, which fundamentally impact the ways in which the police can interact with people in crisis. Knowledge of legislation that regulates the administration of mental health care and specifies the criteria that need to be met for officers to take people experiencing mental health issues into custody is seen as being particularly important (e.g., Cotton and Coleman, 2008).

While we believe that knowledge of organizational policies and laws will have a significant, positive impact on an officer's ability to interact effectively with the public, little research could be found that directly examines this KSA. For example, we could not locate any research that has compared the performance of officers who vary with respect to how much knowledge they possess around these matters. However, there is research indicating that organizational policy can positively influence police behavior, such as reducing their reliance on the use of force (e.g., White, 2001; Ariel et al., 2016; Jennings and Rubado, 2017; Shjarback et al., 2021). Organizational policies seem to have this effect by restricting the conditions under which certain actions (e.g., deadly force) can be taken by officers, thus limiting inappropriate officer discretion, and by providing police organizations or other bodies with the ability to formally address policy violations, which might act as a deterrent to other officers.

An Understanding of Issues Related to Mental Health

Another KSA that has been increasingly highlighted in the literature is a deeper understanding of issues related to mental health (e.g., Cotton and Coleman, 2010; Jennings and Hudak, 2021). This KSA is particularly important given that interactions with persons who have a mental illness (PMIs) account for a significant percentage of police–public encounters in some jurisdictions (e.g., Brink et al., 2011; Boyce et al., 2015). Research suggests that officers do not always feel adequately prepared to handle potential crises involving PMIs (Reuland et al., 2009), and many police professionals and academic researchers have argued that police officers require additional training related to a broad range of mental health topics to address this issue. Suggested topics include the nature of mental illnesses, the tenuous relationship between mental illness and violence, the recognition of symptoms related to various mental illnesses, the sorts of strategies that can be utilized to effectively deal with behaviors exhibited by people experiencing mental health crises, and the likely reactions of PMIs to various police interventions (e.g., Lamb et al., 2002; Coleman and Cotton, 2014; Jennings and Hudak, 2021).

Relatedly, researchers have underscored the importance of officer attitudes with respect to mental health and PMIs. For example, it has been noted that an officer's attitude toward PMIs (which will likely be shaped, in part, through training) is likely to influence their interactions with PMIs, including the outcome of these interactions (Watson et al., 2004; Watson and Angell, 2007). Much like they are in the broader community (e.g., Taylor and Dear, 1981; Corrigan et al., 2003), PMIs are frequently stigmatized by police officers. For example, one attitude that is relatively pervasive in some studies of police officers is that PMIs are likely to be dangerous (e.g., Penn et al., 1999; Ruiz and Miller, 2004; Watson et al., 2004). Even if an officer can accurately determine that they are interacting with a PMI, endorsing such a view will likely result in a suboptimal outcome to the interaction. Because perceived risk of threat plays a key role in an officer's assessment of an encounter (see discussion of perceptual skills below), researchers have argued that reducing biases around mental illness may allow officers to interact with PMIs more effectively (Penn et al., 1999).

Another relevant KSA that has been highlighted relates to an officer's knowledge and understanding of community mental health resources (Lamb et al., 2002). If police officers are unaware of community resources that can help support PMIs, or they do not know how to access them, situations that could potentially be resolved through appropriate referrals and diversions may escalate unnecessarily (e.g., Morabito, 2007; Morabito et al., 2012; Koziarski et al., 2021). Unnecessarily escalating an encounter can be costly, both in terms of officer and public safety, and in terms of police resources (e.g., more time will likely need to be dedicated to the case over time; Coleman and Cotton, 2010; Semple et al., 2021b).

Despite some mixed results, evaluations of mental health training for officers across North America and Europe where many of the above KSAs have been targeted, often report positive findings. For example, Seo et al. (2021) recently conducted a systematic review and meta-analysis of studies that examined the impact of Crisis Intervention Training (CIT) for police officers. Within these studies, there was a substantial effect on reported self-efficacy/confidence in responding to mental health calls ($M_d = 1.10$, $k = 5$) and knowledge of mental illness ($M_d = 0.90$, $k = 8$), and a moderate effect of CIT on attitudes toward PMIs ($M_d = 0.47$, $k = 8$). They also found positive effects for time spent on scene with the individual as well as on the outcome of the call ($M_d = 0.94$, $k = 3$ and $M_d = 0.40$, $k = 8$, respectively). In contrast, the results for observed outcome measures, such as the use of force, arrests, and injury rates to officers and citizens, were less positive, ranging from −0.04 (injuries, $k = 1$) to 0.10 (use-of-force, $k = 3$). Despite the generally promising results reported in this meta-analysis, numerous methodological issues were raised about the studies being conducted on these topics; issues that warrant consideration when interpreting research that purportedly demonstrates the value of mental health training (Seo et al., 2021).

Ability to Interact Effectively and Respectfully With Diverse Community Groups

Perhaps more than any other competency discussed in this paper, the KSA that seems to be occupying most of the public's (and media's) attention is an officer's ability to interact effectively, and respectfully, with individuals from diverse community groups. If officers have biased views toward members of a particular group or are otherwise ill-equipped to interact appropriately with such members, undue conflict is likely to emerge (e.g., officers will be less likely to de-escalate such encounters effectively; Mastrofski et al., 1996; Tyler and Wakslak, 2004; Rosenbaum and Lawrence, 2017). While members of various communities have publicly addressed their tenuous relationship with the police (e.g., homeless young people persons who use substances, the LGBTQIA2+ community, PMIs, etc.; Baron, 2016; Israel et al., 2016; Krameddine and Silverstone, 2016), we focus here on interactions between the police and racialized communities given ongoing concerns about these relationships, which have been reignited since the death of George Floyd in May 2020 at the hands of a Minneapolis police officer (Hill et al., 2020).

Within North America, most of the available police research indicates that force is used disproportionately against members of racialized communities (e.g., Wortley, 2006; Fridell and Lim, 2016; Edwards et al., 2019; Wortley et al., 2020). This finding likely explains in part why members of racialized communities often express negative attitudes toward the police (e.g., Cheurprakobkit, 2000; Rosenbaum et al., 2005; MacDonald et al., 2007; Cao, 2011). As such, police professionals and researchers have argued that more time needs to be dedicated to developing KSAs that will improve police relations with racialized communities, and officer interactions with members of these communities (e.g., Shaffir and Satzewich, 2011; Schlosser et al., 2015; Spencer et al., 2016).

This will likely require the development of numerous KSAs. Included among those that have been emphasized in the literature is an understanding of historic and current police misconduct and how this may shape perceptions of the police among racialized groups, knowledge about how one's place of origin may influence perceptions of the police, awareness of an officer's own attitudes toward various racialized communities, an appreciation for cultural sensitivities, such as how body language may have alternative meanings across racialized groups, and an ability to reduce the expression of racial biases (e.g., Shusta et al., 2002; Ben-Porat, 2008; Schlosser et al., 2015; Spencer et al., 2016; Fridell, 2017).

Surprisingly, our search for literature examining such KSAs in the policing context identified relatively few studies. While research examining racial biases in various policing contexts was plentiful (e.g., traffic pullovers, stop and frisk, and police use of force; Lundman and Kaufman, 2003; Gelman et al., 2007; Paoline et al., 2018), well-controlled examinations of KSAs that might prevent such biases were much more rare. The research we could locate fell into two categories: assessments of cultural awareness (e.g., the importance of respecting diversity) and examinations of implicit bias (e.g., the importance of reducing the activation or managing the expression of implicit racial biases).

Only a small amount of research appears to be conducted on cultural awareness training for police officers, but studies that have been conducted support the value of this KSA. For example, Cornett-DeVito and McGlone (2000) found that two 4-h cultural awareness training sessions had a significant, positive effect on trainees with respect to attitudinal changes (e.g., being non-judgmental). This is generally consistent with evaluations from other fields. Importantly, these evaluations also suggest that such training can impact more than just attitudes; the training can also influence behavior at work. For example, in a meta-analysis of 65 studies, Kalinoski et al. (2013) found that diversity training in a variety of work contexts, including policing, positively influenced a range of affective-based (e.g., attitudes; $M_d = 0.27$, 95% CI [0.21, 0.33], $k = 44$), cognitive-based (e.g., knowledge, $M_d = 0.62$, 95% CI [0.52, 0.72], $k = 25$), and skill-based outcomes (e.g., on-the-job behavior; $M_d = 0.35$, 95% CI [0.20, 0.50], $k = 6$).

The influence of implicit racial biases has been more extensively studied in policing, but only in a limited range of settings. The topic studied most relates to shoot/no shoot decision-making. In their meta-analysis of 42 such studies, Mekawi and Bresin (2015) found mixed results related to shooting biases depending on the way bias was operationalized. For example, when compared to White individuals, participants in these studies are significantly faster to shoot armed Black individuals ($M_d = -0.13$, 95% CI [−0.19, −0.06], $k = 32$), slower to *not* shoot unarmed Black individuals ($M_d = 0.11$, 95% CI [0.05, 0.18], $k = 32$), and have a more liberal shooting threshold for Black individuals ($M_d = -0.19$, 95% CI [−0.37, −0.01], $k = 29$). In contrast, participants in these studies are not more likely, on average, to shoot more unarmed Black individuals as compared to White individuals ($M_d = -0.01$, 95% CI [−0.11, 0.09], $k = 28$). Importantly, and of most relevance to the current review, when examining whether shoot/no shoot decisions are predicted by the prejudicial attitudes of the participants—measured as personal endorsements of stereotypes or knowledge of cultural stereotypes—the meta-analysis found "very small relations with shooter biases" (p. 128). This raises questions about whether the ability to manage prejudicial attitudes is an important KSA to possess within this context; however, the studies included in the meta-analysis lack ecological validity, so the extent to which any of these results generalize to field settings is unclear.[3]

That being said, evaluations of police training programs delivered in real-world settings that are designed to increase awareness of implicit biases also raise doubts about the role of implicit biases in police decision-making (or at least, the impact that implicit bias training can have on decision-making). In one recent study, Worden et al. (2020) carried out a randomized controlled trial of Fair and Impartial Policing (FIP) within the New York City Police Department. Their evaluation examined the effects of this training on officers' beliefs and attitudes (compared to before the training) as well as its effects on enforcement actions. Their results were mixed, but generally not promising.

With respect to officers' knowledge of implicit biases, moderate improvements were seen, although there was some decay observed in follow-up surveys conducted 2–13 months post-training. Only small improvements were observed in officers' attitudes toward discrimination and their motivation to act without prejudice, potentially explained by the fact that, even prior to training, most officers already considered discrimination to be a significant problem and indicated they were motivated to act without bias. In terms of the real-world impact of the training, when officers were asked about the extent to which they applied the FIP training during the month prior to the survey, results revealed that 42% reported not using the training, 31% reported using it sometimes, and 27% reported using it frequently. Relatedly, when Worden and colleagues examined the impact of the training on reducing racial/ethnic disparities in enforcement actions, such as stops, frisks, searches, arrests, and applications of force, results did not reveal evidence that disparities were reduced for those that received the training.

Awareness and Management of Stress Effects

The ability to recognize stress in oneself, understand how it will impact performance, and mitigate its effects have all been identified as important competencies that are apt to improve an officer's ability to effectively manage potentially volatile

[3]It is important to point out that several studies conducted since the time of this meta-analysis are more ecologically valid (e.g., using interactive simulations of police–citizen encounters rather than static images of individuals presented on a desktop computer). Particularly noteworthy are the studies carried out by James and her colleagues. Interestingly, they report results that are drastically different from many of the studies included in the reported meta-analysis (e.g., evidence for a shooting bias against White individuals rather than Black individuals; James et al., 2016). Consistent with this meta-analysis, however, James et al. (2016) found that measures of implicit biases were not predictive of shooting biases.

police–public interactions (e.g., McCraty and Atkinson, 2012; Andersen et al., 2015; Andersen and Gustafsberg, 2016).[4] Police frequently experience high levels of stress during these interactions (Anderson et al., 2002; Andersen et al., 2016; Baldwin et al., 2019) and a heightened stress response can have significant implications for how police officers respond. Indeed, based on our review of the literature, it is clear that while some level of stress can improve performance, significant amounts of stress can result in impairments to various aspects of police performance including shooting accuracy (e.g., Taverniers and De Boeck, 2014), quality of skill execution (e.g., Renden et al., 2014), proportionality of force applied (e.g., Nieuwenhuys et al., 2012), self-control (e.g., Haller et al., 2014), perceptual and attentional control (e.g., Giessing et al., 2019), memory (Hope et al., 2012), and communication (e.g., Arble et al., 2019).

Studies also generally support the fact that one's awareness of stress effects, and more importantly, one's ability to manage those effects, can improve an officer's performance in potentially volatile police–public interactions (e.g., Oudejans, 2008; Nieuwenhuys and Oudejans, 2011; Arnetz et al., 2013). For example, training in environments which gradually increase the level of stress to develop stress resiliency in officers has been associated with improved performance during subsequent high-stress encounters (e.g., Oudejans and Pijpers, 2009; Nieuwenhuys and Oudejans, 2011) and programs that focus on relaxation and imagery training to develop an officers' ability to modulate their stress response during potentially volatile police–public interactions can also improve performance (e.g., Arnetz et al., 2009; Andersen and Gustafsberg, 2016; Andersen et al., 2018). However, more research is certainly needed to ensure that performance improvements regularly transfer to field settings.

Meta-analytic studies also support the importance of these KSAs. For example, a meta-analysis of 37 studies conducted by Saunders et al. (1996), which examined the impact of stress-exposure training on performance in various domains (e.g., sport and medical), revealed that this training has a moderate impact on performance enhancement ($r = 0.296$, $p < 0.001$). A more recent meta-analysis that focused on pressure training, which is like stress-exposure training, reported similar results, including a moderate effect on performance for the three studies that were conducted in the law enforcement context ($g = 0.63$, 95% CI [−0.14, 1.39]; Low et al., 2020).

Strong Communication Skills

The ability to communicate effectively is a KSA that has long been recognized by police professionals and academic researchers as a skill set that will likely assist police officers in preventing encounters from escalating unnecessarily and promoting effective de-escalation (e.g., McCamey and Carper, 1998; Kesic et al., 2013; Police Executive Research Forum, 2016). It has been proposed that both verbal and non-verbal communication can be used by those involved in potentially volatile situations to create clear expectations and accomplish negotiated positions of mutual benefit (Gertz, 1980; Lowe, 1992; Duperouzel, 2008). In the policing context, effective communication skills have been deemed especially important because they can be applied to gain voluntary compliance, hence decreasing the likelihood that officers will have to rely on force (Sun, 2003; Todak and James, 2018).

Much of what is known about the use of communication to effectively manage police–public interactions comes from fields outside of policing (e.g., the healthcare setting; Price and Baker, 2012; Richmond et al., 2012; Engel et al., 2020). However, researchers have argued that many of the same principles that apply to calming agitated individuals in other contexts (e.g., patients) are likely to apply to citizens with whom officers interact (e.g., Oliva et al., 2010; McDermott and Hulse, 2012). Researchers speaking to these issues highlight a series of communication strategies intended to facilitate calmness. Among other things, such strategies include: (1) showing empathy; (2) respecting individuals and their personal space to create safe and comfortable distances; (3) using appropriate body language, such as not concealing one's hands or engaging in excessive staring, which may be interpreted as threatening; (4) establishing rapport (e.g., by introducing oneself) and ensuring that expectations are clear and that individuals are reassured that the intervener wants to help; (5) giving people options or choices to the extent possible; (6) being concise and using simple language to increase understanding and reducing the likelihood of the situation escalating due to confusion; (7) repeating messages, which can combat the effects of limited processing if the individual is agitated; (8) active listening, which involves the intervener demonstrating to the individual that they care and are truly listening, often through the use of verbal and non-verbal gestures (e.g., head nods, restating statements, paraphrasing, and summarizing); (9) setting limits (e.g., being clear about what behavior is and is not acceptable, and what the consequences for unacceptable behavior are); and (10) reducing stimulation (e.g., eliminating unnecessary distractions; Carlsson et al., 2000; Johnson and Hauser, 2001; Duperouzel, 2008; Price and Baker, 2012; Todak and James, 2018).

The limited research conducted within the policing context suggests that communication training can influence officer behaviors. For example, Krameddine et al. (2013) evaluated specially designed scenario-based training to improve police interactions with PMIs, much of which involved post-scenario feedback from instructors and the role players about the officers' use of verbal and non-verbal communication strategies. While officer attitudes toward PMIs did not change as a result of training, there were tangible improvements seen in various real-world behavioral outcomes, including a significant increase in recognizing that mental health issues were the reason for a call, improved efficiency in dealing with mental health calls, and decreases in the use of weapons and physical force during interactions with PMIs. Similarly, during an evaluation of Chicago's Quality Interaction Program, Rosenbaum and Lawrence (2017) found that officers who completed training

[4]Although not examined to the same extent, the ability to recognize stress in others may also be an important KSA. This would likely fall in another domain, likely the perceptual skills discussed below, given that an assessment of the individual, which is largely based on the perceptions of the officer, is commonly included in many of the risk assessment models that police officers rely on. See that section for a discussion of risk assessment.

that focused on communication skills, such as listening, empathy, and procedural justice, were more respectful and reassuring during role play scenarios and relied on force and arrests less often than those who did not receive the training.

Other, more recent evaluations of training programs that focus (at least to some extent) on improving officer communication have also revealed some positive results. For example, a randomized controlled trial of a social interaction training program conducted by McLean et al. (2020) found that trained officers placed high priority on procedurally fair communication during hypothetical police–public encounters. However, analyses did not show an effect of training on police use of force. This stands in contrast to the recent randomized controlled trial of Integrating Communications, Assessment, and Tactics training conducted by Engel et al. (2022). They report on many impacts of this training, including positive changes in officer attitudes, but also changes in actual officer behaviors, most notably significant reductions in the use of force (and associated reductions in citizen and officer injuries).

Decision-Making and Problem-Solving Skills

Officers frequently rely on sound decision-making and problem-solving skills to perform successfully in the field (e.g., Kilner and Hall, 2005; Ward et al., 2011; Suss and Ward, 2012; Preddy et al., 2020). In many cases, decisions will have to be made in a split-second and require rapid problem-solving; at other times, more deliberate decision-making will be possible based on strategic problem-solving skills (Murgado, 2012). While important for most policing tasks, sound decision-making and problem-solving skills are especially important when deciding how to manage a potentially volatile police–public interaction.

The importance of sound decision-making and problem-solving in this context is made evident when one considers the concept of officer-induced jeopardy. Officer-induced jeopardy occurs when an officer fails to make tactically sound decisions, which ultimately places them (and potentially others) at an elevated risk of harm (Klinger, 2005; Cyr, 2016). In some cases, this can lead to a situation where the only viable option to resolve the incident is to use a high level of force (Adang, 2012); had the officer made a different series of decisions, less force (or no force) may have been sufficient for resolving the conflict (Klinger, 2005; Cyr, 2016). Examining data from a Belgian police force, Pauwels et al. (1994) identified several tactical "sins" committed by officers that increased the likelihood of a suboptimal outcome. Examples of such tactical sins include decisions to jump in front of approaching vehicles, not utilizing available cover, and giving chase at any price.

We were unable to locate any systematic reviews or meta-analyses on the topic of police decision-making and problem-solving; however, we identified a reasonably large volume of research pertaining to the application of these skills in the context of potential use-of-force encounters. One KSA that has received a considerable amount of attention is adaptive (or flexible) problem-solving. Collectively, research on this topic suggests that the problem-solving processes that experienced police officers engage in, both in simulated and real-world encounters, are often substantially different from the processes that characterize less experienced officers (e.g., Boulton and Cole, 2016; Heusler and Sutter, 2020; Mangels et al., 2020). Boulton and Cole (2016), for example, found that adaptability was a key factor that distinguished expert authorized firearms officers in the United Kingdom from more junior officers in that experienced officers demonstrated greater flexibility in responding to situational changes in complex incidents, whereas novice officers were bound by more rigid, sequential, and linear decision-making strategies, which tended to align with standard operating procedures. These results are consistent with other research that has revealed important differences in the decision-making and problem-solving abilities of experienced and novice police officers that lead to enhanced performance for experienced officers, such as the ability to anticipate outcomes of interactions (e.g., Tashman et al., 2006; Ward et al., 2011; Suss and Ward, 2013).

The training literature also appears to support the role of these competencies in achieving optimal outcomes in police–public encounters (Preddy et al., 2020). For example, McCombs (2015) examined use-of-force rates over time within the Columbus Police Service following the implementation of a problem-based learning approach for all police recruits. While controlling for unemployment and homicide rates within the city, as well as officer experience, McCombs found that for every hour of problem-based learning that officers received, use-of-force rates decreased by 17 incidents a year. These findings suggest that the training allowed officers to implement problem-solving more effectively during their interactions with the public, in turn reducing the need for officers to use force.

Perceptual Skills

In any given interaction with a member of the public, a police officer is tasked with conducting an initial risk assessment of the situation, which is subject to continuous revision and updating as the situation unfolds (Canadian Association of Chiefs of Police, 2000). This risk assessment is crucial in guiding an officer's response to the situation. Although the risk assessment process is based purely on the officer's perception of the incident, the process is often guided by an overarching use-of-force model or framework (e.g., Canadian Association of Chiefs of Police, 2000). These frameworks represent various factors that an officer should consider when conducting a risk assessment to help ensure an appropriate and justifiable response to an incident. The capacity of an officer to conduct a comprehensive risk assessment affects their ability to appropriately formulate a response to prevent the escalation of an incident, to effectively de-escalate a situation, and/or to apply appropriate force when it is necessary to do so. Given that the entire risk assessment process is driven by an officer's perception, it has been argued that advanced perceptual skills are an important KSA for officers (Dror, 2007; Tiesman et al., 2015).

To ensure that risk is accurately perceived, it has been argued that officers require high levels of situational awareness, which has been defined as "the ability to perceive and process

all potential threats in the environment" (Andersen and Gustafsberg, 2016, p. 4). Situational awareness is thought to occur in three stages (Endsley, 1988). The first stage involves perceiving elements of the environment, the second stage involves understanding the meaning of the identified elements, and the final stage involves the projection of future events that may occur based on an understanding of the situation.

Despite the obvious importance of the risk assessment process for police decision-making during potentially volatile police–public interactions, this process has rarely been the subject of empirical scrutiny within the policing context. Consequently, we were unable to locate any systematic research on the topic of risk assessment. However, our literature search did uncover a small number of empirical studies that support the importance of perceptual skills generally, and situational awareness specifically. For example, with respect to perceptual skills, research has demonstrated that tactical officers are better able to discriminate between threatening (e.g., a gun) and benign (e.g., cellphone) stimuli during rapid shoot/no shoot scenarios compared to more novice officers (Vickers and Lewinski, 2012; Johnson et al., 2014). In part, this ability appears to be due to differences in where officers are focusing their attention; for example, tactical personnel spend more time looking at areas where weapons can be concealed or held (e.g., hands or waist; Heusler and Sutter, 2020) compared to novices who tend to focus on elements like the face of the individual with whom they are interacting (e.g., Vickers and Lewinski, 2012; Landman et al., 2016; Heusler and Sutter, 2020).

Several studies have also demonstrated positive effects of training programs, which seek to improve situational awareness during simulated encounters (e.g., Saus et al., 2006; Andersen and Gustafsberg, 2016; Andersen et al., 2018). Generally, this research suggests that officers who complete these programs have improved situational awareness (e.g., being able to identify more threat cues in the environment) compared to those in control groups, which results in better decision-making. For example, in one study, Saus et al. (2006) attempted to improve situational awareness during use-of-force events by providing 20 new Norwegian police recruits with this sort of training. Training involved participants taking part in scenarios delivered *via* a simulator. Within each scenario, a freeze technique was used whereby the video simulation was stopped during which time participants would be asked about the three phases of situational awareness (i.e., perception, comprehension, and projection); similar discussions were held during debriefings. Those recruits who received training were compared to a control group of 20 new recruits who received more traditional marksmanship training on the simulator. Among other findings, trained recruits demonstrated improved situational awareness and improved decision-making (e.g., shot frequency and hit rate) in a shoot scenario compared to recruits in the control group. Similar results have been reported more recently by Andersen and Gustafsberg (2016).

Motor Skills Related to Use-of-Force

While the use of force should be avoided whenever possible, police officers clearly need to develop the ability to effectively apply force when required to do so. Indeed, the ability to efficiently and effectively gain control of an individual may be crucial when attempts to de-escalate have failed or are not feasible. Under these circumstances, an officer must sometimes use force to protect themselves or others. Appropriate levels of force can also prevent a situation from escalating further, thus reducing the overall potential for harm. For example, as mentioned previously, Ho et al. (2011) examined the use of CEWs within a hospital setting. Ho et al. (2011) found that simply using the laser sighting device, which projects red dots on the individual, prevented interactions with agitated patients from escalating. Ideally, officers should also know what intervention options work best in any given set of circumstances, with respect to both effectiveness and safety (Baldwin et al., 2018; Baliatsas et al., 2021; Semple et al., 2021a).

While recent real-world tragedies, including the recent death of Daunte Wright (Nickeas, 2021) in the United States,[5] clearly highlight the need for officers to have mastery of their use-of-force intervention options, we were unable to locate any systematic reviews, meta-analyses, or experimental research that specifically examined these sorts of KSAs. However, some research supports the view that proficiency in the use of intervention options will likely be associated with numerous benefits, including enhanced public and officer safety. For example, it has been found that injuries to both citizens and officers are more likely when the officer needs to apply additional force after an initial intervention was insufficient at gaining control of the individual (e.g., Adedipe et al., 2012). Similarly, the longer it takes for an officer to gain control of an individual, the greater the likelihood of both parties becoming injured (e.g., Castillo et al., 2012). Other research has found that the longer a conflict between an officer and an individual lasts, the more likely an officer is to use force, even when the individual is displaying non-violent resistance (Alpert et al., 2004; Wolf et al., 2009). Thus, based on existing research, it seems relatively clear that when officers can quickly gain control of resistant or aggressive individuals through the appropriate and effective use of force, officers are likely to prevent the encounters from escalating further, ultimately requiring less force, which likely results in fewer injuries.

It may also be worth highlighting that if officers are able to gain control of a resistant or aggressive individual efficiently and effectively without using force, or using lower levels of force, not only are injury rates to both parties likely to be reduced, but the optics of the encounter will likely improve. Research suggests that the perceived legitimacy of police use-of-force is related to the public's approval of the police (Tuch and Weitzer, 1997; Kaminski and Jefferis, 1998; Weitzer, 2002). Thus, if the public views an officer's use of force as excessive (e.g., because the officer uses force multiple times or escalates their level of force because the initial application of force was ineffective) or biased (e.g., because the officer's use of force seems to be influenced by irrelevant factors, such as the citizen's race), perceptions of the police are likely to be compromised. Therefore, it is arguably more beneficial, from both a safety perspective *and* a public relations perspective,

[5]In the case of Daunte Wright, Officer Kimberly Potter fatally shot the victim when she intended to reach for her CEW.

for an officer to use an effective intervention option once than to use additional force incrementally. In cases where multiple applications of force are used, any recording of the event that surfaces, and the media attention that inevitably follows, will likely only allow viewers to focus on the quantitative aspects of the encounter (e.g., the number of force applications) rather than qualitative components (e.g., the initial application of force was ineffective, but the perceived threat persisted, thus necessitating additional force). As such, efficient and effective force by officers may also improve the perception of any use-of-force encounter.

Emotion and Behavior Regulation

Police are routinely exposed to situations that elicit intense emotions, but which require a controlled response (Berking et al., 2010). By its nature, police work can be dangerous and unpredictable, and it will certainly involve many interactions with individuals who can be anxious, angry, upset, or confused. Officers are tasked with regulating their own emotions and behaviors to make sound decisions during their interactions with the public, regardless of how antagonistic the situation becomes. In many cases, this may allow officers to accomplish important goals (e.g., de-escalating an encounter; Baumeister et al., 2006, 2007). Indeed, Tangney et al. (2004) found that those with higher self-control are better able to inhibit undesirable responses and accomplish their goals in high pressure situations relative to those with lower self-control. Therefore, emotion regulation and behavioral control are likely implicated in an officer's ability to de-escalate and make appropriate use-of-force decisions in the field.

Consistent with this, the need to remain "above" the conflict during tense situations has been highlighted by police as an important KSA (Murphy, 2009; Rajakaruna et al., 2017) and this is supported by the de-escalation literature. For example, in their review of the literature examining key components of de-escalation in healthcare settings, Price and Baker (2012) found that maintaining personal control was particularly important. Furthermore, self-control has been associated with enhanced decision-making in both simulated and real-world settings within policing (e.g., Brown and Daus, 2015; Donner et al., 2017) and non-policing contexts (de Ridder et al., 2012). For example, in one study, police who completed a task that was previously shown to reduce one's self-control (i.e., the cold pressor task; Hagger et al., 2010) were faster to initiate aggressive action toward a role player (Staller et al., 2018). Some researchers have also created proxies for self-control using background information on police officers (e.g., whether the officer had ever had their driver's license suspended) to examine the relationship between complaints against officers and the use of force (Donner and Jennings, 2014; Donner et al., 2017). These studies suggest that lower ratings of self-control are positively associated with officers receiving public complaints for verbal and physical abuse, as well as being involved in police shootings.

One way to increase self-control has been referred to as "thinking slow" (i.e., engaging a cognitive system described as conscious, controlled, deliberate, effortful, statistical, and suspicious; Kahneman, 2011). In contrast, "thinking fast" is automatic, intuitive, unconscious, and effortless, and is largely governed by emotions (Brown and Daus, 2015). The fast-thinking system, while obviously important, particularly for potentially risky split-second situations that require quick, adaptive responses, is prone to systematic errors (Schleifer, 2012). This is likely because the fast-thinking system appears to be largely controlled by one's schemas and stereotypes, which can result in serious mistakes if one is not careful (e.g., unintentionally acting on a racial bias).

Given the potential consequences of "thinking fast," Owens et al. (2018) evaluated a program that sought to help officers develop their ability to "slow down" their thinking during interactions with the public. After being involved in an incident in which a report had been filed or an arrest had been made, 221 officers were randomly assigned to participate in a supervisory meeting while 1,213 officers acted as the control group and did not partake in a meeting. During the meeting, officers were asked a series of open-ended questions designed to get them to slow down and reflect on the decisions they had made on scene (e.g., did they incorporate new information into their understanding of what occurred as the event unfolded, or did they act on autopilot?). Six weeks after the supervisory meeting, officers were 12% less likely to make an arrest and between 16 and 50% less likely to be involved in a use-of-force event compared to those in the control condition. Owens and colleagues concluded that a minor supervisory intervention that encourages officer to slow down their thinking may result in substantive changes in how police and citizens interact with each other. They note that there will always be situations where automated responses (i.e., fast thinking) and punitive outcomes are necessary. However, they argue that, "…to the extent that (otherwise efficient) automation can occasionally lead to the escalation of an encounter, officers who continue to gather and process all information available on scene [i.e., engage in slow thinking] … may be able to recognize and diffuse tense situations sooner" (pp. 48–49).

Treating Citizens in a Procedurally Just Manner

Police professionals and academic researchers, particularly in Australia, the United Kingdom, and the United State, have dedicated much effort over the last several decades to understanding how an officer's treatment of a citizen during their interaction can impact the encounter (McCluskey et al., 1999). More specifically, research has examined how treating citizens in a procedurally just manner influences outcomes of encounters. Given mounting evidence demonstrating that the degree of procedural justice shown by officers during encounters with the public positively influences citizen behavior, it has been argued that this is likely to be a KSA that could enhance an officer's ability to effectively manage potentially volatile police–public interactions (e.g., Mastrofski et al., 1996; Watson and Angell, 2007; Dai et al., 2011).[6]

[6]It should be noted that there are long standing debates about whether the value of procedural justice principles is culturally specific (e.g., Sun et al., 2017).

Procedural justice is generally thought to include several key components. According to Mazerolle et al. (2013), procedural justice in the context of police–public encounters focuses on: (1) dialogue that encourages citizen participation during the interaction prior to an officer reaching a decision (what is called "citizen voice"); (2) neutrality in an officer's decision-making; (3) the expression of dignity and respect throughout the encounter; and (4) attempts to convey to citizens that the officer has trustworthy motives. Research indicates that officers who interact with citizens in a procedurally just manner can generate positive outcomes, such as citizens being more likely to comply with officer requests (e.g., Dai et al., 2011; Walters and Bolger, 2019; Wolfe et al., 2019). Relatedly, other research has shown how procedural justice principles may improve an officer's ability to de-escalate situations or prevent them from escalating in the first place (e.g., Rosenbaum and Lawrence, 2017).

Evaluations of procedural justice training have also generally produced positive results, suggesting that an officer's ability to draw on principles of procedural justice during their interactions with the public is an important KSA. For example, in a systematic literature review of 28 studies, Mazerolle et al. (2013) found that, regardless of the initiative, the public reported an increased willingness to cooperate and comply with police requests in areas where legitimacy-enhancing programs were implemented, in addition to voicing a greater degree of general satisfaction with the police.

OFFICER COMPETENCIES IDENTIFIED BY SUBJECT MATTER EXPERTS

During the interviews, all the SMEs agreed that officers should possess the KSAs identified in our narrative literature review if they are to be able to effectively manage potentially volatile police–public interactions. However, as previously mentioned, they identified two additional sets of KSAs that did not emerge from our review, which they deemed critical: understanding the role of policing in a democratic society and tactical knowledge and skills.

Role of Policing in a Democratic Society

Issues related to the role of policing in a free and democratic society were discussed by several SMEs, revealing a political dimension to managing potentially volatile police–public interactions, and a very compelling case was made that this should be seen as a core KSA for all police officers. The SMEs not only spoke to the importance of developing a practical understanding of the laws governing policing, but also expanded upon this to include a deeper appreciation for issues that extend beyond typical laws that might be emphasized in non-escalation, de-escalation, and use-of-force training, such as local, federal, and international declarations of human rights.

The SMEs also noted the connections between knowledge of these issues and the other KSAs discussed above, such as the competencies related to the policing of diverse communities, including PMIs and racialized citizens. While a deeper understanding of the role of policing in a democratic society cannot eliminate the stigma or biases that some police officers might hold, it does highlight the importance of minimizing stigma and biases as much as possible; moreover, it encourages officers to interact with all members of the public in a fair, respectful, and compassionate fashion, and to always prioritize the sanctity of life.

Although we could not locate any empirical research related to this KSA, it is easy to generate common-sense arguments for why police training should focus on these issues. Developing this KSA through training could logically have a positive impact on how officers manage potentially volatile police–public interactions.

Tactical Knowledge and Skills

Another KSA identified by many of the SMEs that was deemed critical pertains to knowledge of various tactics—such as the effective use of time, distance, cover, and concealment—and the ability of officers to use these tactics effectively during stressful, dynamic interactions with the public. While most of the discussion surrounding sound tactics was found in professional magazines and other outlets (e.g., websites, such as *policeone.com*), which explains why this KSA did not emerge from our literature review, we were able to locate some empirical research on this topic during focused searches conducted following the SME interviews.

Most of the research we found focused specifically on how sound tactics can enhance officer safety in already escalated situations; little systematic research seems to exist to show how tactical knowledge and skills allow police officers to prevent interactions with the public from escalating in the first place. For example, in one study, Sandel et al. (2021) highlighted how moving off the line of attack (i.e., stepping to the side) significantly decreased the number of times a knife wielding individual could make contact with an officer before the officer fired their weapon. In another example, Blair et al. (2019) examined room clearing techniques and found that officers were less likely to be incapacitated from being shot when the officer rapidly entered the room as opposed to leaning out from behind cover or concealment.

IMPLICATIONS FOR POLICE TRAINING AND EVALUATION

The current paper represents a first step in identifying a broad set of KSAs that may be relevant to the management of potentially volatile police–public interactions. While many of the KSAs we identified were supported by a significant amount of empirical research (e.g., the importance of understanding mental health issues), the research surrounding other KSAs is currently underdeveloped (e.g., the importance of managing implicit biases). Conducting additional research on such KSAs should be an immediate priority and carrying out systematic reviews and meta-analyses on those KSAs where adequate research does exist must also be a matter of urgency. Until this work is done, we must be cautious about the weight we put on some of the KSAs highlighted in this paper even

though the unanimous endorsement of each KSA by the SMEs interviewed in the current study (as well as by the policing scholars cited throughout this article) suggests these KSAs are likely to be important for effectively managing police encounters with the public.

This last point raises interesting questions about the value of the current project. Is it a surprise that the SMEs unanimously endorsed the KSAs described above? Would anyone doubt that the police need these KSAs to manage police–public interactions? We do not think it is particularly surprising that the SMEs agreed that the identified KSAs are important now that they have been generated through the literature review, nor do we have reason to believe that others would doubt the value of these KSAs. So, given this, what does this review and the SME interviews contribute to existing literature?

As we highlighted above, the reason we think this exercise was important is that it highlights the complex nature of police–public interactions and the very broad set of KSAs that are likely needed to manage these encounters effectively and ethically. The review also allows us to begin speaking to the sorts of KSAs that should arguably be targeted in training and evaluation, and to clarify where current training and evaluation gaps exist, endeavors that would be challenging without first identifying the relevant KSAs. We need to identify applicants and officers who do not possess (or do not sufficiently possess) all relevant KSAs to appropriately train them on the competencies they lack.

A key priority with respect to training will be to determine the extent to which programming currently in place within police services maps onto the sorts of KSAs highlighted in this paper. Engaging in this process will provide agencies with valuable insights into ways they can modify their training to enhance its effectiveness. For example, our observations of training over the last several years within North American police services suggests that the sorts of tactical skills highlighted above are frequently focused on in training. However, other competencies discussed above are not focused on to the same extent, or at all, even though they are likely to be critical. For instance, we do not know of many North American police services who provide adequate training on stress awareness and management. This is particularly alarming given that other important skills, such as the ability to effectively communicate with potentially violent citizens or to regulate emotions and behaviors, will be more challenging if the officer involved cannot effectively manage their stress. The lack of training in this area is also concerning because good training options arguably do exist (e.g., the iPrep program for modulating physiological stress; Andersen et al., 2018).[7]

[7]We suspect that one of the reasons why these sorts of training programs are not being implemented is because the training is often lengthy. This is a challenge for most police services in North America given that the amount of time dedicated to training after an officer undergoes their initial cadet/recruit training is very limited. For example, once on active duty, it has been estimated that officers in the US receive on average less than one week (i.e., 35 h) of training per year (Reaves, 2010). While we could not locate similar data for Canada, we believe that the situation here is very similar.

Once progress on this mapping exercise has been made, police services will also need to determine how to best tackle the range of KSAs that are highlighted above, assuming future research confirms their importance. In addressing this challenge, several key questions will need to be answered. For example, when should the training for a given KSA take place (e.g., during basic training, in-service training, or both)? How frequently should the training occur to minimize KSA perishability (e.g., once, every training cycle, every other training cycle)? And what methods should be used to deliver the training (e.g., classroom instruction, learning from people with lived experience, scenario-based training, a combination of all these methods)?

Several attempts have been made to articulate effective methods for training delivery in the policing context, which may help answer some of these questions, including methods for training officers on how to manage potentially volatile police–public interactions (e.g., developing scenario-based training for skills acquisition; Bennell et al., 2021; Jenkins et al., 2021). In addition, as mentioned above, some potentially useful training programs already exist for some of the KSAs that emerged from our review, including stress management (e.g., Andersen et al., 2018), interpersonal communication (e.g., Engel et al., 2022), and an understanding of mental health-related issues (e.g., Krameddine et al., 2013). However, there are still significant gaps in the research, which make it challenging to answer the types of questions presented in the previous paragraph, especially for certain KSAs (e.g., emotion and behavior regulation, managing racial biases, and adaptive problem-solving). Therefore, police researchers and police practitioners need to work together to undertake research targeting these questions.

This review also has implications for a related activity that needs urgent attention—the evaluation of non-escalation, de-escalation, and use-of-force training. Police services, generally speaking, do not adequately attend to this task (Bradley and Connors, 2007). This is problematic, even in cases where the training being offered has been validated in other jurisdictions. As we have argued elsewhere (Bennell et al., 2021), there are many reasons why a training validation study may not generalize across jurisdictions, including but not limited to differences in trainee skills, training resources, and trainer qualifications. Evaluations of training should involve police services systematically monitoring their own training to determine whether important KSAs of the sort described above are being developed and modifying said training as needed to ensure it remains effective.

What form should this evaluation take? The process ought to be informed by the outcomes that the training is specifically designed to impact (Bradley and Connors, 2007). In addition, the process of evaluating the KSAs should be made as objective as possible. This can be done by relying on carefully crafted "assessment models," which include detailed scoring rubrics (e.g., Norris and Wollert, 2011; Vila et al., 2018). Finally, given that the goals of non-escalation, de-escalation, and use-of-force training are multifaceted, and may include elements like knowledge acquisition, attitude and behavior change, and even

organizational or community impact, evaluation tools will be required to effectively evaluate these various goals. Such assessments will prevent the need to make inferences about higher-order outcomes (e.g., whether behavior has changed) from evaluations of lower-order outcomes (e.g., whether knowledge has been acquired), which is critical given evidence that lower-order outcomes do not predict higher-order outcomes well (Alliger et al., 1997; Arthur et al., 2003; Saks and Burke, 2012). Moreover, different types of KSAs appear to degrade at different rates (e.g., knowledge degrades faster than skills; Arthur et al., 1998), so it is important to assess these outcomes separately.

CONCLUSION

The current narrative literature review and SME interviews provide preliminary support for numerous KSAs that officers should possess to manage potentially volatile police–public interactions more effectively. We believe that this list of KSAs can provide guidance to police agencies with respect to training and evaluation targets. That being said, it is currently still unclear for some of the KSAs what the exact impact will be on police–public interactions. Elucidating these points should be a priority for police researchers working in this area and for police services. Once this is done, evidence-based training can be developed, and training evaluations carried out, to ensure that police officers possess the necessary KSAs to interact with members of the public in a safe, ethical, and effective manner across the full spectrum of situations in which these interactions take place.

AUTHOR CONTRIBUTIONS

CB conceptualized the project, secured the funding, oversaw the review, and wrote the first draft of the article. BJ conceptualized the project, secured the funding, assisted with the review, and edited the article. BB conceptualized the project, secured the funding, assisted with the review, and edited the article. TS assisted with the review and edited the article. A-JK assisted with the review and edited the article. AB assisted with the review and edited the article. NJ assisted with the review and edited the article. All authors contributed to the article and approved the submitted version.

FUNDING

This research was supported by a contract from Ontario's Ministry of Community Safety and Correctional Services, which was awarded to CB, BJ, and BB, and a grant from the Social Sciences and Humanities Research Council (#435-2017-1354), which was awarded to CB.

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Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

frontiers | Frontiers in Education

TYPE Conceptual Analysis
PUBLISHED 26 September 2022
DOI 10.3389/feduc.2022.730789

OPEN ACCESS

EDITED BY
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SPECIALTY SECTION
This article was submitted to Educational Psychology, a section of the journal Frontiers in Education

RECEIVED 25 June 2021
ACCEPTED 04 August 2022
PUBLISHED 26 September 2022

CITATION
Staller MS and Koerner S (2022) (Non-)learning to police: A framework for understanding police learning. *Front. Educ.* 7:730789. doi: 10.3389/feduc.2022.730789

(Non-)learning to police: A framework for understanding police learning

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For professional policing, learning is key. Since learning can be viewed as a complex process between the individual and information, learning takes place both within and outside the police system as well as during and before employment. The current conceptual analysis delineates different areas of (non-)learning related to policing and argues for the management of learning as a key issue for the police's professionalization. According to this assumption a Police Learning Management Framework is presented, in which the relevant areas of learning as well as the related challenges for police learning on an individual and organizational level are specified. The proposed model calls for a more focused view on police learning which is a prerequisite for professionally coping with the pressing challenges of contemporary policing.

KEYWORDS

police learning, police professionalization, reflective policing, police systems, knowledge management

Introduction

A high quality of police work is essential in a socially fair and democratic society. Especially since the police are mandated with legally using coercive means to uphold the law (Terrill, 2014; Dunham and Alpert, 2021), it is essential that the delegated power is exercised professionally by the individual officer. While democracy does not guarantee that the judgments of the individual police officer will uniformly replicate those of the public, the public has a right to spell out the criteria by which the judgment should be made (Reiman, 1985). This social contract also entails that these criteria are adhered to by competent individuals. As such, ensuring that only competent individuals are tasked with making sound judgments is part of this social contract between the police and the public. To ensure good policing, police institutions invest resources to select both sufficient and qualified police officer candidates usually by using psychological selection procedures and optimally preparing the individuals on the front through education and training for their duties (Yuille, 1986; Feltes, 2002; Cordner and Shain, 2011; Donohue, 2020).

However, analysis of violations of this social contract, such as the inappropriate use of force (Boxer et al., 2021), racially and socially biased policing

(Engel and Cohen, 2014; Abdul-Rahman et al., 2020), and police misconduct (Ivkovic, 2014; Porter, 2021), suggest that the genesis of such events is multi-faceted and cannot only be attributed to the individual's behavior. While personal characteristics may play a role, training experiences, education, socialization, and other influences weigh into the performance in any given situation (Goff and Rau, 2020; Boxer et al., 2021).

Concerning professional conduct, there are a plethora of factors contributing to the competence of quality policing. While expertise might be an essential ingredient for professional police conduct, it is the result of a continuous development of the individual that has to be regularly renewed (Staller and Körner, 2021). It is noteworthy that this development extends beyond experiences in the police domain. Human development is a continuous, never-ending process that is dependent on various contexts and interactions within these contexts leading to individual experiences (Huston and Bentley, 2010; Osher et al., 2018).

We refer to this change in the individual's system state and capacity due to interaction with the environment as *learning*. More specifically, learning occurs as an adaptation to regularities in the environment (Houwer et al., 2013). As such, our conceptualization of learning extends to what is—depending on the literature—referred to as training and/or education in organizational contexts. While *training* in an organization refers to a systematic approach to learning to improve individual, leading to the acquisition of new knowledge or skills (Aguinis and Kraiger, 2009), education encompasses, among other things, taking a reflexive stance toward one role. As such, police education reflects on the intentional, guided, and goal-directed development of police work, the police organization, and police governance (Huisjes et al., 2018). This reflexivity has been described as a key component of good policing (Bergman, 2017; Wood and Williams, 2017), resulting in a shift from only practical vocational training toward hybrid-formats of higher education programs in preparation for police work that has taken place over the last decades in several countries (Paterson, 2011; Frevel, 2018).

Ultimately, police officers have to perform their duties aligned with the goals of society. In order to do that, they have to arrive at an internal capacity, with the skills, knowledge, attitudes, belief system, etc., that allow them to professionally perform that duty. Society, and police organizations as part of it, have to ensure that, when individuals perform that societal task of policing, they have learnt what is needed. By referring to our broad understanding of learning we do not point toward a specific setting where such learning has occurred. Instead, we contend that police officers have been and are subject to various interactional contexts, where learning has the potential to occur and to ultimately unfold its impact when performing their daily duty.

In the current article, we analytically describe several areas where learning does take place—or non-learning understood as the negative value of learning: no adaptation on a certain (normatively set) aspect (e.g., learning to police) despite experiences within the environment. Of course, it can be argued which aspect should normatively be learnt. As such, non-learning is an observation depending on the perspective of the observer, based on the assumption that learning is always taking place (see section "Learning as an interaction process between individual and information"). Building on a systemic view on the area of learning, we selectively focus on five areas of (non-)learning that seem to play a key role in police learning. These areas comprise of what police officers have (or have not) learnt (1) before the job, (2) in preparation for their job, (3) during their job, (4) alongside their job, and (5) by being part of (sub-)system(s) of police. Having a clear concept of what is learnt, where, and when allows the police to (re)direct resources to the learning situations needed for optimal job performance. We finally state three challenges that future scholarly and practical endeavors have to address to further professionalize police learning. Before we start our analytical account of police learning we feel we should present our two general assumptions to the reader that guide our selection, description, and practical implication of our account of police learning.

Assumptions

The management of police-citizen interaction and the mandate to use coercion as key features of policing

The police profession has two structural features that distinguish it from other professions: (a) the mandate to legitimately use coercion and (b) a high potential for experiencing conflict situations during police-citizen interactions that have to be resolved on a continuum ranging from empathy and cooperation to means of coercion.

Both features stem from the inherent assignment of the police: providing safety for its citizen and ensuring that the law is adhered to. Through preventive and repressive measures, the police try to accommodate its mandate. Experiencing that prevention through repression is rather ineffective (Feltes, 2002); police services around the world have adhered more and more to a community-oriented approach of policing over the last decades including "order maintenance, conflict resolution, problem solving, and provision of services as well as other activities" (Feltes, 2002, p. 48). This proactive approach entails managing conflicts when they arise, soundly intervening when they have manifested, and simultaneously enforcing the legislation as mandated. The management of tension and conflict—be it verbal or physical—is structurally embedded in the policing mandate. However, given the social contract it is important to note that this

must be achieved in forms best for the society (Reiman, 1985).

Since not all conflictual situations can be solved by cooperative means and violent acts of individuals have to be responded to, the police are mandated to use coercion and force legitimately (Terrill, 2014; Dunham and Alpert, 2021). The police are even allowed to use deadly force within the limits of the law (Terrill, 2016; Lee, 2017). This power comes with great responsibility: there is the danger the social contract will be violated; that police behavior harms the public more than it helps and serves.

These two distinguished features of the police profession create a field of tension: a high probability of experiencing conflict situations on a daily basis and the legal mandate to use coercion. While many conflict situations may be resolved using cooperative means, the use of coercion seems to provide an appealing shortcut (Staller and Koerner, 2021b). As such, it falls at the discretion of the acting police officer to make a sound judgment in which conflict resolution strategy might be appropriate in any given situation.

The decision of what strategy to employ and how to apply it is highly dependent on the stable and acute factors of the individual: their attitude, belief set, skills, physical characteristics, emotional state, etc. In short, it depends highly on the individual and the current internal system state. And this is—alongside situational factors involved (Cojean et al., 2020)—heavily the result of what the individual acting police officer has explicitly and implicitly learnt so far.

Learning as an interaction process between individual and information

In our account we adopt the broad definition of learning. We account for learning as interaction processes between individuals and information leading to permanent changes in the individual system's capacity. Information potentially to be acted upon is omnipresent: experiences, learning material, thoughts, something we hear, something we see, or something that happens to us. As such, as soon as we interact with our physical or social environment, or with stored or generated information in our minds, we learn. This understanding of learning entails—but does not limit learning to—the mental processes that take place in the individual and that can lead to intended and unintended changes in emotion, cognition, and behavior. Traditionally, and more narrowly, learning in educational and training settings is concerned with the intended changes, also referred to as the *learning outcomes* (Illeris, 2007). With our broad definition we adopt a constructivist view to learning that is more equivalent to the definition of Illeris (2007) who defines learning as "any process that in living organisms leads to permanent capacity change and which is not solely due to biological maturation or aging" (p. 3). Adopting such a constructivist conceptualization has major consequences, especially concerning learning to police. These premises form the basis of our account:

- Premise 1: Learning is a continuous, always-happening process.
- Premise 2: Learning is not fully controllable.
- Premise 3: Learning is done by the individual.

In this constructivist approach (1), learning is more than just engaging in explicit learning settings such as school education or police training. Vast amounts of research show that learning takes place in formal settings, but also in informal environments such as peer talks or media (Hoy and Murphy, 2001; Ichijo and Nonaka, 2007). This directly refers to premise (2). If, when, and to what extent learning occurs eludes external control. While external information the individual acts upon can be influenced, for example, through the presentation of knowledge, setting up learning experiences, managing with what and who individuals engage with, etc., the effects—namely what is learned through these interactions—remains vague. Also, interactions the learning individual will have with material, thoughts, or people are often beyond the control of external influences and remain at the discretion of the individual, which points to premise (3). Ultimately, learning is done by the individual. It is a highly individualized and constructivist process.

This view on learning is in accordance with key assumptions of ecological dynamics, within that process, individual, task, and environmental constraints provide individual affordances and opportunities for learning which allow them to attune to information and to specify and guide their learning process (Seifert et al., 2019). As ecological psychology emphasizes the learning individuum attunes (consciously and subconsciously) to different sources of information to interact with, e.g., learning material, peer groups, social media, or their own thoughts (Wood and Williams, 2017; Staller et al., 2022b). Also, different intensity levels of interaction [e.g., (un-)conscious, (de-)motivated] are heavily dependent on the individual's capacities and state at the moment of interaction (Vansteenkiste et al., 2004; Gorges and Kandler, 2012).

Furthermore, learning as a change in the individual's system's capacity posits that the starting point of any learning process is the current system state that is altered through interaction with information. As such, the starting point is always highly individual depending on different capacities and internal, e.g., emotional and motivational, states (Orth et al., 2019).

Finally, each interaction and the subsequent alteration in the individual's system's state provides an opportunity to interact with by itself. Using those experiences to learn from is at the heart of experiential and reflexive learning theories (Schön, 1983; Brookfield, 1998; Kolb, 2015).

Learning to police with democratic ideals

Based on our identified key aspects, that (a) high-quality policing is heavily dependent on the individual's capacity to responsibly use the mandated power and that (b) learning extends beyond training and educational settings, we propose a framework for police learning. The framework aims at systematizing different areas where learning for policing takes place and that have to be accounted for—and thus be managed—by the police in order to ensure high-quality policing by the individual officers (see **Figure 1**). Within the framework we differentiate police (non-)learning on three dimensions: (a) in and outside the police (gray blocks on the left), (b) formal and not-formal learning (second columns of gray blocks on the left), and (c) the time-line centering on the employment status by the police institution (gray blocks on the bottom).

We purposely chose these three differentiations since they demark different systems (police vs. not-police, formal vs. not-formal learning, and timeline) with different internal system logics. Police and not-police refers to learning within the system of policing or not. We refer to formal learning as highly institutionalized settings that are formally recognized with diplomas and certificates and other organized learning opportunities. We refer to not-formal learning as any other learning taking place such as self-driven searches for knowledge and non-intended implicit learning through any other interaction between the individual and the environment. We are fully aware that there are other conceptualizations of formal and other forms of learning (Eraut, 2000; Nelson et al., 2006; Mallett and Dickens, 2009; Stoszkowski and Collins, 2015). However, for our argument, the differentiation between what is institutionalized and intended (=formal learning) versus what is not (=not-formal learning) seems to us as a pragmatic differentiation. Concerning the timeline, we differentiate between not being employed by the police versus being employed by the organization. Additionally, we differentiate between pre-service training and in-service training, since the formal learning settings are different in nature between these two training and educational settings. The dotted lines depict system barriers between one system and another.

Based on our analytical approach, we now focus on five areas of learning (green circles) that, from our perspective, are essential to be considered when managing learning in policing and that provide various contemporary challenges. After describing the areas of learning and providing an overview of aspects to consider, we point toward the challenges (yellow circles) that from our perspective need to be addressed in order to further professionalize police training and education.

Learning before the job

Individuals have learnt a lot before becoming police officers. Before they enter the system of policing, individuals have learnt in different learning environments (Illeris, 2007): in school, college. Or universities, but also through media, family, peers, and other everyday learning interactions.

As such, individuals already have an individually learned conception about policing and underlying democratic ideals. A study from Germany showed that police recruits at the beginning of their career lie in the typical range for xenophobic attitudes compared to their education and age group (Krott et al., 2018). With what individuals have learnt before the doorstep of their police career is embedded within the societal context, like all learning (Illeris, 2007). This also extends to the current debates about the role and the orientation of policing (Jacobs et al., 2020; Goff, 2021; Koziarski and Huey, 2021; Staller and Koerner, 2021a). Individuals may have developed their individual conception about policing in society: What it entails, how it is embedded within the society, and what its main functions are. Depending on such conceptions individuals will enter to the profession with different premises and expectations. Is policing primarily understood as a public service or is it primarily a crime-fighting endeavor?

The conception about what the police profession is about may be influenced by experiences of the police as addressee or as a family member of a police family (Navarro-Abal et al., 2020)—but also in pop culture (Pautz, 2016; Seeßlen, 2019; Wilson et al., 2019) or police recruitment videos (Koslicki, 2020; Carrier et al., 2021). These conceptions are problematic if they do not match with what the profession is about or what the individual has to expect. For example, depictions and prominence of community-policing versus militaristic themes in videos may suggest a specific understanding of what policing is about (Koslicki, 2020).

Concerning the mandate to use legitimate coercive force, individuals may also bring an understanding of this responsibility to the table. This understanding may differ between the mandate embedded within the social contract and a given authority as an end to itself. For example, for some police recruits to be perceived as an authority seems a motivating factor (Muhadjeri, 2021). While this factor is regularly on the lower end of motives for becoming a police officer, the excitement of work, helping others, fighting crime, and the desire to enforce the law regularly score higher in self-reported motivational studies (Raganella and White, 2004; Wu et al., 2008; White et al., 2010; Lohbeck, 2021).

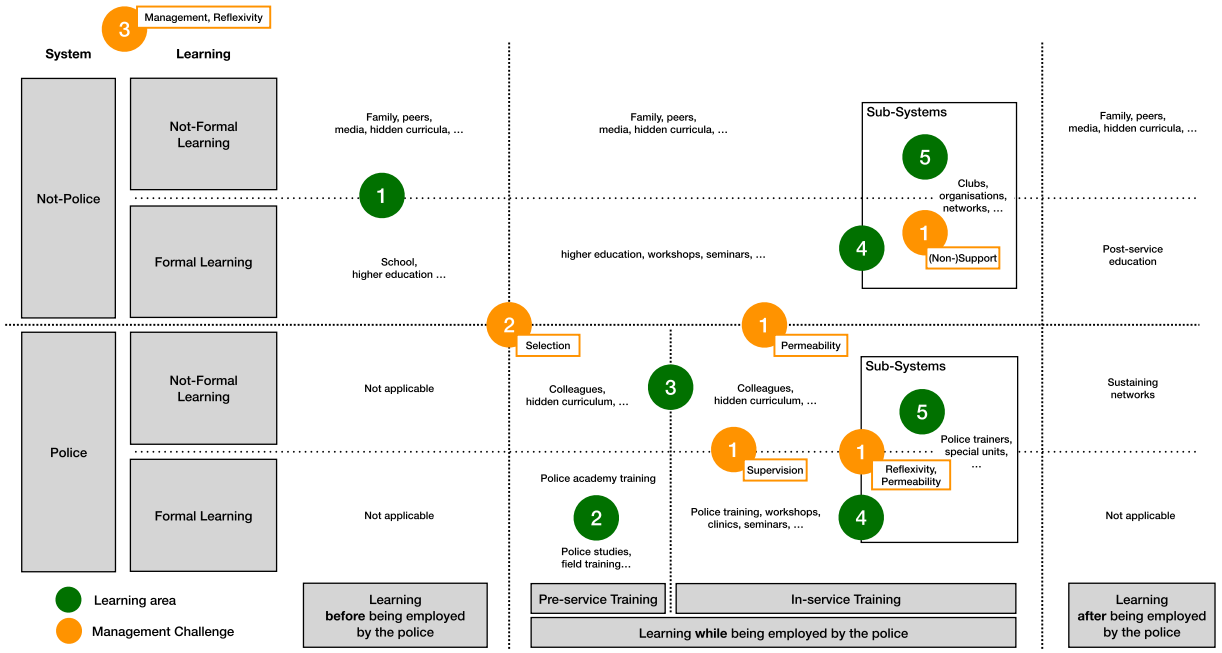

FIGURE 1
Police learning management framework.

Besides learning that has taken place regarding the understanding, expectation, and attitude toward policing and its democratic foundation, individuals also have learnt a lot concerning practical conflict management skills: Through the rise of martial arts and reality-based self-defense systems (Bowman, 2015; Staller et al., 2016), individuals often enter the police service with a background of martial arts (Renden et al., 2015; Körner et al., 2019). A study investigating the effect of martial arts training on solving conflictual situations "hands-on" (Torres, 2018) indicated that prior experience in marital arts training and high perceived use of force self-efficacy predict confidence in resolving conflict physically. On the other side of conflict resolution skills, lots of learning opportunities in cooperative conflict resolution may lead to a learned skill set that emphasizes cooperation over coercion. However, to our knowledge no studies exist examining this linkage with regards to police conflict management. There are indications that individuals that learnt to cope with conflict in ways other than coercion yield these skills in conflict situations during police work (Jaeckle et al., 2019; Ba et al., 2021).

The argument is simple: Individuals are likely to perform what they have learnt, at least when they do not engage in a reflexive account of their learning process. For example, while there is nothing wrong with engaging in martial arts, it is about acknowledging that there may be a blind spot when it comes to conflict management. The argument also extends to biases and fallacies in general. Without reflexivity, individuals may have learnt things that may prove problematic combined with the mandated authority of police (Staller et al., 2022b). The benefit of higher order thinking skills—like reflexivity—may be a reason for results indicating that officers with a pre-service bachelor's degree hold attitudes that are less supportive of abuse of authority (Telep, 2011).

In sum, people have a lot of learning opportunities before they arrive at the doorstep of policing. These depend on the societal constraints the individual is subjected to Illeris (2007). The more learning opportunities that relate to responsible conduct, sound police-citizen interactions, and conflict management, the more likely that these learnt beliefs and skills are put into the field.

Learning for the job

Training and education of police officers is essential factor for ensuring a high quality of police work (Feltes, 2002). Given that individuals—now police recruits—arrive with differing capacities of learnt content, the police have to ensure that individuals learn what is necessary for the police profession. However, since learning is ultimately not controllable and done by the individuals, the police organization is responsible for providing the grounds and the constraints in which learning is facilitated.

In order to prepare for the job, police recruit programs around the world regularly entail three planned learning settings: (a) theory informing class-room settings at the police

academy, the police college, or the police university (Frevel, 2018; Leek, 2020); (b) practical skills training like conflict management training, traffic stop training, etc., (Staller et al., 2021a); and work-integrated learning through supervised and accompanied working in the field, otherwise known as field-training (Engelson, 1999; Hoel and Christensen, 2020).

Such planned learning settings provide the platform for what can be learnt; however, it is worth noting that what is indented to be learnt is not necessarily what is learnt. This issue refers to the difference between an explicit curriculum and a "hidden" one (White, 2006; Staller et al., 2019). For example, while the explicit curriculum in a Police University of Applied Sciences in Germany states that a community-oriented and de-escalative approach to policing is warranted, an analysis found that the vast amount of training content concerns coercive force (Staller et al., 2019, 2021a), providing the "hidden" learning message that conflictual situations are to be solved *via* coercion.

Concerning field training, explicit and implicit learning opportunities also differ: Engelson (1999) found that that although positive explicit values were communicated, several potentially negative implicit values were also communicated to police recruits (Engelson, 1999). Recruits learn more than what is explicitly addressed in field training. Learning within these settings also entails learning police misconduct (Getty et al., 2016). Field-training officers—like police trainers—are role models and peers and are of critical importance for police learning (Belur et al., 2019; Staller et al., 2022a). They can be a source of ethical practice but also of unethical practice (Fekjær et al., 2014; Hoel and Christensen, 2020). For example, the study on police students by Fekjær et al. (2014) showed that, during field training, police students changed their attitude to be more in line with negative characteristics of street cop culture. Police trainers also have the potential to influence the becoming of a police officer negatively. A reason for this might lie in the finding that recruits strive to be accepted; as such they focus on performing and learning what they observe through their field training officers (Hoel and Christensen, 2020). Danger narratives (Branch, 2021; Sierra-Arévalo, 2021) and storytelling (Kurtz and Upton, 2017; Rantatalo and Karp, 2018) implicitly convey a negatively biased perspective on the daily routine and problematic attitudes toward police-citizen interactions. On the positive side, field training officers and police trainers are of critical importance for police recruits in integrating theoretical learning with practical skills (Belur et al., 2019; Staller et al., 2022a). Also, field training officers' professional and emotional support has been accounted for as an important feature by recruits (Hoel, 2019; Hoel and Christensen, 2020).

Also, studies in Germany regularly point toward differences between what is learnt in theory-driven academy settings compared to practical training and field training (Frevel, 2018). Frevel (2018) points out that some lecturers, trainers, and field trainers would disagree with the content taught by their respective partners. While the one side advises to "Forget everything you have learnt at the university, this is the real policing" (p. 209), the other side states "What you have learnt from your tutor is not state of the art and even wrong/illicit" (p. 209).

There is a broad consensus that police are in need of good education, leading toward an orientation toward higher education (Paterson, 2011; Frevel, 2018; Huisjes et al., 2018; Rogers and Frevel, 2018). Research has shown the beneficial aspects of this orientation, like a reduction in police culture (Cox and Kirby, 2018), a reduction in use of force (Rydberg and Terrill, 2010; Vespucci, 2020), or a reduction in xenophobic attitudes (Krott et al., 2018). Compared to a more practical-oriented approach to vocational training, higher educational settings focus on the development of broader skills sets such as such as emotional, cognitive, social and moral skills (Blumberg et al., 2019) as well as scientific thinking and reflective practice (Huisjes et al., 2018) in policing. Recently it has been argued that reflexivity is a key aspect in modern policing (Wood and Williams, 2017; Staller et al., 2022b), a metacognitive capacity and learning content especially prevalent in professional education (Schön, 1983). However, police recruits and officers sometimes wish for more hands-on practical skill experience, indicating a lack of perceived relevance to their daily work (Frevel, 2018; Edwards, 2019).

Learning on the job

When police officers enter their field, they are subjected to a lot of different experiences providing opportunities for (non-)learning. On the positive side, it is the diversity of the task that is regularly stated as one of the main reasons for becoming a police officer (Lohbeck, 2021; Muhadjeri, 2021). Negative accounts of the police job state the "shock of real-world experience" (Behr, 2006, 2017; Wang et al., 2020): the engagement with police-citizen interactions that are perceived as difficult, complex, and non-rewarding. Such interactions provide opportunities for a learning on-the-job situation: for example, the danger of manifesting stereotypes about social groups through cognitive biases when regularly occurring situations are not properly reflected upon has been regularly pointed out. On the other side, police-citizen interactions provide ample opportunities for reflection upon the experiences made, challenging one's assumptions and optimizing interactional behaviors (Staller et al., 2021b). Reflexivity is the key prerequisite here (Wood and Williams, 2017).

As well as their own experiences, officers also learn from their peers (Doornbos et al., 2008): What they do,

how they perceive and interpret situations, and—on an implicit level (see next section)—more general attitudes toward policing and reasoning structures. That learning takes place in everyday policing situations can be seen in results aiming at investigating used de-escalation strategies by officers (Bennell et al., 2021). Officers already learnt a lot before attending de-escalation workshops. Studies aiming at investigating what works in cooperative conflict management regularly tap into these learnt knowledge structures of police officers (Rajakaruna et al., 2017; Todak and White, 2019).

However, without underlying declarative knowledge structures it may be hard to determine what worked and why. Again, reflexivity provides a tool for making meaning—and seeing other perspectives—in police-citizen interactions. As such, supervision is regularly employed in domains that are characterized by power imbalances (Asakura and Maurer, 2018). Police frontline work benefits from this approach (Owens et al., 2018; Staller and Koerner, 2021c). For example, Owens et al. (2018) reported positive effects of police officers reflecting on the process of rather uncritical experiences of police-citizen interactions with supervisors modeling central components of procedural just behavior in these meetings.

There is a lot to learn from day-to-day job experiences (Schweer et al., 2008). However, without proper reflection, problematic lessons can be learnt from these events. Research on cognitive biases and fallacies indicates that no one is immune to drawing biased conclusions from experiences (Dror, 2020; Staller et al., 2021b).

Learning alongside the job

Learning *alongside* the job refers to all intended learning activities that are attended alongside daily work. While this entails continuous professional development (CPD) courses or training sessions on job-related issues (e.g., how to operate a certain system, conflict management training, etc.), learning alongside the job also takes place in privately attended learning settings, such as martial arts classes, reality-based combat training, or attending a university's degree program.

CPD courses can equip police officers with new skills that may be needed due to a change in job demands. For example, a regular police officer may become a police trainer in the academy and may in preparation receive an extra training course for meeting the pedagogical challenges associated with the new role. Also, CPD courses may provide—or explicitly focus—on new perspectives regarding experiences had on duty. For example, implicit bias training and social interaction training may be a useful strategy to reduce inappropriate use of force on minority populations and coercive conflict management strategies with citizens in general. However, the results are mixed (Kahn and Martin, 2020; Wolfe et al., 2020), highlighting the potential without promising guaranteed effects. What is learned and what is not depends on a variety of factors, ranging from factors associated with the learners to those dependent on the trainer or coach. Therefore—in line with our initial assumptions—formal (non-)learning is a non-linear endeavor with the potential, not the promise, of learning.

From the perspective of the institution of police it is also worth considering which CPD activities are mandatory and which are not, which self-selected settings get supported and which do not. The latter aspect refers to formal settings that are attended *alongside* the police outside the police system. There are various providers for formal learning courses aimed at police officers. For example, concerning conflict management, firearms organizations, self-protection, and martial arts academies or networks fight for the limited resource of paying police officers.

Likewise, the higher education sector also offers (part-time) programs to working professionals that are attended voluntarily by motivated police officers (Lee and Punch, 2004). Several authors suggested the benefits of completing a higher education program alongside a job: police officers who engage in education beyond the remit of police training can "add value" to their organizations through the development of critical and wider reflective skills that are then transferable to policing settings (Lee and Punch, 2004; Jones, 2015). For example, attendees of a police studies program reported having developed a more reflexive conduct with members of the public (Jones, 2015), showcasing the adoption of new perspectives on specific police situations. This is a learning outcome that has regularly been described as essential in policing (Wood and Williams, 2017; Staller et al., 2022b).

Learning in closed systems

The police itself can be viewed as a social system: a plurality of social actors who are engaged in a more or less stable interaction according to shared cultural norms and meanings. With this perspective of analysis, research has continuously evidenced that the closeness of the system of policing contributes to another area of learning opportunities: learning from the system-embedded norms and values that are prevalent within the system of policing. Research on police culture shows that a lot is learnt from being a part of the system (Behr, 2006; Charman, 2017). For example, prevalent police narratives and the act of storytelling shape values, beliefs, and decision-making algorithms (Kurtz and Colburn, 2019). Implicit system knowledge is conveyed from one person to another. While, on the one hand, organizational socialization can contribute to imparting professional knowledge to new officers, including specific tactics for professional practice (Ford, 2003; van Hulst, 2013, 2017; Kurtz and Colburn, 2019), it can also manifest problematic values, beliefs, and practices (Branch, 2021).

Concerning the evaluation of such practices, the system's perspective provides a relevant observation: while certain aspects are valued from outside the system as problematic, the within-system perspective yields them as the solution to presented problems. The difference in evaluation lies in the different system logics (Baechler, 2017). This is an aspect that is also learnt within the system.

The power of such system-implicit learning structures has regularly been described through the lenses of socialization: implicit learning within the system has a fundamental impact (Shernock, 1998). For example, a recent study found that personality traits change through socialization and identification within the police organization over 3 years (Alessandri et al., 2020).

The mechanisms through which learning occurs are manifold. Peer associations, reinforcement, and modeling have been described as effective learning opportunities within the system of policing (Chappell and Piquero, 2004; Chappell and Lanza-Kaduce, 2010). Also, storytelling (van Hulst, 2013; Smith et al., 2014; Schaefer and Tewksbury, 2017; Rantatalo and Karp, 2018) and the prevalence of specific narratives, such as the narrative of the police officer continuously being in danger (Woods, 2019; Branch, 2021; Sierra-Arévalo, 2021) or the police being society's last line of defense against chaos (Wall, 2020), form continuous information flows that have the potential to transfer knowledge within an organization (Swap et al., 2015).

It is worth noting that the police service is not a homogeneous system. While there is indeed a common ground between all police organizational units based on the overall framework of policing, police culture within different functional units is different (Gutschmidt and Vera, 2020). As such, socialization within different sub-systems of the police, e.g., special forces, or police use of force training may vary, leading to distinct values, beliefs, and decision-algorithms that circulate in a self-referential loop. This in turn leads to a self-stabilizing system behavior. The more a system closes, the more self-referential it becomes. On a structural level, any changes to the system fail due to the lack of structural linkage to the outside system, e.g., non-special forces or non-use of force training. For example, data about the knowledge management of police use of force trainers showed that the main sources for "new" and valued knowledge stems from within the system, such as other trainers and workshops. While coaches in other domains beyond policing also value social interaction with peers as an area for knowledge generation (Stoszkowski and Collins, 2015), it becomes a problem if the system lacks a structural link to outside information. Concerning police conflict management, an analysis of the workshops and the members journal of an influential police trainer organization in Germany showed that police conflict management is heavily reduced to coercive force (Muhadjeri, 2021). This is a result that has recently also been evidenced in an analysis of police academy basic training curricula in the United States (Sloan and Paoline, 2021). The heavy imbalance toward coercive conflict management options as compared to more cooperative options gets stabilized within the system of police training: trainers seek to know more about these options, resulting in an implementation of these, which in turns creates the need to know more about it. As such, the knowledge of police officers—in this case trainers—forms the basis of the filter that new knowledge is selected through. This is a mechanism that has also been evidenced for knowledge in the context of police special forces (Koerner and Staller, 2021). The sub-system within the police system, e.g., police trainers or special forces, create their own system's logic through which new information is evaluated, discarded, or selected, stabilizing the logic of the system.

Finally, distinct systems, e.g., martial arts clubs, training organizations, higher education settings, or participation in activist groups on social media, implicitly convey knowledge, beliefs, and values next to their external agenda. As such, these learning opportunities have the potential to be beneficial or problematic—depending on the perspective. For example, participants of a police studies program alongside their police work reported that the learning setting provided an opportunity for debate amongst officers, which contrasts experiences of hierarchical rank structures and associated obedience that are required of police officers (Jones, 2015). This exemplifies the different logics between system-based beliefs and values of hegemonic power structures, which have also been reported in other studies (Chappell and Lanza-Kaduce, 2010).

Challenges

So far, we have described the different areas of (non-)learning that contribute to what the individual police officer is able to perform. Based on this conceptual analysis, there are three distinct challenges that have to be addressed. These challenges arise from a systemic perspective on our analysis.

Systems tend to self-stabilize themselves. As such. the border between two systems is of special interest. How do the systems influence each other? How does what is learnt transfer from one system to the other? As such, the structural coupling of systems is of great importance. Social systems such as police and science have the potential to both irritate each other and to mutually provide information for each other to attune to. Such structurally coupled systems allow for a higher degree of internal complexity which in turn increases each system's ability for future learning and performance.

We therefore focus on the different links between the systems: first, the challenge of overcoming non-permeable system barriers as it relates to knowledge management; and second, the transition of individuals between systems that specifically related to the selection of individuals that gain access to new (sub-)systems. Finally, we outline the challenge that

this paper aims at providing a solution to: the management of learning in policing and how this can be achieved.

Challenge 1: Overcoming system barriers

The first challenge relates to the observation that police learning occurs in different systems, and that knowledge structures of one system do not necessarily transfer from one system to the other. As such, the challenge is to implement the mechanism that allows for the different systems to efficiently interact with each other and allow knowledge structures to pass system boarders. In this regard, systems theory proposes a way forward: systems have to structurally be coupled in order to achieve this. Various endeavors in the context of police learning have been deemed as promising (Henry, 2016; Baechler, 2017). For example, structural implemented cooperation between the police and universities *via* funded part-time higher education programs (Jones, 2015), the development of higher education routes into the system of policing (Martin and Wooff, 2018), or forming partnerships aimed at conducting research with the police (Goode and Lumsden, 2016) are all strategies that have been implemented before. However, it is essential that these structural couplings are functional as it relates to the knowledge transfer and ultimately what is learnt by of individuals within the organization. This is an aspect that cannot be taken for granted (Goode and Lumsden, 2016; Koerner and Staller, 2021).

The aspect of structural coupling also holds true for the sub-systems within the police, like police trainer networks or specialized units within the police system. Current evidence in the context of police conflict management training indicates dysfunctional or non-existing structural couplings between sub-systems and the police system as a whole. What is needed on duty does not reflect what is trained (Rajakaruna et al., 2017; Henriksen and Kruke, 2021; LaFrance, 2021; Staller et al., 2022a). A solution in this instance may lie in the structural coupling of a systematic mapping of demands on duty with the alignment and reevaluation of what is actually trained (Koerner and Staller, 2021). While science has mapped the deficit or challenge, practice still struggles to overcome this problem, indicating the challenge that has to be addressed.

Challenge 2: Selection for impact

Concerning knowledge management within systems, the permeability between different (sub-)systems is particularly important when knowledge structures of other systems are a needed resource within the system in focus. As such, in our framework the demarcation lines between different systems are of interest in so far as they present points of potential structural couplings between systems (challenge 1). The decision process of who to select for trespassing such system barriers—including what the individual has learnt so far—also has the potential to effectively function as a structural coupling between systems. These selection processes occur from the beginning of a policing career—as a transition from non-policing to policing—as well as within the system of policing, when individuals are selected for specialized tasks und professional roles, such as working as a police trainer, as a crisis negotiator, or a criminal investigator.

Since (non-)learning within (sub-)systems heavily occurs implicitly, it is essential for police organizations to select individuals for their learning impact on others: explicitly—if they are tasked with the conduct of formal learning settings such as police training—but also implicitly as they interact with colleagues regularly.

Concerning several pressuring issues, such as the structural inequalities in our societies, the inappropriate use of force toward minority populations (Boxer et al., 2021), the overreliance of use of coercive force trainings compared to cooperative conflict management training aiming at building cooperation and trust (Sloan and Paoline, 2021), the selection of who to allow access to (sub-)systems and unfold their impact is essential. Considering what an individual has learnt so far and what the individual is likely to contribute to the learning of others is key when selecting for impact. In a globalized and diverse world, where society is characterized by heterogeneity rather than homogeneity, selecting for different world views, experiences, and perspectives within the organization by selecting for difference rather than similarity is particularly important in systems that have a tendency to self-stabilize themselves through homogeneity.

Since selecting individuals are themselves part of the (sub-)system, it is likely that diversification is overseen based on one's biases toward coherence rather than conflict (Simon et al., 2020). Overcoming this bias is not easy: it needs structurally implanted functional mechanisms (challenge 1). The last challenge to be addressed is reflexivity within the system.

Challenge 3: Enhancing reflexivity in learning to police

The last challenge concerns shifting the perspective of learning in the police toward a standpoint of a systemic view. This results in viewing (non-)learning in policing as a complex process that cannot be controlled in its entirety (premise 2)—but a process that has to be managed. Learning is contingent (Hager, 2012). The appearance of a stimulating learning situation is not predictable, nor what is learnt from it. However, being aware of and having insights into what accounts for learning situations and what can be learnt provide insights of the processes that represent control in contingent systems (Nassehi and Saake, 2002).

And in order to account for what and where can be learnt and is finally learnt, we need to take a step back and recalibrate our perspective from distinct learning settings and situations to seeing how we observe this specific learning setting and situation and what we omit by focusing on a specific aspect. This process of stepping back to observe what we observe is known as reflexivity. Reflexivity allows us to account for the hidden curriculum in formal learning settings that otherwise would remain unnoticed. By presenting our framework and laying out what can(not) be learnt in policing we allow for assessing potential blind-spots in police learning and allow for implementing strategies to manage police learning holistically.

As we have described throughout our paper, (a) various research endeavors have focused on shedding more light into learning processes in different systems related to police learning and (b) practical solutions have been implemented to enhance police (non-)learning in line with democratic ideals. By encouraging taking a reflexive stance toward police learning, we hope we can encourage further research endeavors and creative practical solutions to effectively manage the complexity of learning for policing.

Finally, the call for reflexivity extends beyond the system of policing to the individual police officer. Being aware of what has been learnt and where provides the first step towards uncovering one's own assumptions and beliefs that may limit taking on other perspectives. Consequently, the challenge also extends to individuals through enhancing reflexivity in individual police officers. As such, learning in the police has to be coherently and constructively aligned to foster reflexivity in the individual police officer.

Conclusion

Learning can be viewed as an ongoing interaction between the individual and the environment, resulting in an experience-based permanent change of internal states and capacity that limit and enable how the individual perceives the world and (inter-)acts within. For the professional handling of the sovereign tasks assigned to police officers, they must learn what to do and how. At the same time, their task-related behavior in duty is yet an expression of what has already been learned.

According to this diagnosis, we have identified learning and its management as key issues for the further professionalization of police on an individual and organizational level, resulting in the proposal of a Police Learning Management Framework. Within this framework, learning before the job, for the job, on the job, alongside the job, and within closed systems in and outside of the police have been differentiated and weighted regarding their individual and organizational relevance in the light of current debates and empirical findings.

From the systematics thus obtained, challenges for a management of learning finally result, which we have specified in three directions.

- The first challenge is to systematically orient knowledge creation within the police toward external sources and partners and to enable the necessary organizational conditions for this.
- The second key challenge concerns the selection for and within the police service: for this, the management needs valid criteria that, depending on the task and activity, also demand and promote further requirements in addition to professional and ethical ones, e.g., a balanced pedagogical expertise of police trainers.
- The third challenge relates to a reflexive approach that goes hand in hand with the before mentioned challenges: a reflexivity built into the system of the police and its management of learning that makes it possible to constantly distance oneself from one's own practices and structures and to question them with regard to their preconditions and intended as well as unintended consequences.

Taken together, a more focused view on police learning is a prerequisite for professionally coping with the pressing challenges policing faces today.

Author contributions

MS and SK contributed to the ideas presented. MS wrote the first draft of the manuscript. Both authors contributed equally to editing the first draft to its final version.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

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