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An explorative study of Police student's decision-making in a critical incident scenario simulation

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ABSTRACT

Sound use-of-force decisions are essential for police performance in critical incidents. In this exploratory study we seek to better understand the decision-making processes that are involved. Eighty-six third-year police students performed a use-of-force training exercise in an audio-visual, critical scenario simulation. Participants answered debriefing interviews about their subjective decision processes. Qualitative content analyses of the interviews indicated that the decision-making was based on visual, dynamic, and central information, more than on auditory, static, and peripheral information. Thoughts about the situation as well as thoughts about themselves were reported. Decision strategies were affected by level of expertise. Most participants made decisions that met safety concerns. The current study emphasizes the advantage of familiarizing students with a variety of operational settings, as well as their personal reactions towards them. It suggests the advantages of simulated training that includes psychological factors alongside more tactical and technical factors, including training in stress-regulation techniques.

Introduction

Police officers are frequently exposed to *critical incidents* (Lennie et al., 2020; Van Hasselt et al., 2008) calling for immediate action, where not acting or delayed actions could lead to grave consequences such as injuries and deaths. Critical incidents encountered by police officers are characterized as being unpredictable, potentially uncontrollable, novel, often involving time pressure, uncertainty, potential for dangers and typically involves psychological stress (Baldwin et al., 2021; Sandvik et al., 2020). In this paper, we focus on incidents where the critical aspect represents violent behaviours (or threats of such) towards people (police and/or civilians) in the public space, where the police may respond with use-of-force.

When critical incidents occur, we look to the police for help, as the only occupational group authorized to exert power in the public space in time of peace (Henriksen & Snortheimsmoen, 2017). To make and execute the right *decisions* under critical circumstances is one of the most challenging parts of police work. Making the right decisions in potential use-of-force encounters could prevent severe consequences (Hine et al., 2018). While most people do their best to distance themselves from critical circumstances, police officers are expected to confront and neutralize threats against themselves or the public.

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It is of utmost importance that officers receive appropriate training that enables them to make sound use-of-force decisions (Bennell et al., 2022; Huhta et al., 2021). It is vital to understand the decision processes involved when operating under difficult circumstances. We performed a study to explore police students' decision-making during critical incidents represented by a use-of-force training exercise in an audio-visual scenario simulation. Using students as participants, gave us the opportunity to identify themes that should be properly addressed in their training towards becoming skilled decision-makers.

Naturalistic decision-making in critical incidents

Decision-making is about committing oneself to a certain course of action (Lipshitz et al., 2001). Classical decision theory is typically normative in the search for optimal decision strategies and prescriptive in suggesting some standards to guide ideal rational decision-making (Beach & Lipshitz, 1993; Flin, 1996). These models provide structure, but would cost considerable resources to implement, making them difficult to follow in real world encounters where time pressures are present. The gap between normative decisions, and descriptions of real-world decisions gave rise to *the naturalistic decision model (NDM)*, developed in the late 1980's. Researchers looked for decision strategies from real world settings where experienced decision-makers succeeded (Klein, 2015). NDM addresses decision-making within naturalistic settings and operational environments characterized by time pressures, incomplete information, ambiguity, and limited mental resources. They propose that expert decision-makers overcome difficult conditions by using prior experience when deciding in a faster and more intuitive fashion, making good decisions without comparing options (Kahneman & Klein, 2009; Roberts & Cole, 2018).

Experience represents a key factor in this theoretical framework. Rasmussen (1993) divided expertise into three progressive levels within a naturalistic framework. The *knowledge-based level* represents a cognitive challenging transformation of declarative knowledge to procedural knowledge when deciding on courses of actions. This approach is typically used by people with little prior context-relevant experience. Making decisions on the *rule-based level* involves processing input from the situation and following 'if-this-then-that' rules for actions based on prior experience. Decisions may take different directions based on the rules, leaving the person conscious of several options. This approach is typically used by people who are familiar with the task but lacks extensive experience. When operating at the *skill-based level*, one reacts on raw perceptual elements at an automatic, subconscious level, responding to existing cues associated with actions without the need of interpretation and integration of cues or to consider alternative actions (Greitzer et al., 2010; Rasmussen, 1993). This highest level represents a refined and cost-effective way of making decisions, reserved for those with high contextual expertise. While the NDM is concerned with expert decision-making, it is applicable to studying decisions more generally as the scope is 'the way people use their experience to make decisions in field settings' (Lipshitz et al., 2001, p. 334). This embraces laboratory simulations as they are considered useful for eliciting the same behaviours as within real-world settings without the risks associated with these environments (Lipshitz et al., 2001).

Recognition-primed decision model

NDM represents a unifying framework for several models explaining decision processes (Lipshitz, 1993). *The RPD model* offers an intuitive explanation for how experienced decision-makers execute rapid decisions through pattern matching of a situation, often without comparing options. Two conditions must be in place for the RPD model to apply: The environment must provide valid cues to the nature of the situation and the decision-maker must have had the opportunity to learn relevant cues to recognise the situation (Kahneman & Klein, 2009). The decision-maker uses *situational assessment* to generate a plausible course of action and *mental simulations* to evaluate the generated action. Assessing the situation involves understanding plausible goals, identifying

relevant cues, forming expectancies and typical courses of action. Mental simulation means mentally enacting a sequence of events. Instead of producing and revising multiple options, the decision-maker considers one option at a time (Klein, 1993; Klein & Crandall, 1996).

The RPD model offers three decision-making strategies, depending on the familiarity with the situation. 'Simple match' is when the person directly recognises a typical situation through situational assessment and knows what to do immediately. A second – slightly more time-consuming strategy – involves developing a course of action by mentally simulating what would happen if the alternative were to be implemented including potential modifications if the option is judged inadequate. The third and most complex RPD strategy applies when the situation is less familiar or violates expectations. The decision-maker will seek more information leading to rejection of one (or several) action alternative(s) considered unsuitable, in favour of the next most typical action alternative (Klein & Crandall, 1996). Higher expertise is associated with familiarity with relatively more situations. Consequently, one could expect less complex decision strategies from this group. The RPD-model can be relevant to analyse the differences between decision-making processes at different levels of expertise. Police officers in training may have some relevant theoretical and practical experience in recognising cues but have limited experience when it comes to applying this knowledge in a realistic (real-life or simulated) setting. Identifying their level of decision-making could help us adjust training in accordance with their level, refining the more complex strategies based on knowledge-based and/or rule-based levels of expertise as a foundation for the acquisition of increasingly direct strategies as one accumulates greater experience in the field.

Critical police decision-making

Research on police decision-making in naturalistic environments often describes how experts' decisions differ from decisions made by those with less experience. Suss and Ward (2018) investigated experience-based differences in police decision-making in complex, rapidly unfolding, and uncertain situations. In familiar situations, few options were generated and typically the first option was executed. The more experienced officers generated more relevant options and fewer non-critical options. Boulton and Cole (2016) examined the role of expertise in decision-making by authorised firearms officers during armed confrontations. Experts were more flexible and adaptive in how they responded to a changing situation. In contrast, novices typically worked within a more sequential and linear decision-making process, suggesting adaptive flexibility to be a key feature of expertise within this environment. Finally, Ta et al. (2021) explored how emotional reactivity in officer use-of-force decision-making varies as a function of expertise. With experience, the officers displayed a greater ability to react and assess the situation calmly, with a greater sense of control and positivity. This led to more accurate, effective, and efficient behaviours. This line of research has emphasised the importance of training and experience for making adequate decisions within demanding situations. In contrast, Hine et al. (2018) found that police recruits in a use-of-force training scenario, displayed intuitive rather than analytical decision strategies, which indicates decision strategies normally associated with expert decision-making.

Other studies have investigated the influence of different factors on the decision-making process. The effect of stress and stressful circumstances on performance and decision-making is a recurring theme. Kavanagh (2006) observed officers' decision-making under stressful evolving firearm incidents. She found several changes in the decision process such as downshift to automaticity, relying on schemas and attention narrowing. Klinger and Brunson (2009) studied reports of tense, uncertain police encounters that had led to deadly force. They identified perceptual distortions such as diminished sound, slowed time and tunnel vision. Harris et al. (2017) studied police officers' decision-making and coping under stressful real-life incidents and found that these conditions led to focused attention towards solving problems rather than dwelling on feelings. Moreover, Roberts and Cole (2018) found that police officers relied more on visual than auditory information when subjected to cognitive overload. The association between personality and decision-making are

studied by other contributors. Girodo (2007) found that scoring low on personality traits such as neuroticism and sensation seeking were associated with a greater risk of being shot on the job. Moreover, Huhta et al. (2021) uncovered high extraversion to correlate with errors in critical police decision-making and with a tendency to take unnecessary risks. They also found that higher emotionality was linked to undesirable withdrawal behaviour, which could be counterproductive for police officers in critical encounters. These studies indicate that a number of cognitive, personality and reflective factors may be relevant when studying police decision-making.

The Current study

Rather than investigating any pre-determined factors, the purpose of the current study was to explore which themes that the participants saw as relevant for their decision processes. We investigated the participants' experiences without comparing them to the experiences of more seasoned decision-makers. This allowed us to gain a more authentic insight into the decision-processes of novices. The participants of this study were presented with open questions about perceptions, thoughts, judgements and actions, to facilitate descriptions of the factors they found relevant to their decision-making processes. We believe this explorative and open design, fill a gap in the current literature. The main research question was: *How do police students experience their decision processes during critical incidents?* We specified a set of subordinate research questions designed to explore the complexity of the decision-making processes, including activities such as perceiving cues, choosing and effectuating actions. The following five subordinate research questions guided our data collection: *How do police students: (1) interpret the assignment, (2) experience information through visual and auditory perception, (3) describe their thinking, (4) describe their judgements and (5) describe their actions?*

Method

Participants

The participants in the current study were third-year students at the Norwegian Police University College. Norwegian police training is conducted over a three-year period. In their first year, the students learn basic skills in policing. The second year consists of a supervised apprenticeship in the police force. In their third year (and relevant for the current study), the students attend an intensive scenario-based use-of-force training programme. At the time of data collection, 730 third-year students attended the Norwegian Police University College. The median age of this cohort was 23–24 years by their third year. Approximately 60% of the students had some military training before attending the University College.

All 404 third-year students at one of three Norwegian campuses were informed about the study project during a joint forum. An invitation to participate was sent by email. We emphasized that participating was voluntary, and assured anonymization. We informed that participation or performance would not impact the evaluation of their training. We had the capacity to receive 115 participants in the current study. Ninety-two students signed up early enough to fill the time slots available for the study, of which 86 completed all elements (37% female, compared to 46% females in the total student cohort).

Data collection

The exercise took place in a MILO (multiple interactive learning objectives) Range 4 interactive simulator with the capacity to recreate audio-visual stimuli from a naturalistic setting. The scenario gave participants multiple cues to assess the severity of the encounter (e.g., presence of a weapon), and resembled scenarios they had encountered in previous (simulated) training. The participants

completed the exercise and debriefing interview individually. They were equipped with training oleoresin capsicum (OC) spray, baton and duty weapon (training pistol) with a conversion kit (HKP30L, laser driven). The simulator registered use and accuracy of the OC and duty weapon. The instructor (the third author) briefed the participants about the assignment upfront, and they received limited information intended to include an aspect of uncertainty (for briefing details, see Appendix 1).

In the scenario, the participants met (on screen) a person sitting at a picnic table holding his head in his hands (from now on referred to as 'the perpetrator'). At the beginning of the scenario a pistol was barely visible on the table, within reaching distance. As the exercise proceeded, the participants moved closer to the perpetrator, which made the pistol clearly visible. The perpetrator became increasingly agitated throughout the exercise. He made six brief utterances (e.g., 'Get out of here'). Eventually, he raised from the picnic table, grabbed the pistol, and waved it around. After five more utterances ending in a warning ('I am not gonna warn you again, get out of here!'), he opened fire towards the participants.

We wanted to simulate a critical incident in which all participants had to make critical decisions. The simulator was therefore set up to only respond to the participants' use of the duty weapon. The perpetrator would thus say and do the same things regardless of the participants' communication or other actions. Only shooting the perpetrator (and hitting within hit zones covering his arms, legs, head, and torso) would end the exercise. If no effective shots were fired within 74 seconds, the exercise would end with the perpetrator shooting at the participant.

Immediately after the exercise was over, the interviewer (the first author) entered the room and conducted the debriefing interview. To prevent biased questioning, the interviewer was not present during the exercise, and was not informed about the participant's performance. The interview followed an interview guide consisting of eight open-ended questions (see Appendix 2) based on the five research questions. The interviewer probed each question with a simple: 'anything else?' (Typically, twice) until the participant responded 'no'. At no point during data collection did any of the researchers communicate with the participants about the exercise or performance, other than the fixed briefing and debriefing interview. Participants were instructed to not tell their fellow students about the proceedings of the exercise before completion of the data collection. On average the debriefing interviews lasted about 10 minutes. The interviews were recorded and transcribed, resulting in an extensive dataset of over 100,000 words.

Data analysis

We conducted an exploratory content analysis on the transcribed debriefing interviews. This method can be used qualitatively or quantitatively for systematic analysis of written, verbal, or visual documentation (Wilson, 2016). We chose a qualitative conventional content analysis for this study, where codes should derive inductively from transcriptions with the purpose of describing and better understanding a phenomenon (Fauskanger & Mosvold, 2014). We used inductive, open coding (without codebooks), where codes, categories and abstractions are created by the researcher while reading the text (Elo & Kyngäs, 2008). Our aim was to identify themes that the participants found essential for their experienced decision processes. The data analysis focused on the manifest content with active use of quotes to stay close to the text and to capture the participants' experiences.

Two coders (the first and second author) did the initial sorting of the transcriptions and agreed upon the three broad categories: *Perception of the situation*, *Thoughts and Judgements* and *Actions*. The categories were inspired by the five initial research questions but were altered and condensed to cover topics to decision-making that emerged in the material. Following a discussion about potential subcategories, the first coder continued the inductive work of finding and revising subcategories and codes using the data software NVivo (12 Pro, QSR International Pty Ltd). The subcategories and codes identified by the first coder were subject to ongoing discussions with the second coder and were revised several times to find the best fit with the material. Cross checks

Table 1. Example of the analytic process.

Quote	Code	Subcategory	Category
«He did seem pretty calm at the moment. He was a bit upset, but not aggressive and angry at the beginning" (33).	The perpetrator's mental state	Perception of the perpetrator	Perception of the situation
'I did consider (firing a) warning shot. When he did not comply with orders, Then I did consider warning shot to make him react. But I rejected it rather quickly, as I considered the threat … ' (12).	Considering alternative actions	Action planning	Thoughts and judgements
'It is obvious that the person sitting there is not ok, so I try to reach out to the person. Introduce myself… I am trying to establish contact with the person' (2).	Dialogue-based communication	Verbal Communication	Actions

between related categories, subcategories and codes were run to ensure that all statements belonging to a group were captured and to avoid direct overlaps. See Table 1 for an example of the analysis process from quotes to categories.

Results

In the presentation of interview content, we provide quotes to illustrate subcategories and codes (each followed by participant number), and we state how many of the total sample of 86 have been assigned each code or subcategory. See Table 2 for an overview.

Perception of the situation

We asked the participants what they observed and what the perpetrator communicated in separate questions. The category 'perception of the situation' is divided in three subcategories: 'Perceptions of the perpetrator', 'perceptions of objects', and 'perceptions of surroundings'.

Perceptions of the perpetrator

All 86 participants described the perpetrator's actions. Eighty-four commented on the crucial moment where the perpetrator picked up the pistol: 'He grabs the weapon and stands up. Standing there with the weapon in his hand.' (30). Fifty-five reported that his actions were non-compliant in terms of appearing

Table 2. Overview of categories, subcategories, and codes.

Categories	Subcategories	Codes
Perception of the situation	Perception of the perpetrator	Actions, Location, Mental state, Verbal communication, Non-verbal communication, Appearance
	Perception of the pistol	Delayed recognition, Accurate position, Within reaching distance
	Perception of the surroundings	Picnic-table in green scenery, No other people around
Thoughts and judgements	Action Planning	Planning for use of service weapon, Expressed goal, Alternative actions, Insecurities, Communication as sole remedy
	Threat Assessment	Concerns about the perpetrator, Concerns about the weapon, Perceiving danger, Harmless to me
	Focused thoughts	Focus on the pistol, Focus on the perpetrator
	Thoughts about themselves	Personal state, Self-criticism
	'If-this-then-that rules'	Clear premises, Unclear premises
Actions	Verbal Communication	Giving orders, Declaring their presence, Dialogue-based communication
	Shooting behaviour	Shots fired (warning shots, shots in outer extremities, shots in the centre), Timing of shots

to ignore their orders. Eighty-three commented on the perpetrator's location (i.e., sitting at a wooden picnic table, or where he was situated in relation to the pistol). When describing the perpetrator, 78 participants commented on his perceived mental state. Thirty-seven used words indicating that the perpetrator was sad, whereas 32 referred to him as aggressive. Nine participants stated that they had noticed a change in the perpetrator's state of mind from sad to aggressive: 'At first I thought he seemed a bit discouraged and sad, but when he started talking, I noticed that he was aggressive and grumpy' (58).

The participants remembered little of the verbal messages. The perpetrators verbal message contained six themes (appendix 3). Forty-six reported remembering one theme, five reported two themes whereas three reported three. The remaining 33 remembered nothing of what was expressed verbally. Supporting these findings, 49 participants reported having difficulties perceiving the perpetrators' verbal messages. Eighteen of these attributed the lack of hearing to the experience of high threat and 17 reported to have 'talked over' the perpetrator with orders. Except for two participants, none remembered what the perpetrator said after he picked up the pistol. Out of the two, one remembered hearing the perpetrator's final warning. It seems that receiving verbal messages becomes even harder as the threat increases: ' ... after he picks up the weapon, I understand little of what he is actually saying' (9). Forty-six participants correctly commented on the perpetrator's non-verbal communication. They reported paying special attention to the perpetrators' hands and arms. Body language was used to substantiate their judgements of his mental state: 'From his body-language, he seemed a bit upset. Gave clear signals on being discouraged, shaking his head, looking up and down' (19).

Twenty-five participants commented on the perpetrator's physical appearance. Ten of these gave an incorrect description, e.g., describing wrong clothing. One participant presented a potential reason for not remembering: 'If someone would have asked me to describe him, what kinds of clothes he was wearing, it would have been very difficult because one is constantly looking at the weapon' (30).

Perceptions of objects and surroundings

All 86 participants commented on the pistol (or a pistol-like object): 'Pretty quick, I saw this black object lying on the bench ... He was within an arm's length distance from the object, which proved to be a pistol.' (12). Twenty-seven reported that some time passed before they saw the pistol. Two did not identify the object before the perpetrator picked it up.

After reporting on the perpetrator and the pistol, 80 participants elaborated on the surroundings, although some did so only after probing, and with notably fewer references compared to the extensive citations related to elements such as the perpetrator. They recalled that the picnic table sat on concrete surrounded by green scenery consisting of trees and a slope. Forty-two described, without prompting, that there were no other people around.

Thoughts and judgements

We asked the participants about their thoughts and judgements in two separate questions. Their responses were interwoven and are therefore presented as one category, further divided into the subcategories: 'action planning', '"if-this-then-that" rules', 'thoughts about themselves', 'threat assessment' and 'focused thoughts'.

Action planning

The code action planning refers to all reported intended actions, regardless of whether these actions were subsequently executed or not. All participants presented a relatively coherent plan for their actions. All but one reported thinking about the tasks, such as what they were planning to do and why. They differed in which courses of actions they were planning for, and in how confident they were with their choices and courses of actions.

Sixty-seven participants planned for some use of their duty weapon to pacify the perpetrator if he did not comply. These action alternatives gave rise to many justifications: 'I do think that even though I have pepper spray and baton, it is not relevant when he has access to a weapon. [Such means] are considered insufficient' (29). Twenty-eight participants reported having intentions to solve the mission with communication as the sole remedy: 'I did think a lot about solving the situation without using my weapon, which is why I tried communication for quite some time, even after he was holding the pistol' (75).

Fifty-six of the participants reported thinking about one or several alternative actions not performed. Most of the rejected actions (68 cases) were less intrusive than the chosen action and were rejected for security reasons: 'OC and such, these less intrusive means-of-force practices were not an option. You feel it in your spine that if you are alone, it would be a mistake to change the means-of-force or reduce to for example baton or OC because it is likely that he [the perpetrator] will use the pistol' (6). A few rejected actions (seven cases) represented greater use-of-force than the chosen action (e.g., considering shooting in the centre mass, but settling for the outer extremities).

Forty-one expressed some insecurities about what actions to take. Some concerns were general, articulated as not knowing what to do. Others expressed doubts about whether they should use their duty weapon, others again vacillated between two alternatives, yet others hesitated due to concerns about the legal fundaments for their potential actions.

The participants seemed to agree on the mission goal of separating the perpetrator from his pistol. Sixty-two explicitly stated this goal: 'The primary goal was to "tell him [to move] away" from the pistol' (11). Among the others, this goal was expressed more indirectly (e.g., through the orders).

"If-this-then-that" rules

When planning for actions, 43 participants reported setting premises for when to do what, expressed as 'if-this-then-that' rules. Twenty-eight participants set clear rules for their actions: 'I saw the situation as rather clear cut, not so very complicated in a way. I saw a person with an instable mind at the time being and that he had a life-threatening object close by. If he does not follow my orders, I will shoot him. In a way, that was my frame of reference, and I acted accordingly' (6). Fifteen participants reported to have had 'if-this-then-that' rules without clearly defined thresholds: 'I thought that if he was planning to shoot anyone, then I must do it. But then I was a bit insecure about when can I shoot, when should I shoot?' (21).

Thoughts about themselves

Sixty-five participants reported having thoughts concerning themself during the exercise. Forty participants reflected directly on their psychological state. Fifteen described a state of fear: 'My life is at stake; you can say I was scared that he would take any actions' (12), another 15 described that they felt the lack of control or mental capacity: 'In the beginning I thought that I might be able to solve this by good communication, but I gave that up pretty quickly, because I felt that I lost some control over my own – what should I call it – vigilance' (88). Last, 12 participants described a stressed state: 'My head was filled with stress' (30). Fifty-two participants articulated some sort of self-criticism: 'The more time that went by, the more I thought that the next time he waves [the pistol] . . . So, at the time I thought that I should have done it (30)'.

Threat assessment and focused thoughts

All participants reported on the threats in the scenario, 65 of them concluded on there being high threat: 'When I met him, I saw a weapon lying there. Looks real. A threat to me and to those around. If he is unstable, then he might be willing to use it' (11). In contrast to those reporting high threat, nine participants expressed a different view: 'I think my interpretation was somewhat that he was not angry with me, but more so towards the situation and the people at the embassy. Thus, I think that one way or another, I was not too afraid that he would shoot me' (14). Seventy-eight participants reported concerns about

the weapon as part of their threat assessment, whereas 71 attributed threats towards the perpetrator's mental instability. Sixty-four considered both elements, as illustrated by the first quote in this section. Out of the 12 participants that reported feeling stressed, nine explicitly attributed this stress to threats presented in the scenario. Moreover, threat assessments seemed central to the justifications for actions (or lack of actions) presented by the participants.

Without prompting, 47 participants characterised their thoughts as being focused, describing how all their thoughts were directed at either the pistol or the perpetrator. They expressed how being focused on one thing delayed their recognition of other aspects: 'In the beginning I placed all my focus on the person; hence it took some time before I saw what was on the table' (4). Eleven participants reported to have stayed focused on both aspects simultaneously when assessing the threats, seeing the two in relation to one another (rather than shift focus sequentially): 'I actually judged where he was in relation to the pistol, what his pattern of actions were in relation to the pistol' (66). Two participants identified stress as a catalyst to the focusing of thoughts.

Actions

The participants' reports of behaviours they executed are divided into 'verbal communication' and 'shooting behaviours'.

Verbal communication

Verbal communication is divided into giving orders, declaring the presence of the police and dialogue-based communications. Giving orders was the most frequently reported communication method (reported by 82 participants): '[I] gave him orders to first move away from the weapon, later to let go of the weapon when he picked it up' (37). When the perpetrator did not comply, 58 reported repeating their command with a consequence for not obeying orders. Continuing from the last quote: '[I] said to him that if you do not let go of the weapon, you risk being shot' (37). Most participants reported giving multiple orders or that they repeated the same order many times before they took any further actions.

Sixty-six participants reported initiating communication with the perpetrator by declaring their presence as police officers. Thirty-two reported declaring themselves as 'armed police' at some point during communication. Forty-seven respondents reported engaging in dialogue-based communication in attempts to connect with the perpetrator: '[I] asked who he was. [He] tried to tell me a bit, that no one listened to him and so forth. So, I asked him to open up to me, tell me what had happened. Asked him to calm down, that I only wanted to talk' (14).

Shooting Behaviours

Three types of shots were fired, from least to most intrusive: warning shots, incapacitating shots at the outer extremities (arms and legs), and shots in the centre mass (torso or head).Twenty-three participants reported administering warning shots, often after they had tried giving orders several times: '[I told] him to get away from the weapon. I got no reaction. . . . Then I aimed my weapon at him, ordering him once again. I said that he will be shot if he does not obey my orders. Get a "no" once again and chose to place a warning shot in the ground' (22). Among the 23 participants who administered warning shots, 16 reported to do so after the perpetrator had picked up the pistol.

Thirty-eight participants reported incapacitating shots, out of which eight reported to take this action after they had tried to stop the perpetrator with warning shots. Twenty-seven of the thirty-eight reporting to administer incapacitating shots succeeded and no further action was required. All but one incapacitating shot were effectuated after the perpetrator took up the pistol.

Fifty-nine reported centre mass shots, out of which 36 reported to do so without trying any other category of shots beforehand: 'It was when he first stood up and grabbed the pistol then it was like,

now he presents an even bigger threat to me, he has already denied on what, or denied my instructions, so my choice was to aim a shot at him' (67). Thirteen reported to perform centre mass shots after they fired a warning shot, 11 after they missed in their attempt at an incapacitating shot. Two participants reported to have tried both warning shots and incapacitating shots (that had missed) before centre mass shots as their last resort. All centre mass shots were reported to be administered after the perpetrator had armed himself. Twenty-eight reported to fire towards the perpetrator without considering any other actions first.

Eighty participants reported to have fired before the perpetrator fired, while the remaining six reported to have fired after the perpetrator (there was a slight delay before the simulator registered participants being shot). All participants reported to fire their weapon eventually, either as part of an action plan or not, even though some reported to have fired too late.

Discussion

How do police students experience their decision processes during critical incidents? We found some common tendencies as well as some differences in how the participants perceived, thought, judged, and acted in this critical decision exercise. We will discuss the results in relation to prior research and theories.

Perceived or not perceived

The interviews indicated that participants focused their attention on dynamic and visual aspects of the perpetrator and/or the pistol, while the surroundings were secondary. When characterising the perpetrator, most recollections were about the perpetrator's actions, position, mental state, and non-verbal cues, while fewer were about his appearance and the content of verbal cues.

Narrowing of attention (or 'tunnel vision') when facing a threat is a well-established phenomenon when experiencing stress. Klinger and Brunson (2009) reported tunnel vision as one common perceptual deficiency experienced by police working under challenging circumstances. This phenomenon is defined as a narrowing of the breadth of attention processing, or as a prevailing of central vision at the expense of the peripheral vision resulting in a constricted circular field of view (Kavanagh, 2006; Verhage et al., 2018). Tunnel vision is a plausible reason why aspects of the perpetrator and pistol received more attention than the surroundings in the participants' recollections.

Many participants missed important verbal cues by failing to notice what the perpetrator was saying. Only one participant reported to recall the clear threat the perpetrator shouted towards the end of the scenario. Understanding verbal cues depends on auditory perception; thus, this finding appears to demonstrate a downshift of auditory processing during stress. This is comparable to how Roberts and Cole (2018) described downshifts to visual processing capacities at the expense of phonological processing capacity in their study of cognitive overload among police officers. The phenomenon has also been referred to as stress-induced auditory exclusion, experienced as a temporary loss of hearing (Verhage et al., 2018) or 'diminished sound' (Klinger & Brunson, 2009).

Very few participants could report correctly about the perpetrator's appearance. The lack of a signalment would make it difficult to relocate escaping perpetrators. Appearance cannot be explained as peripheral information nor to depend on auditory perception. The failure to notice appearance must seek other explanations. In contrast to other cues such as e.g., actions, appearance could be considered static (and not threatening) information. This deficiency could therefore be explained as a tendency to overlook static information in critical encounters. Similar tendencies have been shown by Drews et al. (2015) studying information-updating behaviour during information search and decision-making in computer-based wildfire simulations. They found that all participants preferred to explore dynamic information, with a stronger effect for experienced participants.

Thought content: looking in and looking out

The respondents are attentive towards the situation they are set to solve, especially when it comes to central and dynamic aspects. In alignment, much of the reported thought content is solidly rooted in the situation. e.g., all participants reported planning their actions according to presented goals and many described to focus their thoughts on the perpetrator and/or pistol, showing that a considerable amount of thinking was devoted to solving problems in situ. Additionally, they reported much thought content directed toward the self, encompassing reflections upon one's personal state or capacities (manifesting as self-criticism). Previous research has been contradictory about what thought content is of prevalence or the better choice during critical decision-making. Harris et al. (2017) found that during threat-of-death incidents police officers focus their attention on problem-solving rather than their emotional state (self-directed thoughts). In contrast, the attention control theory, postulates that a stressful or threatening stimulus may lead to attention drawn away from task-relevant information in favour of distracting threat relevant information and internal worries, resulting in less cognitive capacity to effective task behaviour (Eysenck et al., 2007). Last, Huhta et al. (2021) found that scoring higher on emotionality – implying emphasis on values and feelings – was related to undesired withdrawal behaviour for police recruits. The latter two contributions could suggest that attention towards internal worries or inner aspects such as values and feelings could come at the cost of effective task behaviour, or that 'looking in' in some cases could come at the cost of 'looking out'. Still, we believe that being aware of and constructively addressing personal states could be beneficial to critical police decision-making, underlining the need for a more nuanced understanding of the influence of emotions and personal states within this area.

In traditional decision theories, emotions have been either absent or looked upon as more irrational influences on cognition considered as the primary and normative factor in decision-making (Anderson, 2006; Lerner et al., 2015; Luini & Marucci, 2015). This has changed in recent years, with a number of studies investigating the contribution of emotion on decision-making (George & Dane, 2016). These endeavours reveal a more nuanced picture of the effects of emotions on decision making, showing that emotions can lead to positive, negative or avoidance effects on decisions (see e.g.; Anderson, 2006; Lerner et al., 2015; Zeelenberg, 2011).

In the current study, some respondents reflected on experiencing fear. Nieuwenhuys and Oudejans (2011) found that anxiety reduced accuracy for police officers' shooting behaviour under pressure. On the other hand, Girodo (2007) showed that police officers scoring low on neuroticism had a greater risk of being shot on the job, indicating that worrying is vital for survival. There are conflicting findings on the effects of fear on police decisions. Moreover, emotions are intimately linked with thought contents through their effects on appraisals e.g., leading fearful people to see greater risks than angry people (Lerner et al., 2015). Action planning could hardly exist without emotions as different actions and contexts would most likely be associated with certain emotions in the first place. Due to their intertwined nature, we believe emotions cannot be separated from problem-solving and decision-making. In this study, half of the participants reported being insecure (representing inner states) about what actions to take (representing thoughts directed towards the situation), supporting this argument.

Many participants reported self-critical thoughts. Despite the potential for self-evaluative thoughts to have positive effects on future behaviours, during critical events they could detract from the cognitive capacity for decision-making. In reviewing complex motor skills and police training, DiNota and Huhta (2019) asserted that expert decision-making is affected by officer's individual perception of their own skills and abilities. The authors do not discuss how perceived action competence affects the preceding decisions, but we assume that perception of high action competence would be favourable to low when operating under difficult circumstances. Self-criticising – suggesting low perceived action competence – during critical events would therefore most likely be counterproductive.

Threat assessment and use-of-force actions

Our participants were assigned a high-threat scenario and threat assessment emerged as a central theme in their reflections. Prior research has established a connection between perceptions of heightened threat and subsequent stress responses, which can lead to perceptual deficiencies bearing a negative effect on critical decision-making and performance (Klinger & Brunson, 2009). Investigations into stress predominantly quantify its presence through physiological indicators such as heart rate, heart rate variability and/or cortisol levels, and shows how stress impacts physiological processes and cognitive-behavioural outputs (See: Andersen et al., 2018; DiNota & Huhta, 2019). Although we had no physiological measurements of stress in the current study, we have reports on experiences of high threat, perceptual distortions, as well as stress responses explicitly attributed to the experience of high threat. Consequently, we may assume that stress had an impact on the decision-making in our study. We must also be aware of the intimate link between emotions and threat perception, as emotion influences threat detection (Baumann & DeSteno, 2010).

Directly or indirectly through related factors, we have reasons to believe that the participants threat assessment influenced the use-of-force decisions and following actions. According to de Tribolet-Hardy et al. (2015), deciding to deploy force is subjective, based on a risk assessment of the changing factors of an encounter. McTackett and Thomas (2017) identified presence of a weapon, non-compliance with police commands, and physical and/or verbal aggression to be factors that most frequently led to police use-of-force. All three factors were present in our scenario and may have substantiated the participants' decisions when using intrusive means-of-force.

Despite differences between jurisdictions concerning use-of-force strategies, there are some commonalities between many Western countries subsumed in the general principles of necessity, proportionality, and precaution (Casey-Maslen & Connolly, 2017). The use-of-force actions are seen as necessary if the situation could not be solved with less use-of-force, as proportional when they are reasonable compared to a desired result and as precautious when the actions are executed with precision and prudence. The current participants demonstrated an effort to solve the exercise using means-of-force with as low potential for physical injury (e.g., communication) for the perpetrator as possible. When using means-of-force actions with high potential for injury, the participants provided extensive justifications for their actions. Many attempted some sort of deescalating communication in the hope for dialogue despite the lack of responses from the perpetrator. Almost all participants reported giving orders (with or without mentioning a consequence) and many repeated these orders several times to give the perpetrator opportunities to obey and avoid being shot. The current scenario challenged the participants to balance the principle of minimal use-of-force with safety concerns. Staying safe required escalating to firearms due to the threat presented by an armed, unresponsive perpetrator. All participants who fired shots at centre mass did so after the perpetrator had armed himself. By that time, shooting would be considered both necessary, proportionate, and precautious. Almost all participants opened fire towards the perpetrator before getting shot at. However, six participants took a significant risk by not shooting early enough. Other examples of risky behaviour were displayed by the few participants who used warning shots after the perpetrator was armed, leaving themselves vulnerable to incoming fire with the muzzle directed away from the threat. These risky behaviours could be linked to the assessment of low threat. Still, out of the nine respondents reporting to have perceived low-threat, only two displayed such risky behaviours.

Decision strategies

Numerous participants conveyed considering alternatives before settling on an action. Moreover, half of the participants reported detailed thought processes characterized by 'if-this-then-that' rules dictating conduct during the exercise. Collectively, these findings imply

that many participants arrived at decisions by mentally simulating the consequences of one or several action alternative corresponding to the two more complex strategies, as suggested by the RPD-model (Klein, 1993; Klein & Crandall, 1996). Further, the use of 'if-this-then-that' rules is compatible with Rasmussens (1993) intermediate rule-based level of expertise, suggesting the second (moderately complex) RPD strategy. Similarly, Boulton and Cole (2016), demonstrated that novices tend to have sequential, linear decision-making processes, thereby lacking the adaptive flexibility of experts. Current findings suggest the incorporation of our student sample into the RPD model of decision-making, still ruling out the proficiently use of the direct and refined 'simple match' strategy. Compared to the stance of Hine et al. (2018) positing that police recruits use the same intuitive decision strategies as experts, the current study proposed a more nuanced comprehension of novices' decision-making processes.

Accounts provided by a minority of participants hinted at a proximity to relatively higher levels of expertise than others. These participants reported heightened sensitivity to cues and nuances, elevated confidence levels, and reliance on more direct decision-making strategies. Due to their lack of experience, students taking more direct decisions could result in more impulsive and risky behaviour. Out of the 28 participants reporting that they did not consider alternatives, six reported to have displayed risky behaviour as previously defined.

Implications for police training

To enable police officers to make sound use-of-force decisions, one must ensure appropriate training (Bennell et al., 2022; Huhta et al., 2021). Time-pressure is one defining characteristic of critical incidents (Baldwin et al., 2021; Sandvik et al., 2020) giving advantages to efficient RPD decision strategies where automatic recognition of a typical situation leads directly to actions (Klein, 1993; Klein & Crandall, 1996). As expected, due to their level of training, we have learned that most participants seemed to operate on an intermediate level of expertise where comparing options would be part of their decision processes. To become skilled decision-makers – with the ability to act in direct ways when time is short – students should be familiarized with a variety of operational settings in training. Such training would provide students with an experience-based repertoire, making it easier to find appropriate action alternatives in critical encounters.

Simulated training represents an indispensable method for this purpose, providing students with experiences in a variety of operational settings without putting them at risk. Even in life-long service, there are high-threat situations that only a few police officers will experience, underlining the necessity of simulations. Police simulator training can evoke similar stress physiology as live scenarios, although to a slightly less extent (DiNota et al., 2023). For simulated training to be efficient, students must be exposed to both low-threat and high-threat scenarios, to learn how to vary their means-of-force in accordance with an ever-changing situation.

Our study highlights the presence of thought content directed towards the situation as well as inwards towards the self. How to successfully combine the two directions, should be addressed in training to encompass the complexity of decision-making processes in difficult circumstances. Traditional police training is often more concerned with technical, tactical and physical aspects of performance and tend to neglect the role of psychological factors such as stress, anxiety and emotions (Luini & Marucci, 2015; Nieuwenhuys & Oudejans, 2011). It has been shown that police training benefits from training for threat, fear (Nieuwenhuys & Oudejans, 2011) and stress (Anderson et al., 2019).

In this study, the participants reported perceptual deficiencies, consistent with previous literature on stress (Klinger & Brunson, 2009). This substantiates the importance of educating police students in stress regulation. Reduced stress could make it easier to notice task-relevant information that supports use-of-force decisions. In their study of application of resilience promotion training among police officers, Andersen et al. (2015) found that participants were able to significantly

reduce their heart rate and to engage in controlled respirations during simulated critical training. Police training could also profit from exploration of optimal levels of stress and fear, making police students better acquainted with personal reactions in threatening and stressful situations, which could lead to more effective management of such reactions.

The current study illustrated that action timing is essential for decision-making. Early in the scenario, there was room to employ means-of-force actions with low potential for physical injury. Later (when the perpetrator had armed himself), the participants' options were limited to directed shots for security reasons, whether with or without communication. No actions, or delayed actions could mean that the participants eventually would have to effectuate centre mass shoots to stop the perpetrator, whereas at an earlier stage the perpetrator could have been stopped with incapacitating shoots. Since timing appears as a key factor in critical decision-making, it should be addressed in police training. To obtain more precise timing through training, one could consider recent research describing different factors important for police to obtain an accurate situational awareness (SA) (Huhta et al., 2023).

Limitations and further research

The current study used a simulator rather than naturally occurring situations. This provided a controlled, standardised, and comparable task that is suitable for reliable and efficient data collection but may have come at the cost of ecological validity. Setting the system to only respond to the participants' use of duty weapon, might have altered the participants' decision-strategies. Similar concerns on the difficulties of reproducing real-world stressors in simulations are shared by Harris et al. (2017).

Even though self-selected recruitment is a cost-effective way to ensure motivated participants, it could lead to a biased sample, where only the students that felt confident with the scenario-based training would join. We should also be aware of the shortcomings of self-report techniques (see e.g., Stone et al., 1999). Due to the constructive nature of the human mind, it is reasonable to expect some discrepancies between the self-report of the cognitive processes and how they were performed at the time. Moreover, there exist the potential for responses influenced by social desirability, given the dual role of the interviewer as an academic instructor. To mitigate this potential bias, we provided explicit guidance regarding our stance and involvement, in addition to informing students about the confidentiality of their responses.

Despite these limitations, we believe this study provides valuable insights into the decision processes among police students with intermediate levels of expertise. We further believe that the results transfer to decision processes for on-duty police officers and other first-responders. Both students, officers on duty and other first-responders may find themselves in a comparable situation with limited real-world experiences with critical decision-making. The training implications of the current study could therefore be relevant for basic training as well as for the operative maintenance training for certified first-responders.

Getting access to experienced decision processes required the use of self-report methodology. To overcome the shortcomings of this approach, further research should complement verbal report with observational data. This could allow for investigation of relations between thoughts, emotions, and actions, leading to potential valuable findings on which mindset and mental state that should be reinforced through training. Occlusion points could also be introduced, allowing participants to immediate comment on a critical scenario instead of reflecting back after the event is over. Case studies or critical incident technique interviews from police officers' decision-making in real-world encounters would also supplement knowledge on these issues and would have advantages in terms of ecological validity (although other methodological issues would then come into play). One should continue to explore the presence and effects of different factors in the decision-making process in critical incidents, as well as to explore how first-responders could balance between inward and outward thinking. Last, further research could benefit from exploring the effects of tailoring police training to individual needs (e.g., giving special attention towards withdrawal tendencies for those scoring high on emotionality).

Disclosure statement

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Ethics approval

The project was approved by the Data Protection Officer at the PHS. A Presentation Assessment was sent to the Regional Committees for medical and health research, and the project was assessed as not subject to application (ref 55,890). The project is registered and developed in accordance with guidelines of the Centre for Research Data (NSD, ref No 297,094).

Consent to participate

Informed consent was obtained from all individual participants included in the study. Before agreeing to participate in the project, all participants had to read through and accept a written informed consent developed in accordance with NSD criteria. (Available on request)

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Appendix 1

The following briefing was communicated verbally by the instructor before each participant entered the exercise:

Situation: You are serving a one-man embassy patrol when you receive a new assignment. You are armed with a pistol for patrolling at the embassy.

Assignment: Tactical Operation Central orders you to drive around the block to provide support. The security guard at reception has called for police assistance due to concerns about a former employee. The former employee showed up, insisting on talking to his former superior. He had no appointment, and his former superior was not able to make time for him. He was ordered away from the building. According to the security guard, the man is now sitting outside the building in an apparently very unstable state of mind.

Appendix 2

Interview guide for the debriefing interview:

Introduction: We will ask you some questions about what you *perceived*, *thought*, and *did* during the exercise. We are interested in actual experiences, thoughts, judgements, and actions there and then, including appropriate actions in your opinion, and actions you would want to reconsider in retrospect. At this time, we are not interested in thoughts and considerations that may have come to you after the exercise

To sum up, we are only interested in "there-and-then" thoughts and considerations, not thoughts and considerations you may have had after the exercise.

(1) What did you know about the assignment before starting the simulated exercise?
(2) What did you see when the exercise started?
(3) What was the perpetrators message to you/what did he say?
(4) What did you think during the exercise? We are looking for thoughts during the exercise, not after.
(5) How did you judge the situation?
(6) How did you act/what did you do step by step?
(7) Did you consider any actions that you rejected, if so what actions?
(8) Did you act according to your own judgements?

Appendix 3

The content of the verbal messages from the perpetrator in the simulated scenario sorted in six themes:

(1) "It's not my fault!"
(2) "That's what they told you?"
(3) "I am not going anywhere."
(4) "They forced me."
(5) "Go away"
(6) "I'm not gonna warn you again!"