Effects of anxiety on police officers’ shooting behavior under pressure: summary, conclusions, and directions for future research
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This thesis concentrated on the effects of anxiety on police officers' shooting performance under pressure. Performing under stressful circumstances is an inherent part of police work. Police officers are often confronted with the aggressive behavior of civilians, need to chase and arrest suspects, and – in extreme cases – end potentially life-threatening situations with their firearm. Over the past decades, police officers have increasingly often been confronted with serious crimes that involve the use of firearms (e.g., Barclay et al., 2003; Timmer & Pronk, 2011), thereby causing a steady increase in the number of officer-involved shootings.

Clearly, getting involved in a potential shootout is a stressful experience, also for police officers (e.g., Anderson et al., 2002; see also Chapter 1). Despite the enormous consequences, however, there is little specific knowledge about the effects of anxiety on police officers' shooting performance. For instance, how does anxiety affect police officers' shot accuracy, do anxious officers make different shooting decisions, and is it possible to counter negative effects of anxiety by training under more realistic circumstances? The aim of the current thesis was to provide answers to these questions.

Although in general, many studies focused on the effects of anxiety on perceptual-motor performance (e.g., shooting), empirical findings are still scattered and an overarching framework that explains the relations between anxiety and performance does not exist. Overall, performance tends to decrease as a result of anxiety. However, with respect to how this change is brought about, opinions differ (see Nieuwenhuys & Oudejans, in press, for a review of this literature). Under anxiety increases in activation of the amygdala (an important emotional center in the brain) are coupled to reduced activity in prefrontal control areas (Bishop et al., 2004a; 2004b; Kim et al., 2004; Somerville et al., 2004). As a result, people generally show increased attention for threat and are more likely to interpret situations in a threat-related manner (Easterbrook, 1959; Bishop, 2007; Eysenck et al., 2007). In addition, behavioral responses to threat (e.g., avoidance) are facilitated, which makes it harder to efficiently execute goal-directed action (Yerkes & Dodson, 1908; Frijda, 1988).

Bringing different lines of research together, Chapter 2 proposed an integrated model to describe the relations between anxiety and perceptual-motor performance, suggesting that the impact of anxiety on performance is not uniform, but – depending
on the type of task that is executed – may occur on three different levels: attentional, interpretational, and behavioral. Tasks that require a great deal of online (visual) control will be strongly affected at the attentional level, tasks that involve judgment and decision making will be strongly affected at the interpretational level, and tasks that are mainly executive - or that allow much freedom of movement - will be strongly affected at the behavioral level (Nieuwenhuys, & Oudejans, in press).

In correspondence with these predictions, and to systematically address the effects of anxiety on police officers’ shooting performance, the current thesis was divided into three different sections. In Section A (threat-related attention) two experiments were reported that tested the impact of anxiety (Chapter 3) and training with anxiety (Chapter 4) on police officers’ shot accuracy. In Section B (threat-related interpretation), three experiments were reported that tested the impact of anxiety (Chapters 5 and 6) and training with anxiety (Chapter 7) on police officers’ shooting decisions. Finally, in Section C (threat-related responses), two experiments were reported that tested the impact of threat-related responses (e.g., avoidance) on police officers’ shooting performance (Chapter 8) and execution of arrest and self-defense skills (Chapter 9).

Summary

A. Threat-related attention

In Chapter 3 (Nieuwenhuys & Oudejans, 2010), the impact of anxiety on police officers’ shot accuracy was investigated. To this end, participants performed a shooting exercise against an opponent that did (high-threat) or did not (low-threat) shoot back with colored-soap cartridges. Results showed that participants experienced more anxiety and shot considerably less accurate when performing under high threat. When they were anxious, participants made themselves smaller and speeded up their performance to avoid getting hit. In addition, participants more often looked away from the opponent and started to blink more frequently. All in all, findings indicated that as a result of anxiety, less time was taken for accurate aiming, thereby causing shot accuracy to be strongly affected.

Next, in Chapter 4 (Nieuwenhuys & Oudejans, 2011), it was tested if training with anxiety can help to reduce negative effects of anxiety on police officers’ shot accuracy. Using a pretest, posttest, and retention-test design, participants again performed a shooting exercise against an opponent that did (high-threat) or did not (low-threat)
shoot back with colored-soap cartridges. Between the pre- and posttest, one group of participants (experimental group) practiced their shot accuracy under high threat, while another group (control group) practiced under low threat. At the pretest, both groups experienced more anxiety and shot less accurate under high threat. At the posttest, however, shot accuracy of the experimental group no longer deteriorated as result of threat, while shot accuracy of the control group remained equally affected. At the retention-test, four months after practice, positive results for the experimental group were maintained. Analyses of gaze behavior indicated that improved shot accuracy was related to increased visual attention to task-relevant information.

B. Threat-related interpretation

In Chapter 5 (Nieuwenhuys, Savelsbergh et al., 2012) the impact of anxiety on police officers’ shooting decisions was investigated. To this end, participants executed a video-based test that required them to shoot or don’t shoot at a suspect who rapidly appeared with (shoot) or without (don’t shoot) a firearm. Threat was manipulated by switching on (high-threat) or switching off (low-threat) a 'shootback canon' that could be used to fire small plastic bullets at the participants. Results showed that when participants were anxious to get hit, they showed a larger bias towards shooting. That is, shooting responses became faster and the percentage of trials on which participants accidentally shot at an unarmed suspect, almost doubled (i.e., from 10% to almost 20%). Underlying this effect, analyses of gaze behavior indicated that anxiety did not affect shooting decisions because of changes in visual attention. Instead, anxiety caused participants to respond ‘at first sight’ and to shoot on the basis of threat-related inferences and expectations (i.e., expecting the suspect to appear with a gun).

In Chapter 6 (Nieuwenhuys, Canal-Bruland et al., 2012) the contribution of visual perception to police officers’ shooting decisions was investigated. To this end, participants were asked to indicate when (i.e., at what distance) they would shoot at an assailant who approached them with a knife. To manipulate threat (and increase anxiety), the suspect carried either a plastic knife (low-threat) or an electrical knife (high-threat). In addition, response mode was manipulated by dividing participants into a group that actually shot the assailant and a group that indicated their shot verbally. After giving their response, participants were asked to provide a perceptual estimate of the distance at which they had shot the assailant. Results showed that when participants actually shot at the assailant, threat-induced increases in anxiety caused them to shoot earlier (i.e., at
a greater distance). At the same time, however, perceptual accuracy remained constant, indicating that rather than affecting basic perceptual processes, anxiety may have biased participants towards a more threat-related interpretation of the situation.

Building on the results of Chapters 5 and 6, Chapter 7 investigated to what extent anxiety-induced errors in police officers’ shooting decisions may be prevented through practice. Using a pretest-posttest design, participants again performed a video-based test that required them to take shooting decisions in relation to a suspect that rapidly appeared with (shoot) or without (don’t shoot) a firearm. As in Chapter 5, threat was manipulated by switching on (high-threat) or switching off (low-threat) a shootback canon that could be used to fire at the participants. In between pretest and posttest, participants were divided over four different training groups to practice their shooting decisions. To assess the influence of training circumstances, training groups were differentiated based on the visual (i.e., real-life vs. video-simulation) and psychological (i.e., high-threat vs. low-threat) context of the practice sessions. On the pretest, threat-induced increases in anxiety generally caused participants to become biased towards shooting. Again, shooting responses became faster and the percentage of trials on which participants accidentally shot at an unarmed suspect strongly increased. However, regardless of the type of training that participants received, these results remained unchanged on the posttest. Based on this finding, it is concluded that anxiety-induced errors in police officers’ shooting decisions are persistent and may be hard to prevent through practice.

C. Threat-related responses

Under anxiety, people generally show an increased tendency to avoid. In Chapter 8 it was tested how police officers’ timing of avoidance responses (i.e., immediate vs. postponed) influenced their shooting performance. Participants performed a shooting exercise against an armed opponent that shot back with colored-soap cartridges (high-threat), while avoidance was manipulated by using a step-fire (immediate avoidance) or fire-step (postponed avoidance) shooting strategy. In Experiment 1, the effect of avoidance on police officers’ shot accuracy was tested by asking participants to execute the step-fire and fire-step shooting strategy. In Experiment 2, the effect of avoidance on police officers’ safety (i.e., chances to get hit) was tested by asking participants to respond to both shooting strategies. As predicted, results showed that high threat facilitated avoidance. That is, using the step-fire shooting strategy (i.e. allowing immediate
avoidance), participants experienced less anxiety, took more time to aim, and shot more accurate than with the fire-step shooting strategy (Experiment 1). At the same time, however, immediate avoidance did not appear to be safer. That is, in response to the step-fire shooting strategy, participants had more time to return fire, thereby lowering their anxiety and increasing their shot accuracy (Experiment 2). Based on these findings it is concluded that automatic response tendencies, such as avoidance, can strongly influence police officers’ safety and shot accuracy in real-life situations.

Finally, Chapter 9 (Nieuwenhuys et al., 2009) investigated the impact of anxiety on police officers’ execution of arrest and self-defense skills. To this end, a new 5-point rating scale was developed (Experiment 1) and used to rate participants performance on a selection of arrest and self-defense skills (Experiment 2). To manipulate threat (and increase anxiety), participants performed against a seemingly aggressive (high-threat) or cooperative (low-threat) opponent. Findings showed that with increased threat, participants’ experienced more anxiety and had more difficulty in executing arrest and self-defense skills. Overall, performance decreased from ‘sufficient’ to somewhere between ‘insufficient’ and ‘average’, indicating that in apprehension of the opponent, participants had problems in keeping their balance and were often not able to generate an adequate amount of force.

Conclusions

Overall, the experiments that were reported in this thesis show that anxiety can strongly influence police officers’ performance in stressful situations. That is, when they were anxious, officers showed increased attention for threat, were more likely to interpret situations as threatening, and had more difficulty in performing goal-directed action. As a result, police officers generally made more decision errors, shot faster, and were considerably less accurate.

With respect to the mechanisms underlying these effects, the current thesis provides initial evidence that how anxiety affects task performance is not uniform, but is dependent on the specific type of task – or elements within a task – that are executed (Nieuwenhuys & Oudejans, in press). Concerning police officers’ shot accuracy, the experiments reported in Chapters 3 and 4 (Section A) suggest that far-aiming is most likely affected by attentional effects of anxiety (e.g., Behan & Wilson, 2008; Causer et al., 2011; Vickers & Williams, 2007; Wilson, Vine, et al., 2009). That is, in Chapter 3,
anxiety-induced reductions in the time that was available to look at the targets caused participants to shoot less accurate (Nieuwenhuys & Oudejans, 2010), while in Chapter 4, improved shot accuracy under anxiety was associated with longer final fixations on the targets (Nieuwenhuys & Oudejans, 2011). With respect to police officers’ shooting decisions, on the other hand, the experiments reported in Chapters 5, 6 and 7 (Section B) indicate that judgement and decision making are likely affected by interpretational effects of anxiety (e.g., Correll et al., 2002; Payne, 2001). That is, in Chapters 5 and 6, it appeared that anxiety-induced changes in the decision to shoot were related to increased perceptions of threat (e.g., expecting a suspect to show up with a gun or perceiving a suspect to be more dangerous) rather than changes in visual attention (Nieuwenhuys, Canal-Bruland et al., 2012; Nieuwenhuys, Savelbergh et al., 2012). In addition, Chapter 7 showed that, unlike shot accuracy, anxiety-induced changes in decision making were relatively persistent and hard to prevent through practice, thus providing further evidence that both tasks may rely on different operational mechanisms (i.e., attentional vs. interpretational). Finally, the experiments reported in Chapters 8 and 9 (Section C) indicate that, under anxiety, automatic behavioral responses to threat (e.g., Eerdman et al., 2012; Roelofs et al., 2010; Stins et al., 2011) may strongly affect movement execution. That is, in Chapter 8, changes in the timing of avoidance movements strongly affected participants’ shooting performance, while in Chapter 9, anxiety-induced changes in body posture (e.g., leaning backwards in apprehension of an opponent’s action) caused a considerable decrease in the effectiveness of arrest and self-defense skills (Nieuwenhuys et al., 2009; see Renden, Landman, Geerts, Jansen, Savelbergh et al., 2012, for a more detailed investigation of this topic).

In sum, it is clear that police officers’ performance is strongly affected by anxiety. However, how anxiety eventually affects performance appeared dependent on the type of task – or elements within a task – that is executed (Nieuwenhuys & Oudejans, in press). That is, shot accuracy was sensitive to attentional effects of anxiety, shooting decisions were sensitive to interpretational effects, and movement execution was sensitive to behavioral response tendencies. In line with other recent studies, which investigated the effects of different types of stressors (DeCaro et al., 2011) and dispositional factors (Geukes, Mesagno, Hanrahan, & Kellman, 2012; Mesagno, Harvey, & Janelle, 2012), the current thesis thus highlights the importance of situational context in anxiety-performance interactions. Although preliminary, the current findings suggest that specific knowledge about situations with which officers are confronted in real-life, and
the type of action that is required from police officers (e.g., decision making, shooting),
may predict the effects of anxiety on their performances. Knowing these effects may
help officers to be safer and increase their effectiveness under stressful circumstances.

**Directions for future research**

By suggesting that effects of anxiety on perceptual-motor performance are not uniform,
but strongly dependent on context (e.g., type of task, type of stressor, dispositional
and social factors), the current thesis opens up several possibilities for future research.
First, based on the finding that effects of anxiety on perceptual-motor performance may
depend on task requirements (e.g., attentional and interpretational demand), future
studies may (1) further investigate how systematic increases in situational complexity
may cause attentional effects of anxiety (i.e., increased attention to threat) to be
increasingly responsible for reduced accuracy, or (2) explore how systematic increases
in situational ambiguity may cause interpretational effects of anxiety (i.e., increased
perceptions of threat) to trigger more errors in judgement and decision making. In
addition, future studies may explore the extent to which different types of stressors
(e.g., reward vs. punishment or acute vs. prolonged) can lead to different effects in terms
of movement outcome (e.g., DeCaro et al., 2011) or how specific dispositional factors
(e.g., experience, personality) may cause individuals to be especially prone to experience
performance decrements in a given context (e.g., Geukes et al., 2012; Mesagno et al.,
2012). Finally, most studies have looked at individual task performance, whereas in real-
life people often cooperate or interact with other people (Chapter 8). As such, future
studies may also investigate anxiety-performance interactions within a social context.

Clearly, by learning more about how contextual factors influence the anxiety-
performance relationship, researchers can begin to develop interventions that are better
accustomed to the specific problems with which anxious individuals are confronted.
Compared to more general interventions (e.g., training with anxiety), it is predicted that
these context-specific interventions may prove more functional in terms of helping
individuals to perform better under stressful circumstances (Nieuwenhuys & Oudejans,
in press).