When practice fails: persistence of errors in police officers’ shooting decisions under anxiety

Abstract

The current study tested whether anxiety-induced errors in police officers’ shooting decisions (i.e., shoot or don’t shoot) may be prevented through reality-based practice. Using a pretest-intervention-posttest design, 57 Police officers participated and executed a low-anxiety and high-anxiety, video-based test in which they provided actual shooting responses (i.e. shoot or don’t shoot) against a suspect, who rapidly appeared with or without a firearm. In between pretest and posttest, officers were divided in four different training groups. To assess the influence of training circumstances, groups were differentiated based on the visual (i.e., real-life vs. video simulation) and psychological context (i.e., high-anxiety vs. low-anxiety) of training sessions. Results showed that, regardless of training circumstances, all groups showed a strong increase in shooting errors from low- to high-anxiety on the pretest and still showed this increase on the posttest. Underlying this effect, it appeared that shooting errors were consistently accompanied with very fast response times, indicating that anxiety may bias officers towards responding on the basis of threat-related expectation rather than actual information. Based on the findings, it is concluded that anxiety-induced errors in police officers’ shooting decisions are persistent and hard to prevent through practice.

Keywords: anxiety, threat, interpretational bias, decision making, training with anxiety, police.
When practice fails: persistence of errors in police officers' shooting decisions under anxiety

Gaining control over automated, fear-related, responses is not easy (e.g., Bargh, 1999). Yet, in several professions, being able to manage your anxieties is essential for performance. For instance, police officers are often confronted with the aggressive behavior of civilians. In such situations, it is important that officers make the right decisions and do not let feelings of fear and anxiety influence their operational performance (cf. Anderson et al., 2002).

Under anxiety, people generally tend to 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, anxiety is believed to facilitate behavioral responses to threat (e.g., avoidance) and make it harder to efficiently execute goal-directed action (Yerkes & Dodson, 1908; Frijda, 1988; Zajonc, 1980; see also Nieuwenhuys & Oudejans, in press). Although police officers are required to perform well under stressful circumstances, several studies have shown that anxiety does not leave them – or their performances – unaffected (e.g., Hulse & Memon, 2006; Nieuwenhuys et al., 2009; Nieuwenhuys & Oudejans, 2010; Nieuwenhuys, Savelsbergh et al., 2012; Shipley & Baranski, 2002; Vickers & Lewinski, 2012).

In the current study we follow-up on a previous experiment in which we showed how anxiety negatively influences police officers’ shooting decisions (Nieuwenhuys, Savelsbergh et al., 2012). Based on this finding, the aim of the current study was to explore the persistence of anxiety-induced errors in police officers’ shooting decisions over time and to test whether the making of such errors may be prevented through reality-based practice.

In our previous experiment (Nieuwenhuys, Savelsbergh et al., 2012), we asked police officers to take shooting decisions (i.e., shoot or don’t shoot) in relation to video-images of a suspect that rapidly appeared with or without a gun. If the suspect appeared with a gun, officers were supposed to shoot at the suspect. If the suspect appeared without a gun, officers were supposed not to shoot at the suspect. Anxiety was manipulated by switching on (high-anxiety) or switching off (low-anxiety) a ‘shootback-canon’ that could fire small plastic bullets at the officers’ legs. When they were anxious to get hit, the officers showed a larger bias towards shooting. That is, shooting responses became faster and the percentage of unarmed suspects that was
B. Threat-related interpretation

accidentally shot at, almost doubled (i.e., from 10% to almost 20%). Underlying this effect, officers’ gaze behavior remained unaffected by anxiety and did not differentiate between correct and incorrect shooting responses (i.e., shooting at armed vs. unarmed suspects). Officers scanned the environment at an equal pace, fixated the same locations and were equally fast to detect the suspect, regardless of their anxiety or the eventual quality of their decision. Nevertheless, incorrect shooting responses occurred almost 20% (100 ms) faster than correct shooting responses. This indicates that in these cases, the officers did not wait for visual information about the suspect’s gun but made their decision on the basis of threat-related inferences and expectations (i.e., expecting that the suspect would appear with a gun; cf. Correll, Wittenbrink, Park, Judd, & Goyle, 2011; Fleming, Bandy, & Kimble, 2010; see Nieuwenhuys & Oudejans, in press and Payne, 2006, for a more theoretical discussion on this type of effects).

Because the ability to make good decisions under stressful circumstances is critical for police officers, the current study aimed to explore whether anxiety-induced errors in shooting decisions may be prevented through reality-based practice. To our knowledge there are no studies directly addressing this topic. However, related work on stereotype threat and weapon identification (Correll, Park, Judd, Wittenbrink, Sadler, & Keesee, 2007; Plant & Peruche, 2005; Plant, Peruche, & Butz, 2005), as well as some of our own experiments on the effects of anxiety on police officers’ shot accuracy (Oudejans, 2008; Nieuwenhuys & Oudejans, 2011), indicate that this might be possible.

When people sit in front of a computer screen and are asked to rapidly judge images of a person holding a gun or another (non-threatening) object, they are more likely to falsely report guns in relation to Black rather than White individuals (e.g., Correll et al., 2002; Payne, 2001). According to Payne (2006) the key mechanism here is that intuitively, Black individuals are more strongly associated with violence. This triggers an increased expectancy of threat and causes people to more often respond on the basis of automatic impulses (see also Correll et al., 2011). The effect of race on weapon identification is widespread and very hard to willfully suppress (e.g. Payne, Lambert, & Jacoby, 2002). However, there are indications that with practice, the observed bias can be eliminated within a relatively short period of time (i.e., by performing an additional 80 trials on the same task; e.g., Correll et al., 2007; Plant & Peruche, 2005; Plant et al., 2005).

Although there are clear parallels with respect to the underlying mechanisms (i.e., enhanced expectancy of threat), identifying weapons on a screen is not the same
as actually shooting at another person. Similarly, stereotype threat is different from the actual possibility of getting hit (cf. Nieuwenhuys, Savelkoull et al., 2012). Such differences in the reality of a task and the specificity and nature of responses can have large consequences for the detection of visual information, decision making, and the eventual action that is undertaken by participants (e.g., Dicks et al., 2010; Mann et al., 2010; Nieuwenhuys, Cañal-Bruland, & Oudejans, 2012; see Pinder, Davids, Renshaw, & Araújo, 2011, for a more theoretical discussion of this topic). As such, it remains to be shown whether positive effects of practice, as reported by Corell et al. (2007) and Plant and Peruche (2005), will hold under more representative circumstances; where police officers’ can actually get hit and indicate their shooting decisions based on actual shooting responses.

With respect to anxiety and police officers’ shooting behavior, it is known that anxiety causes police officers to shoot less accurately (Nieuwenhuys & Oudejans, 2010; Shipley & Baranski, 2002). Recently, however, we showed that by training with anxiety, police officers can improve their shooting performance under stressful circumstances (Nieuwenhuys & Oudejans, 2011; see also Oudejans, 2008). For example, in the experiment of Nieuwenhuys and Oudejans (2011), two groups of police officers practiced their shot accuracy against opponents that shot back (high-anxiety; experimental group) or against opponents that did not shoot back (low-anxiety; control group). While anxiety initially caused a decrease in shot accuracy for both groups, after training, the experimental group was able to maintain performance under high-anxiety. The performance of the control group, on the other hand, was still negatively affected by anxiety (see also Oudejans, 2008). Based on this result, we concluded that the anxiety that is present in real-life situations needs to be represented in training sessions, if practice is to be effective (Oudejans & Nieuwenhuys, 2009; see also Pinder et al., 2011). Analyses of gaze behavior indicated that improved performance under anxiety is likely related to improved goal-directed attention (i.e., maintaining long fixations on the target while reducing distraction from other sources of information). In addition, findings on a retention test showed that positive effects are robust, and remain present for at least four months after training (Nieuwenhuys & Oudejans, 2011).

Surely, being able to accurately shoot at a target is not the same as deciding to shoot or not shoot at another person. That is, while shooting clearly is a motor task, taking the decision to shoot is typically more cognitive. In line with this difference, shot accuracy appears to be affected by visual-attentional effects of anxiety (e.g., ‘where
do I look?; Nieuwenhuys & Oudejans, 2010; 2011), while shooting decisions are mainly affected by interpretational effects of anxiety (e.g., ‘what do I see?; Nieuwenhuys, Savelsbergh et al., 2012). As such, whether training with anxiety is equally effective for shooting decisions as for shot accuracy remains to be investigated. For example, it may be relatively easy to learn how to keep one’s eyes on a target under anxiety, while it is more difficult to objectify one’s interpretation of a stressful situation (see also Payne et al., 2002).

In the current study we aimed to shed more light on this issue. To this end, we adopted our previous shoot-don’t shoot paradigm (Nieuwenhuys, Savelsbergh et al., 2012) and again asked police officers to take shooting decisions in relation to a suspect that rapidly appeared with or without a firearm. As in our previous experiment, anxiety was manipulated by switching on (high-anxiety) or switching off (low-anxiety) a ‘shootback-canon’ that could be used to fire small plastic bullets at the officers’ legs. After a pretest, in which we expected to replicate our previous findings, the officers were divided into four different training groups. To be able to assess the specific influence of training circumstances (see Pinder et al., 2011), these groups were differentiated based on the visual (i.e., real-life vs. video simulation) and psychological context (i.e., high-anxiety vs. low-anxiety) of the training sessions. Consequently, one group practiced against real-life opponents that shot back with colored-soap cartridges (real-life, high-anxiety), one group practiced in a video-simulation environment with shootback-canon (video-simulation, high-anxiety), one group practiced in a video-simulation environment without shootback-canon (video-simulation, low-anxiety), and one group did not perform training sessions at all (control). As in our previous experiments on anxiety and police officers’ shot accuracy (Oudejans, 2008; Nieuwenhuys & Oudejans, 2011), practice consisted of three training sessions that were executed over a period of one month. At the end of the training period, the effects of training were evaluated based on participants’ performance on a posttest.

For the groups that trained with high-anxiety, we predicted that anxiety would no longer affect the quality of their shooting decisions on the posttest (Oudejans, 2008; Nieuwenhuys & Oudejans, 2011; see also Correll et al., 2007; Plant & Peruche, 2005; Plant et al., 2005). In general, we expected that this would be the case for the group that trained against real-life opponents as well as for the group that trained in the video-simulation environment. However, if visual context (i.e., real-life vs. video-
simulation) has a strong influence, positive effects of training with anxiety may also be restricted to the video-simulation environment, because this context matches most closely with the context that was used during the test sessions (Pinder et al., 2011). For the control group and the group that trained under conditions of low-anxiety, we predicted that anxiety would still negatively affect their shooting decisions on the posttest (Nieuwenhuys & Oudejans, 2011; Oudejans, 2008). If training with anxiety would indeed lead to a reduction of incorrect shooting decisions under anxiety, then this would indicate that interpretational and visual-attentional effects of anxiety are equally well trainable. On the other hand, if training with anxiety would not lead to a reduction of incorrect shooting decisions under anxiety, then this would indicate that interpretational effects of anxiety are more persistent and more difficult to prevent through training than attentional effects (cf. Nieuwenhuys & Oudejans, in press).

Methods

The experiment was approved by the Ethics Committee of the research institute. Given the involvement of firearms, the experiment was executed under responsibility of certified police firearms instructors.

Participants

57 police officers (52 men, 5 women) volunteered to participate in the experiment. All participants had a full license to carry a firearm on duty. After performing a pretest (see ‘Experimental Setup, Task, and Conditions’) participants were divided over four training groups: a real-life practice with anxiety (RLP-A) group, a video-simulation practice with anxiety (VSP-A) group, a video-simulation without anxiety (VSP) group, and a control group (see ‘Experimental setup, task and conditions’ for a detailed explanation of the different training circumstances for each group). The RLP-A group consisted of 13 participants (12 men, 1 woman), with a mean age of 36.54 years (SD = 11.38) and a mean working experience of 13.19 years (SD = 12.24). The VSP-A group consisted of

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1 With respect to participants in the VSP-A and VSP groups, pretest results (pooled over both groups) have been published elsewhere (Nieuwenhuys, A., Savelbergh, G. J. P., & Oudejans, R. R. D. [in press]. Shoot or don’t shoot? Why police officers are more inclined to shoot when they’re anxious. Emotion. DOI: 10.1037/a0025699). In that publication we specifically addressed participants’ gaze behavior, which – due to technical problems – was not available at the posttest and for the RLP-A and control groups.
B. Threat-related interpretation

16 participants (14 men, 2 women), with a mean age of 38.07 years (SD = 8.66) and a mean working experience of 15.73 years (SD = 9.76). The VSP group consisted of 18 participants (17 men, 1 woman), with a mean age of 37.41 years (SD = 10.72) and a mean working experience of 14.29 years (SD = 9.33). The control group consisted of 10 participants (9 men, 1 woman), with a mean age of 37.20 years (SD = 8.90) and a mean working experience of 12.90 years (SD = 9.09). Among groups, there were no differences regarding the age and working experience of participants, $F(3,46) = 1.30$, $p = .285$.

Overall, participants’ trait anxiety scores were significantly lower than the norm (i.e., 36.1; with $M = 30.86$, $SD = 6.51$, $t(50) = 5.70$, $p < .001$; STAI A-Trait Scale; Van der Ploeg et al., 1980), indicating that they had no extraordinary tendency to respond to specific situations with large elevations in state anxiety. Again, no significant differences were observed among groups ($F < 1$, $p > .05$). Before the experiment started, all participants provided written informed consent.

**Experimental setup, task and conditions**

The experiment consisted of a pretest, three training sessions, and a posttest.

**Test sessions.** During the pretest and posttest, participants performed a test exercise that was identical to that of Nieuwenhuys, Savelsbergh et al. (in press). Participants took position in an Applied Interactive Systems ('AIS') PRISim® shooting simulator (AIS-solutions Ltd., Wrecclesham, United Kingdom) and responded to life-size video images of a dangerous suspect. In the current setup, video images were projected on a $6 \text{ m} \times 2.5 \text{ m}$ projection screen. Participants stood at a fixed position 5 m away from the screen (see Figure 7.1) and could shoot at the suspect with a blank firing Walther P5 handgun (similar to their duty weapon) that was fitted with a trigger sensor and a laser diode that emitted a single laser pulse (5 ms) upon firing. In case of a shot, the laser pulse was detected by an infrared sensor (60 Hz sampling rate) that was used to record the timing ($\pm 12 \text{ ms}$) and accuracy ($\pm 2 \text{ cm}$) with which the gun was fired.
As in Nieuwenhuys, Savelsbergh et al. (in press), the pretest and posttest consisted of a low-anxiety (LA) and a high-anxiety (HA) condition, which were counterbalanced among participants. In both conditions, participants performed 4 × 12 trials (i.e., 48 in total) of the same experimental task. Each trial started with showing an image of two empty windows (see Figure 7.1). Then, after a randomized period of 1.5, 2, or 2.5 seconds, a suspect would rapidly appear in one of the windows. If the suspect appeared with a gun (i.e., GUN trial, Figure 1, top right) participants were supposed to shoot him as fast and accurately as possible. When participants responded too late (i.e., used more than ~500 ms for their response) or responded inaccurately (i.e., failed to hit the suspect), the suspect would shoot back (see below). If the suspect appeared without a gun (i.e., NO-GUN trial, Figure 1, bottom right) participants were supposed not to shoot at the suspect. In this case, they placed a shot in a black taped square (40 cm × 40 cm) that was positioned well below the two windows in the middle of the screen (see Figure 7.1). Participants were allowed only one shot per trial. Between trials, the screen went black for 3 seconds.

In the LA condition, participants only saw and heard the opponent’s shots, thereby creating a relatively harmless experience. In the HA condition, however, a so-called ‘shootback-canon’ (AIS-solutions Ltd., Wrecclesham, United Kingdom) was activated. The shootback-canon is a manually aimed air-pressure system that was positioned at the bottom-right corner of the projection screen, and which could be used to shoot small plastic bullets (15 mm diameter) at the participants’ legs, at the exact moment of the suspect’s shots. Being hit with such a bullet caused a sensation of pain, the threat of which has been found to cause an increase in participants’ state anxiety (see also Figure 7.1: Overview of the experimental setup (left side) and video image of the suspect on GUN trials (top right) and NO-GUN trials (bottom right). On each trial (GUN and NO-GUN) the suspect could appear in the left as well as in the right window.)
Nieuwenhuys, Savelsbergh et al., 2012). Given the speed of the scenarios, participants failed to be faster than the suspect on ~50% of the GUN trials, thereby providing enough opportunity to shoot back with the shootback canon. To maintain threat and minimize physical inconvenience, each participant was hit on a limited number of HA GUN trials (i.e., 5-7 times in total, randomly divided over trials; cf. Nieuwenhuys, Savelsbergh et al. in press). On other trials the shootback-canon was aimed slightly off target, thereby preventing the participants from being hit.

Training sessions. In between the pretest and posttest all groups (with exception of the control group) performed three training sessions (see also Nieuwenhuys & Oudejans, 2011). During each training session, participants individually performed seven extended scenarios in which they practiced to take shooting decisions. The training scenarios were situated in a wide range of different contexts (e.g., a café, a house or a car park) and – due to an extended period of verbal interaction with the suspect – generally lasted longer than the test trials (i.e., ~ 60 seconds vs. ~ 5 seconds). Nevertheless, shooting decisions (i.e., shoot or do not shoot) were again taken within less than a second, as at the end of each scenario, the suspect would suddenly reach for his gun (shoot) or raise his hands (not shoot; see Figure 7.2 for an example).

In general, the training scenarios were similar for all groups. However, to assess the influence of visual (i.e., real-life vs. video-simulation) and psychological context (low-anxiety vs. high-anxiety), the specific circumstances under which the training occurred were explicitly manipulated. The RLP-A group practiced against real-life opponents that shot back with colored soap-cartridges (real-life, high anxiety; see also Nieuwenhuys & Oudejans, 2011), the VSP-A group practiced in the AIS video-simulator with the shootback canon explicitly switched on (video-simulation, high anxiety), the VSP group also practiced in the AIS video-simulator but with the shootback canon explicitly switched off (video-simulation, low anxiety), and the control group did not practice at all.
Dependent variables

Test sessions

Manipulation check. To analyze the effect of our anxiety manipulation during the pretest and posttest, we assessed participants’ subjective ratings of anxiety and mental effort (in each condition) by using two distinctive visual-analogue scales (i.e., the ‘anxiety thermometer’, Houtman & Bakker, 1989; and Rating Scale for Mental Effort [RSME], Zijlstra, 1993). Furthermore, we continuously assessed participants’ heart rate by using a Polar wristwatch.

Shooting decisions. Shooting decisions were analyzed on the basis of the AIS data, by comparing the percentage of correct responses on GUN trials (i.e., shooting the suspect when he appeared with a gun) and the percentage of incorrect responses on NO-GUN trials (i.e., accidentally shooting an unarmed suspect).

Response times. Response times (ms) were analyzed using the AIS and expressed in relation to participants’ shooting decisions on GUN and NO-GUN trials, respectively. Response times were measured from the first moment that the hands of the suspect...
became visible in the video scenarios (i.e., GUN / NO-GUN stimulus onset) until the firing of the gun by the participant.

**Shot accuracy.** Shot accuracy was analyzed on the basis of the AIS data and operationalized as the percentage of target (suspect) hits on GUN trials.

**Training sessions**

**Manipulation check.** To analyze the extent to which training circumstances were different for each training group (RLP-A, VSP-A, and VSP), we performed a manipulation check of anxiety at each training session. To this end, we assessed participants’ subjective ratings of anxiety and mental effort by means of the ‘anxiety thermometer’ (Houtman & Bakker, 1989) and RSME (Zijlstra, 1993), and continuously assessed participants’ heart rate by using a Polar wristwatch.

**Statistical Analysis**

To verify whether our manipulation of anxiety at the pretest and posttest had been successful, anxiety scores, mental effort scores, and heart rate values were collectively analyzed by using a $4 \times 2 \times 2$ (training group $\times$ condition $\times$ test) mixed-design MANOVA, with repeated measures on test (pretest and posttest) and condition (LA and HA) and with training group (RLP-A, VSP-A, VSP and control) as a between-subject factor. Decision making and response times were analyzed using univariate $4 \times 2 \times 2 \times 2$ (training group $\times$ test $\times$ condition $\times$ decision quality) mixed design ANOVAs, with repeated measures on test (pretest and posttest), condition (LA and HA) and decision quality (correct and incorrect), and with training group (RLP-A, VSP-A, VSP and control) as a between-subject factor. Shot accuracy was analyzed by using a univariate $4 \times 2 \times 2$ (training group $\times$ test $\times$ condition) mixed-design ANOVA, with repeated measures on test (pretest and posttest) and condition (LA and HA) and with training group (RLP-A, VSP-A, VSP and control) as a between-subject factor.

To verify our manipulation of anxiety during the training sessions, anxiety scores, mental effort scores, and heart rate values (averaged over the different training sessions) were collectively analyzed by using a three-way MANOVA, with training group (RLP-A, VSP-A and VSP) as a between-subject factor.

For the MANOVAs, a significant multivariate effect was followed-up by conducting
univariate ANOVAS on each of the respective variables (anxiety, mental effort and heart rate). For the ANOVAs, significant main effects or interactions were followed-up by conducting post-hoc pairwise comparisons with Bonferroni correction. For each analysis, effect sizes ($\eta^2$) were calculated. The alpha level for significance was set at $p < .05$.

**Results**

**Manipulation Checks**
Table 7.1 shows an overview of the anxiety scores, mental effort scores, and mean heart rate values at the pretest, training sessions, and posttest.

**Test sessions.** The MANOVA that was executed for the anxiety scores, mental effort scores and mean heart rate values at the pretest and posttest showed a significant multivariate effect of test (pretest vs. posttest), $\lambda = .755$, $F(3,50) = 5.43$, $p = .003$, $\eta^2 = .245$, and condition (LA vs. HA), $\lambda = .280$, $F(3,50) = 42.97$, $p < .001$, $\eta^2 = .720$, and no significant effect of training group or any of the interactions (all $p$s > .11).

For the effect of test (pretest vs. posttest), follow-up univariate ANOVAs showed that anxiety scores did not change significantly from pretest to posttest, $F(1, 52) = 2.11$, $p = .15$, $\eta^2 = .039$, mental effort scores were somewhat higher on the posttest than on the pretest, $F(1, 52) = 5.25$, $p = .023$, $\eta^2 = .096$, and mean heart rate values were somewhat lower on the posttest than on the pretest, $F(1, 52) = 5.25$, $p = .004$, $\eta^2 = .145$ (see Table 7.1).

For the effect of condition (LA vs. HA), follow-up univariate ANOVAs showed that anxiety scores, mental effort scores and mean heart rate values were all significantly higher in the HA than in the LA condition, with $F(1,52) = 114.67$, $p < .001$, $\eta^2 = .688$, $F(1,52) = 41.48$, $p < .001$, $\eta^2 = .444$ and $F(1,52) = 17.96$, $p < .001$, $\eta^2 = .257$, respectively (see Table 7.1).

All in all, these results indicate that for each training group, our manipulation of anxiety was equally successful on both tests.

**Training sessions.** The MANOVA that was executed for the anxiety scores, mental effort scores and mean heart rate values during the training sessions showed a strong multivariate effect of training group (RLP-A, VSP-A and VSP), $\lambda = .477$, $F(6,84) = 6.27$, $p <
Follow-up, univariate ANOVAs showed a non-significant effect for anxiety score, $F(2,44) = 1.97$, $p = .15$, $\eta^2 = .082$, and significant effects for mental effort score and mean heart rate value, with $F(2,44) = 3.91$, $p = .027$, $\eta^2 = .151$ and $F(2,44) = 18.32$, $p < .001$, $\eta^2 = .454$, respectively. Post-hoc analyses showed that mental effort scores and mean heart rate values of the RLP-A group were significantly higher than those of the VSP-A and VSP groups, with $p = .046$ and $p = .009$ for mental effort and $p < .001$ for mean heart rate (see Table 7.1). There were no significant differences between the VSP-A and VSP group (all $p > .50$).

Overall, the significant multivariate effect indicates that the RLP-A group trained with more anxiety than the other groups. However, it should be noted that for all groups, anxiety levels at the training sessions were at, or above, what was measured during the HA test sessions (see Table 7.1). This was the case for anxiety scores, mean heart rate values, and mental effort scores. As such, although anxiety levels of the RLP-A group were higher than those of the other groups, all groups practiced with high-anxiety.

Table 7.1 shows an overview of the anxiety scores, mental effort scores, and mean heart rate values at the pretest, training sessions, and posttest.
Shooting decisions
Because participants always responded correctly on GUN trials (see Table 7.2) the analysis of shooting decisions was confined to the percentage of incorrect responses on NO-GUN trials (i.e., accidentally shooting at unarmed suspects). The ANOVA that was executed showed a significant main effect of test (pretest vs. posttest), $F(1,53) = 4.24$, $p = .044$, $\eta^2 = .074$, and condition (LA vs. HA), $F(1,53) = 53.93$, $p < .001$, $\eta^2 = .504$, and no significant effect of training group or any of the interactions (all $p$s $> .31$). The main effect of test showed that the percentage of incorrect responses in NO-GUN scenarios was significantly lower on the posttest than on the pretest (i.e., $M = 12.20\%$, $SD = 1.26$ vs. $M = 14.07\%$, $SD = 1.52$; see Table 7.2). The main effect of condition showed that the percentage of incorrect responses on NO-GUN trials was significantly higher in the HA than in the LA condition (i.e., $M = 16.51\%$, $SD = 1.68$ vs. $M = 9.74\%$, $SD = 1.04$; see Table 7.2).

Response times
The ANOVA that was executed for the response times showed a significant effect of decision quality (correct vs. incorrect), $F(1,47) = 290.44$, $p < .001$, $\eta^2 = .861$, test (pretest vs. posttest), $F(1,47) = 22.21$, $p < .001$, $\eta^2 = .299$, and condition (LA vs. HA), $F(1,47) = 35.89$, $p < .001$, $\eta^2 = .408$, which were overruled by a significant interaction between decision quality and test, $F(1,47) = 9.38$, $p = .004$, $\eta^2 = .166$, and a marginally significant interaction between decision quality and condition, $F(1,47) = 3.87$, $p = .055$, $\chi^2 = .076$. The main effect of training group and all other interactions were non-significant ($p$s $> .27$).

Overall, the interaction effects showed that incorrect shooting responses were made much faster (i.e., 80 ms, 17%) than correct shooting responses ($p < .001$, $F$s $> 96.70$; $M = 381$ ms, $SD = 7$ vs. $M = 461$ ms, $SD = 6$; see Table 7.2). In addition, while the speed with which incorrect shooting responses were made remained more or less equal over time, $F(1,47) = 0.17$, $p = .68$, $\chi^2 = .004$ ($M = 383$ ms, $SD = 9$ vs. $M = 380$ ms, $SD = 7$) and did not show significant changes as result of anxiety, $F(1,47) = 3.15$, $p = .083$; $M = 375$ ms ($SD = 8$ vs. $M = 388$ ms, $SD = 7$), correct shooting responses were made significantly faster on the posttest than on the pretest, $F(1,47) = 23.95$, $p < .001$, $\chi^2 = .338$ ($M = 450$ ms, $SD = 7$ vs. $M = 473$ ms, $SD = 6$) and were also faster in the high-anxiety than in the low-anxiety condition $F(1,47) = 36.78$, $p < .001$, $\chi^2 = .439$ ($M = 448$ ms, $SD = 7$ vs. $M = 475$ ms, $SD = 7$; see Table 7.2).
B. Threat-related interpretation

Shot accuracy

The ANOVA that was executed for shot accuracy showed a significant main effect of condition, $F(1,48) = 9.49, p = .003$, $\eta^2 = .165$, and no other main effects or interactions (all $ps > .09$). In general, shot accuracy was lower in the HA than in the LA condition ($M = 80.10\%$, $SD = 2.00$ vs. $M = 85.16\%$, $SD = 1.66$; see Table 7.2).

Discussion

The current study aimed to explore if training with anxiety can help to reduce anxiety-induced errors in police officers’ shooting decisions (i.e., shoot or do not shoot). Previous work of Nieuwenhuys, Savelsbergh et al. (in press), showed that when police officers are anxious to get hit, an increased expectancy of threat (e.g., expecting to see a gun), generally causes officers to shoot earlier and accidentally shoot more often at unarmed suspects (cf. Payne, 2001; Correll et al., 2002; Fleming et al., 2010). To examine whether training with anxiety may help to prevent anxiety-induced errors in shooting decisions, we used a pretest-intervention-posttest design. During the pretest and posttest, police officers took position in a shooting simulator and made shooting...
decisions in relation to a suspect that rapidly appeared with or without a gun, while anxiety was manipulated by switching on (high-anxiety) or switching off (low-anxiety) a ‘shootback-canon’ that could be used to fire small plastic bullets at the officers’ legs (cf. Nieuwenhuys, Savelsbergh et al., 2012). During the intervention period, officers were split into four training groups. A first group practiced against real-life opponents and could be hit by colored-soap cartridges (real-life, high-anxiety), a second group practiced in a video-simulation environment and could be hit by plastic bullets (video-simulation, high-anxiety), a third group also practiced in a video-simulation environment but could not be hit by plastic bullets (video-simulation, low-anxiety), and a final group did not practice at all (control).

Based on previous experiments, which showed that training with anxiety helped to improve police officers’ shot accuracy under stressful circumstances (Oudejans, 2008; Nieuwenhuys & Oudejans, 2011), we generally predicted that – for those groups that trained with high-anxiety – anxiety would no longer affect the quality of shooting decisions on the posttest. For the control group and the group that trained with low-anxiety we predicted that anxiety would still equally affect their shooting decisions on the posttest.

Despite the fact that our manipulations were successful on both tests and training sessions (see Table 7.1), results showed that training did not lead to a reduction in anxiety-induced shooting errors. That is, in line with findings of Nieuwenhuys, Savelsbergh et al. (in press), all groups showed a strong increase in shooting errors from low- to high-anxiety on the pretest and still showed this increase on the posttest. Generally, the percentage of incorrect shooting decisions went up from about 10% in the low-anxiety condition to over 16% in the high-anxiety condition (see Table 7.2). Relatively, this indicates an overall increase of nearly 60% due to anxiety (cf. Payne, 2001; Correll et al., 2002; Fleming et al., 2010). In addition to the observed increase in anxiety-induced shooting errors, police officers tended to shoot faster under anxiety, leading to a small but consistent decrease in shot accuracy (Nieuwenhuys & Oudejans, 2010; 2011; Nieuwenhuys, Savelsbergh et al., 2012).

Because the effect of anxiety on shooting decisions remained persistent from pretest to posttest, we conclude that – regardless of training context – anxiety-induced errors in police officers’ shooting decisions may be difficult to prevent through practice. Of course it is possible that we would have found positive effects of training if participants had practiced more often, or if training sessions would have involved more
repetitions (cf. Correll et al., 2007). However, police officers generally do not have much
time available for practice, which makes a large increase in practice volume practically
unfeasible. In addition, previous work using similar manipulations of anxiety showed
that comparable amounts of practice were sufficient to improve police officers’ shot
accuracy (Oudejans, 2008; Nieuwenhuys & Oudejans, 2011; see also Shipley & Baranski,
2001).

In this regard, it is important to note that – in terms of task requirements – being
able to shoot accurately at a target is not the same as taking the decision to shoot
at another person. That is, while shooting itself is clearly a motor task, taking the
decision to shoot is typically more cognitive. In line with this difference, Nieuwenhuys
and Oudejans (in press) suggested that while shot accuracy appears to be affected
by visual-attentional effects of anxiety (e.g., ‘where do I look?’; Causer et al., 2011;
Nieuwenhuys & Oudejans, 2010; 2011), shooting decisions are mainly affected by
interpretational effects of anxiety (e.g., ‘what do I see?’; Nieuwenhuys, Savelsbergh
et al., 2012; cf. Payne, 2001; Correll et al., 2002; Fleming et al., 2010). In line with this
suggestion, the current study showed that incorrect shooting decisions (accidentally
shooting at an unarmed suspect) were consistently made much earlier (i.e., ~80 ms
or 17%) than correct shooting decisions (correctly shooting at an armed suspect; see
Table 7.2), indicating that in these cases, officers did not wait for visual information
about the suspect’s gun but decided to shoot on the basis of threat-related inferences
and expectations (i.e., expecting the suspect to appear with a gun; see also Payne,
2001; Correll et al., 2002; Fleming et al., 2010). Under anxiety, expectations of threat
were increased, leading to earlier shooting and an increase in shooting errors. Based
on our finding that this remained unchanged from pretest to posttest, we conclude
that, apparently, it is much harder to control one’s expectations under anxiety (see
also Payne et al., 2002) than it is to simply maintain visual-attention on a target
(e.g., Nieuwenhuys & Oudejans, 2011; Wilson et al., 2011). Future research is needed
to develop more effective training methods that, perhaps, need to involve specific
feedback about the timing of shots in relation to the availability of information.

Although we were unable to show positive effects of training in the current study,
previous work on weapon identification and stereotype threat indicated that in other
contexts it is possible to improve judgment and decision making under challenging
circumstances (e.g., Correll et al., 2007; Plant & Peruche, 2005; Plant et al., 2005). An
important difference between this work and the current experiment, however, is that
the current experiment involved a shooting task that was much more realistic. For example, in our task, police officers’ could actually get hit and indicated their shooting decisions based on actual shooting responses. Such differences in the reality of a task and the specificity and nature of responses have large consequences for the detection of visual information, decision making, and the eventual action that is undertaken by participants (e.g., Dicks et al., 2010; Mann et al., 2010; see also Pinder et al., 2011). In addition, the reality-based nature of our shooting task may have led to larger and more persistent changes in shooting decisions as a result of threat (cf. Nieuwenhuys, Canal-Bruland et al., 2012) that, apparently, are difficult to prevent through reality-based practice. All in all, based on our results, it is questionable whether the positive findings of Correl et al. (2007) and Plant and colleagues (Plant & Peruche, 2005; Plant et al., 2005) will hold under more realistic circumstances.

If effects of anxiety on shooting decisions are indeed persistent, then this has important consequences for police officers. First, the effects of anxiety on perception and overall shooting behavior should be taken into account when entering a potentially stressful situation. In this light, it is also important to look at individual differences in the ability to maintain performance under anxiety (e.g., Jostmann & Koole, 2007), as this might help to prevent accidents and improve effectiveness under stressful circumstances. Second, in case of legal investigations of police shootings, the possible role of anxiety should also be included. That is, because the effects of anxiety on police officers’ shooting decisions appear hard to prevent through training, in some situations, the extent to which officers can personally be held responsible for their actions might be limited (see also Payne, 2006).

All in all, the current study confirms that police officers are more inclined to shoot when they are anxious (Nieuwenhuys, Savelsbergh et al., 2012). As a result of anxiety, police officers showed an increased expectancy of threat, which caused them to neglect visual information, shoot earlier and accidentally shoot more often at unarmed suspects. Importantly, these effects were persistent over time, and remained unchanged as a result of reality-based practice. Future research is necessary to develop more effective training methods. Until that time, it is important to acknowledge that anxiety can strongly influence police officers’ perception and shooting behavior under stressful circumstances.