Sitting duck or scaredy cat? How avoidance influences accuracy in police officers’ shooting performance under threat

Abstract

Under high threat people generally show an increased tendency to avoid. In this study we tested how the timing of avoidance responses (i.e., immediate vs. postponed) influences police officers’ shooting performance under threat. 15 Experienced police officers were confronted with an armed assailant who could fire with painful, colored soap cartridges (high-threat), and responded by using a step-fire (immediate avoidance) or fire-step shooting strategy (postponed avoidance). Experiment 1 tested how the timing of avoidance responses influenced police officers’ own shot accuracy. Experiment 2 tested how the timing of avoidance responses influenced their safety (i.e., chance to get hit). Overall, results showed that the threat of being hit facilitated immediate avoidance. With the step-fire shooting strategy, officers experienced less anxiety, took more time to aim, and shot more accurately than with the fire-step strategy (Experiment 1). At the same time, executing the step-fire strategy also provides an assailant with more time, causing officers to have a relatively large chance of getting hit before they are able to return fire (Experiment 2). Based on these findings it is concluded that avoidance can strongly influence police officers’ shooting performance under threat. To better understand the impact of avoidance in real-life situations, researchers are recommended to increasingly examine threat-induced responses within a functional context.

Keywords: anxiety, threat, avoidance, accuracy, performance, police.
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When people are under threat they tend to behave differently. Fortunately, most people will only experience this occasionally, as truly threatening situations are not often encountered. For some people, however, confrontations with severe threat are more common, for instance, because it is at the very heart of their jobs. Think, for instance, of fire-fighters trying to rescue someone from a burning house, a surgeon performing a live-saving operation, or a police officer in confrontation with a dangerous criminal. In these and other situations, slight changes in behavior, which may occur as a result of threat, can have very serious consequences (e.g., Smith, Petruzzello, Kramer, & Misner, 1997; Wilson et al., 2011; Nieuwenhuys, Savelsbergh et al., 2012). Against this background, it is important to learn more about the effects of threat on behavior and – based on the specific mechanisms and processes that are involved – develop approaches that help people to adequately perform under stressful circumstances.

From the psychological literature it is known that strong emotions give rise to automatic motivational orientations that facilitate specific behavioral responses (e.g., Frijda, 1988; Zajonc, 1980). In effect, positive stimuli have been shown to facilitate approach behavior, while negative stimuli, such as threat, have been shown to facilitate avoidance behavior. In the laboratory, approach-avoidance behavior has traditionally been examined by asking individuals to execute elementary, one-dimensional responses (e.g., button pressing; Krieglmeyer et al., 2010; or pushing vs. pulling a lever; Chen & Bargh, 1999) in reaction to artificial, affective stimuli that are presented on a screen (e.g., pictures of happy vs. angry faces; Roelofs, Hagenaars, & Stins, 2010; Stins et al., 2011; or pictures of positive vs. negative life events; Eerland, Guadalupe, Franken, & Zwaan, 2012). Although this has led to relatively clear and consistent findings, supporting the existence of automatic response tendencies, the operationalization of affective stimuli and approach-avoidance responses has remained artificial, indirect, and – often – not reflective of real-world consequences. For instance, because approach-avoidance responses are often examined in isolation of functional goals, it is unclear whether they are debilitating or facilitative in terms of task performance. In addition, several studies have shown that visual perception and behavioral responses are strongly dependent on the realism of a particular situation (e.g., Dicks et al., 2010; Mann et al., 2010; Nieuwenhuys, Canal-Bruland et al., 2012; see Pinder et al., 2011, for
an overview of this literature). For these reasons, the current study aimed to assess
the functional consequences of approach-avoidance responses in a more realistic
context, that is, police officers’ shooting responses in relation to a deadly assailant, who
threatens to shoot them with a firearm.

With respect to police officers’ shooting responses, international surveys indicate
that police officers are increasingly often confronted with serious crimes that involve
the use of firearms (e.g., Barclay et al., 2003). Consequently, the number of officer-
involved shootings has steadily increased over the past decades, leading to higher
mortality rates and an increase in hospitalization and legislation costs. In response to
an armed assailant, who suddenly draws a firearm, police officers are basically taught
two different shooting strategies that help them to quickly eliminate the danger
and – at same time – prevent themselves from being hit. The first strategy is to step
aside as quickly as possible and then shoot at the assailant, the second strategy is
to immediately shoot at the assailant and then step aside. Obviously an important
difference between these two strategies is the timing of avoidance: in the first strategy
(step-fire), police officers are allowed to immediately avoid threat – by quickly stepping
away from the assailant’s line of fire – while in the second strategy (fire-step), police
officers postpone their avoidance in order to first take a shot.

Unpublished data from a sample of 183 officers (Nieuwenhuys, 2011) shows that,
under practice conditions, police officers’ shot accuracy is consistently high (i.e., >
90% hits) and does not differentiate between the step-fire and fire-step shooting
strategy (M = 93.62% hits, SD = 13.25 vs. M = 95.08% hits, SD = 16.80; t = 1.01, p =
.31). In contrast, when police officers fire in real-life situations, shot accuracy has been
reported to be as low as 13% - 50%, depending on the threat with which officers are
confronted (e.g., Morrison & Villa, 1998; Schade, Bruns, & Morrison, 1989). In real-life
situations, the threat of being hit by an assailant suddenly increases the need to avoid.
As such, the timing of avoidance responses (immediate vs. postponed) may have a
strong effect on police officers’ shot accuracy in real-life (cf. Nieuwenhuys & Oudejans,
2010; 2011; Nieuwenhuys, Savelbergh et al., 2012).

Holding on to the aforementioned shooting strategies (i.e., step-fire vs. fire-
step), the current study tested how the timing of avoidance responses (immediate
vs. postponed) influences police officers’ shooting performance under threat. This
was done in two experiments. In Experiment 1, we tested how avoidance influences
police officers’ own shot accuracy. Participants (police officers) used the step-fire or
fire-step shooting strategy and shot at a stationary assailant (played by an experienced firearms instructor) who occasionally shot back with painful, colored soap cartridges (e.g., Nieuwenhuyys & Oudejans, 2010; 2011; Oudejans, 2008; Shipley & Baransi, 2002; Vickers & Lewinski, 2012). Next, in Experiment 2, we estimated how avoidance may influence police officers’ chances to get hit. This time, participants played the assailant and – while remaining stationary – attempted to shoot at a confederate officer (played by the same firearms instructor) who executed both shooting strategies (i.e., step-fire vs. fire-step) and again shot back with colored-soap cartridges.

**EXPERIMENT 1**

In Experiment 1, we specifically examined if police officers shoot more accurately when they first step aside and then fire (step-fire) or when they first fire and then step aside (fire-step), while they were facing a stationary assailant who shot back with colored-soap cartridges. Based on the approach-avoidance literature (e.g., Chen & Bargh, 1999; Eerland et al., 2012; Krieglmeyer et al., 2010; Roelofs et al., 2010; Stins et al., 2011), we predicted that – in general – the threat of being hit would promote avoidance, thereby making it more easy for police officers to immediately step aside (congruent response) and harder to remain in position to first take a shot (incongruent response; e.g., Nieuwenhuyys & Oudejans, 2010; 2011; Nieuwenhuys, Savelsbergh et al., 2012). Based on this difference, we expected that our participants (police officers) would prefer executing the step-fire shooting strategy and would experience less anxiety when they were allowed to immediately step aside (step-fire; cf. Roelofs et al., 2010).

With respect to anxiety and shooting performance, findings from the perceptual-motor literature indicate that with increased anxiety, people tend to speed up their performance and spend less time fixating the targets that they are supposed to hit. In general, this allows less time to fine-tune movements on the basis of visual information (e.g., target location) and, hence, causes a considerable decrease in shot accuracy (e.g., Behan & Wilson, 2008; Nieuwenhuyys & Oudejans, 2010, 2011; Wilson, Vine et al., 2009; see Nieuwenhuyys & Oudejans, in press, for an overview of this literature). Because in the current study participants always performed under relatively high-levels of anxiety (i.e., the assailant could always shoot back), we generally expected to see fast shooting times and, potentially, an overlap in the execution of shooting and stepping movements for both shooting strategies. Overall, we expected that this would
cause participants to shoot considerably less accurate than under practice conditions (Nieuwenhuys, 2012; cf. Nieuwenhuys & Oudejans, 2010, 2011). However, based on our prediction that immediate avoidance would be accompanied with reduced anxiety, we expected that, in this case, participants would take more time for their shot and shoot more accurately than when avoidance had to be postponed.

**Method**

Experiment 1 was approved by the ethical committee of the research institute. Given the involvement of firearms, the experiment was executed under the responsibility of certified police firearms instructors, following their standard safety protocol.

**Participants**

15 Experienced police officers (12 men, 3 women), with a mean age of 38.2 years (SD = 9.0) and a mean working experience of 14.8 years (SD = 7.5), volunteered to participate in the experiment. All participants had had a full license to carry a handgun and were familiar with the step-fire and fire-step shooting strategies. As measured with the STAI (A-Trait Scale; Van der Ploeg et al., 1980), participants’ trait anxiety scores were significantly lower than the norm (M = 27.9, SD = 3.7, t = 8.61, p < .001), indicating that they had no extraordinary tendency to respond to specific situations with high elevations in state anxiety. Before the experiment started, all participants provided written informed consent.

**Procedure**

Participants were measured individually, on a single day. The experiment consisted of 40 trials of a high-threat shooting exercise, which was executed according to two different strategies: step-fire (SF) or fire-step (FS; see below). In both strategies, participants responded to a starting signal (whistle) and – as quickly and accurately as possible – fired 1 round at a stationary assailant who was fitted with a white chest target (28 cm × 28 cm). The assailant, who was played by an experienced firearms instructor, also drew his gun at the starting signal and, on each trial, also fired 1 round at the participant. On most trials, the assailant’s gun would be loaded with blanks. However, to make sure that the exercise was conducted under high-threat, the blanks were occasionally replaced with colored-soap cartridges, causing participants to
be actually hit on 5-7 trials (cf. Nieuwenhuys & Oudejans, 2010; 2011). The distance between the participant and the assailant was set at 5 m, which is in line with average shooting distances seen in reality (e.g., Naeyé et al., 2001).

Before each trial, participants were informed about the specific strategy (SF or FS) that they were supposed to execute. In the SF condition, participants first stepped 1 meter to the left or right and then fired at the assailant’s chest target (see Figure 8.1a, top). In the FS condition, participants first fired at the assailant’s chest target and then stepped 1 meter to the left or right (see Figure 8.1a, bottom). To make sure that the assailant would show realistic responses in relation to the participants’ actions, the indication of strategy (SF or FS) and direction of the step (left or right) was only made visible to participants (and not to the assailant). In case of both strategies, participants were explicitly instructed to act as quickly as possible but to make sure that they would hit the target. To prevent automaticity in participants’ responses, the execution of SF and FS trials was alternated with catch-trials, in which participants were instructed to fire and remain stationary.

Material

The experiment was executed in a large dojo (12 m × 12 m) at the facilities of the police academy. Participants and the assailant shot with 9 mm handguns, which were identical to their duty weapon (Walther P5), but specifically prepared to fit colored-soap cartridges (Simunition®, FX® Marking Ammunition; Oudejans, 2008; Nieuwenhuys & Oudejans, 2010; 2011). For safety reasons, the participant and the assailant both wore a protective overall, a face mask and a throat protector. To analyze participants’ shot and movement execution the entire experiment was recorded on video by using two
C. Treat-related responses

high-definition digital video cameras (Creative VADO® HD, 30 Hz). One camera (camera 1) recorded a close-up of the participant (see Figure 8.1a), while the other camera (camera 2) recorded an overview of the experimental setup (see Figure 8.1b). After the experiment, the images of both cameras were uploaded on a personal computer (HP Compaq 8510p) and synchronized for later analysis by using Adobe Premiere® video editing software. In this process, the images of both cameras were de-interlaced, thereby increasing the frame rate to 60 Hz (17 ms).

**Dependent variables**

**Preference.** To indicate whether participants had a preference for executing the SF or FS shooting strategy, after finishing the experiment, each participant was asked which strategy had felt most natural to them: (a) SF, (b) FS, or (c) no difference.

**Anxiety.** To indicate the extent to which executing the SF and FS strategy under high-threat led to feelings of anxiety, directly after the experiment, participants reported how anxious they had felt while executing the different strategies. This was done using a 10 cm long visual-analogue scale (ranging from ‘not anxious at all’ to ‘extremely anxious’) called the ‘anxiety thermometer’ (Houtman & Bakker, 1989).

**Shot accuracy.** Shot accuracy was assessed by calculating the percentage of trials (%) on which participants hit the assailant’s chest target.

**Shot execution.** For both shooting strategies (SF and FS), we registered the time between the starting signal (whistle blow) and the exact moment (video frame; 17 ms) at which participants first started to draw their gun (i.e., shot initiation time; in ms) and shot at the assailant (i.e., shot completion time; in ms). In addition, we calculated the duration of each shot (i.e. shot duration; in ms) by subtracting the shot initiation time from the shot completion time. Finally, for those trials that the assailant actually shot back, we also registered the moment (relative to the starting signal) at which the assailant fired his gun (shot completion time – assailant; in ms).

**Step execution.** With respect to step execution, we registered the time between the starting signal and the moment (video frame; 17 ms) at which participants first started
to step aside (i.e., step initiation time; in ms) and ended their step (i.e., step completion time; in ms). In addition, we calculated the duration of each step (i.e., step duration; in ms) by subtracting the step initiation time from the step completion time. To identify the start and end of the stepping movement, shoulder displacement was used as an indicator.

**Statistical analysis**

Differences between the two shooting strategies (FS and SF) were analyzed by using two-tailed, paired t tests. In addition, Cohen’s d was calculated for each effect, to provide an estimate of the effect size (Cohen, 1988). The alpha level for significance was set at $p = .05$.

**Results and discussion**

Table 8.1 shows an overview of the results for all dependent variables.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Shooting strategy</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>SF</td>
</tr>
<tr>
<td></td>
<td>M (SD)</td>
</tr>
<tr>
<td>Anxiety (0-10)</td>
<td>3.74 (2.02)</td>
</tr>
<tr>
<td>Shot accuracy (% hits)</td>
<td>51.33 (17.16)</td>
</tr>
<tr>
<td>Shot initiation time (ms)</td>
<td>157 (91)</td>
</tr>
<tr>
<td>Shot completion time (ms)</td>
<td>951 (180)</td>
</tr>
<tr>
<td>Shot duration (ms)</td>
<td>786 (147)</td>
</tr>
<tr>
<td>Shot completion time – assailant (ms)</td>
<td>683 (145)</td>
</tr>
</tbody>
</table>

|                                           | FS                |
|                                            | M (SD)            |
| Anxiety (0-10)                            | 4.85 (2.29)*      |
| Shot accuracy (% hits)                     | 44.00 (17.85)*    |
| Shot initiation time (ms)                 | 73 (55)**         |
| Shot completion time (ms)                 | 768 (129)**       |
| Shot duration (ms)                        | 659 (79)**        |
| Shot completion time – assailant (ms)     | 613 (86)          |

| Step execution                            |                 |
|                                            | SF                |
|                                            | M (SD)            |
| Step initiation time (ms)                 | 268 (168)        |
| Step completion time (ms)                 | 1224 (233)       |
| Step duration (ms)                        | 956 (134)        |

|                                            | FS                |
|                                            | M (SD)            |
| Step initiation time (ms)                 | 693 (259)**       |
| Step completion time (ms)                 | 1717 (344)**      |
| Step duration (ms)                        | 1022 (201)*       |

* $p \leq .05$, *** $p \leq .001$
In line with our finding that immediate avoidance was accompanied by a relative reduction in anxiety, participants’ shot accuracy was considerably better when they first stepped aside than when they first fired, $t(14) = 2.32, p = .036, d = 0.42$ (see Table 8.1). This result confirms earlier findings and indicates that shot accuracy is affected by changes in anxiety (Nieuwenhuys & Oudejans, 2010; 2011).

Underlying the results for shot accuracy, shot and step execution times showed considerable overlap for both shooting strategies, indicating that participants generally attempted to perform “as quickly as possible” (see Figure 8.2). When participants first fired at the assailant (fire-step strategy), the time that was taken for each shot was pressured by the urge to step aside quickly. On the other hand, when participants were allowed to immediately step aside (step-fire strategy), the time that was needed to step aside was used to already draw the gun. As a result of speeding up, the overall level of shot accuracy (i.e., ~48% hits; see Table 8.1) was considerably lower than what is normally observed during practice and examination (i.e., ~94% hits; Nieuwenhuys, 2011; cf. Nieuwenhuys & Oudejans, 2010; 2011). However, because participants were relatively early to draw their gun when they immediately stepped aside, shot durations were longer for the step-fire than for the fire-step shooting strategy, $t(12) = 4.67, p = .001, d = 1.08$. Potentially, this provided participants with more time to aim, and – as can be seen in Table 8.1 – enabled them to maintain better shot accuracy (cf. Behan & Wilson, 2008; Nieuwenhuys & Oudejans, 2010; Wilson, Vine et al., 2009). At the same time, step duration was significantly shorter for the step-fire strategy, $t(14) = 2.51, p = .025, d = 0.39$ (Table 8.1), thereby indicating that – also in terms of movement execution – threat may have facilitated immediate avoidance (cf. Chen & Bargh, 1999; Eerland et al., 2012; Krieglmeyer et al., 2010; Roelofs et al., 2010; Stins et al., 2011).

All in all, the findings of Experiment 1 confirm that high-threat is accompanied by an increased tendency to avoid. Consequently, when police officers are confronted with an assailant who suddenly draws a firearm, they experience more anxiety when they have to postpone avoidance in order to first fire (fire-step) than when they are allowed to avoid immediately and fire afterwards (step-fire). In line with this difference, police officers’ shot accuracy is better in combination with immediate avoidance, potentially because with less anxiety, more time is taken for aiming. With respect to overall effectiveness, however, an important question that remains is whether immediate avoidance also reduces the chances that officers are hit by an assailant. In this respect,
it is important to note that when our participants executed the step-fire strategy, their shot completion time was ~ 270 ms slower than that of the assailant (i.e., 951 ms vs. 683 ms; see Table 8.1) and ~180 ms slower than when they executed the fire-step shooting strategy (i.e., 951 ms vs. 768 ms; Table 8.1). As such, although avoiding officers move quickly, the fact that they shoot slower may give assailants the opportunity to quickly shoot back before officers are able to return fire (see Table 8.1). Whether immediate avoidance is safer than postponed avoidance was tested in Experiment 2.

Figure 8.2: Timing of shot and step execution for the step-fire (SF) and fire-step (FS) shooting strategy.

**EXPERIMENT 2**

In Experiment 2, we specifically investigated whether police officers are safer when they first step aside and then fire (step-fire), or when they first fire and then step aside (fire-step). To this end, participants (police officers) took up the role of the assailant and – while remaining stationary – shot at a confederate officer (played by the same firearms instructor as in Experiment 1) who acted according to both shooting strategies and shot back with colored-soap cartridges (Oudejans, 2008; Nieuwenhuys & Oudejans,
With respect to participants’ shot accuracy in response to the step-fire and fire-step shooting strategy, two factors were deemed important: (a) the anxiety that is experienced in response to either strategy (Nieuwenhuys & Oudejans, 2010; 2011; see Experiment 1) and (b) the difficulty that is associated with shooting at a moving vs. a stationary target (e.g., Schendel & Johnston, 1982; Causer et al., 2011).

With respect to the first, we predicted that participants might experience less anxiety when the confederate officer first stepped aside. That is, for the step-fire shooting strategy, the confederate officers’ shooting responses are expected to be slower than for the fire-step shooting strategy (see Experiment 1). Potentially, this would allow participants to take more time for their shot and, hence, reduce their anxiety. If anxiety is indeed lower in response to the step-fire strategy – and participants take more time for their shot – then shot accuracy is likely to be better when the confederate officer first steps aside (e.g., Behan & Wilson, 2008; Nieuwenhuys & Oudejans, 2010; 2011; Wilson, Vine et al., 2009).

On the other hand, if the confederate officer immediately steps aside, then participants will have to adjust their aiming to his movement. Arguably, this increases complexity and, hence, might affect shot accuracy (cf. Schendel & Johnston, 1982; Causer et al., 2011). From an evolutionary perspective it would make sense if immediately stepping aside is functional and would actually reduce officers’ chances of getting hit (e.g., Frijda, 1988; Zajonc, 1980). If this is indeed the case, then participants’ shot accuracy should be worse when the confederate officer first steps aside.

With respect to which of these two factors (i.e., decreased anxiety or increased complexity) would have the largest influence on participants’ shot accuracy, and would thus lead to increased (or decreased) safety for officers in real-life, we had no a-priori expectations.

**Method**

Experiment 2 was approved by the ethical committee of the research institute. Given the involvement of firearms, the experiment was executed under the responsibility of certified police firearms instructors, following their standard safety protocol.
Procedure
In Experiment 2, the same 15 police officers as in Experiment 1 participated. The experimental setup and procedure were exactly the same as in Experiment 1 (see Figure 8.1), with the sole exception that participants now took up the role of the assailant, remained stationary, and shot at a confederate officer who acted according to the step-fire (SF) or fire-step (FS) shooting strategy. The confederate officer was played by the same firearms instructor as in Experiment 1. Participants performed 20 trials in response to the SF as well as the FS shooting strategy (40 in total), the order of which was completely randomized. With the exception of step execution (participants remained stationary), dependent variables were the same as in Experiment 1. For each participant, Experiment 2 was executed approximately 15 minutes after finishing Experiment 1, thus providing them with enough time to rest (cf. Nieuwenhuys & Oudejans, 2010; 2011).

Results & Discussion
Table 8.2 shows an overview of the results for all dependent variables.

In line with our first prediction, participants seemed to experience less anxiety when the confederate officer first stepped aside than when he first fired, $t(14) = 1.80, p = .093, d = 0.50$ (see Table 8.2). Although with a two-tailed test, the observed difference just failed to reach significance at the .05 level, the strength of the effect indicates that the extra time that was available in response to the step-fire strategy, is likely to have caused a reduction in the anxiety that participants experienced. In line with this difference, participants took more time for their shot (i.e., shot durations were longer), $t(12) = 2.21, p = .047, d = 0.30$, and shot accuracy was significantly better, when the confederate officer first stepped aside, $t(14) = 2.267, p = .040, d = 0.47$ (see Table 8.2).

When the confederate officer first stepped aside, participants’ shot completion time was approximately 120 ms faster than that of the confederate officer (i.e., 780 ms, SD = 101, vs. 907 ms, SD = 207); see Table 8.2). This suggests that participants indeed aimed and shot at the confederate officer while he was executing the step. Compared with a stationary situation, this arguably makes shooting more complex (Schendel & Johnston, 1982; cf. Causer et al., 2011). In response to the fire-step strategy, however, it appeared that participants were approximately 250 ms later than the confederate
officer (i.e., 750 ms, SD = 100, vs. 500 ms, SD = 201; see Table 8.2). This suggests that, also in this case, participants shot at the confederate officer when he was executing the step. As such, shooting was equally complex in response to the step-fire and fire-step shooting strategy (Schendel & Johnston, 1982; cf. Causer et al., 2011), thereby explaining why the observed findings for shot accuracy closely matched with the anxiety that was experienced by participants (cf. Experiment 1).

All in all, a combination of relatively low levels of anxiety and taking more time to execute the shot enabled participants to hit the confederate officer more often when he executed the step-fire strategy than when he executed the fire-step strategy. As such, the findings of Experiment 2 seem to show that – in confrontation with an assailant who suddenly draws a firearm – it may be safer for officers to postpone avoidance and surprise the assailant with a quick shot, than to avoid immediately and get shot before being able return fire.

Table 8.2: Overview of the results for each dependent variable in Experiment 2, for the fire-step (FS) and step-fire (SF) shooting strategy.

<table>
<thead>
<tr>
<th>Variable</th>
<th>SF M (SD)</th>
<th>FS M (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anxiety (0-10)</td>
<td>3.73 (2.67)</td>
<td>4.91 (2.02)*</td>
</tr>
<tr>
<td>Shot accuracy (% hits)</td>
<td>49.00 (18.54)</td>
<td>40.00 (19.64)*</td>
</tr>
<tr>
<td>Shot execution</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shot initiation time (ms)</td>
<td>121 (72)</td>
<td>163 (136)</td>
</tr>
<tr>
<td>Shot completion time (ms)</td>
<td>780 (101)</td>
<td>750 (100)**</td>
</tr>
<tr>
<td>Shot duration (ms)</td>
<td>646 (70)</td>
<td>576 (126)*</td>
</tr>
<tr>
<td>Shot completion time – confederate officer (ms)</td>
<td>907 (207)</td>
<td>500 (201)</td>
</tr>
</tbody>
</table>

* p ≤ .05, ** p ≤ .01, + p = .093

**General Discussion**

Overall, the current study tested how the timing of avoidance responses (immediate vs. postponed) influences police officers’ effectiveness (shot accuracy and chances to get hit) in relation to a threatening assailant, who suddenly draws a firearm. To manipulate avoidance, we used two shooting strategies that officers normally apply in this type of
confrontation. That is, immediately step away from the assailant’s line of fire and then shoot back (step-fire; immediate avoidance) or immediately shoot back and then step away from the assailant’s line of fire (fire-step; postponed avoidance; Nieuwenhuys, 2011).

In line with the approach-avoidance literature (Chen & Bargh, 1999; Eerland et al., 2012; Krieglmeyer et al., 2010; Roelofs et al., 2010; Stins et al., 2011), we predicted that – as a result of the threat of being hit – officers would prefer immediate avoidance and, thus, experience less anxiety when they were allowed to immediately step away from the assailant’s line of fire. As appeared from Experiment 1, this is exactly what we found. In addition, because officers experienced lower levels of anxiety, they took more time to aim and shot significantly more accurate with the step-fire than the fire-step shooting strategy (cf. Behan & Wilson, 2008; Nieuwenhuys & Oudejans, 2010; Wilson, Vine et al., 2009). Although from an evolutionary perspective one would expect immediate avoidance to also be functional in terms of reducing police officers’ chances to get hit (e.g., Frijda, 1988; Zojonc, 1980), Experiment 2 showed that this was not the case. Instead, immediate avoidance seemed to buy assailants some extra time to shoot back, thereby reducing their anxiety and shoot more accurately, before an officer is able to return fire (cf. Behan & Wilson, 2008; Nieuwenhuys & Oudejans, 2010; Wilson, Vine et al., 2009).

With respect to police officers’ shot accuracy, the current study confirms that there are big differences between shooting in real-life and shooting in practice (Oudejans, 2008; Nieuwenhuys & Oudejans, 2010; 2011). Overall, participants’ shot accuracy was around 45% (see Table 8.1 and Table 8.2), which is comparable to what is seen in real-life (i.e., 13% - 50%; Morrison & Villa, 1998; Schade et al., 1989), but considerably lower than what is achieved during practice and examination (i.e., > 90%; Nieuwenhuys, 2011). Collectively, these figures indicate that with respect to police officers’ shot accuracy there is still much to gain. In this respect, the current study shows that exploring the advantages (and disadvantages) of different shooting strategies (i.e., step-fire vs. fire-step) may be a fruitful endeavor. Based on our findings it seems that although immediate avoidance is more natural and associated with better shot accuracy, immediately shooting back is safer and provides officers with a relatively good chance of shooting an assailant before he/she is able to return fire. In addition, immediately shooting back may become increasingly effective when police officers start practicing their shot accuracy under realistic high-threat circumstances (e.g.,
Of course, more work is needed to further establish these findings. In the current study, avoidance was limited to quickly stepping aside one meter to the right or left. Clearly, the effects of avoidance on police officers’ shot accuracy and chances to get hit may be different when officers would be allowed to avoid over greater distances, take cover behind obstacles, or shoot more than once. In addition, rather than always having one person (i.e., officer or assailant) remain stationary, actual shootouts are characterized by two people that are interacting. Although such variation may challenge experimental rigidity, future studies should attempt to address these matters.

With respect to the literature, the current study is one of the first to assess functional effects of approach-avoidance behavior in a reality-based setting, that is, police officers’ shooting responses in relation to an assailant who threatens them with a firearm. Approach-avoidance behavior has usually been investigated by examining elementary, one-dimensional responses (e.g., button pressing; Krieglmeyer et al., 2010; or pushing vs. pulling a lever; Chen & Bargh, 1999) in relation to artificial, affective stimuli that are presented on a screen (e.g., pictures of happy vs. angry faces; Stins et al., 2011; or pictures of positive vs. negative life events; Eerland et al., 2012). Although this has lead to relatively clear and consistent findings, supporting the existence of automatic response tendencies, how participants respond in such a situation is not necessarily representative of their natural behavior (e.g., Dicks et al., 2010; Mann et al., 2010; Nieuwenhuys, Canal-Bruland et al., 2012; see Pinder et al., 2011, for an overview of this literature). In addition, approach-avoidance responses have often been assessed in isolation of functional goals and real-world consequences, making it hard to estimate the extent to which they may interfere with task performance.

By testing the effects of avoidance on police officers’ shooting performance under realistic high-threat circumstances, the current study showed that automatic response tendencies can strongly influence task performance (e.g., shot accuracy) and, at the same time, have large consequences for the safety of individuals (e.g., getting shot by the assailant). As appears from our findings, effects of avoidance on task performance may be determined by the anxiety that is associated with performing a specific type of behavior. That is, a shooting strategy that incorporated immediate avoidance was found to improve police officers’ shot accuracy under threat, potentially because it offered a relative reduction in the anxiety that was experienced.
Of course, the current findings are not conclusive with respect to how avoidance responses influence the behavior and operational performance of individuals in different settings. As such, more research is needed to further our understanding of this matter. For instance, rather than altering the timing of responses that are provided by individuals (e.g., immediate avoidance vs. postponed avoidance), future studies might manipulate the spatial location of perceived threat, or alter the timing with which threat is visually presented during the execution of goal-directed movement. We believe that by investigating individuals’ responses to threat within a functional context (e.g., operational performance) scientists can begin to test the actual impact of avoidance in real-life situations. We hope that in this respect, the current study can be of inspiration.

All in all, the current study showed that even for police officers, who are used to perform under stressful circumstances, high threat creates an increased tendency to avoid (e.g., Frijda, 1988; Zajonc, 1980). When police officers were confronted with a threatening assailant, who suddenly drew a firearm and occasionally shot back with (painful) colored-soap cartridges, allowing immediate avoidance had a positive influence on officers’ shot accuracy, potentially as it reduced the anxiety that they experienced. At the same time, however, results indicated that immediate avoidance was not necessarily associated with increased safety. Based on our findings it is concluded that avoidance tendencies can strongly influence operational performance and the safety of individuals. However, whether police officers are better off as sitting ducks or scaredy cats is a question that requires further scrutiny.