Acta Psychologica 187 (2018) 9–18

Contents lists available at ScienceDirect

Acta Psychologica

journal homepage: www.elsevier.com/locate/actpsy

Can threat detection be enhanced using processing strategies by police trainees and officers?

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ARTICLE INFO

Keywords:
Visual attention
Threat detection
Processing strategies
Police
Cueing paradigm

ABSTRACT

The ability to detect threatening stimuli is an important skill for police officers. No research has yet examined whether implementing different information processing strategies can improve threat detection in police officers and police trainees. The first aim of our study was to compare the effect of strategies accentuating the processing of the emotional or the semantic dimension of stimuli on attention towards threatening and neutral information. The second aim was to consider the impact of PTSD symptoms on threat detection, as a function of processing strategies, in police officers and trainees. In a cueing paradigm, participants had to respond to a target that was presented following a threatening or neutral cue. Participants then answered a question, known beforehand, concerning the cue. The question was used to induce a more emotional or semantic processing strategy. Results showed that when the processing strategy was emotional, police trainees and officers were faster to detect the target when it followed a threatening cue, compared to a neutral cue, independently of its spatial location. This was not the case when the processing strategy was semantic. This study shows that induced processing strategies can influence attentional mechanisms related to threat detection in police trainees and police officers.

1. Introduction

The ability to detect threatening stimuli is an important skill for police officers, in order for them to be able to adjust their behavior efficiently. Indeed, police work involves arresting suspects, managing domestic situations or monitoring crowd behavior. Police officers are often in potentially dangerous situations. They need to be able to rapidly detect threatening information in complex and rapidly changing environments. Research shows that threatening stimuli generally receive privileged attentional processing (Blanchette, 2006). In this paper, we explore the possibility that such attentional mechanisms may be influenced by the use of voluntary processing strategies, which may favor the processing of the emotional or the semantic dimension of stimuli. More specifically, the aim of our study was to examine whether emotional or semantic processing strategies can improve the detection of threatening stimuli in police trainees and police officers.

The impact of emotion on visual attentional processes can be studied using different paradigms. Stormark, Nordby, and Hugdahl (1995) adapted the cueing paradigm of Posner (1980) by manipulating the emotional valence of words used as cues. In this paradigm, a cue is presented, followed by a target that appears in the same location (valid condition) or in another location (invalid condition). The logic is that if attention is attracted by a cue, then participants should be faster to detect the target in valid condition, because attention is already focused in that location. This validity effect should be even more pronounced when the cue is threatening, if these attract attention more than neutral stimuli. Indeed, participants are generally faster to detect the target in the valid condition when the cues are emotional relative to neutral (Stormark et al., 1995). This prioritized processing of emotional stimuli, spatially localized, has also been found with emotional faces (Fox, 2002) and aversively-conditioned color cues (Koster, Crombez, Van Damme, Verschuere, & De Houwer, 2004).

The attentional prioritization of emotional stimuli has also been demonstrated with other paradigms, including the dot-probe task (Calvo & Lang, 2004; Frewen, Dozois, Joanisse, & Neufeld, 2008) and the visual search task (Blanchette, 2006; Öhman, Flykt, & Esteves, 2001). In the latter, a target must be detected among distractors. Threatening stimuli are detected faster (Öhman et al., 2001) and benefit from the first fixation, even when instructions ask participants not to pay attention to them (Nummenmaa, Hyönä, & Calvo, 2006). In this way, many studies establish that the detection of negative, particularly threatening stimuli is more efficient than that of neutral stimuli. One explanation of this effect is that attentional resources are limited and allocated in priority to the location of threatening stimuli. More

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https://doi.org/10.1016/j.actpsy.2018.04.010
Received 13 January 2017; Received in revised form 17 April 2018; Accepted 17 April 2018

specifically, in the cueing paradigm, attentional resources are distributed across the visual space and the threatening cues cause an increase of attentional resources on the location of threatening stimuli, allowing a better detection of a target following in this same location relative to other locations. This effect can be considered as a threat-related spatial vigilance.

Threatening stimuli benefit from attentional priority and this kind of prioritization can occur spatially, as seen previously, but can also occur independently of the spatial dimension. Indeed, the presentation of threatening stimuli may induce a specific emotional state, temporarily increasing anxiety, which could lead to a general over-activation of attentional processes (Dennis & Chen, 2007; Fernández-Castillo & Caurcel, 2015). This increased vigilance would create a general advantage in processing targets presented after threatening cues, no matter where these targets occur. This would result from the anxious state leading to an increased spread of attention across the visual field, which would lead to more efficient target detection. In this way, the presentation of threatening cues may also lead to a general, non-spatial increased alertness for all targets.

The ability to detect threatening information can be modulated by psychological factors such as emotional traits or emotional state (Bar-Haim, Lamy, Pergamin, Bakermans-Kranenburg, & van IJzendoorn, 2007; Bradley, Mogg, Falla, & Hamilton, 1998; Fox, 2002; Mogg & Bradley, 2002). Individuals with high or low levels of anxiety may both initially direct their attention towards threat, while only high anxious individuals show greater difficulty disengaging their attention from a threat (Frewen et al., 2008). Attentional processes can also be modulated by the emotional state of individuals (Bar-Haim et al., 2007; Fox, 2002; Gotlib, Krasnoperova, Yue, & Joormann, 2004; Hankin, Gibb, Abela, & Flory, 2010; Mogg & Bradley, 2002; Mogg, Millar, & Bradley, 2000).

Attentional mechanisms may also be influenced by exposure to threatening events (Frewen et al., 2008). Individuals exposed to intense stressful events such as sexual assault or earthquakes exhibit increased vigilance towards stimuli specifically related to the events (Caparos & Blanchette, 2014; Latack, Moyer, Simon, & Davila, 2017; Zhang, Kong, Han, Najam Ul Hasan, & Chen, 2014) or more generally to threatening stimuli (Pollak & Tolley-Schell, 2003). These studies show that attention towards threat can be modulated by past experiences and that these effects are closely bound with the emotional response triggered by these events (Coyle, Karatzias, Summers, & Power, 2014; Infurna, Rivers, Reich, & Zautra, 2015). Therefore, it is necessary to take into account prior emotional experiences related to potentially traumatic events when studying attention towards threatening stimuli. This is particularly important with police officers who are particularly at risk of being exposed to violent, critical incidents in the course of their work (Hodgins, Creamer, & Bell, 2001). Even trainee police officers often have prior professional experiences, in the army or as security agents for example, before integrating police training that may be associated with increased risk of exposure to stressful events (Buchanan, Stephens, & Long, 2001).

The allocation of attentional resources can thus be modulated by internal control system which includes past experiences but also current goals (Folk, Remington, & Johnston, 1992). This internal control system represents a balance between a rigid network necessary to ensure the processing of important stimuli and a flexible network allowing adaptation to change in current goals and circumstances. Stimuli that are relevant for the task, for instance because they share attributes with the target, are more likely to attract attention (for example, a red shirt will attract attention more when we are looking for someone wearing a red hat) (Folk et al., 1992 cited by Corbetta & Shulman, 2002). Anticipated knowledge of the target characteristics to be detected (such as size) improves target detection (Hodsoll & Humphreys, 2001). Providing information about the nature of the stimulus before it is presentation can activate internal control mechanisms (Hodsoll & Humphreys, 2001). These predispose participants to detect information consistent with their expectations, or relevant for their goals. A number of results support the important role of expectations and information processing strategies in attentional orientation. However, most of this research has been conducted with neutral information. Little research has explored whether emotional information detection can be modulated by inducing voluntary information processing strategies.

In this study, we examined whether threat detection can be influenced by encouraging participants to process the emotional or the semantic dimension of stimuli. This could be particularly relevant for police officers in their everyday work and with police trainees who must learn to become effective at processing threatening stimuli. To this end, we examined threat detection using a cueing paradigm including threatening or neutral cues. After detecting the target, participants answered one of two questions concerning the cue: “Is it dangerous?” or “Is it an object?”. These questions were known by participants beforehand and should preferentially induce more emotional or semantic processing of the stimuli. Such a protocol allows for a direct comparison of the influence of affective and semantic processing strategies on attention to threatening cues.

Our hypothesis was that inducing an emotional processing strategy would lead to more efficient threat detection, compared to a semantic processing strategy, in police officers and future police officers. We wanted to examine this both in terms of spatial prioritization and general vigilance. A secondary objective was to investigate whether the influence of processing strategies on threat detection was modulated by self-report PTSD symptoms related to prior emotional experiences.

2. Experiment 1

2.1. Method

2.1.1. Participants

Participants were 68 police trainees from the École National de Police du Québec (14 women; M age = 22.8, *SD* = 2.9). They followed three years of police techniques and they were recruited during the last stage of their training, which involved 15 weeks at the École National de Police du Québec. During this period, they are trained in shooting and driving in high speed.

Participants were recruited in school, following a brief explanation of the project provided in class. The only exclusion criterion was not to have normal or corrected to normal vision. We took into account participants' field experience prior to starting police training, as this could influence levels of post-traumatic stress symptoms. Fifteen of the participants reported having at least six months of experience in security activities or military experiences.

2.1.2. Apparatus

The presentation of the attentional task and data collection were conducted with a PC laptop with standard screen (34.0 cm × 27.2 cm) of resolution 640 × 480 and a refresh rate of 60 Hz. Participants had to place their head on a chin rest located 60 cm from the screen. E-prime software was used to deliver stimuli and record responses and reaction times. Manual responses to the task were collected from designated responses keys on the computer's keyboard.

2.1.3. Material

2.1.3.1. Pilot study: stimuli selection and validation. A pilot study was conducted in order to determine which words to include in the cueing paradigm. A total of 71 police trainees (a separate group from those taking part in the main experiment) evaluated 98 threatening and neutral French words on a scale from 1 (absolutely neutral) to 7 (highly emotional). Some of these words were taken from an existing database (Syssau & Font, 2005) and others inspired by studies of post-traumatic stress. The mean (*M* = 2.89, *SD* = 1.75) and the median (*Mdn* = 3) were determined for all words. We considered words to be emotional if 80% (at least 57) of participants evaluated them as equal or superior to the median. Conversely, if 80% of participants evaluated a word below the median, it was considered neutral. Following this process, we kept 52 words (26 neutral,