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Performance in a blocked versus randomized emotional Stroop task in an aged, early traumatized group with and without posttraumatic stress symptoms

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ABSTRACT

Background and objectives: Attentional biases (AB) for trauma-related stimuli have been examined in many studies assessing different trauma samples. In emotional Stroop tasks (EST), blocked and single-trial formats are used almost interchangeably in clinical research. There is reason to believe that different designs yield different results and assess different processes, which, however, has been hardly examined in studies. Furthermore, there is a dearth of information about AB in older trauma survivors with posttraumatic stress symptoms.

Methods: Older adults with ($n = 20$) and without PTSD symptoms ($n = 26$) as well as non-traumatized controls ($n = 21$) completed an EST, in which words were presented both blocked and randomized.

Results: Analyses revealed that individuals with PTSD symptoms showed AB for trauma- and depression-related words; however, mode of administration did not significantly influence reaction times.

Limitations: The emotional Stroop task cannot disentangle the underlying cognitive mechanism (i.e., facilitation, interference, avoidance).

Conclusions: PTSD symptoms in older trauma survivors are associated with AB. Overall, participants with PTSD symptoms did not show greater impairment of cognitive control in comparison to both control groups. Results also illustrate that methodological differences between task versions need to be considered more thoroughly.

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1. Introduction

Against the background of demographic change in many industrialised countries, it is important to increase our theoretical understanding about cognitive mechanisms that are impaired in older individuals with psychological disorders, such as post-traumatic stress disorder (PTSD), in order to develop and improve current treatments for the elderly population (e.g., Böttche, Kuwert, & Knaevelsrud, 2012). With a lifetime prevalence of 1.3%–8.3% (e.g., Breslau, 2012), PTSD is a common psychiatric disorder and rates are considerably higher in high risk populations, for example, individuals exposed to forced displacement (e.g., Steel et al., 2009). Due to armed conflicts and wars as well as the tremendous number of refugees worldwide (United Nations High Commissioner for

Refugees [UNHCR], 2015), the health care system will be confronted with an increasing number of older individuals with PTSD in the coming years. Thus, more detailed knowledge about cognitive mechanisms and PTSD in old age is required.

1.1. Attentional biases in PTSD

Attentional biases (AB) play an important role in the pathogenesis of PTSD (Ehlers & Clark, 2000; Foa, Huppert, & Cahill, 2006). A plethora of studies investigated AB in PTSD (e.g., Cisler et al., 2011; Constans, 2005); surprisingly, there are hardly any studies that assessed whether these biases are also present in older individuals (i.e., >65 years). AB were mostly assessed using emotional variants (Williams, Mathews, & MacLeod, 1996) of the classic Stroop task (Stroop, 1935). In its original version, words of one category are presented on a single card (card or blocked presentation format) and participants are instructed to name the print color of each color word as fast as possible. As this procedure is

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rather imprecise (e.g., dealing with errors, mean reaction time is calculated across all words, MacLeod, 2005), a single-trial (randomized presentation) format was developed, in which each stimulus is presented individually. For the assessment of AB in PTSD, both versions (blocked and single-trial) of the emotional Stroop task (EST, Williams et al., 1996) were administered. The most consistent evidence for AB towards trauma-related stimuli across different types of trauma was found with blocked presentation formats (e.g., Cisler et al., 2011). One study (Fleurkens, Rinck, & van Minnen, 2011) provides evidence that hyperarousal was related to more generalized AB to non-threatening, but thematically related words. Although many studies using randomized presentation formats also detected AB in PTSD (e.g., Bryant & Harvey, 1995; Foa, Feske, Murdock, Kozak, & McCarthy, 1991), closer inspection reveals that evidence is less robust (e.g., Deveneni, Blanchard, Hickling, & Buckley, 2004; Wittekind, Jelinek, Kellner, Moritz, & Muhtz, 2010). Furthermore, both formats probably tap different processes, this aspect is addressed in the following.

1.2. Underlying mechanisms and assessed processes

Despite numerous studies investigating AB using the EST, its underlying mechanisms are subject of ongoing debate (e.g., Algom, Chajut, & Lev, 2004; McKenna & Sharma, 2004; Williams et al., 1996). However, to infer what mechanisms drive AB (for reviews see Hayes, VanElzakker, & Shin, 2012; Shvil, Rusch, Sullivan, & Neria, 2013; Van Bockstaele et al., 2014)¹, it is important to understand what processes are captured with the EST. While some approaches assume that AB (as assessed with the EST) are particularly driven by bottom-up processing (i.e., attention is involuntarily directed to threatening stimuli [attentional facilitation] thereby disrupting performance, e.g., Williams et al., 1996), others claim that the emotional Stroop effect (ESE) mainly relies on top-down processing (e.g., Algom et al., 2004; McKenna & Sharma, 2004). The latter is important to maintain goal-directed behavior but is impaired by anxiety resulting in difficulties to disengage attention from threatening stimuli (e.g., Derryberry & Reed, 2002; Eysenck, Derakshan, Santos, & Calvo, 2007), which, in turn, results in impaired task performance (i.e., slowed color-naming [interference]).

How can the different processes be captured with an EST? One means is to contrast blocked and randomized presentation formats (Cisler et al., 2011): Assuming that threatening stimuli grab attention (i.e., automatic processing), the slowing in the EST should occur on any single threat-relevant trial (e.g., McKenna & Sharma, 2004). Consequently, there should be a significant ESE in randomized formats which should not be significantly larger in blocked formats. If strategic processes are at play, the blocked presentation format should result in larger interference effects as difficulties with disengagement (e.g., Pineles, Shipherd, Mostoufi, Abramovitz, & Yovel, 2009; Pineles, Shipherd, Welch, & Yovel, 2007) add up and cognitive control (CC) might be further depleted (e.g., Eysenck et al., 2007). Thus, the two formats seem to assess different processes;

¹ Generally, AB might be driven by facilitation (i.e., preferential engagement with emotional stimuli), interference (resulting from difficulties to disengage attention from emotional stimuli), or avoidance (i.e., attention is directed away from emotional stimuli, Cisler & Koster, 2010). Many theoretical models have been put forward to explain the underlying mechanisms of AB (for an overview see Van Bockstaele et al., 2014). While two studies found evidence that PTSD is associated with interference, but not facilitation (Pineles et al., 2009, 2007), more recent evidence was ambiguous (for a review see Shvil et al., 2013). As the aim of the present study was to (a) study the underlying processes by contrasting randomized versus blocked formats and (b) clarify methodological aspects when investigating AB, we did not specifically assess the different AB components.

however, they are used almost interchangeably in clinical research². To date, three studies administered both a blocked and a randomized format within one PTSD study (Cassiday, McNally, & Zeitlin, 1992; Kaspi, McNally, & Amir, 1995; McNally, Amir, & Lipke, 1996). Unfortunately, interpretability of all studies is compromised as participants were either randomized to one of the two formats (Cassiday et al., 1992; Kaspi et al., 1995) or different stimuli and modalities (card versus computer) were used (McNally et al., 1996). To the best of our knowledge, there has been no study that systematically compared blocked versus randomized presentation formats within one clinical sample.

1.3. Attentional biases, PTSD and aging

Normal aging is associated with cognitive alterations and generally, older individuals perform more poorly in most cognitive tasks compared to younger individuals (e.g., Verhaeghen & Salthouse, 1997). Furthermore, it was found that older individuals with PTSD perform worse across several cognitive measures than healthy older individuals (e.g., Schuitevoerder et al., 2013). Amongst others, executive functioning is worse in older individuals with PTSD compared to non-PTSD and non-trauma controls (Hedges' g 0.80 and 1.49, respectively). As there is evidence that individual differences regarding executive functioning (e.g., cognitive control) influence the magnitude of AB (e.g., Bardeen & Orcutt, 2011; Schoorl, Putman, Van Der Werff, & Van Der Does, 2014), a decline of CC, which is accompanying aging and worsened in individuals with PTSD, might be associated with greater difficulties to withdraw attention from threatening stimuli, which, in turn, might lead to an aggravation of AB (e.g., Schoorl et al., 2014). If this was the case, AB should be more pronounced within blocked presentations. However, the decline of executive functioning might not affect all individuals alike, thus, depending on the level of CC, there might be individual differences as to the amount of AB. This factor was not considered sufficiently in previous studies.

Most of the studies so far that assessed the association between anxiety and AB in older individuals relied on samples with sub-clinical anxiety or generalized anxiety disorder (Beaudreau, MacKay-Brandt, & Reynolds, 2013). Taken together, results provide rather consistent evidence that anxiety in older age is linked to AB towards negative emotional stimuli (e.g., Fox & Knight, 2005; Price, Eldreth, & Mohlman, 2011; Price, Siegle, & Mohlman, 2012; however, see Mohlman, Price, & Vietri, 2013). To the best of our knowledge, there is only one study that specifically addressed AB in older individuals with PTSD (i.e., > 65 years; Wittekind et al., 2010). Individuals who fled or were displaced as children during or after World War II (WWII) with ($n = 22$) and without PTSD ($n = 24$) as well as 11 healthy, non-traumatized participants completed an EST with five different word conditions (neutral, Stroop, trauma, anxiety, depression). In this PTSD group, no evidence for an AB towards trauma-relevant material was found. However, the non-significant findings might partly be explained by methodological issues as a randomized presentation format was used, which, as discussed above, provided ambiguous results. Thus, results need to be replicated with blocked presentation formats before firm conclusions can be drawn.

² Furthermore, RTs in blocked formats might be further increased due to methodological aspects: Carry-over effects (i.e., emotional stimuli disrupt performance of subsequent stimuli) take stronger effect in blocked formats (e.g., McKenna & Sharma, 2004; Sharma & McKenna, 2001). Beyond, inter-item priming between stimuli of the same condition might be more pronounced in the blocked format as stimuli are presented concurrently, leading to more interference (Dalgleish, 1995). These methodological differences further constrain comparability between studies.

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