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Early emotional processing deficits in depersonalization: An exploration with event-related potentials in an undergraduate sample

Conny W.E.M. Quaedflieg [a,*], Timo Giesbrecht [a], Ewout Meijer [a], Harald Merckelbach [a], Peter J. de Jong [b], Haraldur Thorsteinsson [b], Tom Smeets [a], Daphne Simeon [c]

[a] Faculty of Psychology and Neuroscience, Maastricht University, the Netherlands
[b] Department of Clinical Psychology and Experimental Psychopathology, University of Groningen, the Netherlands
[c] Department of Psychiatry, Beth Israel Medical Center, New York, NY, USA

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ABSTRACT

Emotional stimuli may draw attention to such an extent that they hamper the processing of subsequent signals, a phenomenon termed emotion-induced blindness (EIB). As depersonalization is associated with self-reported attenuated emotional responses, the present study explored whether individuals scoring high on the Cambridge Depersonalization Scale (CDS; $n=15$) exhibit a diminished EIB effect relative to low CDS scoring individuals ($n=15$), and whether attentional processes reflected in event-related potentials (ERPs) are implicated in this effect. We obtained an EIB effect such that emotional distractors that preceded targets with a lag of 200 ms reduced correct detection of targets. Although the magnitude of this effect was similar for high and low CDS participants, high CDS participants exhibited a significantly lower ERP amplitude at the frontal lead in the 200–300 ms window than did low CDS individuals to targets that followed emotional versus neutral distractors. This latter effect was significantly related to the Alienation factor of the CDS. This pattern suggests that difficulties in the discrimination between emotional and neutral stimuli relate to the feeling of unreality in depersonalization.

1. Introduction

Emotionally salient stimuli tend to capture and hold attention. This characteristic helps us to prioritize information processing in an increasingly complex world (Nummenmaa et al., 2006; Vuilleumier, 2005; Schupp et al., 2006). Most et al. (2005) demonstrated that the attention-grabbing and -holding capabilities of emotional stimuli are so profound that attention remains focused even after the offset of the emotional stimuli. Specifically, these authors showed that individuals performed substantially worse at correctly perceiving target stimuli when these targets were preceded by an emotionally aversive distractor, a phenomenon dubbed emotion-induced blindness (EIB).

Evidence showing that emotional stimulus value helps us to focus our limited amount of attention to potentially relevant stimuli is abundant. However, one may wonder whether this is also true for individuals suffering from depersonalization and derealization, as these individuals report a lack of emotional responsivity to other people or external events (e.g., objects) (Simeon, 2004) and concomitant high levels of internal distress and anxiety (Simeon and Abugel, 2006). The Diagnostic and Statistical Manual of Mental Disorders (DSM IV-TR; American Psychiatric Association, 2000) describes depersonalization and derealization as "an alteration in the perception or experience of the self so that one feels detached from, and as if one is an outside observer of, one's mental processes or body (e.g., feeling as in a dream)" and "an alteration in the perception or experience of the external world so that it seems strange or unreal (e.g., people seem unfamiliar)", respectively.[1] Transient experiences of depersonalization are common in the general population, with a prevalence of about 19% as found in a representative telephone survey that measured the self-reported presence of DSM-IV criteria for DPD/DR during the last 12 months (Aderibigbe et al., 2001). However, when depersonalization becomes persistent or recurrent and is associated with significant distress and/or impairment, a diagnosis of Depersonalization Disorder (DPD) should be considered. Using the Present State Examination, the prevalence of DPD was estimated to be 0.95% in a recent population-based birth cohort from the UK (Lee et al., 2012).

Although pertinent research into the cognitive impairments associated with depersonalization is limited (Giesbrecht et al.,

* Correspondence to: Conny Quaedflieg, Faculty of Psychology and Neuroscience, Maastricht University, PO Box 616, 6200 MD, Maastricht, the Netherlands. Tel.: +31 43 388 4536, fax: +31 43 3884196.
E-mail address: conny.quaedflieg@maastrichtuniversity.nl (C.W.E.M. Quaedflieg).

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[1] Depersonalization and derealization are highly related to each other, which is why, in line with common practice in the literature, we will use the term depersonalization as encompassing both phenomena.

2008a), robust evidence both on the behavioral and on the neurobiological level shows that DPD goes along with deficits in emotion processing. On the behavioral level, two factor analytic studies addressing the Cambridge Depersonalization Scale (CDS), a self-report questionnaire measuring DPD symptoms, identified five unique subscales of which emotional numbing explained the largest proportion of variance in CDS scores (Sierra et al., 2005; Simeon et al., 2008). Further support for a deficit in the normal discrimination between emotional and neutral material comes from imaging and autonomic response studies. For example, Sierra et al. (2002b) showed that DPD patients exhibit reduced skin conductance responsivity (SCR) to emotionally aversive, but not unspecific, stimuli compared with both normal controls and anxiety disordered patients. This finding is underlined by data from our laboratory showing that in DPD patients the time course of physiological responding to an emotionally negative video differs profoundly from that typical for normal controls. That is to say, patients exhibit a reduced latency of SCRs in combination with a subsequent flattening of responses (Giesbrecht et al., 2010). Germane to this are also experimental studies on dissociation indicating that high levels of dissociation are associated with rapid habituation of the SCR. For example, Giesbrecht et al. (2008b) noted that students with heightened acute dissociation as indexed by the Peritraumatic Dissociative Experiences questionnaire (PDEQ) showed a relatively fast habituation of SCR, defined by the occurrence of two consecutive non-response SCR trials (<0.05 microsiemens), to aversive auditory stimuli.

Using functional magnetic resonance imaging (fMRI), Medford et al. (2006) demonstrated that in contrast to findings in healthy controls, encoding of emotional and neutral words did not lead to differential patterns of brain activation in patients with DPD. Both emotional and neutral words were processed in a highly similar manner in this group. Behaviorally, the patients exhibited better memory for aversive as compared to neutral words, but there was no enhancement of memory for neutral words in an aversive context compared to a neutral context. More strikingly, in another study, DPD patients rated aversive stimuli as equally emotional as the neutral scenes (Phillips et al., 2001). These ratings went along with increased activation in the right ventral prefrontal cortex (Brodmann area (BA) 47), but not the left insula in response to aversive scenes compared to healthy controls and patients with Obsessive-compulsive disorder. This is of particular relevance as the ventrolateral right prefrontal cortex, an area involved in appraisal and regulation of emotion, inhibits the insula, an emotion sensitive area especially for negative emotions and disgust (Phillips et al., 2001). This pattern of findings is consistent with the view of selective inhibition of emotion processing or a emotional shut-down mechanism that some researchers have postulated to be typical for dissociation in general and depersonalization in particular (Sierra and Berrios, 1998; Giesbrecht et al., 2008b).

The EIB is a behavioral phenomenon that only demonstrates visual processing impairments without unveiling the underlying biological mechanism. Skin conductance measurements to some extent capture this mechanism, but merely index overall physiological arousal. Whereas changes in metabolism or blood flow are indirect reflections of neuronal activity, electroencephalography (EEG) can provide direct real-time information about ongoing cerebral processes. One way to expand the current corpus of knowledge on emotion processing and depersonalization symptoms is to use event related potentials (ERPs) obtained using EEG. ERPs reflect cortical information processing and have widely been used to study emotion and attention (Cacioppo et al., 2007; Luck et al., 2000; Schupp et al., 2006).

The present study aimed to further investigate emotion processing in depersonalization by combining the EIB paradigm with an ERP approach. More specifically, we explored how a tendency to experience depersonalization symptoms affects the time course of disengagement from emotional stimuli at the behavioral level (as reflected in the EIB effect) and at the electrophysiological level (reflected in ERP indices of early attentional processing and emotional arousal). To isolate ERP responses, difference waves to targets were calculated by subtracting ERPs to targets that followed neutral distractors from ERPs to targets that followed emotional distracters (Luck et al., 2000). This corrects for the overlap of stimuli in the rapid serial visual presentation (RSVP) paradigm and enables isolation of the ERPs for targets due to the well-known affect and arousal sensitivity of EEG components.

To the extent that individuals with a heightened tendency to depersonalize exhibit a blunted processing of emotional stimuli, one would expect these individuals to demonstrate a less pronounced EIB effect quantified by the correct detection rates of targets following emotional stimuli. Second, to the extent that blunted emotion processing associated with depersonalization is related to early attention and emotional arousal mechanisms, one would expect this to be reflected in the ERPs of persons scoring high on depersonalization. Specifically, we predicted that participants scoring high on depersonalization would exhibit a smaller difference in ERP amplitude to targets that followed emotional versus neutral distractors compared with participants scoring low on depersonalization. Finding such a pattern would provide insight into time course of disengagement from emotional stimuli in depersonalization.

2. Methods

2.1. Participants

During mass testing sessions ($N=310$), undergraduate students enrolled at Maastricht University filled out the Cambridge Depersonalization Scale (CDS; Sierra and Berrios, 2000; see below). For the current study, students with CDS scores below 55 or above 80 were invited to volunteer as participants. The overwhelming majority of participants, who were invited to participate, agreed to volunteer in this study. They were given a financial compensation or partial course credit. Cut-off scores were based on Sierra and Berrios' (2000) suggestion to use a cutting score of 70 for the detection of DPD. The sample comprised 15 low-depersonalization individuals and 15 high-depersonalization individuals.[2] The two groups did not differ in terms of age (see Table 1) and were matched in terms of gender, with both groups containing 11 women. The study was approved by the standing ethical committee of the Faculty of Psychology and Neuroscience, Maastricht University, and all participants were naïve as to the purpose of the study.

2.2. Measures

Cambridge Depersonalization Scale (*CDS; Cronbach's alpha=0.95;* Sierra and Berrios, 2000). The CDS consists of 29 items that require respondents to rate depersonalization symptoms over the "last 6 months" on a 5-point frequency scale (anchors: 0=*never*; 4=*all the time*) and a 6-point duration scale (anchors: 1=a *few seconds*; 6=*more than a week*). All CDS frequency and duration scores are summed to obtain a total score. The scale is able to differentiate between patients with DPD and patients with anxiety disorders, patients with temporal lobe epilepsy, and healthy controls. Sierra and Berrios (2000) report sound psychometric properties for the CDS. In a factor analytic study, Sierra et al. (2005) identified four CDS subscales: Anomalous Body Experiences (e.g., "I have to touch myself to make sure that I have a body or a real existence."), Emotional Numbing (e.g., "When I weep or laugh, I do not seem to feel any emotions at all."), Anomalous Subjective Recall (e.g., "It seems as if things that I have recently done had taken place a long time ago."), and Alienation from Surrounding (e.g., "Out of the blue, I feel strange, as if I were not real or as if I were cut off from the world.").

Dissociative Experiences Scale (DES; Cronbach's alpha=0.92; Bernstein and Putnam, 1993). The DES is a 28-item self-report scale that asks respondents to indicate the frequency of various dissociative experiences rated on 0% to 100% visual-analogue

[2] One high-depersonalization participant performed just about chance level (mean accuracy=61%, 3.13 *SD*'s below the mean) on the Emotional Scenes Task, probably indicating a lack of motivation. This participant was excluded from the study and another participant was recruited to replace the excluded participant.