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Digestive and cardiovascular responses to core and animal-reminder disgust

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ABSTRACT

The two-stage model of disgust differentiates between core and animal-reminder (AR) disgust [Rozin P., Fallon A., 1987. A perspective on disgust. Psychological Review 94, 23–41]. This study investigates whether core and A-R disgust elicit distinct physiological reaction patterns. Further, in line with the idea that A-R disgust is critically involved in blood phobia and may explain typical phenomenology of psychopathological symptoms (e.g., dizziness), we investigated whether physiological patterns (if present) would differ specifically for A-R disgust between high and low blood-fearful participants. Therefore, high ($n = 30$) and low ($n = 30$) blood-fearful individuals engaged in guided imagery of core disgust, A-R disgust, and neutral stimuli. Overall, both disgust scripts lead to increased activity in the digestive component of the autonomic nervous system (ANS). For cardiac components, sympathetic activity decreased, whereas no parasympathetic reactivity was observed compared to the neutral script. No differences were observed in physiological reactivity between the A-R and core disgust scripts. Meanwhile, in line with the idea that disgust is involved in blood phobia, subjective symptoms of vomit and dizziness did differentiate between high and low blood-fearful participants, as subjective symptoms were most pronounced in the high blood-fearful group. Contrary to our expectations, increases in subjective symptoms were apparent for both disgust types and not specifically for A-R disgust. So, physiological reactivity appeared relatively independent of type of disgust elicitor which, in turn, may reflect a general hard-wired protective mechanism to prevent contamination with pathogens.

From an evolutionary perspective, disgust is seen as a defensive mechanism protecting the organism from contamination by pathogens (Rozin and Fallon, 1987). Accordingly, disgust is focused on the intersection between the body and the environment and concentrates on the skin and body apertures (Rozin et al., 1995; Fessler and Haley, 2006). The strength of the disgust response increases as a function of proximity of the potential contaminant and the sense of inclusion. Thus, the closer the stimulus and/or the more intense the physical contact, the stronger is the disgust response. Core disgust is exemplified by food-rejection responses, reactions that occur at the threat of consuming a disgusting stimulus (Rozin and Fallon, 1987; Power and Dalgleish, 1997).

In his two-stage model of disgust, Rozin and colleagues argued that the defensive mechanism of disgust originally evolved to prevent the body from contamination by pathogens and toxins from the outside environment (core disgust) is extended to stimuli and/or behaviors that remind us of our animal nature (Rozin et al., 1999a). Accordingly, people are not only disgusted at the prospect of having to consume something disgusting, they also tend to be disgusted by stimuli that emphasize the similarities between humans and animals. This reminder that people are of animal origin is a thought that most people consider unacceptable (Rozin et al., 1999a), presumably because humans wish to rise above the animal kingdom, and not be reminded that they too are mortal creatures of flesh and blood. Therefore, disgust for these stimuli is labeled animal-reminder disgust (A-R; Haidt et al., 1994).

Consistent with the two-stage disgust model of Rozin et al. (1999a), factor analytical studies have shown that core disgust and animal-reminder disgust elicitors can be systematically distinguished as separate constructs (Olatunji et al., 2007). Moreover, there is accumulating evidence that disgust is involved in various psychopathological complaints (Olatunji and McKay, 2007). Adding to the validity to differentiate between A-R and core disgust, a series of studies provided evidence that A-R and core disgust are differentially involved in these various types of psychopathological symptoms. For example, fear of spiders is typically associated with heightened levels of core disgust propensity (i.e., tendency to experience core disgust more rapidly),

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whereas fear of blood–injury stimuli has been found to be specifically associated with a heightened disgust propensity for A-R stimuli (de Jong and Merckelbach, 1998). More recently, Sawchuk et al. (2000) corroborated these earlier findings showing that blood–injection phobics displayed a stronger disgust propensity for A-R stimuli than spider phobics or non-phobics, whereas no such difference was evident for core disgust stimuli.

The major aim of the present study was to establish whether core and animal-reminder disgust may not only vary in their reference to different classes of disgust elicitors, but perhaps also in their concomitant response patterns of the autonomic nervous system (ANS). If so, this would not only further substantiate the validity of distinguishing between different types of disgust, it may also help explaining the typical phenomenology of psychopathological symptoms that are related to each of these types of disgust.

For example, blood phobia is typically characterized by dizziness and feeling faint (Page, 1994), whereas these symptoms are usually absent in other disorders in which disgust is also assumed to be critically involved such as spider phobia. One explanation might be that specifically confrontation with A-R disgust stimuli (e.g., blood) results in a sympathetic withdrawal and/or parasympathetic activation of cardiovascular components of the ANS resulting in a drop in blood pressure which, in turn, may give rise to feelings of dizziness. Indeed, blood and injection stimuli have been found to lead to the so called diphasic response (i.e., initial increase in sympathetic nervous system (SNS) activity, followed by a sudden and possibly parasympathetically mediated drop below baseline levels). Most importantly, this response was most pronounced in blood-fearful persons with relatively high levels of disgust propensity (Page, 2003).

Since core disgust originates from a withdrawal response regarding the oral incorporation of potential contaminants (Rozin et al., 1999a,b), it would make sense that core disgust typically activates digestive rather than cardiovascular components of the ANS (e.g., saliva production, tendency to vomit). This may explain why feelings of dizziness are generally absent in psychopathological symptoms in which core disgust rather than A-R disgust is assumed to be critically involved (e.g., spider phobia; de Jong and Merckelbach, 1998). Germane to the alleged role of the digestive nervous system in food aversion responses, it has been shown that consuming aversive bitter tasting foods increases saliva production (Norris et al., 1984). Such increased saliva production is closely associated with a gaping response or vomiting (Hornby, 2001) and is thus likely to be the result of experienced disgust or nausea.

We decided to use guided imagery, because it might well be that using emotionally more intense movie clips or behavioral experiments may elicit 'fight/flight'-responses that interfere with the generation of straightforward disgust responses. That is, the 'fight/flight'-response is associated with an increase in sympathetic and parallel decrease in parasympathetic reactivity (Barron and van Loon, 1989; McDougall et al., 2005). It has been proposed that disgust is associated mainly with parasympathetic activity (Levenson, 1992). Since increases in sympathetic activity are generally associated with fear and anxiety, it is reasonable to assume that emotionally intense stimuli that evoke stronger sympathetic activity will reduce the sensitivity of the procedure to detect genuine disgust-induced (para)sympathetic response patterns. Imagination procedures seem less susceptible to such undesirable influences as participants remain in control over their emotional regulation, yet, they are nevertheless effective in evoking emotions (Lang, 1979; Prkachin et al., 1999; Vrana, 1993). Moreover, confrontation with a stressor may activate particularly sympathetically mediated activity in the cardiovascular system (Barron and van Loon, 1989). Since we were interested in parasympathetic influences on the cardiovascular system, imagery was chosen as it may limit the effects of sympathetically mediated activity on this system.

To examine whether distinct disgust types evoke separate physiological response patterns, the study focused on core and A-R disgust elicitors. Core disgust imagery was hypothesized to induce activity of the digestive component of the ANS (increase in saliva production), whereas A-R disgust imagery was hypothesized to elicit reactivity of the vascular component (characterized by SNS withdrawal and PNS activation as indexed by increased T-wave amplitude, increased activity in the high frequency power band of heart rate variability, and a decrease in mean arterial pressure).

Further, given the predominant role of disgust in blood phobia (e.g., Page, 1994), we tested whether blood-fearful participants and non-blood-fearful participants would differ in their subjective and physiological responding to core and A-R disgust elicitors. On the basis of previous findings that blood-fearful individuals typically display inflated levels of A-R disgust propensity (e.g., de Jong and Merckelbach, 1998), we anticipated that high blood-fearful individuals would report more intense feelings of disgust and heightened physiological reactivity in response to A-R imagery than to core imagery compared to low blood-fearful individuals (in particular, increased T-wave amplitude, increased activity in the high frequency power band of heart rate variability, and a decrease in mean arterial pressure). There are only a few studies in the literature that examined the peripheral physiological reactivity toward disgusting stimuli, and all of these studies used blood-related stimuli such as cardiac surgery clips (e.g., Palomba et al., 2000). It is therefore difficult to decide on the basis of these earlier findings whether these responses are specific for blood-related stimuli or are also representative for A-R disgust or disgust in general. Especially, since blood-fearful individuals report to experience both fear and disgust for blood stimuli (e.g., Lumley and Melamed, 1992; Tolin et al., 1997; Ritz et al., 2005). Therefore, an A-R script was used without references to blood stimuli to avoid confounding by fear-induced physiological reactivity. Reactivity during core disgust imagery was assumed to be similar for both groups (in particular, increased production of saliva and increased activity in the m. levator).

1. Methods

1.1. Participants

The participants were students at Maastricht University, from the faculties of Health Sciences, Medicine, and Psychology. The participants were recruited via posters, and advertisements in the university buildings and asked to complete the blood subscale of the medical fear survey (MFS; Kleinknecht et al., 1996). From a total of 246 respondents, the 30 lowest and 30 highest blood-fearful individuals were invited to participate in the present experiment. Since most of the students at these faculties are women, the research population also consists predominantly of women (86.7%). The mean age was 22.9 years (S.D. = 6.86). Participants were assigned to the high blood-fearful group, if two of the following criteria were met: (a) they rated themselves at least 7 on a scale from 1(=not blood fearful at all) to 10 (=extremely blood fearful), (b) MFS-blood >5, and (c) blood–injury phobia questionnaire-fear subscale (BIQ-fear; de Jong and Merckelbach, 1998) >20. Participants were assigned to the low blood-fearful group, if they (a) rated themselves non-blood fearful (<5), (b) MFS-blood <5, and (c) BIQ-fear <18. Of the blood-fearful group, 90% were women (27 women and 3 men) whereas in the low blood-fearful group, 83% were women (25 women and 5 men).

1.2. Materials

1.2.1. Questionnaires on fear of blood

1.2.1.1. Multidimensional blood/injury phobia inventory (MBPI; Wenzel and Holt, 2003). This questionnaire was devised to measure the full range of phobic fears in blood phobia. The MBPI assesses four types of stimuli (injections, injury, hospitals, blood) and five types of responses (fear, avoidance, worry, fainting and disgust), and a self versus other focus. It consists of 40 items on a five-point scale (0 = very slightly or not at all; 4 = extremely). Based on factor analysis, six subscales have been identified in the MBPI: injections, hospitals, fainting, blood-self, injury and blood–injury–others (Wenzel and Holt, 2003). Internal consistency is good (Cronbach's alpha = .91).