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Disgust- and anxiety-based emotional reasoning in non-clinical fear of vomiting



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ABSTRACT

Background and objectives: Emotional reasoning has been described as a dysfunctional tendency to use subjective responses to make erroneous inferences about threatening outcomes in objectively safe situations (e.g., "If I feel anxious/disgusted, there must be danger/risk of becoming ill"). Prior studies found evidence for anxiety-based emotional reasoning (ER) in several anxiety disorders as well as disgust-based ER in healthy individuals scoring above the clinical cut-off on a measure of contamination fear. The current study tested whether disgust- and anxiety-based ER might be involved in fear of vomiting, a phobic disorder in which both fear/anxiety and disgust are assumed to play an important role.

Methods: Non-clinical participants scoring high (>75%; n = 35) and low (<25%; n = 38) on a measure of fear of vomiting were presented with a series of scripts describing objectively safe everyday situations that systematically varied in the absence/presence of the actor's disgust/anxiety response. Following each script, participants rated their perceived danger and threat of contamination/illness.

Results: In line with hypotheses, specifically high vomit-fearful individuals used experienced disgust and anxiety to overestimate risk of becoming ill. Follow up analyses taking into account shared variance between both emotions revealed that more pronounced ER in the high vomit fearful group was mainly driven by the emotion of disgust.

Limitations: Current study asked participants to imagine experienced emotions in scenarios instead of experimentally inducing real-life emotions.

Conclusions: These findings are consistent with the view that disgust-based ER is involved in fear of vomiting.

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1. Introduction

According to the Diagnostic and Statistical Manual of Mental Disorders (DSM-5, APA, 2013), patients with a specific phobia of vomiting (SPOV) show an irrational fear of vomiting together with avoidance behaviours related to vomiting-relevant situations. SPOV is also known as emetophobia. Descriptive studies on clinical features indicate that emetophobia has an early onset (between 13 and 18 years) and a chronic course with a large number of patients showing marked impairments in daily life (Lipsitz, Fyer, Paterniti, & Klein, 2001; Veale & Lambrou, 2006). Regarding prevalence rates, Becker et al. (2007) found a point prevalence rate of 0.1% for SPOV in a sample of 2064 young German women (18–24 years of age).

Using more lenient inclusion criteria for investigating elevated (non-clinical) levels of fear of vomiting in the population, a recent study using a Dutch community sample (Van Hout & Bouman, 2012) showed a point prevalence rate of 8.8% with the proportion of women being four times higher than the proportion of men (see also Veale & Lambrou, 2006). Avoidance and safety seeking behaviours vary greatly between subjects with fear of vomiting; commonly reported are checking food for expiration dates, avoiding drunk, sick and/or unhealthy people, carrying or taking stomach pills, avoidance of taking alcohol, and eating unknown food. For some women, their fear of vomiting would even let them consider postponing pregnancy because of the risk of pregnancy-related nausea and vomiting. The focus of emetophobic fears can differ across individuals; for some individuals their fear is focussed on vomiting themselves or on vomiting in the presence of others, whereas others tend to fear seeing others vomiting. Given these loci, it may not come as a surprise that surveys involving emetophobic participants have found a significant overlap in

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phenomenology with panic disorder, OCD-contamination fear, and social anxiety/agoraphobia (i.e., fear of negative social evaluation) (Boschen, 2007; Van Hout & Bouman, 2012; Veale & Lambrou, 2006).

With the aim of improving current understanding of emetophobic fears, Boschen (2007) proposed a conceptual model describing predisposing factors, an acute phase, and maintenance factors underlying pathological fears of vomiting. In his model, predisposing factors consist of general anxiety vulnerability (e.g., neuroticism, trait anxiety) and somatization vulnerability (vulnerability to express anxiety through gastrointestinal somatic symptoms such as nausea and “butterflies.”). According to Boschen (2007) both vulnerability factors may increase the risk of interpreting interoceptive cues as indication of imminent vomiting during the acute phase of the disorder (e.g., entering vomit-related but objectively safe situations). Finally, this misinterpretation of innocuous cues as signals of immediate danger will lead to typical avoidance and safety-seeking behaviours and a consequent failure to gather disconfirming evidence in the maintenance phase of the disorder.

Although this conceptual model provides a helpful framework for understanding emetophobia, by exclusively focussing on fear-based mechanism it seems to ignore that other emotions than fear may play a role as well. As vomit is among the universally accepted disgust stimuli (Rozin, Haidt, & McCauley, 2000) it seems reasonable to assume that in addition to fear/anxiety also disgust might be involved in emetophobia. In support of this, it has been shown that people with emetophobia have increased levels of both disgust propensity and disgust sensitivity (van Overveld, de Jong, Peters, van Hout, & Bouman, 2008). Disgust propensity has been described as a tendency to experience disgust in a wide variety of situations (low disgust threshold), while disgust sensitivity indicates how awful participants consider disgust experiences in general (van Overveld, de Jong, Peters, Cavanagh, & Davey, 2006). Moreover, within the group of people with emetophobia there was a strong relationship between the strength of symptoms and the level of disgust sensitivity. A more recent study that was designed to evaluate the psychometric properties of a recently developed inventory to measure emetophobic symptoms similarly showed that high scoring individuals on fear of vomiting were also likely to report high levels of disgust sensitivity (Veale, Ellison, et al., 2013; Veale, Murphy, Ellison, Kanakam, & Costa, 2013; see also Boschen, Veale, Ellison, & Reddell, 2013).

One way disgust may promote the development and persistence of emetophobic concerns is via emotional reasoning. Emotional reasoning involves using feelings as validation of dysfunctional thoughts and beliefs, for example, “If I feel anxious, there must be danger”, or “If I feel disgusted, I must be getting ill” (Arntz, Rauner, & van den Hout, 1995; Verwoerd, de Jong, Wessel, & van Hout, 2013). People with a tendency to show emotional reasoning may draw conclusions about the presence of impending danger purely on emotional response information. In the absence of objective danger, this heuristic would hamper the identification of false alarms (i.e., feelings of fear/disgust but no danger/risk of becoming ill) and contribute to the persistence of erroneous, phobic beliefs (cf. Slovic, Finucane, Peters, & MacGregor, 2002). In other words, if people erroneously interpret feelings of fear or disgust as signalling danger, and use their emotional response as input in the process of validating their lingering concerns they will enter a danger-confirming vicious circle.

In a first experiment to test emotional reasoning in anxiety disorders, participants read a series of scenarios comprising of four versions of each scenario that always started identical but ended differently in a way to systematically vary the absence/presence of

objective danger and the absence/presence of anxiety responses (Arntz et al., 1995). Following each script, participants rated the level of perceived danger. By systematically varying the absence/presence of the actor's anxiety response, this design allowed testing whether patients with anxiety disorders infer danger on the basis of anxiety responses (in addition to objective threats). In support of the hypothesis that anxiety patients would use the emotional information to infer danger, specifically anxiety patients reported higher threat ratings for the scenarios in which an anxiety response was present relative to scenarios in which the anxiety response was absent. More recent research demonstrated that this type of emotional reasoning might not be restricted to anxiety-based inferences and showed evidence for disgust-based reasoning in fear of contamination (Verwoerd et al., 2013): When contamination fearful individuals were presented with disgust response information in scenarios low in objective threat, they significantly overestimated the risk of contracting a disease.

The major aim of the current study was to investigate whether emotional reasoning might also be involved in fear of vomiting. Since both anxiety and disgust seem involved in emetophobia, we included measures of both disgust and anxiety-based emotional reasoning. Participants high and low on fear of vomiting (Bouman & van Hout, 2006; van Overveld et al., 2008) were presented with a series of objectively safe vomit-related scripts (e.g., a hospital visit) varying in the presence/absence of a disgust/anxiety response. Subsequently, participants rated the scenarios on perceived danger, risk of contamination, and risk of becoming ill. Because disgust is a defensive emotion that specifically serves disease-avoidance (e.g., Curtis, 2013), we anticipated that disgust-based reasoning would be especially pronounced with regard to the participants' estimations of the risk of becoming ill (cf. Verwoerd et al., 2013). Because anxiety serves a more general threat-avoidance function, we anticipated that adding an anxiety response would result in a more general increase in participants' danger/risk ratings.

2. Method

2.1. Participants

Participants (N = 144; mean age = 22.62, SD = 7.12) were recruited via mail contact and social media such as Facebook. The majority of participants were female (77%) which reflects the gender distribution of the undergraduate psychology student population at our university. Based on scores of the Emetophobia Questionnaire (EQ; Bouman & van Hout, 2015 unpublished manuscript), groups scoring high and low on fear of vomiting were selected by taking participants from the highest- (EQ > 174; n = 35; 89% females; range: 174–328) and lowest quartile range (EQ < 133; n = 38; 66% females; range: 98–133).

2.2. Materials

2.2.1. Online task

The task and questionnaires were generated using Qualtrics Labs, Inc. software, version 12.018 of the Qualtrics Research Suite Copyright© 2005, which specializes in the construction of online questionnaires. This method provided the opportunity for participants to complete the study from their own PC at home at a self-selected time.

Scenarios. We constructed the scenarios along the lines of Verwoerd et al. (2013; see also Arntz et al., 1995). Participants were presented with a series of scripts describing everyday scenarios which were objectively safe but relevant for people with elevated scores on fear of vomiting (see below). Each scenario was followed

by six 100 mm visual analogue scales (VAS), on which they could rate the event on various aspects. Three VASs were used as the dependent variables: danger, risk of contamination, and risk of becoming ill. The scales ranged from 0 = *no danger at all* to 100 = *very dangerous*, 0 = *absolutely no risk of contamination* to 100 = *very high risk of contamination*, and 0 = *absolutely no risk of becoming ill* to 100 = *very high risk of becoming ill*. The three other VASs were used as filler items to render the aim of the study less obvious. Each participant was presented with 8 unique scripts/stories that were randomly connected to particular response information. For all participants always 2 scenarios indicated that the actor experienced a disgust response, in 2 other scenarios the actor experienced anxiety/fear, whereas in the 4 remaining scripts emotional response information was omitted. All scenarios were shown on separate screens, and were randomly ordered, for each individual separately.

The following sample items illustrate the three types of scenarios for one particular story/script:

Scenario without emotion response information (translation of original scenario in Dutch):

“On a Sunday morning you wake up early. You had a good rest. Because it is a sunny morning, you decide to go for a run in the local park. During running you notice an odd feeling in your stomach, probably because you did not eat enough during breakfast. Fortunately, you are almost home. Back home, you take a banana”

Scenario with disgust response information:

“On a Sunday morning you wake up early. You had a good rest. Because it is a sunny morning, you decide to go for a run in the local park. During running you notice an odd feeling in your stomach, probably because you did not eat enough during breakfast. Fortunately, you are almost home. Back home, you suddenly feel disgusted”

Scenario with anxiety response information:

“On a Sunday morning you wake up early. You had a good rest. Because it is a sunny morning, you decide to go for a run in the local park. During running you notice an odd feeling in your stomach, probably because you did not eat enough during breakfast. Fortunately, you are almost home. Back home, you suddenly feel anxious”

To control for potential order effects related to the content of the specific stories/scripts, the 8 scenarios with and without emotion response information (anxiety, disgust) were counterbalanced over 4 versions of the task. Each version consisted of the same 8 stories/scripts but varied in the specific endings (disgust response, anxiety response, no response).

2.2.2. Emetophobia Questionnaire(EQ)

The EQ (Bouman & van Hout, 2015 unpublished manuscript; van Overveld et al., 2008). contains 115 items on various aspects of emetophobia, such as worrying about vomiting, bodily sensations, fear of vomiting (e.g., ‘I am afraid of becoming nauseous’), avoidance of vomit-related situations (e.g., ‘I avoid being around people who look as if they may be sick’) and items (the last 16) dealing with the consequences of emetophobia in everyday life. Items are answered on a 5-point Likert scale (1 = ‘not at all’ to 5 = ‘very much’). In the current study, the total scores for the first 98 items (scoring range: 98–574; $\alpha = .96$) were selected for further

analyses (see van Overveld et al., 2008). The last 16 items that focused on dealing with the consequences of emetophobic fears in everyday life were not used in the current unselected sample of participants.

2.2.3. Disgust propensity and sensitivity scale-revised (DPSS_R)

The DPSS_R (van Overveld et al., 2006) consists of 16 items measuring disgust propensity (i.e., the tendency to experience disgust in a wide variety of situations) and sensitivity (i.e., how awful do participants consider this disgust experience). Items are rated on a 5-point scale from 1 (=‘never’) to 5 (=‘always’) with total scores ranging from 16 to 80. The DPSS-R and its subscales have shown to be internally consistent with alphas $> .71$ (e.g., van Overveld et al., 2006; van Overveld et al., 2008). In the present study internal consistency was high for both propensity and sensitivity (alphas $> .79$).

2.3. Data reduction and statistical analyses

Prior to selection of the final 8 scripts (i.e., thematic stories), a larger set of 16 scripts without emotion response information was presented to 4 experts in the field of emetophobia. These persons were asked to rate the scripts on relevance for people with a fear of vomiting (0 = not relevant at all; 7 = very much relevant) and emotionality (−3 = strong negative valence; 0 = neutral; +3 = strong positive valence). This resulted in the selection of a series of 8 scripts that could be defined as relevant and objectively safe (relevance scores equal to or above 5 and emotionality ratings between −1 and 1).

For the main analyses, the VAS ratings of the dependent variables ‘danger’, ‘risk of becoming contaminated’, and ‘risk of becoming ill’ were subjected to 3 mixed ANOVAs conducted to investigate disgust- and anxiety-based reasoning. In these analyses, EQ-scores (high and low) were included as between-subject factor, and scores for ER (disgust, anxiety) as within-subject factor. These ER scores were computed by subtracting the ratings related to scenarios without an emotional response from ratings related to scenarios in which an emotional response (disgust or anxiety) was present. This was done for each of the 3 outcome measures separately. To check for potential order effects, analyses were repeated with a dummy coded covariate representing the 4 versions participants were randomly allocated to. As none of the main or interaction effects with version approached significance these findings are not reported in the results section. If any of the 3 ANOVAs on danger, contamination, or illness ratings showed evidence for more pronounced emotional reasoning in the high EQ group, analyses were followed up by logistic regression analyses testing unique contributions of both disgust- and anxiety-based ER in the prediction of high fear of vomiting. In these analyses group membership was included as dependent variable and the indices for disgust and anxiety-based ER as independent variables. This type of analysis makes it possible to test unique effects of ER when taken into account the variance shared on the outcome measures between emotions of disgust and anxiety.

Because of the unequal gender distribution between the low- (66% female) and high (89% female) EQ group, we repeated all main analyses with only the group of female participants included. These analyses did not alter the main pattern of findings regarding the two-way interactions with EQ-group. Therefore, we omitted these analyses from the article and report only the results using the total sample. As measure of effect size, we reported partial η^2 (small = .01, medium = .07, large = .14; cf. Cohen, 1992).

3. Results

3.1. Descriptive statistics and explorative correlations

An overview of the VAS-ratings for ‘danger’, ‘risk of becoming contaminated’, and ‘risk of becoming ill’ is presented in Table 1. Furthermore, using the whole sample of 146 participants, both disgust propensity and disgust sensitivity showed strong and positive correlations with total scores on the EQ (propensity: $r(144) = .56, p < .001$; sensitivity: $r(144) = .74, p < .001$).

3.2. Emotional reasoning

3.2.1. Danger

The ANOVA with danger ratings as dependent variable showed an intercept significantly different from zero, indicating that in general, adding an emotion response to scenarios resulted in higher danger ratings, $F(1, 71) = 15.66, p < .001$, partial $\eta^2 = .18$. The main effect of group did not reach significance, suggesting no evidence for more pronounced ER in the high EQ group $F(1, 71) = 2.12, p = .15$, partial $\eta^2 = .03$. Additionally, the non-significant main effect of emotion response revealed that in general the strength of emotional reasoning was similar for disgust and anxiety, $F(1, 71) = 0.61, p = .41$, partial $\eta^2 = .01$. This pattern was similar for both groups as evidenced by the absence of a significant interaction between type of emotion and group membership, $F(1, 71) = 0.31, p = .58$, partial $\eta^2 < .01$.

3.2.2. Risk of becoming contaminated

Results of the ANOVA with scenarios rated on risk of becoming contaminated showed a significant intercept, $F(1, 71) = 18.76, p < .001$, partial $\eta^2 = .21$, indicating a general effect of ER on contamination ratings. The main effect for type of emotion response approached significance, suggesting that overestimation of contamination ratings based on emotion response information was stronger for the emotion of disgust than for anxiety, $F(1, 71) = 3.96, p = .05$, partial $\eta^2 = .05$. This pattern was similar for both groups as was evidenced by the absence of two-way interaction between group and response, $F(1, 71) = 0.75, p = .39$, partial $\eta^2 = .01$. There was no main effect of group, $F(1, 71) = 2.31, p = .13$, partial $\eta^2 = .03$, indicating that the overall strength in ER was similar for both groups.

3.2.3. Risk of becoming ill

In line with the analyses above, results of the mixed ANOVA revealed a significant intercept, $F(1, 71) = 33.19, p < .001$, partial $\eta^2 = .32$ indicating an overall effect of ER on risk of becoming ill ratings. Overall, ER was similar for both emotional responses as was

Table 1

Means (SD) of inferring danger, risk of becoming contaminated and risk of becoming ill for the 3 types of scenario-conditions, based on disgust response information, anxiety response information and no response information separately for the high (n = 35) and low (n = 38) scoring groups on the Emetophobia Questionnaire.

EMO group	Response		
	None	Disgust	Anxiety
Danger			
Low	2.69 (6.10)	4.32 (5.29)	6.22 (9.00)
High	6.46 (9.71)	11.19 (13.13)	12.92 (13.25)
Contamination risk			
Low	3.75 (5.83)	8.19 (11.82)	6.19 (9.89)
High	5.21 (9.19)	14.85 (18.60)	11.11 (14.90)
Illness risk			
Low	3.38 (5.55)	8.51 (11.16)	8.48 (12.03)
High	6.57 (11.38)	20.76 (20.63)	19.41 (17.55)

Note: EMO Group = Emetophobia group (high, low).

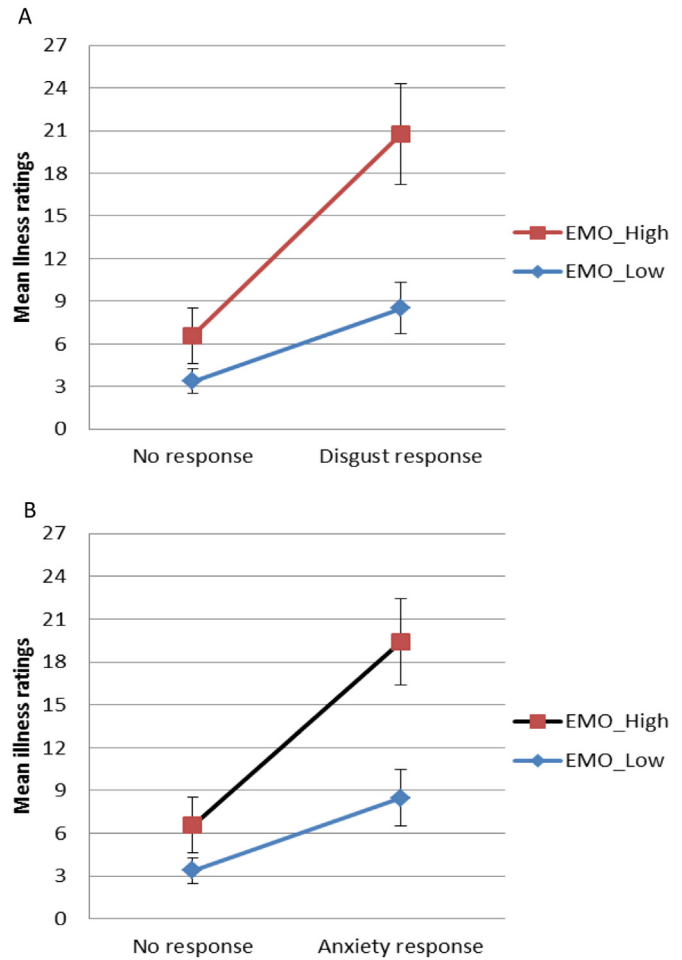


Fig. 1. a) Group means of risk of becoming ill ratings of participants with high and low scores on emetophobia (EMO high/low) as function of disgust response information (present/absent). Steeper slopes reflect stronger tendencies to show disgust-based emotional reasoning. b) Group means of risk of becoming ill ratings of participants with high and low scores on emetophobia (EMO high/low) as function of anxiety response information (present/absent). Steeper slopes reflect stronger tendencies to show anxiety-based emotional reasoning.

evidenced by the absence of a main effect of Emotion, $F(1, 71) = 0.52, p = .47$, partial $\eta^2 < .01$. Importantly, the expected main effect of Group was significant, $F(1, 71) = 5.87, p < .05$, partial $\eta^2 = .08$, indicating that overall ER was most pronounced for the high EQ group. The enhanced ER was largely similar for both emotions as was evidenced by the absence of an interaction between type of emotion and EQ group, $F(1, 71) = 0.50, p = .48$, partial $\eta^2 < .01$ (see also Fig. 1 a and b).

3.3. Testing unique effects of disgust- and anxiety-based ER on fear of vomiting

A logistic regression analysis¹ was conducted to predict high vs. low fear of vomiting using difference scores for disgust- and

¹ To keep this final analysis in line with the earlier mixed ANOVAs that included only high and low scoring participants on the EQ, we decided to use logistic regression instead of multiple linear regression including the entire sample of 144 participants. For the interested reader: a linear regression-analysis provided conceptually similar results with only ER disgust showing independent predicting properties for participants' EQ scores, R^2 total model = 5%, $F(141) = 3.58, p < .05$; Beta ER-Illness disgust = .23, $t(143) = 2.61, p = .01$; Beta ER-Illness anxiety = -.003, $t(143) = -0.39, p = .70$.

anxiety-based ER as predictors. A test of the full model against a constant only model was statistically significant, indicating that the predictors as a set reliably distinguished between scoring high and low on the EQ (chi square = 7.19, $p = .03$ with $df = 2$). The Wald criterion demonstrated that only disgust made a unique contribution to prediction of group membership (Wald = 4.47, $p = .013$). With disgust taken into account, anxiety-based ER was no longer related to scoring high on fear of vomiting (Wald = 0.26, $p = .61$).

4. Discussion

The main findings can be summarized as follows: (i) participants generally used emotional response information (anxiety and disgust) to infer danger, risk of contamination, and risk of becoming ill; (ii) the impact of emotional response information on the subjective risk of becoming ill was especially pronounced in high vomit fearful participants; (iii) follow up analyses taking into account shared variance between both emotions revealed that more pronounced ER in the high vomit fearful group was mainly driven by the emotion of disgust.

These findings suggest that when feeling disgusted or anxious, people may have a general tendency to use these emotional responses to infer danger as well as heightened risk of contamination. This type of emotion-based reasoning (ER) was however unrelated to high levels of vomiting fear. Furthermore, results indicate that high vomiting fearful individuals not just show a bias to relate disgust or anxiety to danger or a heightened probability of contamination per se, but to a heightened probability to contracting a disease. In other words: these individuals specifically overestimate the negative/threatening outcomes associated with disgust or anxiety.

The currently observed involvement of ER in fear of vomiting extends earlier research using script-based methodology to investigate ER in anxiety disordered adults (Arntz et al., 1995; Engelhard, Macklin, McNally, van den Hout, & Arntz, 2001) and contamination-fearful individuals (Verwoerd et al., 2013). In addition to earlier questionnaire studies suggesting a prominent role of enhanced disgust (sensitivity) in emetophobia patients (Boschen et al., 2013; van Overveld et al., 2008), current findings point to a specific role of disgust responding in strengthening illness concerns through ER. The observed role of disgust in fear of vomiting, both in self report studies and as reflected by presently observed higher disgust-based reasoning is consistent with the alleged adaptive function of disgust to protect humans from risk of disease (Oaten, Stevenson, & Case, 2009). The current observation that also participants low in fear of vomiting showed a tendency to overestimate outcomes based on disgust responses, may suggest that disgust-based reasoning serves an adaptive function of protecting the individual against potential contagion/illness, but that in its stronger variants, this reasoning bias may become dysfunctional, supporting the persistence of fear of vomiting.

The current findings may help improving the conceptual understanding of emetophobic complaints and suggest that it might be relevant to include disgust sensitivity to trait anxiety and somatization sensitivity as an additional predisposing factor to the model proposed by Boschen (2007). In the acute phase of the model (i.e., entering objectively safe, but vomit-related situations), interoceptive cues related to disgust and/or anxiety responding may be interpreted as signals of imminent danger (vomiting). A candidate cognitive process underlying these dysfunctional interpretations could be emotional reasoning. Finally, both disgust- and anxiety-based emotional reasoning may impact on all factors outlined in the model of Boschen (2007) and lead to active avoidance of real or imagined nauseates, worry or concern about future vomiting, development of attention bias for interoceptive

cues, and a failure to habituate or use of disconfirming evidence (cf. Boschen, 2007). In sum, current evidence related to the involvement of the emotion of disgust as well as the cognitive process of emotional reasoning may lead to a deeper and extended conceptual understanding of risk for and persistence of the core symptoms of emetophobia.

This study has several limitations that could be addressed in future research. First, our sample of high and low scoring participants on fear of vomiting was selected from a population of students with no formal diagnosis of emetophobia. Therefore, future studies should replicate the current findings by comparing a group of formally diagnosed emetophobic patients with a group of healthy controls. Relatedly, no psychometric evaluation has been published for the EQ, the scale on which we based our selection of high and low scoring participants on fear of vomiting. Therefore in future studies, current findings should be replicated using scales with strong psychometric properties such as the EmetQ-13 (i.e., Boschen et al., 2013).

Second, it should be acknowledged that in line with the tradition of emotional reasoning research we used a scenario approach. Concerning the validity of this approach, it is possible that effects of an emotional response in real-life situations may not fully correspond with the effect of imagined situations with descriptive information about the presence of such a response (see Parkinson & Manstead, 1993). An important next step for future research in the field of emotion-based reasoning would, therefore, be to explore whether disgust elicited in an experimental setting would have similar effects on individuals' inferences of danger ratings as adding disgust response information to descriptive scenarios. For example, it would be interesting to see whether participants' probability ratings of contracting a disease when touching particular items would increase when concurrently an actual disgust response is elicited (e.g., by particular odors; see e.g., Tybur, Bryan, Magnan, & Caldwell Hooper, 2011). An informative example of such a study is reported by Olatunji & Armstrong (2009) who randomly divided participants high and low in contamination fear to an auditory disgust (viewing pictures of disgusting scenes, hearing disgusting sounds)- or neutral emotion induction condition. Participants were subsequently exposed to 5 stimuli with increased potential for contagion in a public rest room. Results showed that high contamination fearful individuals allocated to the disgust condition showed the largest difference in distress ratings with the low scoring individuals when asked to touch stimuli with low potential for contagion (i.e., touching the inside of a bathroom sink). A similar ecologically valid method might be developed to investigate disgust-distress associations in the context of fear of vomiting. In addition, as the current approach requires participants to actively imagine everyday situations, vividness of imagery may be important for testing the effectiveness of adding an emotional response to descriptive scenarios. Future studies may take into account vividness of imagery by adding specific individual differences measures such as the Questionnaire upon Mental Imagery (QMI; Sheehan, 1967).

Third, the data are silent about the important role of causality. If emotional reasoning indeed plays a critical role in the maintenance of fear of vomiting, it follows that an intervention targeted at lowering disgust- and or anxiety-based reasoning would reduce individuals' fear of vomiting. An interesting approach of how such an intervention may look like is described in a study by Lommen, Engelhard, and van Hout (2013). In their intervention study, spider fearful participants were systematically directed to infer danger or safety outcomes based on the presence versus the absence of objective danger information in scenarios and to ignore emotional response information. Interestingly, this procedure was not only effective in reducing anxiety based emotional reasoning, but also

reduced spider-related danger beliefs. A similar training regimen might be developed for people diagnosed with emetophobia.

Fourth, in this study, fear of vomiting was used as a single construct as indicated by total scores on an emetophobia questionnaire (Bouman & van Hout, 2015 unpublished manuscript). Yet, it has been proposed that patients with a phobic fear of vomiting could also be classified by their primal fear related to the act of vomiting itself, seeing others vomiting in once presence (i.e., fear of coming into contact with vomit), and vomiting in the presence of others (McNally, 1997; Van Hout & Bouman, 2012). Future studies may explore whether emotional reasoning plays a differential role dependent on the locus of the fear of vomiting. For instance, disgust driven overestimation of the risk of becoming ill might be most pronounced in individuals who fear others vomiting in their presence, while for patients who fear vomiting in the presence of others anxiety driven overestimation of the risk of negative evaluation by others might be most prominent. In addition, individuals with a fear of the act of vomiting itself may use anxiety response information to overestimate fear of losing control over the situation. All in all, selection of participants on these more specific fears with related concerns (e.g., contamination versus social evaluation) may increase the sensitivity of future studies investigating the proposed role of emotional reasoning and other cognitive mechanisms in phobic fear of vomiting.

Future research may further explore how the emotions of fear and disgust would interact in the persistence of emetophobic complaints. Based on the observed prominent role of disgust sensitivity in fear of vomiting (e.g., Boschen et al., 2013; van Overveld et al., 2008; Veale, Ellison, et al., 2013; Veale, Murphy, et al., 2013) one would expect a bi-directional relationship with both emotions strengthening the influence of each other (e.g., Woody & Techman, 2000). To disentangle the influence of both emotions it would be critical to independently induce anxiety and fear in future research. Future work may also compare the current findings on emotional reasoning with other cognitive factors that have been found to contribute to the persistence of SPOV. For instance, both vomit-related autobiographical memories (Veale, Ellison, et al., 2013; Veale, Murphy, et al., 2013) as well as intrusive mental images related to earlier aversive vomit experiences (Price, Veale, & Brewin, 2012) were more frequent in patients with SPOV. According to Veale (2009), aversive memories of vomiting in the past may become associated with fear. These past experiences become fused with the present so that they are re-experienced as if they are to be repeated in safe and harmless situations such as visiting a restaurant. It would be interesting to explore in future research how these memory phenomena might co-occur with emotional reasoning based on fear and disgust in a way that contributes to a further increase of avoidance behaviours, evaluation of vomiting as one of extreme awfulness, and to the maintenance of these phobic fears (Veale, 2009).

5. Conclusions

In conclusion, the current study supports the view that emotional reasoning is involved in fear of vomiting. A critical next step would be to study whether experimentally reducing emotional reasoning would result in reduced fear. Such approach would not only be of great theoretical relevance but may also contribute to the currently available treatment options. Successful replication of this basic finding in a clinical sample of emetophobic patients may also provide fresh clues for clinical interventions. That is, future studies may combine current exposure-based treatment for emetophobia with specific interventions developed to counter dysfunctional reasoning based on the emotions of disgust and anxiety.

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