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Abstract

A negative body image and appraisals of disgust with one's (physical) self reflect schematic representations of one's body, which we classified under the term *repulsive body image* (RBI). We propose that an RBI biases autobiographical memory processing towards schema (=RBI)-congruent and over-general memories. Women with high (H_{RBI} ; $n = 61$) and low (L_{RBI} ; $n = 64$) levels of habitual body-directed self-disgust were asked to retrieve memories in response to abstract body words in a minimal instruction Autobiographical Memory Test. Compared to the L_{RBI} group, the H_{RBI} group recalled a higher number of autobiographical memories that involved appraisals of the own body as disgusting, and reported elevated habitual tendencies to prevent experiencing disgust towards the own body. Neither RBI scores nor tendencies to prevent experiencing body-related disgust were found to be statistically significant predictors of memory specificity. The overall low memory specificity could be indicative of a need for more sensitive measures of autobiographical memory specificity to examine disgust-driven avoidance at the memory level. Nevertheless, the current results may indicate that disgust-related memories and the prevention of experiencing disgust towards the own body could play a role in body image concerns.

Keywords

repulsive body image, self-disgust, autobiographical memory, memory specificity, disgust prevention

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Introduction

Body image concerns are a predominant issue in today's society. Particularly young women, for example, over-evaluate the importance of their physical shape, and are dissatisfied and pre-occupied with their appearance (Cash, 2002). This phenomenon, termed *negative body image*, seems to be highly persistent and associated with adverse effects on mental wellbeing and eating habits (Davison &

McCabe, 2005; von Lengerke et al., 2012; Wilson et al., 2013). Importantly, a negative body image is considered a

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factor in the development, maintenance, and relapse of eating disorders (Fairburn et al., 2003; Johnson & Wardle, 2005; Stice & Shaw, 2002; Thompson et al., 1999; Williamson et al., 2004). Therefore, it is crucial to examine factors involved in the development and maintenance of a negative body image in order to understand why negative body appraisals are so persistent and immune to corrective information.

An emerging body of research suggests that feelings of disgust towards the own body or parts thereof play a role in body image concerns and eating disorders. Next to shared risk factors implicated in the development of both body image concerns/eating disorders and self-disgust (e.g., exposure to objectifying social influences; sexual trauma; cf. Fox et al., 2015), women with (subclinical) eating disorder symptoms appear to show increased levels of disgust towards overweight bodies (Griffiths & Troop, 2006; Harvey et al., 2002; Uher et al., 2005), bodily products (Aharoni & Hertz, 2012; Mayer et al., 2008; Troop et al., 2002), and the self (e.g., Bell et al., 2017; Chu et al., 2015; Espeset et al., 2012; Olatunji et al., 2015). Particularly in light of recent research indicating that a negative body image is closely associated with feelings of disgust towards one's own body (Moncrieff-Boyd et al., 2014; Stasik-O'Brien & Schmidt, 2018; von Spreckelsen et al., 2018), it appears that there is a close interconnection between a negative body image and body-related self-disgust. These constructs are structurally similar. They represent schema-like constructs consisting of an affective/evaluative component (e.g., body dissatisfaction, fear of gaining weight; Cash, 2002; the feeling of disgust; Powell et al., 2015), and a cognitive/behavioral component (e.g., importance of and preoccupation with weight and shape, body checking; Cash, 2002; appraisal of the self as disgusting; Powell et al., 2015). Due to the close connection and similarity, we introduce the term *repulsive body image* (RBI), to denote a schematic representation of the own body marked by body-directed self-disgust in combination with other body image concerns that characterize a negative body image.

In line with research on schemas and cognition (e.g., Beck & Haigh, 2014), it has been proposed that people endorsing eating disorder symptoms show biased cognitive processing towards information related to appearance, body weight or shape (e.g., Altabe & Thompson, 1996; Vitousek & Hollon, 1990). One cognitive process that is especially closely interconnected with a person's self-concept is the recall of autobiographical memories. If a person's self-concept is characterized by a negative body image, autobiographical memory recall is likely to be biased towards negative past experiences with one's body. For example, eating disorder patients appear to be biased towards appearance- and eating-related words during free and cued recall (e.g., E. Griffith et al., 2015; Hermans et al., 1998; Hunt & Cooper, 2001; Sebastian et al., 1996). However,

other research indicating poor recall of body-related information in eating disorder patients (Legenbauer et al., 2010) might be reflective of avoidance processes. When people engage in strategic (generative) memory searches, activity spreads through the autobiographical knowledge hierarchy, starting at the higher levels (life-stories, -themes and -periods, general events), and continuing to the lower levels containing specific and sensory details (Conway & Pleydell-Pearce, 2000). Specific autobiographical memories can trigger intense emotions (Conway et al., 2004; J. M. G. Williams et al., 2007), which people might be motivated to avoid experiencing (J. M. Williams, 2006).

Based on our assumption that a negative body image can include disgust-based appraisals of the own body, we expect that an RBI promotes the retrieval of RBI-congruent memories, which, if they are specific, can trigger intense feelings of disgust. Disgust is a powerful defensive emotion that has evolved to protect organisms from contamination by eliciting a strong urge to avoid disgust-elicitors (e.g., pathogens, inappropriate sexual partners, and moral transgressions; Curtis et al., 2011; Tybur et al., 2009). As potential disgust-elicitors, RBI-congruent specific memories may be avoided strategically in order to prevent feeling disgust. Generative memory searches may therefore be aborted relatively early at the level of semantic-categorical representations (e.g., "I always look gross at the beach") that lack specific information (cf. J. M. G. Williams et al., 2007). In support of this notion, preliminary evidence indicates that eating disorder patients show reduced autobiographical memory specificity in response to (body/eating-related) cue words (e.g., Bomba et al., 2014; Kovács et al., 2011; Laberg & Andersson, 2004; Nandrino et al., 2006). On the whole, such RBI-congruent over-general memory processing could be an important factor in the persistence of a negative body image. Because autobiographical memories serve as a crucial source of how people define themselves (Conway et al., 2004), a bias towards RBI-congruent memories will likely affirm the schematic RBI. Furthermore, if access to specific body-related memories is blocked, the chance of updating negative schemas about a person's appearance is impeded (cf. Förster et al., 2006; Salkovskis, 1991) by obstructing the processing of potentially corrective information. Moreover, by avoiding the emotional state of disgust, habituation to feelings of aversion to one's own body is prevented.

In the current study, we asked women with high and low levels of habitual body-directed self-disgust to retrieve memories in response to relatively abstract body-related cue words in a minimal instruction version of the *Autobiographical Memory Test* (AMT; Debeer et al., 2009). This AMT version was chosen because it appears to be most suitable in non-clinical populations (Debeer et al., 2009). We choose abstract cue words in order to elicit generative memory retrieval which is initiated by general triggers (e.g., global cognitions/general themes in conversations; Conway

& Pleydell-Pearce, 2000). Only women were recruited for a more homogenous sample with regard to body image issues (e.g., focus on body fat). We used levels of habitual body-directed self-disgust as a proxy for RBI, due to the lack of a direct measure assessing RBI. It should therefore be noted that in the current study we do not directly assess the construct of the RBI but focus on the disgust-related dimension of the RBI. To investigate the suitability of this proxy, we examined whether women with high versus low body-directed self-disgust also differed significantly on other body image concerns (in addition to examining relationships between RBI group categorization, body-directed self-disgust scores, eating disorder symptoms, and body centrality ratings of memories). Our main predictions were that participants with high body-directed self-disgust levels would (1) recall a significantly higher proportion of memories with RBI-related content, (2) show a stronger habitual motivation to prevent experiencing disgust, and (3) recall a significantly lower proportion of specific memories than participants with low levels of body-directed self-disgust. With regard to the third hypothesis, we further predicted that higher disgust prevention would be related to a lower proportion of specific memories, and that the negative association between disgust prevention and memory specificity would be stronger in women with a high RBI than in women with a low RBI.

Method

Study Design and Sample

The current study had a cross-sectional natural groups design. Group assignment was based on high (H_{RBI}) and low (L_{RBI}) levels of habitual body-related disgust, assessed via a pre-screening. A power analysis (G*Power - version 3.0; Faul et al., 2007) based on an independent samples t -test detecting a medium effect size ($d = 0.5$) with a power level of 0.80 and an alpha level of .05 (one-sided) yielded a total sample size of 128 (64 per group) for the main study. The final sample was drawn from a population of women living in Groningen and consisted of 125 participants, with H_{RBI} : $n = 61$ and L_{RBI} : $n = 64$ (after participant exclusion). The age of the participants ranged from 17 to 36 with a mean of 21.18 (SD : 3.20) years. The majority of participants were German (40.8%), followed by Dutch (16.0%), and English (12.8%), with the rest (30.4%) indicating a variety of other nationalities. Most participants studied Psychology (73.6%), 25.6% studied in another field, and 0.8% did not study. See Appendix A for a detailed description of the participant flow (including inclusion and exclusion criteria).

Materials

All study materials can be found on the OSF (<https://osf.io/me352/>).

Self-Disgust Eating Disorders Scale. The Self-Disgust Eating Disorders Scale (SDES) (Moncrieff-Boyd et al., 2014) is a self-report questionnaire that assesses levels of disgust directed towards the own body. The 16 items are rated on a 7-point Likert scale ranging from “strongly agree (1)” to “strongly disagree (7).” After removing six filler items, 10 reverse-scored items are used for scoring. Total scores may range from 10 to 70, with higher scores representing higher levels of body-related self-disgust. The SDES had a Cronbach’s alpha of .93 in the current study.

Selection of RBI groups. Self-Disgust Eating Disorders Scale threshold scores of ≥ 40 (H_{RBI}) and ≤ 20 (L_{RBI}) were chosen to select our groups of interest. We based our selection on the Likert scale answer categories of the SDES (1–7) and the inspection of SDES scores in an unselected sample of a previous study ($N = 346$; von Spreckelsen et al., 2018), thus considering both evaluative and statistical criteria. We decided for a threshold of SDES ≥ 40 for the H_{RBI} group because it represents a relatively high level of self-disgust without threatening the feasibility of selecting a large enough sample (around 20% of respondents from our previous study scored ≥ 40). A (reverse-coded) four or higher on the SDES Likert Scale corresponds to answers ranging from “neither agree nor disagree” to “strongly agree.” For the L_{RBI} group, we chose the threshold of SDES ≤ 20 to ensure a large enough distinction to SDES scores in the H_{RBI} group while similarly ensuring the feasibility of finding enough participants for our sample (35% of respondents scored ≤ 20). A (reverse-coded) two or lower on the SDES Likert Scale corresponds to answers ranging from “disagree” to “strongly disagree.” It should be noted that the SDES tends to show a right-skewed distribution in unselected samples (this was the case in von Spreckelsen et al., 2018 & the distribution of screening responses in this and other studies; von Spreckelsen et al., 2021b).

Computerized Minimal Instructions Version of the Autobiographical Memory Test (AMT). In the computerized minimal instructions AMT (Debeer, et al., 2009), participants were asked to recall personal experiences in response to 10 abstract body/weight-related cue words (see Appendix B). In line with Debeer and colleagues (2009), participants were given a time-limit of 1 minute to write down each memory. They were instructed not to include events that happened in the last 7 days and that had been written down in response to a previous word cue. Each cue word was presented individually on the computer screen with the instruction “Can you write down a personal experience that the word _____ reminds you of?” and a text box in which participants could type their answer. Below the textbox, a statement indicated that participants will automatically be forwarded to the next cue word after 1 minute. The time-limit started at the moment in which the cue word appeared. Dutch and German participants

completed the AMT in their native language, and participants with other nationalities completed the AMT in English.

Memory Ratings. Participants were shown a quote of each memory they provided in response to the cue words and answered a few questions about each memory. Each memory quote was presented individually on the computer screen in the same order as presented in the AMT. We relied on self-reported ratings because the memory dimensions of interest could not be adequately assessed by an objective rater. An exemption was the memory specificity rating, for which we used a hybrid of self-report and experimenter ratings.

Specificity. Participants rated the specificity of the memory by choosing one of four categories: (a) a specific memory (memory of an event that occurred within the course of 1 day; e.g., “the visit to the beach with my friends a month ago”), (b) a categoric memory (memory of a summary of multiple events; e.g., “visiting the beach with my friends”), (c) an extended memory (memory of a period longer than 1 day; e.g., “the last summer vacation at the beach”), or (d) an omission (no memory was recalled).

Specificity coding. In addition to the self-reported coding of memories, the specificity of memories was coded by two raters (cf. Debeer et al., 2009). The raters were blind to the condition of the participants although we cannot rule out that the content of memories could have potentially given away group membership. In addition to the four categories for the self-reported coding by the participants (specific, categoric, extended, and omission), the two raters could categorize memories into (e) a semantic associate (verbal associations with the cue; e.g., “the beach”), or (f) rest (memory violating the instructions; e.g., referring to an event in the past 7 days). A first rater coded all memories, which were then compared to the self-reported code given by the participant. All memories for which the codes were diverging from each other were coded by the second rater. In order for a memory to be classified, two out of the three codes (by the participant, the first rater, and the second rater) needed to be the same. If this was not the case, the memory was coded as “rest.” Memories assigned to the “rest” category (due to diverging codes), were further distinguished into “rest-general” if all three codes fell within the general categories (categoric, extended, and semantic associate), or “rest-other” if there was no consensus in the codes to whether the memory is specific or general. In total, 89.4% (1118 out of 1250) memories could be categorized, and 10.6% were uncategorized as rest-general (36) or rest-other (96) memories. Cronbach’s alpha of the specificity coding was .64 (it should be noted that Cronbach’s alpha underestimates the reliability of dichotomous data; J. W. Griffith et al., 2012).

Body centrality. Participants indicated the centrality of their own bodies in each memory (“How central/prominent

was your body in the memory you recalled?”) with a slider scale ranging from 0 (Not at all) to 100 (Very much). Cronbach’s alpha was .66 in the current study.

RBI theme. Participants were asked to indicate whether “This memory involves an image of my body that is characterized by:” (a) dissatisfaction and (b) disgust on two separate VAS slider scales ranging from 0 (not at all) to 100 (very much). Four additional slider scales were included as distractor items and assessed pride, acceptance, happiness, and shame. We calculated RBI theme scores by averaging the disgust and dissatisfaction ratings across recalled memories. Cronbach’s alpha was .84 for the disgust ratings, .80 for the dissatisfaction ratings, and .90 for the combined disgust and dissatisfaction ratings.

Disgust Avoidance Questionnaire. The Disgust avoidance questionnaire (DAQ) (von Spreckelsen et al., 2021a) assesses people’s tendencies to avoid experiencing disgust and consists of 17 items and four subscales: disgust prevention, disgust escape, cognitive disgust avoidance, and behavioral disgust avoidance. We assessed disgust prevention with the disgust prevention subscale of the DAQ, which had a Cronbach’s alpha of .87 in the current study. The Body-related Disgust Avoidance Questionnaire (B-DAQ) is a body-related version of the DAQ (see <https://osf.io/4mzfs/>), and assesses people’s tendencies to avoid experiencing body-related disgust. The B-DAQ consists of 18 items and four subscales: disgust prevention, disgust escape, cognitive disgust avoidance, and behavioral disgust avoidance. We assessed body-related disgust prevention with the disgust prevention subscale of the B-DAQ (Cronbach’s alpha = .90). The DAQ and B-DAQ items are answered on a 7-point Likert scale (0: strongly disagree—7: strongly agree) and subscales are calculated by summing up the items per subscale. We report on average subscale scores to aid comparability of scores between the DAQ and B-DAQ.

Eating Disorder Examination-Questionnaire Version 6.0 (EDE-Q 6.0). The EDE-Q (Fairburn & Beglin, 2008) is a 28-item self-report questionnaire assessing eating symptomatology on four subscales (restraint, eating concern, weight concern, and shape concern). We used the weight and shape concern subscales as a measure of negative body image, because they represent a multifaceted assessment of negative body image (e.g., body dissatisfaction, over-evaluation of and preoccupation with shape/weight). The items of the subscales are answered on a 7-point Likert scale (0: no days—6: every day). EDE-Q subscale scores are calculated by averaging item scores, and EDE-Q total scores are calculated by averaging the EDE-Q subscales scores. Cronbach’s alpha values were .94 (shape concern subscale; eight items), .86 (weight concern subscale; five items), and .96 (total EDE-Q).

Additional questionnaires. A number of additional questionnaires were administered, including a concreteness rating of the AMT cue words, the Center for Epidemiologic Studies Depression Scale—Revised (CESD-R; Eaton et al., 2004), an English language assessment, a brief demographic assessment, a motivation-check, a “remarks” field, and (in the screening only) a simulation assessment and distraction questionnaires. See Appendix C for details.

Procedure

Screening. The screening was conducted online in Qualtrics (Qualtrics ©, Provo, UT), and included a short description of the use for the screening, an informed consent form, and short demographic assessment. The latter included an assessment of participants’ understanding of English at a professional level, to ensure that invited participants were able to complete all questionnaires and the AMT properly. After filling in the distraction questionnaires, participants filled in the SDES, two simulation items which were used to deselect participants who simulate their responses in the screening, and a request for receiving an invitation to the main study. Eligible participants were contacted via e-mail, which included an invitation code and a link to the main study.

Main Study. The main study took place in different locations in the Faculty of Behavioural and Social Sciences at the University of Groningen. Participants were tested individually or with 1–2 other participants simultaneously in a room with a female experimenter present. The study was administered via Qualtrics (Qualtrics ©, Provo, UT) on either a desktop computer or a laptop. Participants were asked to read the research information and sign the consent forms. Participants filled out the demographic assessment and the SDES (the SDES acted as a schema-activation). Participants were then asked to engage in the AMT and subsequently in the memory and concreteness rating. Afterward, participants filled out the DAQ, the EDE-Q, the CESD-R, and the English Language Assessment (only if the AMT was completed in English). Finally, participants indicated whether they participated in the study seriously, could leave comments, were debriefed and watched a short animal video as a mood repair. Participants were neither told that they were selected based on SDES scores, nor were they told into which group they were categorized. The experimenter was blind to the RBI group of the participants.

Analysis

The analyses were conducted in SPSS version 26 (IBM Corp., 2019) and JASP version 0.12.2 (JASP Team, 2020). As a first step, we examined RBI group differences in body-directed self-disgust (SDES; main study), eating disorder

symptoms (EDE-Q total scores), negative body image (EDE-Q shape concern & weight concern subscales), average body centrality ratings of the memories, and correlations of SDES scores with EDE-Q total and shape- and weight-concern scores. To test our first hypothesis that H_{RBI} recalled a significantly higher proportion of memories with an RBI-theme than L_{RBI} (1), we aimed to conduct a one-way MANOVA with RBI group as the independent variable (IV) and the disgust and dissatisfaction memory ratings (RBI theme) as the dependent variables (DVs). The RBI theme ratings were calculated by averaging the disgust and dissatisfaction ratings across all recalled memories (i.e., number of memories not coded as an omission). Checking MANOVA assumptions led to winsorizing one outlier (see Supplementary S1, <https://osf.io/me352/>). Due to indications that assumptions may have been violated even after winsorizing, we followed-up the results of the MANOVA with group comparisons that have less stringent assumptions, by examining RBI group differences in disgust and dissatisfaction ratings using separate Welch’s t-tests. Again, we winsorized an extreme value in the L_{RBI} group to improve the distribution of disgust ratings in the L_{RBI} group. Due to the increased number of tests, we adjusted alpha to 0.01 (5 tests; Bonferroni correction).

To test our second hypothesis stating that H_{RBI} showed a stronger motivation to prevent experiencing disgust than L_{RBI} (2), we conducted two independent samples Welch’s t-tests with RBI as the IV and sum scores on the disgust prevention subscales of the DAQ and of the B-DAQ as the DVs. Examinations of assumptions did not indicate violations. To test our third prediction that H_{RBI} showed reduced memory specificity compared to L_{RBI} (3a), we aimed to conduct an independent samples Welch’s t-test with RBI as the IV and the proportion of specific memories as the DV. The proportion of specific memories was calculated by dividing the number of memories coded as specific by the total number of items/cues (i.e., including omissions). We observed a strong right-skew in the distribution of specific memories in the overall sample (see Supplementary S2, figure 1a–c; <https://osf.io/me352/>) and both RBI groups (see Supplementary S2, figure 2a–c for H_{RBI} & figure 3a–c for L_{RBI} ; <https://osf.io/me352/>). Due to the strong skew, we decided to conduct a Mann–Whitney U test. We then examined the association between disgust prevention and proportion of specific memories (overall and per RBI groups) by calculating Kendall’s tau-b correlation coefficients (due to the skewed distribution). We tested all group comparisons with Bayesian statistics to provide complementary information to the common null hypothesis significance tests (especially if $p > .05$). We used default priors (recommended in case of insufficient prior knowledge) and evaluated Bayes Factors (BF) according to common guidelines (van Doorn et al., 2019).¹

Results

Descriptives

In general, the distribution of sample characteristics appeared similar in both RBI groups. See Table 1 for the frequencies of participants in the H_{RBI} versus L_{RBI} groups for age, participant pool, field of study, and AMT language.

Body Image, Eating Disorder Symptoms, & Body Centrality Ratings

We found large differences on SDES, EDE-Q total and shape-, & weight-concern subscales, with higher scores in the H_{RBI} group compared to the L_{RBI} group (see Table 2 for descriptives, Welch's t-tests, effect sizes, & Bayes Factors; α 's = .0125 adjusted to four comparisons; Bonferroni correction). The Bayes Factors indicated strong evidence for the alternative ($H_{RBI} > L_{RBI}$) over the null hypothesis ($H_{RBI} = L_{RBI}$). Examinations of correlations of SDES total scores indicated strong associations with total EDE-Q ($r(123) = .71$), EDE-Q shape-concern ($r(123) = .74$), and EDE-Q weight concern scores ($r(123) = .69$: all p 's < 0.01; α 's = .0167 adjusted to three comparisons; Bonferroni correction). On average, the H_{RBI} group indicated that their bodies were more prominent in their memories compared to the L_{RBI} group (see Table 2 for descriptives, Welch's t-test, effect size, & Bayes Factor), with a moderate effect size and the Bayes factor indicating strong evidence in favor of the alternative ($H_{RBI} > L_{RBI}$) over the null hypothesis ($H_{RBI} = L_{RBI}$).

Hypothesis (1) Memory Ratings: RBI Theme

The means and standard errors of disgust and dissatisfaction ratings per RBI group can be found in Table 2. The MANOVA indicated that there was a statistically significant difference in RBI theme ratings, that is disgust and

dissatisfaction ratings, based on RBI group, $F(2, 122) = 52.12$, $p < .001$; Wilk's $\Lambda = 0.539$, partial $\eta^2 = .46$. Repulsive body image group differences in disgust and dissatisfaction ratings on separate Welch's t-tests showed large differences between the RBI groups, with the H_{RBI} group rating their memories to be more in line with a body image characterized by disgust and dissatisfaction than the L_{RBI} group (see Table 2 for Welch's t-tests, effect sizes, and Bayes Factors). The Bayes Factors indicated strong evidence for the alternative ($H_{RBI} > L_{RBI}$) over the null hypothesis ($H_{RBI} = L_{RBI}$). The results were based on winsorized data and were comparable to results obtained using non-winsorized data (see Appendix D).

Hypothesis (2) Disgust Prevention

With regard to the DAQ, we did not find a statistically significant difference between the RBI groups in their levels of general disgust prevention, with the Bayes factor indicating inconclusive evidence (see Table 2 for descriptives, Welch's t-test, effect size, and Bayes Factor). However, the H_{RBI} group exhibited higher levels of body-specific disgust prevention compared to the L_{RBI} group (see Table 2), with the Bayes factor indicating strong evidence for the alternative ($H_{RBI} > L_{RBI}$) over the null hypothesis ($H_{RBI} = L_{RBI}$). These results partly support our hypothesis by showing that the H_{RBI} group reported being more likely to prevent experiencing disgust in response to their own bodies, but not in general.

Hypothesis (3) Memory Specificity

The proportions of different types of memories (specific, general, semantic associate, & omissions) in each RBI group can be found in Table 2. The Mann-Whitney U test on RBI group differences in the proportion of specific memories was not statistically significant and the Bayes

Table 1. Sample Characteristics (Age, Participant Pool, Field of Study, & AMT Language) per RBI Group.

	H_{RBI} ($n = 61$)	L_{RBI} ($n = 64$)
Age	20.87 ($SD = 2.27$)	21.48 ($SD = 3.88$)
Participant pool		
Paid ^a	45.9%	45.3%
Course credit ^b	54.1%	54.7%
Field of study		
Psychology	72.1%	75.0%
Other	27.9%	25.0%
AMT language		
English	45.9%	40.6%
German	42.6%	39.1%
Dutch	11.5%	20.3%

Note. ^a Participation compensated by payment; ^b Participation compensated by course credit.

Factor indicated moderate evidence for the null ($H_{RBI} = L_{RBI}$) over the alternative hypothesis ($H_{RBI} < L_{RBI}$; see Table 2; comparable to results obtained with Welch's t-test, see Appendix D). Given the results on disgust prevention above, we examined associations between body-related disgust prevention (B-DAQ prevention subscale) and proportion of specific memories. We did not find statistically significant correlations in the overall sample ($r_T(123) = .02$; $p = .725$; $BF_{10} = 0.13$), in the L_{RBI} group ($r_T(62) = .08$; $p = .385$; $BF_{10} = 0.25$), or the H_{RBI} group ($r_T(59) = -.02$; $p = .806$; $BF_{10} = 0.17$). Because none of the correlation coefficients was statistically significant, we refrained from comparing the coefficients between the groups. In sum, we did not find support for our hypothesis that memory specificity was lower in the H_{RBI} group, that it was negatively associated with disgust prevention, and that this negative association was stronger in the H_{RBI} than the L_{RBI} group.

Exploratory Analyses

All exploratory/follow-up analyses can be found in Appendix E. First, we examined whether levels of body-related and general disgust prevention were similar in the H_{RBI} group. This was supported by Bayesian analyses. In the L_{RBI} group, body-related disgust prevention appeared lower than general disgust prevention. Second, we examined whether depression levels were associated with lower memory specificity. We did not find statistically significant associations. Last, we examined whether RBI and disgust prevention may have been associated with lower AMT cue concreteness ratings, but did not find statistically significant relationships between these variables.

Discussion

We argued that disgust-evoking cognitive schemas about the body (i.e., RBI's) can bias autobiographical memory processing towards the preferential recall of RBI-congruent and over-general memories. In the current study, we asked 125 women with high (H_{RBI}) and low (L_{RBI}) levels of habitual body-directed self-disgust to retrieve memories in response to 10 abstract body-related cue words in a minimal instructions AMT. In line with our first hypothesis, we found that the H_{RBI} group recalled a significantly higher proportion of memories with RBI-related content than the L_{RBI} group. Partly in line with our second hypothesis, we found that compared to the L_{RBI} group, the H_{RBI} group showed higher tendencies to prevent experiencing disgust in response to their own bodies, but not in general. Last, the H_{RBI} group did not show significantly lower memory specificity than the L_{RBI} group, and tendencies to prevent experiencing body-related disgust were not found to be predictive of memory specificity. The data did thus not support our third hypothesis.

Participants with a high RBI endorsement rated their memories to be more representative of a body image characterized by disgust and dissatisfaction than participants with a low RBI endorsement. These findings provide support for the link between self-concept and autobiographical memories (Conway et al., 2004), by showing that (emotional) self-appraisals were apparent in autobiographical memories. Because autobiographical memories provide continuity to the self across time (e.g., Conway & Pleydell-Pearce, 2000), a bias towards experiences in which the body was appraised as negative potentially results in the stability of negative body appraisals over time. The biased autobiographical memories may thus feed-back into the self-concept, making negative body appraisals more generalizing and persisting. Importantly, this influence might be further strengthened due to disgust being one of the appraisals apparent in body-related autobiographical memories. Disgust, as described earlier, is highly persistent because it motivates the avoidance of exposure to disgusting cues (Rozin et al., 1999; van Overveld et al., 2010).

Women with high RBI levels seemed more likely to prevent experiencing disgust in response to their own bodies than participants with low RBI levels. An exploratory analysis suggested that this level of body-related disgust prevention may be similar to the level of general disgust prevention in the high RBI group. In other words, it appeared that the high RBI group was just as prone to prevent experiencing disgust in response to their own bodies as in response to common disgust-elicitors (e.g., pathogens). Disgust prevention is an adaptive process if (proportionally) experienced in response to functional stimuli that pose a threat to the organism (e.g., pathogens; Oaten et al., 2009). If experienced in response to a dysfunctional stimulus (i.e., the own body), disgust prevention may promote the persistence of the disgust-association (by obstructing exposure to the stimulus; cf., Salkovskis, 1991) and thus may become maladaptive. Disgust-associations with the own body in women with high RBI levels might therefore be similarly persistent and resistant to extinction as commonly endorsed disgust-associations with, for example, pathogenic stimuli. Because these speculations are partly based on exploratory findings and on measures in need of (further) validation (DAQ & B-DAQ), further research is needed to substantiate the proposed relationship between disgust prevention levels and persistence of disgust-associations with the own body.

We theorized that in women with high RBI levels, body-related disgust prevention would promote the recall of less specific memories, because of specific memories representing disgust-elicitors. Contrary to our predictions, we did not find a relationship between RBI levels or disgust prevention and memory specificity. The level of memory specificity was very low in the total sample, with participants recalling approximately two specific memories on

Table 2. RBI Group Means (SEs) and Statistics on Body Image (SDES; EDE-Q), Memory Ratings, Disgust Prevention, and Memory Type Proportions.

	H _{RBI} (n = 61)	L _{RBI} (n = 64)	<i>t</i> ^a	Df	<i>p</i> ^b	<i>d</i>	BF ₁₀ ^c
SDES	43.82 (0.81)	19.61 (0.65)	23.39	116	<.001	4.17	4.12 × 10 ⁴³
EDE-Q	3.08 (0.16)	1.06 (0.12)	10.29	112	<.001	1.83	2.32 × 10 ¹⁵
Shape concern	4.15 (0.18)	1.55 (0.14)	11.40	116	<.001	2.03	8.47 × 10 ¹⁷
Weight concern	3.72 (0.18)	1.25 (0.16)	10.30	120	<.001	1.83	1.88 × 10 ¹⁵
Memory ratings							
Body centrality	66.10 (2.46)	51.44 (2.90)	3.86	121	<.001	0.69	236.25
RBI theme							
Disgust ^d	39.27 (2.59)	11.33 (1.53)	9.29	98	<.001	1.67	2.26 × 10 ¹³
Dissatisfaction	57.43 (2.70)	25.31 (2.03)	9.50	113	<.001	1.71	5.41 × 10 ¹³
Disgust prevention							
DAQ	4.96 (.13)	4.77 (.13)	0.98	123	.164	0.18	0.47
B-DAQ	5.01 (.12)	3.66 (.13)	7.42	122	<.001	1.33	7.55 × 10 ⁸
Memory type proportions			<i>U</i> ^e				
Specific	.17 (.02)	.19 (.03)	1941		.960	0.01	0.22 ^f
General	.56 (.03)	.58 (.03)					
Semantic associate	.13 (.03)	.08 (.02)					
Omission	.07 (.01)	.06 (.01)					
Rest	.07 (.01)	.09 (.01)					

Note. ^a Welch's *t*-test. ^b one-sided *p*-value. ^c The BF values are based on the student's *t*-test; ^d Results refer to analysis with winsorized outlier; ^e *U* = Mann–Whitney *U*; ^f The BF value was based on the Mann–Whitney *U* test (1000 samples); DAQ = disgust avoidance questionnaire (sum scores were: 44.61 [1.20] in H_{RBI} & 42.95 [1.19] in L_{RBI}). B-DAQ = body-specific disgust avoidance questionnaire (sum scores were: 45.08 [1.10] in H_{RBI} & 32.91 [1.22] in L_{RBI}). SDES = self-disgust in eating disorders scale. EDE-Q = eating disorder examination questionnaire.

average. This restricted range/variability of specific memories in our sample likely made it difficult to test our predictions and might have also obscured an association between depression levels and memory specificity in our follow-up analyses. The low memory specificity deviated from previous research using the minimal instructions AMT (e.g., Debeer et al., 2009). For the current AMT, we deliberately selected rather abstract body-related cue words to elicit generative memory retrieval. Although body-related cue words may in themselves be considered quite concrete (as they refer to a physical entity), average cue ratings were around halfway between abstract and concrete. The combination of these cue words with the design of the minimal instructions AMT (i.e., no explicit instructions to recall specific memories) might have caused participants to recall mainly general memories (cf. Conway, 1996). Future research may determine whether the use of concrete body-related cue words and/or more elaborate (traditional) AMT instructions would elicit more specific autobiographical memories.

Sample Representativeness and Limitations

We aimed to select a group of women with high RBI levels and a group of women with low RBI levels via our screening by means of the SDES, a measure of habitual levels of body-directed self-disgust. Re-examining body-directed self-

disgust in the lab indicated that we were successful in selecting two groups with high and low SDES scores (H_{RBI}; L_{RBI}). We considered scores on the SDES as a proxy of RBI but not as a direct assessment of RBI. Importantly, we found strong correlations of total SDES scores with EDE-Q weight and shape-concern subscales which is in line with previous research (Moncrieff-Boyd et al., 2014; Stasik-O'Brien & Schmidt, 2018; von Spreckelsen et al., 2018). This highlights a strong association between body-related self-disgust and other negative body-related emotions, cognitions, and behaviors, thus lending support to our notion of a RBI. Furthermore, it suggests that the SDES acted as successful proxy for RBI, as our groups not only displayed high (low) levels of body-directed self-disgust but also high (low) levels of other body image concerns. Nonetheless, we want to emphasize that the SDES should not be regarded as a direct assessment of RBI, especially in light of the somewhat arbitrary nature of the SDES threshold which we used to select our groups.

Self-disgust represents an extremely negative appraisal of the self (Powell et al., 2015) and would therefore be expected in women scoring on the extreme of the negative body image continuum. In our sample, the group of women with high self-disgust levels exhibited elevated (sub-clinical) eating symptomatology scoring in the 80th–85th percentile of the EDE-Q score distribution in samples of young women (e.g., Carter et al., 2001; Luce et al., 2008; Mond et al., 2006). This finding fits with research indicating that self-disgust is prevalent

in people diagnosed with an eating disorder (Fox et al., 2015). Although our sample was non-clinical, our findings may well have implications for women diagnosed with an eating disorder or those at risk of developing one. Because our sample consisted of mainly Dutch or German, young (psychology) undergraduates, future research is necessary to examine whether our findings can be replicated in samples of different ages, educational levels, and ethnicities. With regard to gender, we selected a female-only sample to create a more homogenous representation of body image concerns. However, we would applaud further research to also examine whether self-disgust-related processes play a similar role in all genders. Finally, we did not have sufficient power to adequately test for small effect sizes in the current study. Although small effect sizes may be of little practical significance in themselves, they might be worthwhile examining when aiming to investigate questions of clinical relevance in sub-clinical samples.

Conclusion

This study provides initial evidence for a preferential recall of autobiographical memories that involve disgusting appraisals of the own body in women who have a highly negative and repulsive image of their bodies. Those women also seem to show a heightened inclination to prevent experiencing disgust towards the own body. Such disgust-related processes might contribute to negative body concerns becoming persistent and resistant to extinction. Because of the lack of conclusive findings of disgust-driven avoidance at the memory level, further research is needed to examine whether disgust-related biases play a role in reduced memory specificity.

Declaration of Conflicting Interests

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Ethics Approval

The study was approved by the Human Research Ethics committee of the University of Groningen (Ethics approval numbers: 17347-SP-NE [Screening] & 17367-SP-NE [Main Study]).

Informed Consent

Informed consent was obtained from all individual participants included in the study.

Data Availability Statement

The data that support the findings of this study are openly available on the OSF at <https://osf.io/me352/>.

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Supplemental Material

Supplemental material for this article is available online.

Note

1. $BF_{10} > 10$: strong evidence for the alternative over the null; > 3 : moderate evidence for the alternative over the null; $1/3$ – 3 : inconclusive evidence; $< 1/3$: moderate evidence for the null over the alternative; $< 1/10$: strong evidence for the null over the alternative.

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Appendix A Participant Flow

In total, 1754 participants filled out the online screening that was posted on Facebook and two University-based participant platforms (*Paid*: Participation compensated by payment; *Course Credit*: Participation compensated by course credit). Of those, 467 (26.6%) participants were invited to participate in the study, because they fulfilled the following inclusion criteria: (a) being female, (b) scoring either ≥ 40 ('high RBI'; H_{RBI}) or ≤ 20 ('low RBI'; L_{RBI}) on a measure of RBI (i.e., the SDES), (c) indicated that they understood English at a professional level, (d) answered questions designed to detect simulation negatively and (e) gave consent to be contacted for participation in the lab-based study. The data collection was conducted in two waves (first wave: May 2018–August 2018; second wave: September 2018–December 2018).

During the first wave of data collection, data of 60 participants was collected with a higher number of participants in the L_{RBI} group ($n = 43$) than the H_{RBI} group ($n = 17$). In order to avoid systematic differences between the groups other than RBI scores, we excluded 26 L_{RBI} participants from the first wave to achieve equal proportions of participants in each RBI group. We sorted all L_{RBI} participants into three blocks corresponding to AMT language (DE, EN, NL). We then randomly excluded participants from each block in order to match the number of participants per AMT language condition in the H_{RBI} group. As a result, we retained 17 participants in the L_{RBI} group (n per AMT condition: $n_{(DE)} = 8$; $n_{(NL)} = 1$; $n_{(EN)} = 8$), resulting in a total of 34 participants in the first wave (17 per RBI group). In the second wave, the data of an additional 98 participants were collected.

From the resulting 132 (H_{RBI} : $n = 65$; L_{RBI} : $n = 67$) participants, seven participants were excluded due to the following reasons: two participants were excluded because they indicated that they did not participate in the study seriously (H_{RBI} : $n = 1$ & L_{RBI} : $n = 1$) and five participants were excluded because they showed poor performance on a brief English language assessment (H_{RBI} : $n = 1$ & L_{RBI} :

$n = 2$; excluded if answered ≥ 3 out of five questions incorrectly; only applicable to participants engaging in the AMT in English) or indicated that they did not understand English at a professional level when it was re-assessed in the lab (H_{RBI} : $n = 2$; only applicable to participants engaging in the AMT in Dutch/German). Other exclusion criteria were inadequate responses in the AMT (giving non-sense responses on 50% of the responses in the AMT), or indications of biased responding (e.g., correctly guessing the hypothesis of the study) in the remarks written by participants in the end of the study, but did not lead to any further exclusions of participants. After exclusion, we reached a final sample size of 125 participants (H_{RBI} : $n = 61$; L_{RBI} : $n = 64$).

Appendix B

We presented the following cue words to the participants in the following order:

Order	Language		
	English	German	Dutch
1	Attractive	Attraktiv	Aantrekkelijk
2	Thick	Dick	Dik
3	Muscular	Muskuloes	Gespierd
4	Heavy	Schwer	Zwaar
5	Slender	Schlank	Slank
6	Ugly	Haesslich	Lelijk
7	Skinny	Mager	Mager
8	Plump	Fuellig	Vol
9	Sporty	Sportlich	Sportief
10	Chubby	Mollig	Mollig

Appendix C

Additional Questionnaires

Cue concreteness rating. Participants were presented with all cue words and were asked to rate their concreteness. The instructions were (adapted from Brysbaert, et al., 2014, p. 906): “Some words refer to things or actions in reality, which you can experience directly through one of the five senses. We call these words concrete words (e.g., ‘sweet’). Other words refer to meanings that cannot be experienced directly but which we know because the meanings can be defined by other words. These are abstract words (e.g., ‘justice’). Still other words fall in-between the two extremes, because we can experience them to some extent and in addition we rely on language to understand them. We want you to indicate how concrete the meaning of each word is for you by using a

5-point rating scale going from abstract to concrete.” Cronbach’s alpha was .52 in the current study.

Center for epidemiologic studies depression scale – revised. The CESD-R (Eaton et al., 2004) is a 20-item self-report screening for depressive symptoms which are rated based on their frequency in the previous 1–2 weeks. The answer options range from 0 (Not at all or less than 1 day a week), 1 (1–2 days last week), 2 (3–4 days a week), 3 (5–7 days last week) to 4 (Nearly every day for 2 weeks). Cronbach’s alpha was .69 in the current study.

English language assessment. Participants who completed the AMT in English were asked to fill out an English language test that included five questions which included a question or incomplete sentence which the participants had to answer or complete correctly (e.g., Question: “Can I park here?” Answers: “(a) Sorry, I did that.”; “(b) It’s the same place.”; “(c) Only for an hour.”).

Demographic assessment. The demographic assessment included questions asking for participants’ age, gender, nationality, primary language, language proficiency (“Which of the following languages can you understand at a professional level?”) and field of study.

Motivation. In order to assess participants engagement in the study, they were asked whether they were able to stay motivated and engage in the study seriously (“Was it for any reasons not possible for you to stay motivated during the study?”—“I was not able to stay motivated and to properly engage in the study”/“I was able to stay motivated during the study.”)

Remarks. Participants were asked to write down what they thought the hypothesis of the study was. In addition, they were given the possibility to write down any remarks/notes they had about the study.

Simulation assessment. Two items of the Structured Inventory of Malingered Symptomatology (SIMS; Smith & Burger, 1997; “I never laugh”, “I have trouble remembering my date of birth”) were included in the screening. Only participants who gave a negative answer to both questions were invited to the study.

Distraction questionnaires. The screening included a questionnaire assessing body image (WCS; Killen et al., 1994; of importance to another, unrelated study), and two filler questionnaires, assessing mood (PANAS; Watson et al., 1988) and mindfulness (MAAS; Brown & Ryan, 2003).

Appendix D

Hypothesis (1) Memory Ratings: RBI Theme

The MANOVA results on the non-winsorized data were: $F(2, 122) = 51.04, p < .001$; Wilk's $\Lambda = 0.544$, partial $\eta^2 = .46$. The non-winsorized results of the disgust ratings were: $t(101) = 9.08; p < .001; d = 1.63; BF_{10} = 7.11 \times 10^{12}$.

Hypothesis (3) Memory Specificity

The results obtained with the Welch's t-test were: $t(120) = 0.51; p = .304; d = 0.09; BF_{10} = 0.29$.

Appendix E

Exploratory Analyses

A Bonferroni correction was applied to adjust for multiple testing of the exploratory analyses (alphas adjusted to five tests to $\alpha = .01$).

General and Body-related Disgust Prevention in H_{RBI} Group

In our analysis, we found that the H_{RBI} group had significantly higher levels of body-related disgust prevention than the L_{RBI} group (see Table 2). In the descriptives, the mean value of body-related disgust prevention appeared similar to the mean value of general disgust prevention in the H_{RBI} group (see Table 2). Avoidance tendencies associated with common disgust-elicitors (i.e., general disgust prevention) are assumed to contribute to the persistence of those common disgust-appraisals (e.g., von Spreckelsen et al., 2021). Tendencies to prevent experiencing disgust in response to the own body that are of similar strength as tendencies to prevent experiencing disgust in response to

common disgust-elicitors may have implications for the persistence of disgust-related body-appraisals. Therefore, we wanted to examine whether the levels of body-related and general disgust prevention are similar in the H_{RBI} group. We conducted a Bayesian paired sample t-test comparing body-specific and general disgust prevention levels in the H_{RBI} group. The Bayes factor indicated that there was moderate evidence for the null ($B-DAQ = DAQ$) over the alternative ($B-DAQ \neq DAQ$) hypothesis ($BF_{01} = 6.55$). For comparison, we found strong evidence for the alternative ($B-DAQ < DAQ$) over the null hypothesis ($B-DAQ = DAQ$) in the L_{RBI} group ($BF_{10} = 2.66 \times 10^8$; see Table 2 for means and standard errors).

Role of Depression Levels in Memory Specificity

Based on previous research showing an association between depression and reduced memory specificity (e.g., J. M. G. Williams et al., 2007), we examined whether higher depression scores (CESD) were associated with lower memory specificity. We calculated a Kendall's tau-b correlation coefficient (due to the skewed distribution of the proportion of specific memories), which was not statistically significant ($r_T(123) = -.07; p = .336; BF_{10} = 0.21$).

Cue Concreteness Ratings

Due to our inconclusive findings with regard to the association of RBI and body-related disgust prevention with memory specificity, we examined whether RBI and body-related disgust prevention may have already played a role in the evaluation of the cue words in the AMT. In theory, an RBI and a heightened tendency to prevent experiencing disgust may have promoted the body words to be evaluated as less concrete in order to prevent triggering concrete (negative) emotional states. To investigate

Table E1. Means with Standard Errors of Specificity Proportions, Memory RBI Theme Ratings in the Whole Sample and per RBI Group Across the Three Different AMT Languages.

	Dutch			English			German		
	Overall	H_{RBI}	L_{RBI}	Overall	H_{RBI}	L_{RBI}	Overall	H_{RBI}	L_{RBI}
N	20	7	13	54	28	26	51	26	25
Specificity	.19 (.04)	.20 (.08)	.19 (.04)	.20 (.03)	.20 (.04)	.21 (.04)	.15 (.02)	.14 (.02)	.17 (.04)
RBI theme	29.98 (4.97)	47.50 (7.80)	20.55 (4.74)	31.09 (2.85)	44.18 (3.68)	16.99 (2.67)	36.27 (3.30)	53.08 (3.63)	18.80 (2.67)

Note. Specificity = proportions of specific memories; RBI theme = combined disgust and dissatisfaction memory ratings.

this, we examined whether the RBI groups differed in their cue concreteness ratings, whether there was a negative relationship between body-related disgust prevention, and whether this relationship was stronger in the H_{RBI} compared to the L_{RBI} group. Cue concreteness ratings were summed across all 10 cues, with a possible scoring range between 10 (abstract) and 50 (concrete). We did not find a significant difference (Welch's *t*-test) between RBI groups on cue concreteness ratings (H_{RBI} : $M = 33.16$, $SE = 0.71$; L_{RBI} : $M = 33.25$, $SE = 0.66$; $t(122) = 0.09$; $p = .465$; $d = 0.02$; $BF_{10} = 0.20$). We also did not find a significant correlation (Pearson's product-moment correlation) between body-related disgust prevention (B-DAQ disgust prevention) and cue concreteness ratings, in the overall sample ($r(123) = .18$; $p = .048$; $BF_{10} = 0.77$), in the L_{RBI} group ($r_s(62) = .13$; $p = .299$; $BF_{10} = 0.26$), in the H_{RBI} group ($r_s(59) = .32$; $p = .012 > \alpha = .007$).

Although in the H_{RBI} group the Bayes Factor indicated moderate evidence for the alternative ($B-DAQ \neq DAQ$) over the null hypothesis ($B-DAQ = DAQ$; $BF_{10} = 3.39$), this was in the opposite direction as we predicted. Due to this and due to the correlation coefficient not reaching statistical significance ($\alpha = .01$), we did not engage in further comparisons of the coefficients between the groups.

AMT Language

In order to provide information on memory rating scores across AMT languages, we report descriptives of specificity proportions and memory RBI theme ratings in the whole sample and per RBI group across the three different AMT languages (Dutch/English/German) in [Table E1](#).