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Is self-disgust an implicit or explicit emotional schema?

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Abstract

Self-disgust, a negative self-conscious emotional schema that is associated with mental health difficulties in both clinical and non-clinical populations, is typically assessed with self-reported measures that target physical and behavioural aspects of the self. The aim of the present research was to develop and validate a novel implicit self-disgust measure (ISDM) using an Implicit Association Task (IAT) paradigm, across three studies. Study 1 developed a list of disgust-related and positive words that were rated for emotional valence and arousal and informed the content of the ISDM. Study 2 developed and examined the ISDM using the single-target IAT in a non-clinical population and showed that scores in the ISDM were significantly associated with self-reported self-disgust. Study 3 partly replicated the findings of Study 2 among participants with trauma-related experiences and following a mood induction paradigm, showing a significant association between the ISDM and the physical aspect of self-reported self-disgust. These findings are significant because they have implications about the automaticity of self-disgust in people with traumatic experiences which can further inform clinical practice and interventions targeting self-disgust.

Keywords: Self-disgust; implicit self-disgust; implicit association test;; traumatic experiences.

Is self-disgust an implicit or explicit emotional schema?

Self-disgust is theorised to be a negative self-conscious emotion schema (Powell, Overton, Simpson, 2013; Powell, Simpson and Overton, 2015) that reflects disgust towards the physical (physical self-disgust: “*I find myself repulsive*”) and behavioural (behavioural self-disgust: “*I often do things I find revolting*”) aspects of the self (Overton, Markland, Taggart, Bagshaw & Simpson, 2008). Furthermore, self-disgust is a cognitive-affective construct that requires self-awareness, symbolic representation of the self, and cognitive complexity (Lazarus, Ypsilanti, Powell, & Overton, 2019; Powell et al., 2015), and high levels of self-disgust are associated with adverse psychological and mental health outcomes (Ille et al., 2014). Specifically, self-disgust has been positively associated with maladaptive loneliness (Ypsilanti & Lazarus, 2022), attentional avoidance of self-relevant stimuli among older adults (Ypsilanti, Robson, Lazarus, Powell, & Overton, 2020), and mediated the association between loneliness and depression among healthy individuals (Ypsilanti, Lazarus, Powell, & Overton, 2019). Higher self-disgust is also associated with symptoms of depression, body image disturbance, and trauma-related psychological difficulties (Akram et al., 2022; Clarke, Simpson, & Varese, 2019), symptoms of insomnia (Ypsilanti, Lazarus, Robson, & Akram, 2018), social anxiety (Amir, Najmi, Bomyea, & Burns, 2010), bulimia and obsessive-compulsive disorder (Olatunji, Cox, & Kim, 2015), borderline personality disorder and psychoticism (Ille et al., 2014), PTSD (Brake, Rojas, Badour, Dutton, & Feldner, 2017), suicide risk (Schienle, Schwab, Höfler, & Feudenthaler, 2020), and reduced psychological well-being in cancer patients (Azlan, Overton, Simpson, & Powell, 2017).

Self-disgust is considered to be distinct from other negative self-conscious emotions in many respects. For instance, whereas self-disgust involves core aspects of the self and is an enduring emotion, guilt and embarrassment are more transient and are associated with specific actions one has performed (Powell et al., 2015). Importantly, Powell et al. (2015) asserted that self-disgust has evolved from disgust, a core mechanism protecting the self from contamination from

physical (e.g., parasites, germs) and social pathogens (e.g., socio-moral violations), which evolved from emotions that signify submission to social rank. Similarly, self-disgust demarcates from associative learning processes involving the self and contamination acts, as reflected in traumatic experiences (e.g., feeling self-disgusted following sexual trauma) – such associative processes are not relevant to other negatively valenced self-conscious emotions, such as shame, guilt, and embarrassment (Clarke et al., 2019). Lastly, self-conscious emotions, such as self-hatred, differ from self-disgust because they integrate a higher level of anger (Ekman & Cordaro, 2011), which is not characteristic of self-disgust experiences. Other research has also indicated that self-disgust had distinctive and unique phenomenological properties, including a state of revulsion, a discrete expressive profile (e.g., facial expression), links with contamination and the laws of contagion and similarity (avoiding contact for an extended time to avoid “contamination”), and specific appraisals (e.g., “*Yuck, I’m repulsive*”; Powell et al., 2015). Finally, self-disgust has been associated with reduced grey matter volume in the areas associated with the “disgust” network, such as the insula (Schienle & Wabnegger, 2019).

The aforementioned research provides two important insights: self-disgust is a relevant psychological construct for better understanding mental health difficulties (e.g., how they develop and become perpetuated), and that self-disgust presents a unique emotional experience that is distinctive from other forms of adverse self-conscious emotions. However, important questions about the nature and measurement of self-disgust remain. For example, it is unclear whether self-disgust is evident at an implicit level, or whether it is the result of conscious recall of and attention to salient self-relevant experiences. Consequently, if self-disgust operates at an implicit level, there is a need for measures that can capture related processes (e.g., the automatic association between self-relevant stimuli and disgust responses). Nevertheless, so far self-disgust has been measured with self-reported measures, the most widely used ones including the Self-Disgust Scale (SDS; Overton, Markland, Taggart, Bagshaw, & Simpson, 2008) and the Questionnaire for the Assessment of Self-Disgust (QASD; Ille et al., 2014). This presents two major limitations. Firstly,

the use of self-reported measures of self-disgust does not allow us to examine self-disgust at an implicit level. Secondly, self-reported measures, especially for personally relevant and sensitive topics (such as the assessment of the self as disgusting and revolting) can be subject to response biases (Bensch et al., 2019; Paulhus, 1986; Stöber, 2001). Even if people were willing to report self-relevant experiences, such as self-disgust, these may be less accessible through introspection at the time of reporting (Greenwald & Banaji, 1995).

An inquiry into implicit self-disgust can be usefully informed by the extant research on implicit social cognition, especially as this pertains to the self. This research recognises that past experiences can affect future thoughts, emotions, and behaviours outside conscious awareness (Greenwald & Lai, 2020). From a theoretical standpoint, self-disgust can be represented at an implicit level and accordingly influence self and other judgments and behaviours for the following reasons. Firstly, self-disgust is said to develop in early stages of development together with self-consciousness (Powell et al., 2015). After all, a symbolic representation of the self is necessitated for the experience of self-disgust, and self-disgust may emerge from the chronic failure to regulate behaviour and from acting in ways that further elicit and perpetuate feelings of self-disgust (Lazuras et al., 2019). Secondly, in line with cognitive models of depression, negative thoughts and emotions towards the self can become automatic and inform future judgments and views of the self (Bargh, 1992; Clarke & Goosen, 2009). This is in line with recent evidence showing that self-disgust was associated with automatic attentional processes related to the self (i.e., attentional avoidance of self-relevant visual stimuli, such as one's own face; Ypsilanti et al., 2020). Relatedly, research has also demonstrated that implicit self-evaluations can operate and influence behavioural and psychological outcomes outside of conscious awareness (Greenwald & Banaji, 1995; Koole, Dijksterhuis, & Knippenberg, 2001). Lastly, implicit measures are already being used to assess the basic emotion of disgust and the findings have demonstrated a significant association between implicit and explicit disgust and disgust propensity measures as well as mental health outcomes, such as PTSD (e.g., Nicholson & Barnes-Holmes, 2012; Rüsç et al., 2011). Berger and Anaki (2021) have also

developed an implicit association test for social disgust, but this is focused on explaining inter-group relations and how related social attitudes are formed and perpetuated.

Developing an implicit measure of self-disgust is important because it will improve our understanding of the nature of self-disgust. This is particularly relevant to disentangling explicit and implicit self-disgust and determining whether implicit self-disgust can be automatically activated. Secondly, an implicit measure of self-disgust can inform current research and clinical practice with regards to mental health difficulties (e.g., whether implicit self-disgust is associated with mental health difficulties; whether clinical interventions are effective in reducing explicit and implicit levels of self-disgust). The purpose of the present research, therefore, is to develop the first implicit self-disgust measure (ISDM), in an effort to further advance research on self-disgust and its psychological and mental health correlates. To this end, we conducted three studies. Studies 1 and 2 focused on the development of the ISDM, and Study 3 focused on validating the ISDM in individuals with higher levels of trauma-related difficulties, a population that is likely to experience higher self-disgust levels (Brake et al., 2017; Clarke et al., 2019; Ypsilanti et al., 2020). These studies are presented as follows.

Study 1

The Implicit Association Test (IAT) is a reaction-time task that has been widely used in implicit social cognition research (Fazio & Olson, 2003; Nosek, Hawkins, & Frazier, 2011), and has been used for the reliable assessment of implicit self-referential constructs and self-evaluations, such as implicit self-esteem (for a review see Krause, Back, Egloff, & Schmukle, 2011). The central idea behind the IAT is that stored mental representations (e.g., *I find myself disgusting*) are reflected in how quickly people associate a given stimulus (e.g., the self) with positive or negative attributes (e.g., disgusting; Greenwald, Poehlman, Uhlmann, & Banaji, 2009). To the best of the authors' knowledge, only one study used the IAT to assess how quickly people associated disgust-related words with the self. Specifically, Rüsçh et al. (2011) used the IAT to examine if healthy females

and females who had undergone sexual trauma and suffered from Borderline Personality Disorder (BPD), PTSD, or a combination of BPD and PTSD, associated self and other-related stimuli with either anxiety or disgust. They found that, compared to healthy participants, females with clinical symptoms demonstrated a stronger association between disgust and self-related stimuli, although the IAT-based disgust responses were not associated with self-reported measures of self-disgust.

Nevertheless, Rüsç et al. (2011) used only three words were used to denote disgust: disgust, disgusting, and nauseated. This is a methodological limitation because there are many lexical variables that can impact word processing, including number of letters, frequency, semantic ambiguity, imageability, arousal and valence (González-Nosti et al., 2014; Acha & Perea, 2008; Pexman, 2012; Kousta et al., 2009). Ferré et al., (2017) argue that to obtain reliable data on emotion effects, stimuli must be well-characterised and controlled. There are two main theoretical approaches that determine how words are rated and matched across emotional dimensions when used in lexical decision studies (Harmon-Jones et al., 2017); the dimensional theory and the discrete theory.

The dimensional theory suggests that all words should be rated on valence (the extent something represents something pleasant/unpleasant) and arousal (how activating the word is). Extreme valence of stimuli (positive or negative) facilitates word processing (Kousta et al., 2009) regardless of polarity. However, there is a processing advantage in comparison to neutral words and, therefore, control measures should reflect the polar opposite to be able to match valence. How intense/activating a word is, can be described by its arousal rating. Arousal and valence are thought to work in congruence in capturing attention. Valence guides attention, whereas arousal modulates attention (Sutton & Lutz, 2019). The discrete theory suggests that emotions are discrete entities, and each emotion is believed to evoke a specific response and so emotion-based ratings determine the expected response from a word. Words are rated in respect to how much they describe one of the five basic emotions: sadness, happiness, fear, disgust and anger.

Although the number of discrete emotions is debated, there tends to be consensus that the five listed above are considered primary emotions (Balota et al., 2007, Ferré et al., 2017). Research has shown that the dimensional and discrete approaches to understanding emotions should be combined to provide a more solid and reliable rating system by rating words on axes of emotion, valence and arousal (Harmon-Jones et al., 2017). In Study 1, both discrete and dimensional approaches were combined to select and validate disgust-related words as a first step towards developing a novel IAT-based self-disgust measure, also labelled the Implicit Self-Disgust Measure (the ISDM). Study 1 is an exploratory study aimed at creating stimuli (i.e., words) to inform the ISDM.

Methods

Participants

Participants ($n = 109$) from Sheffield Hallam University were recruited through university emails. As this was an exploratory study for the development of study materials, power analysis was not conducted, but to help ensure sufficiently reliable estimates, a minimum target sample of 100 participants was used. The study adhered to the Code of Human Research Ethics of the British Psychological Society and received ethics approval from the respective board of Sheffield Hallam University.

Materials

A list of 74 disgust-related words was initially developed from a range of previously published word norms (ANEW, Bradley & Lang, 1999; WordNet, Fellbaum, 1998) as well as an online thesaurus (thesaurus.com). These words were then matched as far as possible for word-length with positive words to also be included in the word ratings task. The inclusion of positive words was important to ensure that in future included stimuli which were from both poles of the

valence dimension but were also equally matched in terms of their absolute valency scores. Details of the rating questions are provided within the procedure.

Procedure

Participants followed a link which took them to an online survey hosted on Qualtrics. They were told the study would involve rating words based on the emotions they relate to. Participants were presented with all of the 74 words in alphabetical order (e.g., abhorrent, gallant, overjoyed and yucky), and asked to assess each word in respect to how much they related to each of the five discrete emotions, e.g. *“To what extent does the word ‘repulsive’ relate to the following emotions?”* on a 5-point Likert scale (1= ‘not at all’ to 5= ‘extremely’). The words were then rated in terms of valence, e.g. *“To what extent do each of the words relate to something positive?”*, on a 7-point Likert scale, (1= ‘very negative’ to 7= ‘very positive’) and arousal, e.g. *“To what extent do each of the words make you feel aroused”*, on a 7-point Likert scale, (1= ‘very calm’ to 7= ‘very active’), the rating scales were devised based on similar scales used in previous studies by Ferré et al. (2017) and Moors et al. (2013). All words were rated for the discrete emotions before rating all the words in the same order for valence and arousal. The task took around 10 minutes to complete.

Results

Repeated measures ANOVAs were conducted for each word on the ratings given for the five emotions as dependent variables to allow a comparison across the five emotions. For inclusion in the final word pool for subsequent studies disgust and positive words had to have their highest ratings on their respective emotion dimension and also their ratings on that dimension be significantly different from all other emotion ratings. Out of the ANOVAs conducted, six disgust words were removed, due to not being significantly different from another emotion (mostly anger). The words were then matched with positive words for length (Acha & Perea, 2008), absolute valence and arousal ratings. The mean valence scores were compared on the 7-point Likert scale to make sure the valence scores were equal distance away from the neutral centre point. The average

valence for the positive words was 5.77 ($SD= 0.21$) and the average valence for the disgust words was 1.87 ($SD=0.38$). The difference between the two arousal scores within a matched word pair were taken, and any scores further than 0.5 apart were discarded. The arousal mean score for positive words was 3.88 ($SD= 0.18$) and the arousal mean for disgust words was 3.89 ($SD= 0.32$). Overall, these matching steps resulting in removing 20 words, leaving a total of 27 word-pairs (see Appendix A for the arousal and valence scores for each word).

A split-half reliability was conducted to ensure the alphabetical ordering of the words in the study had not impacted on the results and the scores proved to be very similar, helping to rule out significant order effects, $r_{SB}= .940$. Partial eta squared for the ANOVAs described above to distinguish the emotion bases of the selected words all showed large effects (ranging from $\eta_p^2=0.271$ to $\eta_p^2=0.885$)

Study 1 Discussion

In Study 1, a list of 27 pairs of words depicting disgust and happiness (assessed with positive words) were developed, matched for word length, arousal, and valence. The word pairs from this study provide a useful, valid stimuli source for future disgust-related experimental research. To our knowledge, this is the first study to use a set of disgust-related and positive words in the English language to be matched for arousal and valence, for the purpose of informing the content of an IAT-based measure of self-disgust (the ISDM).

Study 2

Study 2 used the pool of words validated in Study 1 to develop a single target IAT to measure self-disgust (the ISDM). It was hypothesised that scores in the ISDM would positively correlate with scores in self-reported self-disgust. It was also expected that ISDM responses would be positively correlated with variables known to be highly associated with self-reported self-disgust, namely, symptoms of depression and anxiety.

Methods

Participants

The study was conducted in two stages – a screening stage (Stage 1) and an IAT task phase (Stage 2). The screening phase was included to determine participant's explicit self-disgust levels, with the aim of selecting a similar number of participants with low, medium, or high levels of self-disgust to ensure a range of explicit self-disgust scores were represented in the sample. An a priori power analysis was used with G*Power 2.0 software and indicated that for a correlational analysis a sample size of 82 participants was required, for power set at 0.80 and $\alpha = 0.05$, for a moderate effect size (0.3). Power analysis calculations were also informed by previous research on the association between self-disgust and mental health outcomes (Clarke et al., 2019). Overall, 223 participants were recruited in the Stage 1 of the study, and 166 (74.4%) of these provided complete data and contact information to participate in Stage 2. Screening data were used to split potential participants into low, middle, and high self-disgust groups using quartile cut off scores from previous research (Ypsilanti et al., 2020).

A final sample of 83 participants completed Stage 2 and were recruited online via social media and using the recruitment platform Prolific Academic (www.prolific.co) and were compensated for their participation. Inclusion criteria specified participants must be aged between 18 and 60 and either have English as a native language or attain a minimum level 6.5 IELTS score. Participants were aged between 19 and 59 ($M = 32.30$, $SD = 12.12$). Most of the participants self-identified as females (78%) and were right-handed (92%), and 28% of participants reported that they had a history of mental health difficulties. The study adhered to the Code of Human Research Ethics of the British Psychological Society and received ethics approval from the respective board of Sheffield Hallam University.

Materials

Depression, Anxiety and Stress Scales (DASS-21, Lovibond & Lovibond, 1995)

The DASS consists of three sets of 7 items, designed to measure depression, anxiety and stress. Participants are asked to rate the items (e.g., “I felt that I had nothing to look forward to”) on a four-point Likert scale, according to how much they feel each statement has applied to them over the past week (0 = Did not apply at all, 3 = Applied most of the time). The present study demonstrated a high internal consistency for total scores of all sets (Cronbach’s $\alpha = 0.93$).

Self-Disgust Scale (Overton et al., 2008)

The SDS is an 18 item self-report questionnaire of disgust towards the self. Responses are recorded on a 7-point Likert scale (1 = strongly agree, 7 = strongly disagree) with participants rating how much they agree each statement is descriptive of them (e.g. “I find myself repulsive”). The scale is comprised of 2 subscales; physical self-disgust (disgust directed towards enduring aspects of the self) and behavioural (disgust directed towards one’s behaviour). Internal consistency coefficients were high for the present study in both subscales (physical self-disgust $\alpha = 0.88$ and behavioural self-disgust $\alpha = 0.87$) as well as the total scale ($\alpha = 0.93$).

Test of Self-Conscious Affect (TOSCA 3SC; Tangney et al., 2000)

The TOCSA-3SC is composed of 11 negative scenarios yielding indices of shame, guilt and blame. Individuals are asked how likely they are to react in a number of ways to each scenario. Responses are rated on a 5-point Likert scale, (1 = not likely, 5 = very likely), with higher scores indicating a greater proneness to react in a certain way, e.g. higher scores indicate greater feelings of guilt, shame and blame. There was an acceptable overall internal consistency in this study ($\alpha = 0.71$). This scale was included due to previous research indicating similarities between self-disgust and self-conscious emotions.

Self-Disgust Visual Analogue Scale (SD VAS)

Participants were asked to rate on a 1-100 scale how disgusting they felt; “Thinking about myself now, it makes me feel...” from “Not at all disgusted” to “Extremely disgusted”. This was adapted from the disgust VAS used by Powell et al. (2015). The VAS aimed to capture a state self-disgust measure.

Implicit Self-Disgust Measure (ISDM)

The single-target IAT task (ST-IAT) informed the development of the ISDM in this study, and this involved one target category (self) and two attribute categories (positive and disgust). Previous studies that developed ST-IAT measures (e.g., Siegel, Dougherty and Huber, 2012; Meissner and Rothermund, 2013; van Tuijl, de Jong, Sportel, de Hullu and Nauta, 2014) used between 5 and 8 words for each target and attribute. For this reason, 8 words were selected for each attribute in the present study. For the target words, using previous “*self*”-related IATs, there were only 4 words that were appropriate. See Table 1 for the words used within the ISDM in the present study.

Inquisit software was used to develop the task with the ST-IAT template (Millisecond Software, 2015b). The ST-IAT utilizes a 5-block structure (Bluemke & Friese, 2008) and takes approximately 3.5 minutes to complete. Block 1 consists of attribute sorting - participants are asked to categorize words into disgust or positive. A word is presented in the centre of the screen and participants must choose the side of the screen with the correct category by pressing keys “A” or “L”, this block has 20 trials.

In Block 2, the target is added, 2 categories are presented on one side (e.g. positive and self) and the other attribute on its own on the other side (disgust). Once again participants are asked to categorize the words into these groups. Block 2 has 20 trials and is identical to Block 3 but it has 40 trials.

For Blocks 4 and 5, the target is swapped to the other side of the screen, so it is paired with the opposite attribute (e.g., positive on left and disgust and self on the right). Block 4 consisted of 20 trials and Block 5 of 40 trials.

In the present study, the block sequence was counterbalanced with respect to the side of the screen that disgust was presented, as well as the first pairing (whether self was paired with positive or disgust first). No error message was displayed if the wrong category was selected to avoid a subsequent delay (see Figure 1).

Procedure

This study was conducted across two time points (or parts). Part 1 involved the completion of an online (Qualtrics) survey including demographic information and self-reported measures of self-disgust (SDS), depression and anxiety symptoms (DASS), and self-conscious emotions (TOSCA), presented in a counterbalanced manner. Participants were then asked to leave an email address to be contacted for the second part of the study. Two weeks after part one completion, participants were contacted with a link to complete part 2. The delay between the two phases of the study was employed to ensure that participants responses to the ISDM were not primed by self-reported self-disgust. Part two involved completing the SD VAS and the ISDM. The VAS was used to see if participants were primed by the ISDM. Therefore, half of the participants completed the disgust VAS before completing the ISDM, and the other half after. Participants who left their contact details after completing the ISDM, were contacted after a further 2 weeks to repeat the ISDM to test for purposes of test-retest reliability.

Results

All data were analysed in Jamovi Version 1.6 (The jamovi project, 2021). D scores were used for the IAT calculations. D scores are calculations designed for IATs and are thought to be most effective in understanding a response rather than latencies (Greenwald et al., 2003). D scores are the mean of incompatible trials within the block, minus the mean of compatible trials within the block, all divided by the standard deviation of all the trials within the block. Three scores are calculated for the single-target IAT, those for the trial blocks (blocks 2 and 4) known as D_a , those for the experimental blocks (blocks 3 and 5; D_b) and a combined total D score (blocks 2-5). Greenwald et al. (2003) suggest the D score (including the practice trials) is the best performing score for measuring IAT performance. D scores were reversed for individuals who experienced the attributes on the opposite sides to ensure they were comparable with one another.

Total scores were calculated for the self-report measures, and their distribution was inspected. Tests of normality and histograms identified that all the variables apart from D (ISDM) scores and TOSCA-blame showed significant violations of the assumption of normality, indicating that non-parametric analyses should be used (see Table 2 for descriptive statistics of the variables).

Spearman's correlations were conducted between the ISDM scores and other study variables (see Table 3). The range of percentage of correct trials in the IAT ranged from 57.50% to 100% (*Med*= 95.00, *IQR*= 9.17). The ISDM scores did not significantly correlate with any other variable (two-tailed) apart from TOSCA blame scores ($r_s(81) = -0.25, p = .025$).

There was only one directional hypothesis made, due to being based on previous literature (Hofmann et al., 2005), and was between implicit and explicit tests. One-directional Spearman's correlations were run between explicit self-disgust (i.e., physical, behavioural, and total score) and ISDM scores. Significant small-to-moderate associations were identified between the ISDM score and the total score of explicit self-disgust ($r_s(81) = 0.20, p = .036$), and between the ISDM score and the physical self-disgust ($r_s(81) = 0.18, p = .048$). The association between behavioural self-disgust and the ISDM was non-significant ($r_s(81) = 0.16, p = .077$).

Thirty-four participants completed the ISDM again 2 weeks after their first time, for test-retest reliability purposes. A moderate degree of reliability was found: $ICC = .52, 95\% CI = .016 - .759, F = 2.033, p = .023$.

Study 2 Discussion

Study 2 employed a single target IAT to develop and pilot-test an implicit measure of self-disgust (i.e., the ISDM) in the general population. In support of the study's hypothesis, small to moderate correlations were observed between the ISDM and self-reported self-disgust. Interestingly, this contrasts with the findings by Rüsçh et al. (2011) who did not observe a significant correlation between IAT-based disgust scores and self-reported self-disgust. Hofmann et al. (2005), in a meta-analysis identifies that the relationships between explicit and implicit measures

is generally small to moderate if evident at all, which is congruent with the findings of the present study.

However, the ISDM (D scores) in the present study was not significantly associated with self-reported depression symptoms, shame, and guilt, and with the self-disgust VAS measure. The sample was from the general population and, therefore, we expected that their self-disgust scores would be lower than those reported in previous research with clinical populations (Ille et al., 2014). Ypsilanti et al. (2020a) reported levels of self-disgust in a group of veterans with PTSD to be almost three times higher than in the general population, the absence of these extreme differences could explain the differences not being significantly different. Further to this, Rusch et al. (2011), identified elevated levels of both implicit and explicit disgust in trauma-related disorders.

Study 3

Study 3 aimed to replicate the findings of Study 2 among participants who had experienced trauma. This population was of particular interest because previous research has indicated that they exhibit higher levels of self-disgust, compared to individuals without trauma experiences (Ypsilanti et al., 2020; Sonnier et al., 2019). As such, self-disgust responses may have become internalised and be automatically elicited in response to salient, self-related stimuli (Badour & Adams, 2018). Further extending the findings from Study 2, the primary hypothesis of the study was that ISDM scores would be positively correlated with explicit self-disgust, especially among participants with traumatic experiences. It was also hypothesised that individuals reporting more traumatic experiences would report significantly higher levels of explicit and implicit self-disgust, than participants without traumatic experiences.

Methods

Participants

Overall, 100 participants took part in the study in two groups, 50 participants were recruited who had experienced trauma-related experiences and 50 participants who had not. The trauma

group were required to have had Trauma Related Experiences (TRE). This was ascertained via self-report, and participants were recruited through Prolific Academic (www.prolific.co). Participants were asked the same sociodemographic questions as in Study 2. The trauma group were aged between 18 and 44 ($M = 24$, $SD = 6.16$), 54% were female, 42% identified as male and 4% identified as other. The majority of participants were right-handed ($n = 42$), with a small proportion who were left-handed ($n = 7$) and one participant who was ambidextrous. The control group ($n = 50$), also recruited through Prolific, specifically did not have self-reported TRE. The control group were aged between 18 and 49 ($M = 24.82$, $SD = 7.15$). 66% were males and 34% identified as female. The majority were right-handed ($n = 42$) with the remaining 8 participants being left-handed. Two of these participants stated they have a mental health diagnosis. A priori power analysis with G*Power 3.1.9.7 indicated that, for alpha level set at 0.05, and statistical power of 0.80, a total sample size of $N = 64$ was required for a medium effect size (0.3) correlational analysis, and a total size of $N = 102$ (51 participants in each group) was required for a medium effect size (0.5) for mean differences between two independent groups. All participants were compensated for their time with Prolific credit. Other inclusion criteria for both groups were that individuals had to be over the age of 18 and either be a native English speaker or attain an IELTS score of 6.5 or higher. The study adhered to the Code of Human Research Ethics of the British Psychological Society and received ethics approval from the respective board of Sheffield Hallam University.

Materials

Emotion Induction Prime

An emotion induction prime was used, based on the self-disgust emotion induction task used by Tsatali et al. (2019), where participants recounted experiences that made them feel disgusted with themselves. Tsatali et al. (2019) used verbal narrations, but for this study, a writing task was used instead of a narrative task. Participants were randomly split into two groups for which prime they experienced. Half of them were presented with the self-disgust prime and asked “*I want you to*

write about one of the most traumatic and upsetting experiences of your life; please focus on an experience that you felt disgust towards the self. It could be an experience which made you feel negatively about yourself or a past experience when you did not like yourself. The important thing is that you write about your deepest thoughts and feelings. Ideally, whatever you write about should deal with an event or experience that you have not talked with others about in details”, the other participants were presented with the neutral prime and asked “I want you to write about what you did during the past 24 hours. You should describe your activities and schedule in detail, discussing the facts and circumstances as objectively as possible. You might describe what you had for dinner last night, what time you got up this morning, and so forth. The important thing is you discuss the facts and try to remain objective about your activities”. There was no time limit or any instructions on the required length of these passages.

Self-Disgust Scale (Overton et al., 2008)

As described in Study 2. Internal consistency reliability coefficients were good for the present study in both subscales (behavioural self-disgust $\alpha = 0.77$ and physical self-disgust $\alpha = 0.85$) and there was high internal consistency reliability for the total scale ($\alpha = 0.90$).

Hospital Anxiety and Depression Scale (HADS; Zigmond & Snaith, 1983)

The HADS was used to measure depression in this study. The HADS is a 14-item scale used to measure depression (e.g. I feel as if I am slowed down) and anxiety (e.g. worrying thoughts go through my mind), specifically within clinical groups (Herrmann, 1997). Participants score items on a 4-point Likert scale of how often they have had certain feelings within the past week. The HADS-anxiety subscale demonstrated a good internal reliability $\alpha = 0.84$, and the HADS-depression subscale demonstrated an acceptable level of internal consistency, $\alpha = 0.76$.

PCL-5 with LEC-5 and Criterion A (Weathers et al., 2013)

The PCL-5 with LEC-5 and Criterion A is comprised of 3 subscales to measure key symptomology of PTSD based on DSM-5 criteria. Part 1 is the Life Events Checklist (LEC-5) and includes 17 items. In the LEC-5, participants are asked to respond for each type of life event (e.g.

sexual assault, or a fire or explosion etc.), whether they have experienced this and if so, to what extent were they involved (e.g. happened to them, witnessed it, heard about it, part of their job). Part 2 is known as the Criterion A subscale, focusing on trauma details. The criterion A subscale focuses on the most traumatic experience of the individual and asks for more details, including how long ago it happened, who was involved, how many times it has happened and a brief description of the event. Part 3 is the PTSD Checklist (PCL-5). The PCL-5 is made up of 20 items - participants are asked to rate how often they have experienced these during the past month on a 5-point Likert scale (0= not at all, 4= extremely) (e.g., repeated, disturbing and unwanted memories of the stressful event). This was only given to the group with trauma related experiences. The PCL-5 has shown high internal consistency in previous studies $\alpha = 0.95$ (Blevins et al., 2015). In the current study there was also excellent internal consistency, $\alpha = 0.95$.

Self-Disgust Visual Analogue Scale (SD VAS)

As described in Study 2. Participants were asked to rate on a 1-100 scale how disgusted they felt with themselves.

ISDM

The ISDM was described in Study 2. However, due to Study 2 showing no impact of the side of screen that the attribute was presented on, this was no longer counterbalanced.

Counterbalancing of the first pairing (i.e., whether they saw “self and disgust” vs “positive”, or “self and positive” vs “disgust” first) was continued due to strong literature suggesting the pairing order can have an impact on responses (e.g., Nosek et al., 2003).

Procedure

The study was run using Qualtrics for the completion of questionnaires and Inquisit V4 (2015) for the IAT. Participants were initially asked to complete a series of demographic questions, and then were randomly allocated to either the neutral or the disgust priming condition in the emotion induction prime task. Once completed, they reported how disgusted they felt on a scale

from 1-100 (VAS). They were then redirected to Inquisit where they completed the single target ISDM. Finally, participants completed the questionnaires HADS, SDS and PCL-5 (trauma group only) in a counterbalanced order. The study took approximately 20-30 minutes to complete.

Results

An initial sample of 100 participants was recruited for the study (50 participants in each group). Two participants did not respond to the prime and, therefore, were removed from the analysis. The written responses to the prime were checked to ensure that those in the prime group did indeed talk about a trauma (this was true for all participants) and that those in the control group did not report experiencing any specific trauma within the past 24 hours. Four participants were removed from the control prime condition due to writing about a potentially traumatic previous 24 hours. One further participant was removed from the trauma group for missing data. This resulted in a final group of 93 participants (48 in the control group and 45 in the trauma group).

We calculated the total length of the prime, which ranged from 3 words to 866 words ($M=131.15$, $SD=115.73$). Participants in the trauma group who were also emotionally primed on average wrote the longest texts ($M = 165.04$, $SD = 182.15$), compared to trauma group participants who were in the neutral prime condition ($M = 133.90$, $SD = 91.55$). Within the control group, the written task lengths were longer for those with the neutral prime ($M = 128.56$, $SD = 82.60$) in comparison to those presented with the self-disgust prime induction ($M = 93.00$, $SD = 57.29$). Because the normality assumption was violated for the self-disgust VAS scores (Shapiro Wilk's $W = 0.927$, $p < .001$), a Mann-Whitney U test was conducted to check whether the emotion induction task had an impact on the VAS scores. The results showed that those that were primed scored significantly higher ($Med=40$) on the self-disgust VAS, than those who were presented with the neutral prime ($Med=20$), $U=973$, $p=.03$.

Mean and standard deviation scores for the study variables for the two (control and trauma) groups are presented in Table 4. Shapiro-Wilk's test of normality and Levene's test of homogeneity

of variances were statistically non-significant ($p \geq 0.50$), therefore, parametric analyses were used. One-Way ANOVA (three groups: male, female, other) showed that there were no gender differences in any of the variables that were measured in the study.

Pearson's correlations were conducted between the variables in the study (i.e., explicit and implicit measures of self-disgust, and anxiety and depression symptoms) for the trauma (Table 5) and the control group (Table 6). Self-reported (or explicit) self-disgust was significantly associated with its component dimensions (behavioural and physical), and with anxiety and depression symptoms in both groups. In the trauma group, self-reported self-disgust was also significantly associated with the total PCL score ($r = 0.59, p < .001$). Implicit self-disgust (ISDM) was not significantly associated with other variables in the control group. However, ISDM scores were significantly and positively associated with the physical (self) component of self-disgust ($r = 0.29, p = .036$), anxiety symptoms ($r = 0.28, p = .044$) and the total PCL score ($r = 0.39, p = .005$), in the trauma group. The association between the total score in self-reported self-disgust and ISDM scores was marginally non-significant ($r = 0.27, p = .054$).

Furthermore, independent samples t-test showed that participants in the trauma group scored significantly higher in explicit self-disgust, $t(98) = 5.31, p < .001$, anxiety symptoms, (HADS-A) $t(98) = 4.86, p < .001$, and depression symptoms (HADS-D), $t(98) = 3.79, p < .001$. There were marginally non-significant group differences in the ISDM, $t(98) = -1.74, p = .084$.

A 2x2 ANOVA with Group (trauma vs control) and prime condition (neutral vs self-disgust) was conducted for implicit and explicit self-disgust. The results indicated that there were no significant main effects or a significant interaction for implicit self-disgust. There was a significant main effect of Group [$F(1,96)=27.67, p < .001, \eta^2=.22$], with the trauma group reported higher self-disgust compared to the control group.

Study 3 Discussion

The aim of Study 3 was to use the ISDM in a population with traumatic experiences. The results partly supported the hypotheses of the study by showing that implicit self-disgust (ISDM)

was significantly associated with the physical component of explicit self-disgust. This is similar to the findings reported in Study 2. However, unlike study 2, in Study 3 implicit self-disgust was not associated with the total explicit self-disgust score. Accordingly, in Study 3 the significant association between implicit and the physical component of explicit self-disgust was only observed among participants in the trauma group, and not among control group participants. The ISDM scores were significantly related to the total score for trauma (PCL-5), suggesting that implicit self-disgust may be present in people experiencing PTSD symptoms more frequently. This lends further support to previous research indicating on self-disgust among people with PTSD (Ypsilanti et al., 2020). Also, ISDM scores were significantly associated with anxiety symptoms in the trauma group. This is consistent with previous research showing positive significant associations between self-disgust and anxiety, although the effect size of the correlation observed in the present study ($r = 0.28$) was lower than that reported previously ($r \sim 0.45 - 0.47$; Clarke et al., 2019).

Taken together, the slightly inconsistent findings between Studies 2 and 3 about the relationship between implicit self-disgust and the total score in explicit self-disgust could be attributed to statistical power in Study 3. Although the total sample used in Study 3 was adequate for detecting a significant medium-sized effect with statistical power set at 0.80, having used a larger sample (e.g., $N > 60$) within each group, could have revealed statistically significant correlations between implicit self-disgust and the total score in explicit self-disgust. Hofmann et al. (2005) identified inconsistencies between implicit (IAT-based) and explicit measures and provided different explanations for them, including the effects of untested moderator variables, order of explicit and implicit tasks, and sampling error. The present results also partly supported the second hypothesis of the study. Although there were no significant differences in ISDM scores between the control and trauma groups, the trauma group reported significantly higher levels of explicit self-disgust. Interestingly, there were no significant sex differences in both implicit and explicit self-disgust, and also there was non-significant main effect of the priming task and non-significant

interaction between the priming task (neutral vs. self-disgust-related) and the group (i.e., trauma vs. control).

General Discussion

Study 1 developed a set of words to accurately convey disgust and an opposing matched emotion of happiness (assessed by positive words), within the UK in the English language. The words were matched for length, arousal and valence. Study 2 developed the ISDM, a novel single-target IAT measure to assess implicit self-disgust, and this showed small-to-moderate correlations between implicit self-disgust (ISDM) and explicit self-disgust (total score and self-disgust related to physical aspects of the self), and with blame, as measured by the TOSCA. However, no other correlations were observed between explicit self-report measures known to be related to explicit self-disgust and the ISDM. These findings suggested the ISDM was measuring some aspect of the latent trait of self-disgust. In study 3, the newly developed ISDM was used with a mood induction priming task in a population of individuals with trauma-related experiences who are known to have pronounced levels of self-disgust and a control group. Although implicit self-disgust did not correlate with the total and behavioural component of explicit self-disgust, it correlated with the physical component of self-disgust, but only in the trauma group.

The progressive and iterative approach used throughout the three studies shows a robust and rigorous methodology. Validating words and matching words (as done in Study 1) is common in developing lexical decision tasks or ERP tasks (González-Nosti et al., 2014). Due to IATs using speed in relation to a word the participant reads, it was deemed crucial to ensure minimal extraneous variables impacting the results. Also due to the closeness and similarity of other constructs, such as shame and guilt (Fox et al., 2018), it was important that the population deemed the words to be specifically “disgust” or “positive” eliciting words.

The ISDM was used in a population without any pre-identified mental health issues (Study 2) as well as in a population with trauma-related experiences (Study 3). Self-disgust has been seen in both healthy and clinical populations (e.g., Powell et al., 2015; Badour et al., 2012; Simpson et

al., 2020). The results by Study 2 and 3 partly support the notion that the implicit self-disgust measure (ISDM) tapped onto the same latent construct as the explicit self-disgust measure.

Although the overall results provide some supporting evidence for the implicit measure of self-disgust (ISDM) especially with regards to trauma-related experiences, the findings should be treated with caution. It is possible there may be something intrinsic to self-disgust that makes the development of an implicit measure difficult. Self-disgust may not be an automatic emotion but necessitate schematic and cognitive self-reflection. Given the inconsistency of the observed relationships among relevant variables and the D scores, it may mean that the ISDM may not be picking up self-disgust-related cognitive associations that require more conscious awareness. Research highlights the need for self-awareness and self-representations in the development of self-conscious emotions (Tracy & Robins, 2004), which may not be exclusive to the development of the emotion but also in its expression as well. A conscious awareness of the self may be needed for continued activation of self-disgust. Another reason for the inconsistent associations between the ISDM and explicit self-disgust scores could be that explicit and implicit measures of cognitive-behavioural attributes do not always correlate highly (Hoffman et al., 2005). This could explain why implicit levels of self-disgust are more noticeable in a population at higher risk for mental health difficulties, such as people who had experienced trauma. Implicit attitudes are conceptualised as automatic, resistant to change, and independent from context (Albarracín & Vargas, 2010), and it is common that explicit and implicit attitudes of the same construct can differ (Hofmann et al., 2005). Banaji and Greenwald (2013) maintain implicit attitudes are good at predicting real world behaviour independent of explicit attitudes. Another possibility is that explicit and implicit self-disgust do not correlate in a linear fashion and the discriminatory power exists only in those people with extreme levels of self-disgust (such as those who have experienced trauma).

There is an abundance of research in the relationship between implicit and explicit measures. Low correlations are often found between explicit and implicit measures (Nosek, 2007; Payne et al., 2008; Hofmann et al., 2005, Klavina et al., 2012; Schimmack, 2021). The low

correlations seen are possibly a result of motivational biases in explicit measures, lack of access to implicit representations, influencing factors and independence of the underlying constructs (Hofmann et al., 2005). Based on a sample of 126 studies comparing IAT responses to explicit self-report measures, the mean effect size (retrieved from Pearson correlations) was 0.24 (Hofmann et al., 2005) which is very close to the correlation seen in Study 2. Greenwald et al. (1998) identified self-esteem as having the lowest correlation (0.13) between implicit and explicit measures in a meta-analysis. Research suggests this specific relationship for self-esteem may be due to the complicated and multifaceted construct based on the self-concept (Bosson et al., 2000; Shavelson et al., 1976). Self-disgust is also thought to be part of the self-concept of an individual (Schienle & Wabnegger, 2019) and has shown both direct and reflected appraisal, linking self-disgust to an individual's self-concept (Leary & Tangney, 2012), this should be kept in mind when considering the limited correlations seen between self-disgust explicit and implicit measures.

All the tasks had a cross-sectional design which was crucial at this point in the development of the measure to understand the efficacy of the measure. Test-retest analyses in these studies showed reasonably positive correlations in the D scores which point towards good reliability over a short period of time as well as the ISDM capturing a trait measure of self-disgust. However, unfortunately, the number of participants who participated in the re-testing of the ISDM was very low and, therefore, these findings should be read with caution. It would also be of interest to use the ISDM in a longitudinal study with self-disgust to see if there are any relationships between the implicit self-disgust and other self-report measures over time. In addition to this, power calculations for the studies in this paper were based on medium effect sizes, however, the effects seen were small to medium. The differences seen between studies 2 and 3 may have been due to the sample sizes and power, and thus could be investigated further. This future research should utilise larger sample sizes to ensure that the analyses are suitably powered.

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Table 1*Words selected for the ST-IAT task.*

Category	Words
Target 1: Self	Myself, Me, Self, I
Attribute 1: Disgust	Revolting, Vile, Atrocious, Repulsive, Disgusting, Rotten, Gruesome, Sickening
Attribute 2: Positive	Beautiful, Nice, Inspiring, Brilliant, Optimistic, Strong, Terrific, Desirable

Table 2*Median Scores and Inter-Quartile Range (IQR) for the Study Variables (n = 83).*

	Median	IQR
ISDM	-0.29	0.29
Self-disgust total	29.00	20.50
Self-disgust physical	13.00	10.50
Self-disgust behavioural	11.00	11.00
Depression	11.00	5.00
Anxiety	9.00	3.00
Stress	13.00	5.00
Shame	36.00	6.00
Guilt	48.00	6.00
Blame	24.00	7.50
SD VAS	20.00	42.50

Table 3*Associations between the Study 2 Variables (N = 83).*

	1	2	3	4	5	6	7	8	9	10	11
1. ISDM	—										
2. Self-disgust (total)	0.20	—									
3. Self-disgust (physical)	0.18	0.93***	—								
4. Self-disgust (behavioural)	0.16	0.92***	0.74***	—							
5. Depression symptoms	0.11	0.68***	0.56***	0.68***	—						
6. Anxiety symptoms	0.01	0.58***	0.55***	0.51***	0.65***	—					
7. Stress symptoms	-0.01	0.53***	0.47***	0.51***	0.72***	0.61***	—				
8. Shame	0.01	0.55***	0.52***	0.54***	0.49***	0.43***	0.53***	—			
9. Guilt	0.07	0.11	0.10	0.11	0.05	0.03	0.21	0.52***	—		
10. Blame	-0.25*	0.12	0.03	0.20	0.28*	0.17	0.30**	0.13	-0.24*	—	
11. VAS self-disgust	0.16	0.72***	0.72***	0.59***	0.49***	0.42***	0.43***	0.43***	0.15	0.05	—

Note. * $p < .05$, ** $p < .01$, *** $p < .001$.

Table 4*Median and IQR Scores between Trauma and Control Groups (Study 3)*

	Trauma Group		Control Group	
	<i>Mean</i>	<i>SD</i>	<i>Mean</i>	<i>SD</i>
Self-disgust (total)	46.52	12.04	34.02	11.48
Self-disgust (physical)	20.14	5.89	13.60	5.85
Self-disgust (behavioural)	19.58	5.70	15.40	4.93
ISDM	-0.33	0.35	-0.21	0.36
Self-disgust VAS	43.38	28.22	31.06	27.14
Depression symptoms	8.28	3.79	5.48	3.58
Anxiety symptoms	11.64	2.60	9.30	2.19

Table 5*Bivariate Correlations between Measures of Self-Disgust, Depression, and Anxiety Symptoms in the Trauma Group (Study 3)*

	1	2	3	4	5	6	7
1. Self-disgust (total score)	-						
2. Self-disgust (physical)	0.88****	-					
3. Self-disgust (behavioural)	0.88****	0.61****	-				
4. ISDM	0.27	0.29*	0.16	-			
5. Anxiety symptoms	0.55****	0.49****	0.47****	0.28*	-		
6. Depression symptoms	0.59****	0.54****	0.49****	0.23	0.34*	-	
7. PTSD symptoms (PCL total score)	0.59**	0.57****	0.51**	0.39**	0.66****	0.46****	-

Note. * $p \leq .05$; ** $p \leq .005$; **** $p \leq .001$.

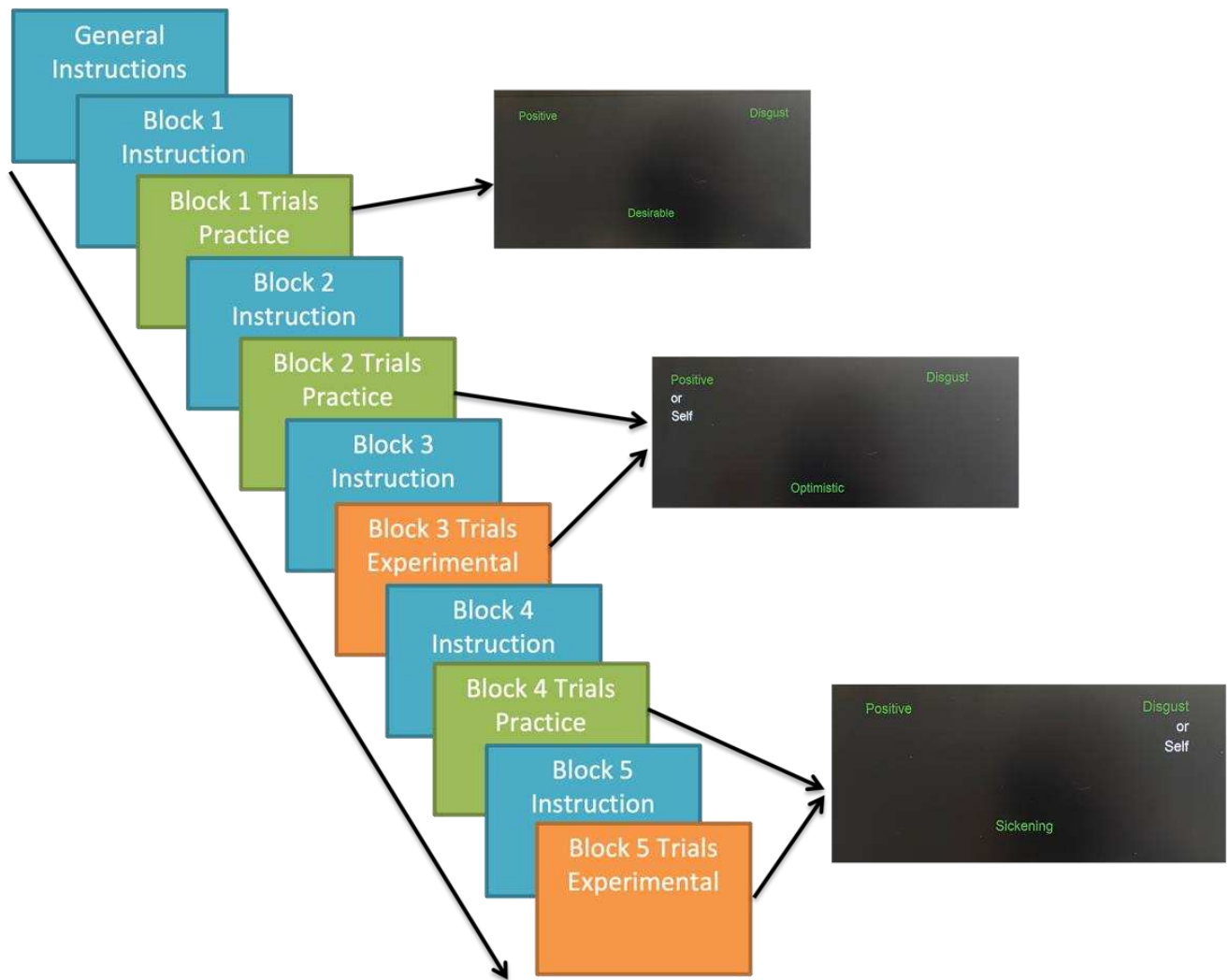
Table 6*Bivariate Correlations between Measures of Self-Disgust, Depression, and Anxiety Symptoms in the Control Group (Study 3)*

	1	2	3	4	5	6
1. Self-disgust (total score)	-					
2. Self-disgust (physical)	0.94***	-				
3. Self-disgust (behavioural)	0.90***	0.73***	-			
4. ISDM	-0.00	-0.02	0.00	-		
5. Anxiety symptoms	0.52***	0.42**	0.58***	0.21	-	
6. Depression symptoms	0.69***	0.65***	0.60***	0.21	0.45***	-

Note. * $p \leq .05$; ** $p \leq .005$; *** $p \leq .001$.

Figure 1

ISDM (single-target IAT paradigm) Task Block Sequence. T= 3.5minutes.



Appendix A. *Arousal, valence and effect size data for matched word pairs.*

Disgust	Valence	Arousal	Effect Size	Positive	Valence	Arousal	Effect Size	Arousal change	Length
Revolting	1.57	4.11	0.594	Beautiful	6.37	4.17	0.752	-0.06	9
Vile	1.62	4.12	0.618	Nice	5.61	3.71	0.828	0.41	4
Repulsive	1.63	4.22	0.612	Brilliant	6.31	4.24	0.861	-0.02	9
Atrocious	1.63	3.99	0.689	Inspiring	6.17	4.48	0.746	-0.49	9
Disgusting	1.65	4.07	0.619	Optimistic	5.88	4	0.760	0.07	9
Rotten	1.65	3.86	0.642	Strong	5.73	3.99	0.373	-0.13	6
Gruesome	1.68	3.88	0.601	Terrific	5.85	4.12	0.667	-0.24	8
Sickening	1.69	3.95	0.583	Desirable	5.9	3.82	0.66	0.13	9
Rancid	1.72	3.94	0.608	Elated	5.67	3.94	0.775	0	6
Repugnant	1.73	4.02	0.540	Overjoyed	6.13	4.35	0.820	-0.33	9
Reeking	1.75	3.92	0.617	Amiable	5.21	3.48	0.471	0.44	7
Appalling	1.81	4	0.613	Resilient	5.14	3.99	0.271	0.01	9
Foul	1.81	3.88	0.644	Kind	6	3.49	0.784	0.39	4
Vulgar	1.87	4.02	0.556	Joyful	6.15	4.2	0.885	-0.18	6
Hideous	1.9	3.84	0.577	Gallant	4.9	3.47	0.542	0.37	7

Filthy	1.92	3.8	0.602	Bright	6.05	3.81	0.809	-0.01	6
Putrid	1.93	3.96	0.557	Heroic	5.87	4.03	0.553	-0.07	6
Repellent	1.97	3.87	0.530	Fulfilled	5.73	3.43	0.751	0.44	9
Gross	2.01	3.71	0.639	Proud	5.9	4.09	0.781	-0.38	5
Horrid	2.04	3.69	0.646	Worthy	5.88	3.67	0.581	0.02	5
Grim	2.05	3.65	0.582	Wise	5.58	3.45	0.550	0.2	4
Contaminated	2.07	3.97	0.576	Advantageous	5.56	4.04	0.597	-0.07	12
Abhorrent	2.09	3.65	0.568	Efficient	5.25	3.67	0.572	-0.02	9
Dirty	2.1	3.93	0.561	Happy	6.28	3.92	0.877	0.01	4
Ghastly	2.18	3.7	0.484	Sincere	5.26	3.3	0.368	0.4	7
Yucky	2.26	3.39	0.617	Merry	5.84	3.74	0.885	-0.35	5
Festering	2.28	3.94	0.452	Proactive	5.62	4.27	0.568	-0.33	9

Note. Arousal change refers to the difference in the arousal ratings per pair. Effect size refers to the partial eta squared values from the ANOVA analyse.