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The Down-Regulation of Disgust by Implementation Intentions: Experiential and Physiological Concomitants

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Abstract

Emotion regulation plays a key role in mental health and psychopathology. Therefore, it seems important to develop effective forms of emotion regulation. Implementation intentions are if-then plans that help people attain their self-regulatory goals. Perspective-taking and response-focused implementation intentions have been shown to reduce feelings of unpleasantness and arousal, respectively, in response to briefly presented disgusting pictures. The present study addressed the open research questions whether forming these types of implementation intentions is effective in regulating affect during prolonged presentation of disgusting pictures, and whether it is associated with changes in physiological arousal. Eighty-one participants viewed disgusting, neutral, and pleasant pictures of 6 s duration under four instructions: the goal intention to not get disgusted, this goal intention furnished with a perspective-taking or a response-focused implementation intention, and no emotion regulation instructions. The dependent variables were ratings of disgust, valence, arousal, and electrodermal activity. Only perspective-taking implementation intention participants significantly reduced their disgust and unpleasantness as compared to goal-intention and control participants. Arousal and skin conductance did not significantly differ between conditions. The effectiveness of response-focused but not perspective-taking implementation intentions seems to be substantially reduced during sustained exposure duration.

Keywords: Implementation intentions; emotion regulation; reappraisal via perspective taking; disgust; skin conductance

The Down-Regulation of Disgust by Implementation Intentions: Experiential and Physiological Concomitants

The regulation of emotions has been defined as "the processes by which we influence which emotions we have, when we have them, and how we experience and express them" (Gross, 2002, p. 282). Emotion regulation figures prominently in mental health (Gross & Muñoz, 1995; Kring & Sloan, 2009). Different emotion regulation strategies can have different consequences in terms of short- and long-term costs and benefits (Gross, 2002; Webb, Miles, & Sheeran, 2012). Accordingly, it seems important to gain a more comprehensive understanding of the effects of diverse regulatory processes and strategies with the ultimate goal of promoting healthy and effective forms of emotion regulation. The present research contributes to this goal by combining Gross's (1998, 2002) process model of emotion regulation with Gollwitzer's implementation intentions (i.e., if-then plans, Gollwitzer, 1999) as a self-regulatory strategy to down-regulate disgust. According to Rozin, Haidt, and McCauley (2008), disgust has evolved from a "simple" food rejection system based on distaste to a more complex rejection system that protects the body but also the soul from a broad range of elicitors such as sexual behaviors, violations of the exterior envelope of the body and certain moral offences. Thus, different types of disgust can be distinguished. In the present study, we focus on mutilation-related disgust, which is elicited in relation to mutilation, injury, and blood. Research into disgust regulation is of great importance when considering that disgust is involved in several psychiatric disorders (Rozin et al., 2008), and its appropriate management is a necessity in many work settings (Diefendorff, Richard, & Yang, 2008).

In his process model of emotion regulation, Gross (1998, 2002) distinguishes between antecedent- and response-focused emotion regulation strategies. Antecedent-focused

strategies refer to things we do before appraisals give rise to a full-blown emotional response, whereas response-focused processes occur after the emotional responses are generated. Within this broad scheme, Gross defines five families of more specific strategies: four antecedent-focused emotion regulation strategies (situation selection, situation modification, attentional deployment, cognitive change) and one response-focused emotion regulation strategy (response modulation).

For a wide range of behaviors, people often fail to translate their intentions into actual goal directed behaviors (Webb & Sheeran, 2006). Gollwitzer (1999) differentiates two kinds of intentions: goal intentions and implementation intentions. Goal intentions define desired end states and have the general format of "I want to attain Z!" (e.g., "I want to eat healthily!") . Implementation intentions are formed to help realize the goal intention by specifying when, where, and how goal-directed responses should be initiated. They generally have an if-then structure "If situational cue X is encountered, then I will do behavior Y!" (e.g., "If I am home and want to have a snack, then I will eat a piece of fruit!"). Thus, implementation intentions link a goal-relevant situational cue (e.g., "I am home and want to have a snack") with a goal-directed behavior (e.g., "I will eat a piece of fruit"). A meta-analysis of 94 studies found a medium to large effect of implementation intention formation on goal attainment ($d_+ = 0.65$) over and above the impact of goal intention strength (Gollwitzer & Sheeran, 2006). The effects of implementation intentions are explained by the fact that the mental link created between critical cue and behavior turns the control of goal-directed responses from conscious and effortful top-down control by the goal intention into an automated and effortless bottom-up stimulus control (Brandstätter, Lengfelder, & Gollwitzer, 2001; Gollwitzer & Schaal, 1998; Webb, Schweiger Gallo, Miles, Gollwitzer, & Sheeran, 2012; Webb & Sheeran, 2007).

People often struggle to effectively regulate their emotional responses when instructed to set an emotion regulation goal. In particular, people fail to effectively suppress their feelings

when asked to do so (Webb et al., 2012a). Evidence is being recently accumulated that forming implementation intentions might be an effective way of enacting desired emotion regulation strategies (Webb et al., 2012b). Relevant to the present study, forming the goal intention "I will not get disgusted!" together with the perspective-taking implementation intention "And if I see blood, then I will take the perspective of a physician!" significantly reduced unpleasantness when looking at pictures showing bloody burn victims and mutilated bodies compared to a goal intention only condition (Schweiger Gallo, McCulloch, & Gollwitzer, 2012, Study 1). Moreover, using the response-focused implementation intention "And if I see blood, then I will stay calm and relaxed!" was effective in reducing self-reported arousal compared to a mere goal intention (Schweiger Gallo, Keil, McCulloch, Rockstroh, & Gollwitzer, 2009, Study 1; Schweiger Gallo et al., 2012, Study 2). The use of implementation intentions has also proved effective in the regulation of other emotions such as fear (Schweiger Gallo & Gollwitzer, 2007; Schweiger Gallo et al., 2009, Studies 2 and 3) and anxiety (Varley, Webb, & Sheeran, 2011).

The present study

The down-regulation of negative emotions is by far the most common emotion regulation effort. Further, people seem to have two main targets of regulation, their emotional experience (i.e., their feelings) and their emotional displays (i.e., emotion expression). The present study focuses on the down-regulation of feelings of disgust. In terms of Gollwitzer's (1999) model, the down-regulation of feelings of disgust can be conceived as the desired end-state one wishes to attain and can be expressed in the form of a goal intention (i.e., "I will not get disgusted!"). The emotion regulation strategies of the process model of emotion regulation (Gross, 2002) can be framed in the form of if-then plans. We consider here an antecedent-focused strategy, cognitive change, and a response-focused strategy, response modulation. Cognitive change works by activating alternative meanings of the critical

situation at hand. Response modulation refers to the modification of experiential, behavioral or physiological response tendencies. More specifically, in the present research we evaluate the effectiveness of forming the goal intention to not get disgusted in tandem with two implementation intentions that comprise these forms of emotion regulation in the then part of the plan. These are an implementation intention that specifies a perspective-taking strategy and thereby consists in changing the meaning of the stimuli (perspective-taking implementation intention), and an implementation intention that targets the experiential component of the emotion and thus aims at modulating the response to the stimuli (response-focused implementation intention). The goal intention and implementation intentions tested here are intentionally identical to those used by Schweiger Gallo et al. (2009, 2012). Yet, compared to these previous investigations the current study presents three main advancements.

First, in previous research on emotion regulation and implementation intentions stimuli were shown very briefly (i.e., 100-300 ms and masked; Schweiger Gallo & Gollwitzer, 2007; Schweiger Gallo et al., 2009, 2012). This method allows for processing key elements of the pictures but precludes in-depth processing and elaboration of the stimulus. Results of these studies demonstrated that implementation intentions were effective in down-regulating self-reported unpleasantness and arousal by blocking the emergence of the habitual emotional reaction at its onset. Yet, if this blocking effect persists when the unpleasant stimuli are fully processed over an extended period of time, which is a more realistic real-life scenario than minimal duration of exposure, remains to be determined. More prolonged duration of affective stimulation leads to progressively greater emotion intensity (e.g., Goldin et al. 2005), and prolonged presentation of highly arousing unpleasant pictures results in stronger defensive activation than brief presentation (Codispoti, Bradley, & Lang, 2001). Consequently, the strength of the emotion regulation behavior activated by the

implementation intention at stimulus onset may weaken because of the sustained presence and processing of highly disgusting stimuli. It is also plausible that prolonged exposure to disgust-inducing stimuli might allow people with mere goal intentions to find and implement effective emotion regulation strategies. Thus, this research's first aim was to investigate whether implementation intentions prove beneficial over and above mere goal intentions during sustained stimulus presentation.

A second goal of the present research was to extend previous work in terms of physiological and self-reported outcome measures. A combination of self-reported and physiological variables allows for a more critical test of the effectiveness of implementation intentions. One study found that forming an antecedent-focused implementation intentions specifying an ignore response with respect to fear-eliciting stimuli affected electrocortical activity (Schweiger Gallo et al. 2009, Study 3). The present study extends this work by examining the impact of forming two different types of implementation intentions in the context of disgust regulation on electrodermal activity, which is controlled by the sympathetic branch of the autonomic nervous system. There is some evidence that consciously down-regulating the emotional experience in a picture viewing paradigm is associated with larger electrodermal activity than simply attending to the affective stimuli (Ohira et al., 2006). Skin conductance response (SCR; i.e., the phasic increase in conductance shortly following stimulus onset) is a reliable index of the physiological arousal induced by pictures depicting bloody burn victims and mutilated bodies (Bradley, Codispoti, Cuthbert, & Lang, 2001) and correlates with self-reported arousal (Lang, Greenwald, Bradley, & Hamm, 1993).Thus, because using implementation intentions should make emotion regulation more automatic and less effortful, individuals forming implementation intentions that significantly reduce self-reported arousal compared to forming mere goal intentions and no emotion regulation control, may be expected to also show smaller SCR to disgusting contents. Skin conductance level (SCL)

reflects the tonic level of electrical conductivity of the skin. Increased sympathetic activation as indexed by SCL has been found to accompany self-control effort and cognitive demand (e.g., Mehler, Reimer, & Coughlin, 2012; Sheppes, Catran, & Meiran, 2009). In the present study SCR was used as an indicator of the effectiveness of the self-regulation instructions in down-regulating disgust at the picture level, whereas SCL assessed over the entire emotion regulation task served as a physiological index of the overall effort expended in regulation.

So far, self-reported outcome measures of studies on disgust regulation and implementation intentions were ratings of arousal and valence. Feelings of disgust were not yet focused on. They were examined in the present study along with valence and arousal ratings.

Finally, potential interindividual differences in emotion reactivity have not yet been controlled for in research on emotion regulation and implementation intentions. To increase internal validity, taking interindividual differences in emotion reactivity into account was a third aim of this research.

Hypotheses for self-reported valence and arousal ratings of the disgusting pictures were based on previous findings by Schweiger Gallo et al. (2009, 2012) and were as follows. Compared to participants forming no emotion-regulation goals (control group, CG) and those forming a mere goal intention (GI), participants forming the perspective-taking implementation intention (PT-II) were expected to report less unpleasantness, whereas participants forming the response-focused implementation intention (RF-II) were expected to report less arousal. Because disgust ratings relates positively to ratings of unpleasantness and arousal (Schweiger Gallo et al., 2012), we predicted that both PT-II and RF-II participants would show a significant reduction in self-reported disgust as compared to CG and GI participants. Ratings of disgust, valence, and arousal were not expected to be significantly different between CG and GI participants (Webb et al., 2012a). Concerning the electrodermal activity we had the following predictions. The RF-II group, but not the PT-II group, would display lower SCRs

than the CG and GI groups, whereas the CG, GI, and PT-II groups would not significantly differ from each other. Finally, consistent with the idea that the goal-directed responses specified in implementation intentions are initiated automatically and thus effortlessly we expected the SCL of PT-II and RF-II participants during the entire emotion regulation task to be not significantly different from the SCL of CG participants.

Method

Participants

Participants were recruited from the Lausanne area through advertisements placed in different public places, in newspapers, and on websites. The Hospital Anxiety Depression Scale (Zigmond & Snaith, 1983, 14 items, example items "I get sudden feelings of panic", "I still enjoy the things I used to enjoy", Anxiety and Depression scale min = 0, max = 21, see Bjelland, Dahl, Haug, & Neckelmann, 2002, for examination of the psychometric properties) was used as screening instrument, and only individuals with scores lower than 11 (i.e., the usual cut off score between mild and moderate cases as recommended by the test's authors, Snaith & Zigmond, 1994) on both scales were invited to participate. This was done to avoid the experience of excessive emotional distress among vulnerable people. Fifty-two women and 29 men with a mean age of 28.15 years (*SD* = 6.53), with French mother tongue, and good self-reported general health participated.

Design

We used a 4 (Experimental condition) x 3 (Picture type) x 2 (Picture set) mixed factorial design. *Experimental condition* is a between factor with the four groups CG, GI, PT-II, and RF-II. *Picture type* is a within-participants factor with the three categories of pictures disgusting, neutral, and pleasant. *Picture set* is also a within-subjects factor with the picture Set 1 and Set 2.

Stimuli and their presentation

The affective stimuli were 68 pictures taken from the International Affective Picture System (IAPS; Lang, Bradley, & Cuthbert, 2005; the IAPS numbers can be obtained from the corresponding author). Six example pictures were shown at the beginning of the experiment. These pictures served to familiarize the participants with the procedure and to make sure that all participants had the same information and expectations about the type of pictorial contents. The remaining 62 pictures were divided into a first set of 16 pictures and a second set of 46 pictures. The first picture of each set was a neutral picture that served as "filler" and was not taken into account in the analyses. The remaining 15 pictures of Set 1 consisted of five disgusting, five neutral, and five pleasant contents, and the remaining 45 pictures of Set 2 consisted of 15 disgusting, 15 neutral, and 15 pleasant contents. These 45 pictures were the same as those used by Schweiger Gallo et al. (2009 Study 1, 2012 Study 1). The disgusting pictures showed bloody burn victims and mutilated bodies. Within the bi-dimensional model of valence and arousal, such contents are rated as negative and high-arousal (Bradley et al., 2001a; Gomez & Danuser, 2010).The main discrete emotion elicited by these images is disgust (Bradley, Codispoti, Sabatinelli, & Lang, 2001). Further, watching these pictures is associated with an increase in skin conductance that is significantly larger compared to neutral contents (Bradley et al., 2001a; Codispoti & De Cesarei, 2007). The neutral contents were images of neutral human faces and household objects, and the pleasant pictures included images of food, babies, and erotic heterosexual couples.

The pictures were presented with E-prime 2.0 Professional on a 19 in. computer screen located at a distance of 60–70 cm from the participants' eyes. Each image was shown for 6 s with a variable intertrial interval of 22-26 s. The pictures were shown in five different orders that were counterbalanced across experimental conditions. To guarantee an even distribution of the three types of pictures (disgusting, neutral, pleasant) across sets, each block of three

pictures consisted of one disgusting, one neutral, and one pleasant picture. No more than two pictures of similar valence were presented consecutively. Further, we made sure that across the five presentation orders the same picture was presented on average both at the beginning, in the middle, and in the final part of the set of pictures.

Measures

Responses to the pictures. Self-reported ratings were collected for *disgust*, *valence*, and *arousal*, through paper-and-pencil administration. Disgust was assessed with a 9-point scale. Anchors of the scale were *not at all disgusted* and *extremely disgusted*. Judgments of valence and arousal were registered with the 9-point Self-Assessment Manikin (SAM, Lang et al., 2005). The SAM consists of two 9-point scales representing different levels of valence and arousal, each containing five graphic figures. It ranges from a smiling, happy figure to a frowning, unhappy figure when representing the valence dimension. For the arousal dimension, SAM ranges from an excited, wide-eyed figure to a relaxed, sleepy figure. The subject can place an "X" over any of the five figures in each scale, or between any two figures. The ratings were scored so that 1 = *not at all disgusted*, *very unpleasant*, and *very low arousal*, and 9 = *extremely disgusted*, *very pleasant*, and *very high arousal*, respectively.

Skin conductance was recorded with Psylab (Contact Precision Instruments, London, UK). Two pre-wired 8mm diameter Ag/AgCl electrodes were placed adjacently on the hypothenar eminence of the left palmar surface. The electrodes were filled with TD-246 Skin Resistance–Skin Conductance Electrode Paste (Med Associates Inc., St. Albans, VT), formulated with 0.5% saline in a neutral base. Two indices of electrodermal activity were computed, the skin conductance response (SCR) and the skin conductance level (SCL).

Post-presentation questionnaire. After viewing all pictures, a questionnaire consisting of seven questions referring to the presentation of the second set of pictures was administered to measure *commitment to the instructions*, *emotion regulation strategies*, and *perceived*

performance. To assess commitment, we asked "How committed did you feel to the regulation intention/instructions?". Three questions were used to assess emotion regulation strategies: "How much did you try to control your negative feelings?", "How much did you try to think about the unpleasant pictures in a way that decreased your emotion?", and "How much did you try to ignore the unpleasant pictures?". Perceived performance was measured with three questions: "How difficult was it to control negative feelings?", "Did your regulation intention/instructions help you control negative feelings?", and "How well did you succeed in realizing the goal expressed in the instructions?" All items were accompanied by 9-point scales ranging from 1 (*not at all*) to 9 (*very*) (see Schweiger Gallo et al., 2009).

Participants' characteristics and mood. Four personal characteristics susceptible of modulating emotional responding and regulation were assessed. *Disgust sensitivity* was measured with the 27-item Disgust Scale – Revised (Haidt et al., 1994, modified by Olatunji et al., 2007, example item "It would bother me tremendously to touch a dead body", scale min = 0, max = 4; see Overveld, de Jong, Peters, & Schouten, 2011, for examination of the psychometric properties). The Emotion Regulation Questionnaire (Gross & John, 2003; see Melka, Lancaster, Bryant, & Rodriguez, 2011, for examination of the psychometric properties) was used to measure the habitual use of *expressive suppression* (4 items, example item "I keep my emotions to myself", scale min = 1, max = 7) and *cognitive reappraisal* (6 items, example item "I control my emotions by changing the way I think about the situation I'm in", scale min = 1, max = 7). *Social desirability* was assessed with the Marlowe–Crowne Social Desirability Scale short form C (Crowne & Marlowe, 1960; Reynolds, 1982, 13 items, example item "No matter who I'm talking to, I'm always a good listener", scale min = 0, max = 13; see Verardi et al., 2010, for examination of the psychometric properties). Prior to the picture presentation, the participants filled in one SAM and one state scale of the State-Trait Anxiety Inventory (STAI Y-A, Spielberger, 1983, 20 items, example item "I am tense", scale

min = 20, max = 80; see McDowell, 2006, for a discussion on the psychometric properties) to measure their *current mood*.

Procedure

Participants were tested individually in one experimental session. After arrival, the experimenter provided the participants with an outline of the experiment and an explanation of the measurements. Participants were told that they would be requested to watch several pictures on a computer screen and report their emotional responses to each picture. The participants then signed informed consent forms. Next, the skin conductance electrodes were attached, and the rating scales were explained in detail. Participants were told that they would have to report their emotions immediately after the presentation of each picture using three scales for disgust, valence, and arousal. They were advised to always rate how they felt at the moment they saw the pictures and to perform the ratings spontaneously and quickly. Thereafter, the six practice trials were performed. Next, the current mood of the participants was assessed with the SAM and STAI questionnaires.

Just before the first set of pictures, all participants received the same written instruction: “We are going to show you now fifteen or so different images. Please, watch all pictures and rate immediately after each one how you felt during its presentation using the three corresponding scales”. The 16 pictures of Set 1 were then shown.

Afterward, participants were randomly assigned to one of four experimental conditions. CG participants (13 women, seven men) received the same instruction as for the first set of pictures (“fifteen” was replaced with “fifty”). GI participants (13 women, seven men) were asked to form the goal intention “I will not get disgusted!”. PT-II participants (13 women, seven men) were first asked to form this same goal intention and then add the if-then plan “and if I see blood, then I will take the perspective of a physician!”, and RF-II participants (13 women, eight men) were first asked to form this same goal intention and then add the if-

then plan “and if I see blood, then I will stay calm and relaxed!”. Participants were asked to take time to read the instructions and repeat them to themselves until they felt ready. Next, the second set of 46 pictures was presented.

After the last rating, the electrodes were removed, and participants completed the postexperimental questionnaire, the Disgust Scale – Revised, the Emotion Regulation Questionnaire, and the Marlowe–Crowne Social Desirability Scale short form C. Finally, participants were fully debriefed about the purpose of the experiment, given a compensation of 20 Swiss francs, and thanked.

Data reduction and analysis

Self-reported data were complete for all participants. Due to measurement errors skin conductance data were not available for three participants.

For each participant mean scores of disgust, valence, and arousal ratings were computed for the five disgusting, neutral, and pleasant pictures of Set 1 and for the 15 disgusting, neutral, and pleasant pictures of Set 2. To compute SCR change scores were calculated for each picture by subtracting the mean skin conductance of the 1-s interval immediately prior to picture onset from the peak skin conductance of the interval between 1 and 4 s after picture onset (Lang et al., 1993). Mean scores of skin conductance were then computed for the different picture types of Set 1 and Set 2 as done for the affective ratings. SCL was determined by calculating the mean skin conductance over the entire presentation of Set 1 (approximately 8 minutes) and the entire presentation of Set 2 (approximately 23 minutes).

Disgust, valence, arousal, and SCR were then analyzed as follows. Four (Experimental condition: CG, GI, PT-II, RF-II) x 3 (Picture type: disgusting, neutral, pleasant) repeated measures ANOVAs were performed on change scores from Set 1 to Set 2. Significant interactions between Experimental condition and Picture type were followed up by one-way (Experimental condition) ANCOVAs for each picture type on the mean scores of Set 2 using

the mean scores of Set 1 as covariate. Significant effects of the experimental condition were followed up by five a priori contrasts: CG vs. GI, CG vs. PT-II, GI vs. PT-II, CG vs. RF-II, and GI vs. RF-II. Because our hypotheses about the differences between conditions were unidirectional, we carried out one-tailed tests. To counteract the problem of multiple comparisons, we used Holm's multistage procedure (Holm, 1979). SCL was analyzed with a one-way (Experimental condition) ANCOVA on the mean scores of Set 2 using the mean scores of Set 1 as covariate.

Randomization checks on age, anxiety and depressive symptoms, disgust sensitivity, habitual use of expressive suppression and cognitive reappraisal, social desirability, and momentary mood (valence, arousal, anxiety) were performed with one-way (Experimental condition) ANOVAs. The answers to the post-presentation questionnaire were also analyzed with one-way (Experimental condition) ANOVAs. Significant effects were followed up by two-tailed pairwise comparisons using Holm's method. Finally, we examined the robustness of our findings for disgust ratings, valence ratings, arousal ratings, SCR, and SCL when adjusting for participants' characteristics and commitment to the instructions. An alpha level of .05 was used for all statistical tests. A Greenhouse–Geisser epsilon (ε) correction was performed, with reported significance levels referring to corrected *df*. As measures of effect size, we report partial eta squared (η_p^2) and unbiased Cohen's *d* (Hedges & Olkin, 1985).

Results

Participants' characteristics and randomization check

There were no significant differences between the four experimental conditions for any of the personal variables, *F*s(3, 77) < 1.08, *p*s > .36, η_p^2 < .05, except for age, *F*(3, 77) = 3.04, *p* = .034, η_p^2 = .11. The GI group (*M* = 25.75, *SD* = 5.07) was significantly younger than the RF-II group (*M* = 31.33, *SD* = 5.13), *p* = .036. Means, *SD*s, and Cronbach's alphas for the other

characteristics were as follows: anxiety, M = 6.32, SD = 2.10, α = .46; depression, M = 2.74, SD = 2.10, α = .55; disgust sensitivity, M = 1.92, SD = 0.54, α = .83; expressive suppression, M = 3.62, SD = 1.31, α = .78; cognitive reappraisal, M = 4.98, SD = 1.13, α = .78; social desirability, M = 5.26, SD = 2.65; α = .65; state anxiety, M = 29.02, SD = 5.88, α = .85; state valence, M = 7.19, SD = 1.39; state arousal, M = 4.07, SD = 1.86.

Effects of the experimental condition

Table 1 reports the estimated marginal means of disgust, valence, arousal, and SCR of the disgusting, neutral, and pleasant pictures of Set 2 for the four experimental groups.[1]

Disgust ratings. The main effects of picture type, $F(2, 154) = 121.57$, $p < .001$, $\varepsilon = .63$, $\eta_p^2 = .61$, and experimental condition, $F(3, 77) = 8.12$, $p < .001$, $\eta_p^2 = .24$, were significant. More importantly, the repeated measures ANOVA yielded a significant interaction of experimental condition and picture type, $F(6, 154) = 5.63$, $p = .001$, $\varepsilon = .63$, $\eta_p^2 = .18$. The one-way ANCOVA for the disgusting pictures was significant, $F(3, 76) = 7.41$, $p < .001$, $\eta_p^2 = .23$. Planned comparisons revealed significant differences when comparing PT-II with both CG (mean difference = -1.84), $p < .001$, $d = 1.41$, and GI (mean difference = -1.33), $p = .004$, $d = 1.02$. The difference between RF-II and CG was also significant (mean difference = -0.97), $p = .026$, $d = 0.75$. On the contrary, the difference between RF-II and GI (mean difference = -0.47), $d = 0.36$, and the difference between GI and CG (mean difference = -0.51), $d = 0.39$, were not significant, ps > .21. The one-way ANCOVAs for the neutral and pleasant pictures were not significant, $F(3, 76) = 1.22$, $p = .31$, $\eta_p^2 = .05$ and $F(3, 76) = 1.91$, $p = .14$, $\eta_p^2 = .07$, respectively.

Valence ratings. The repeated measures ANOVA revealed main effects of picture type, $F(2, 154) = 61.33$, $p < .001$, $\varepsilon = .91$, $\eta_p^2 = .44$, and experimental condition, $F(3, 77) = 3.57$, $p = .018$, $\eta_p^2 = .12$. More importantly, the interaction of experimental condition and picture type

was significant, $F(6, 154) = 2.82$, $p = .015$, $\varepsilon = .91$, $\eta_p^2 = .10$. The one-way ANCOVA for the disgusting pictures was significant, $F(3, 76) = 3.83$, $p = .013$, $\eta_p^2 = .13$. Planned comparisons revealed significant differences when comparing PT-II with both CG (mean difference = 0.68), $p = .005$, $d = 1.03$, and GI (mean difference = 0.49), $p = .048$, $d = 0.74$. The difference between RF-II and CG (mean difference = 0.44), $d = 0.66$, the difference between RF-II and GI (mean difference = 0.24), $d = 0.37$, and the difference between GI and CG (mean difference = 0.19), $d = 0.29$, were not significant, ps > .05. The one-way ANCOVAs for the neutral and pleasant pictures were not significant, $F(3, 76) = 1.31$, $p = .28$, $\eta_p^2 = .05$ and $F(3, 76) = 0.36$, $p = .78$, $\eta_p^2 = .01$, respectively.

Arousal ratings. The main effect of picture type was significant, $F(2, 154) = 57.63$, $p < .001$, $\varepsilon = .90$, $\eta_p^2 = .43$, whereas the main effect of experimental condition was not significant, $F(3, 77) = 1.83$, $p = .15$, $\eta_p^2 = .07$. Importantly, the repeated measures ANOVA revealed no significant interaction of experimental condition and picture type, $F(6, 154) = 1.63$, $p = .15$, $\varepsilon = .90$, $\eta_p^2 = .06$.

Skin conductance. For SCR the main effect of picture type was significant, $F(2, 148) = 14.96$, $p = .001$, $\varepsilon = .98$, $\eta_p^2 = .17$, whereas the main effect of experimental condition was not significant, $F(3, 74) = 0.03$, $p = .99$, $\eta_p^2 = .00$. Moreover, the repeated measures ANOVA revealed no significant interaction of experimental condition and picture type, $F(6, 148) = 1.61$, $p = .15$, $\varepsilon = .98$, $\eta_p^2 = .06^2$.

The CG group ($M = 3.92$ μS, $SEM = 0.18$ μS), GI group ($M = 3.91$ μS, $SEM = 0.17$ μS), PT-II group ($M = 3.82$ μS, $SEM = 0.17$ μS), and RF-II group ($M = 3.98$ μS, $SEM = 0.16$ μS) did not differ in their SCL during Set 2, $F(3, 73) = 0.14$, $p = .93$, $\eta_p^2 = .01$.

All effects of the experimental condition reported above remained unchanged when controlling for gender, age, anxiety and depressive symptoms, habitual use of cognitive reappraisal and expressive suppression, disgust sensitivity, social desirability, state valence,

state arousal, state anxiety, and commitment to the self-regulation instructions. The latter was high is all groups ($M > 8.10$) and did not differ between groups, $F(3, 77) = 1.23$, $p = .30$, $\eta_p^2 = .05$.

Emotion regulation during the second set of pictures

For the question "How much did you try to control your negative feelings during the unpleasant pictures?" there was a significant effect of the experimental condition, $F(3, 77) = 8.13$, $p < .001$, $\eta_p^2 = .24$. CG participants ($M = 3.30$, $SD = 2.45$) tried significantly less to control their negative feelings than GI ($M = 6.10$, $SD = 2.27$), PT-II ($M = 6.35$, $SD = 2.23$), and RF-II participants ($M = 6.19$, $SD = 2.23$), all ps $< .001$. The three latter groups did not differ significantly from each other, all ps $= 1.00$.

For the question "How much did you try to think about the unpleasant pictures in a way that reduced your emotion?" there was a significant effect of the experimental condition, $F(3, 77) = 2.91$, $p = .040$, $\eta_p^2 = .10$. Participants of the RF-II ($M = 5.90$, $SD = 2.53$), PT-II ($M = 5.60$, $SD = 2.54$), and GI conditions ($M = 5.30$, $SD = 2.18$) reported on average to have tried harder to think about the unpleasant pictures in a way that reduced their emotions than CG participants ($M = 3.80$, $SD = 2.57$). Only the difference between RF-II and CG groups was significant, $p = .048$.

For the question "How much did you try to ignore the unpleasant pictures?" there was a significant effect of the experimental condition, $F(3, 77) = 2.86$, $p = .042$, $\eta_p^2 = .10$. RF-II participants ($M = 4.67$, $SD = 2.83$) had the highest mean score followed by GI ($M = 4.20$, $SD = 2.69$), PT-II ($M = 3.25$, $SD = 2.67$), and CG participants ($M = 2.45$, $SD = 2.33$). However, no pairwise comparison was significant, $p > .05$.

Perceived performance

There were no significant differences for the three questions assessing perceived performance between GI, PT-II, and RF-II participants, $Fs(2, 58) < 2.06$, $p > .14$, $\eta_p^2 < .07$.

Discussion

In the present study we investigated the effects of forming two different types of implementation intentions (i.e., perspective-taking and response-focused) as a strategy for down-regulating disgust on self-reported feelings (disgust, valence, and arousal) and electrodermal activity. The main findings were that participants who formed the goal intention "I will not get disgusted!" together with the perspective-taking implementation intention "And if I see blood, then I will take the perspective of a physician!" rated the disgusting pictures as less disgusting and less unpleasant than participants in the control and mere goal intention conditions. Participants who formed the goal intention together with the response-focused implementation intention "And if I see blood, then I will stay calm and relaxed!" rated the disgusting pictures as less disgusting and less unpleasant than participants in the control condition but not participants in the mere goal intention condition. No significant effects of the self-regulation instructions were found either for self-reported arousal or indices of electrodermal activity.

Compared to forming a mere goal intention, forming a goal intention together with a perspective-taking implementation intention was found to be more effective in down-regulating unpleasantness, and forming a goal intention together with a response-focused implementation intention was found to be more effective in reducing arousal when viewing disgusting pictures presented very briefly (Schweiger Gallo et al., 2009, 2012). The present study extends these findings by showing that forming the goal intention to not get disgusted together with a perspective-taking implementation intention is an effective strategy for down-regulating feelings of disgust and unpleasantness when being exposed to disgusting pictures

for several seconds. Comparing the size of the observed effects with those previously reported with fleeting pictures facilitates the evaluation of how this study's results fit into the existing literature and informs judgment regarding the potential impact of exposure duration. In the study by Schweiger Gallo et al. (2012, Study 1) the effect sizes of forming the perspective-taking implementation intention compared to receiving no regulation instructions and to forming the goal intention were d = 1.29 and d = 0.81, respectively. In the present study the effect sizes for the same comparisons were d = 1.03 and d = 0.74, respectively. These are medium-to-large effects according to Cohen's (1992) criteria for interpreting effect sizes. These data suggest only a small loss of the relative effect of the perspective-taking implementation intention in the case of longer exposure duration. Thus, the present results suggest that perspective-taking implementation intentions prove beneficial over and above mere goal intentions in down-regulating negative feelings and do not lose much of their advantage during sustained stimulus presentation.

The response-focused implementation intention specifying the behavior "I will stay calm and relaxed!" has been found to help people down-regulate their subjective arousal in response to briefly presented disgusting pictures (Schweiger Gallo et al., 2009, 2012) and fear-eliciting pictures (Schweiger Gallo & Gollwitzer, 2007). Compared to the goal intention and to no regulation instructions, this implementation intention had significant large-sized effects on self-reported arousal in previous investigations (ds = 0.90 to 1.44) but only nonsignificant medium-sized effects in the present study (ds = 0.51 and 0.58). Moreover, the effect size for the difference in arousal ratings between the goal intention condition and the control condition in the current study (d = 0.07) was in the same range as in the studies by Schweiger Gallo et al. (ds = -0.02 to 0.19). These data suggest that compared to very brief exposure in the range of hundreds of milliseconds, exposure to disgusting contents in the range of several

seconds is associated with a reduced effectiveness of response-focused implementation intentions.

The relative strength of the habitual response and of the if-then-guided response is supposed to determine goal attainment (Webb, Sheeran, & Luszczynska, 2009). Schweiger Gallo et al.' studies suggest that perspective-taking and response-focused implementation intentions by forging a strong association between the cue and the behavior specified in the if-then plan are both highly effective in initiating the goal-directed emotion regulation strategy. The present study indicates that sustained exposure duration may weaken the cue-behavior link in the case of response-focused implementation intentions but not, or only to a much lesser degree, in the case of perspective-taking implementation intentions.

A framework to understand these differential effects of the two types of implementation intention is provided by the process-specific timing hypothesis (Sheppes & Gross, 2011). According to this hypothesis the later the emotion-regulatory process takes place, the more likely it is to be affected by emotion intensity. Modulation of the experience of emotion occurs later than reappraisal in the emotion generative cycle (Gross, 2002). Compared to brief exposure duration, prolonged stimulus presentation appears to induce more intense negative emotions (Codispoti et al., 2001; Goldin et al., 2005). Response modulation during seconds-long affective stimulation is not accompanied by the increase in physiological arousal that has been reported with exposure durations ranging from one to several minutes (Dan-Glauser & Gross, 2011; Gross, 1998). These accounts support the idea that the effectiveness of response-focused implementation intentions may be affected more strongly by the duration of affective stimulation and thus the intensity of the emotion that is being regulated than the effectiveness of perspective-taking implementation intentions. Future research may test more critically this proposition by having participants exposed to stimuli of different lengths.

The perspective-taking implementation intention proved markedly better than the response-focused implementation intention in down-regulating feelings of disgust. This finding is in line with the broader emotion regulation literature indicating that perspective taking is more effective than response modulation strategies in regulating experiential outcomes of emotion (Webb et al., 2012a). It is worth mentioning that the effect size of the perspective-taking implementation intention relative to the goal intention obtained here (d = 1.02) is above the 95% CI [0.44, 0.78] based on 31 studies investigating the effects of reappraising via perspective taking on self-reported emotional outcomes (Webb et al., 2012a). This lends support to the idea that framing a perspective-taking emotion regulation in the form of an if-then plan increases its effectiveness.

Another major advancement of the present study compared to previous work on emotion regulation and implementation intentions was the inclusion of a measure of peripheral physiological arousal, electrodermal activity. Contrary to our hypothesis, SCR to the disgusting pictures was not lower among participants forming the response-focused implementation intention compared to goal-intention (d = -0.10) and control-group participants (d = -0.16). This finding can be seen as consistent with the result for self-reported arousal, which was not significantly reduced among response-focused implementation intention participants compared to control and goal-intention participants.

SCR and SCL over the entire emotion regulation task were not higher among the perspective-taking implementation intention group compared to the control group. This suggests that forming a perspective-taking implementation intention is an effective way of reducing unpleasant feelings that is not taxing in terms of physiological arousal. This is in line with the idea that implementation intention effects rest on automatic instigation of goal-directed responses without depletion of self-regulatory resources (Scholz et al., 2009).

No differences between goal-intention and implementation intention participants on commitment to emotion regulation in the down-regulation of disgust were observed. This precludes alternative interpretations of the findings in terms of different levels of commitment between experimental conditions and is consistent with a meta-analysis showing that forming implementation intentions does not increase commitment to the goal intention (Webb & Sheeran, 2008). Furthermore, the goal-intention and the implementation intention groups did not differ significantly in their self-reported performance and emotion regulation attempts. Overall, these findings are in line with Gollwitzer's (1993, 1999) assumption that implementation intention effects are based on action control processes that operate outside of people's awareness and thus are commonly difficult to consciously perceive.

Groups did not differ in their scores on social desirability, and when these scores were entered into the analyses, results remained unchanged. Therefore, we can reasonably assume that participants' affective ratings were not affected by social desirability bias.

It could be argued that participants forming the perspective-taking implementation intention effectively down-regulated disgust and unpleasantness because they were provided with more information about the behavioral strategy to adopt in order to achieve their emotion regulation goal than participants forming the mere goal intention. This alternative account can be confidently ruled out on the basis of previous findings showing that forming a goal intention furnished with an implementation intention (e.g., I will correctly solve as many problems as possible and if I start a new problem, then I will tell myself: I can do it!) was significantly more effective than forming a goal intention that spelled out the then part of the implementation intention but did not use the if-then format (e.g., I will correctly solve as many problems as possible and I will tell myself: I can do these problems!; Bayer & Gollwitzer, 2007).

Studies that asked participants to make repeated regulation attempts have obtained larger effects than studies that required participants to make few regulation attempts, suggesting a practice effect on participants' efficiency in applying emotion regulation strategies (Webb et al., 2012a). To test this possibility we divided the 45 pictures of Set 2 into three blocks, each comprising five disgusting, five neutral, and five pleasant pictures and included the factor *block* into the statistical analyses. No interaction between experimental condition and block was significant for any dependent variable and type of pictures, in particular not for disgust and valence ratings of the disgusting pictures (*p*s > .28). This indicates that practice effects cannot explain our findings and that the perspective-taking implementation intention is highly effective from the very first disgusting stimuli, and its effectiveness is maintained throughout repeated exposure.

Compared to no emotion regulation, the goal intention had nonsignificant small effects on all three self-reported ratings (*d*s = 0.07 to 0.39). These effect sizes are comparable to those found in a larger set of studies by Webb et al. (2012a) where *d*s were between -0.19 and 0.43 (d_+ = 0.03) across 10 studies investigating the effects of experiential suppression on self-reported emotional outcomes. This shows that in the present study the effect of forming the goal intention to not get disgusted was not underestimated.

The present research informs applied research and clinical interventions. Using perspective-taking implementation intentions should be particularly valuable for professionals who are often confronted with disgust-inducing situations and could complement long-term clinical interventions that aim at facilitating the control of disgust in patients with psychopathologies such as obsessive-compulsive disorders, phobias, and eating disorders.

In conclusion, the present study has shown that forming a goal intention to not get disgusted together with a perspective-taking implementation intention is an effective strategy for down-regulating feelings of disgust and unpleasantness during sustained presentation of highly

disgusting contents. These beneficial effects did not emerge for a response-focused implementation intention. Moreover, there was no effect on electrodermal activity. Compared to very brief exposure, sustained exposure to unpleasant stimuli seems to leave the effects of perspective-taking implementation intentions largely unaffected but to reduce substantially the magnitude of the effects of response-focused implementation intentions.

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Footnotes

1 Analysis of the responses to the pictures of Set 1 yielded the expected effects. The effect of picture type was significant for all three ratings, $F(2, 154) > 262$, ps $< .001$, $\varepsilon > .54$ and $< .87$, $\eta_p^2 > .77$, and for SCR, $F(2, 148) = 26.84$, $p < .001$, $\varepsilon = .77$, $\eta_p^2 = .27$. The mean disgust rating of the disgusting pictures ($M = 7.44$, $SD = 1.69$) was significantly higher than the mean disgust rating of the neutral ($M = 1.33$, $SD = 0.51$) and pleasant ($M = 1.33$, $SD = 0.47$) pictures, ps $< .001$. The mean valence rating of the disgusting pictures ($M = 1.56$, $SD = 0.82$) was significantly lower than the mean valence rating of the neutral ($M = 5.33$, $SD = 0.63$) and pleasant ($M = 7.27$, $SD = 0.77$) pictures, ps $< .001$. Pleasant pictures were rated more positively than neutral pictures, $p < .001$. The mean arousal rating of the disgusting pictures ($M = 6.51$, $SD = 1.74$) was significantly higher than the mean arousal rating of the neutral ($M = 2.49$, $SD = 1.31$) and pleasant ($M = 4.44$, $SD = 1.52$) pictures, ps $< .001$. Pleasant pictures were rated as more arousing than neutral pictures, $p < .001$. The mean SCR of the disgusting pictures ($M = 0.20$ μS, $SD = 0.24$ μS) was significantly higher than the mean SCR of the neutral ($M = 0.05$ μS, $SD = 0.12$ μS) and pleasant ($M = 0.07$ μS, $SD = 0.11$ μS) pictures, ps $< .001$.

2 Results remained unchanged also when analyses were run with log-transformed skin conductance data. In order to exclude the possibility that “particular” participants confounded the results for SCR, supplementary analyses were carried out without non-responders (defined as participants who had a negative mean SCR to the disgusting pictures of Set 1) and atypical responders (defined as participants whose mean SCR to the disgusting pictures of Set 1 was smaller than the mean SCR to the neutral pictures of Set 1). The interaction of experimental condition and picture type remained nonsignificant, ps $> .09$, as well as the effect of the experimental condition of all one-way ANCOVAs for the disgusting pictures, ps

> .87, the neutral pictures, *p*s > .26, and the pleasant pictures, *p*s > .12. Also for SCL, the effect of the experimental condition remained nonsignificant when non-responders and atypical responders were excluded, *p*s > .71. A decrease of SCR to the disgusting pictures from Set 1 to Set 2 was evident (the mean scores of SCR of Set 1, M = 0.16 μS, SD = 0.14 μS, and Set 2, M = 0.08 μS, SD = 0.11 μS, for the CG group were significantly different, $t(17) = -3.42$, $p = .003$). Yet, affective discrimination was still present during Set 2 (for the CG group, the mean SCR of Set 2 for the disgusting pictures, M = 0.08 μS, SD = 0.11 μS, was significantly higher than the mean SCR of Set 2 for the neutral pictures, M = 0.02 μS, SD = 0.07 μS, $t(17) = 2.71$, $p = .015$), in line with previous work showing that although electrodermal activity in response to repeated exposure to pictures of the same affective valence tends to decrease, affective discrimination is maintained across time (Bradley, Cuthbert, & Lang, 1996).

Table 1

Estimated Marginal Means and Standard Errors (in Parentheses) of Disgust, Valence, Arousal, and SCR of Picture Set 2 for Control, Goal Intention, Perspective-Taking Implementation Intention, and Response-Focused Implementation Intention Condition

	Picture type											
	Disgusting				Neutral				Pleasant			
Condition	Disgust	Valence	Arousal	SCR	Disgust	Valence	Arousal	SCR	Disgust	Valence	Arousal	SCR
CG	6.70 (0.29)	1.81 (0.15)	5.53 (0.26)	0.10 (0.02)	1.58 (0.10)	4.81 (0.09)	2.34 (0.16)	0.02 (0.02)	1.63 (0.09)	6.96 (0.13)	4.18 (0.18)	0.04 (0.02)
GI	6.19 (0.29)	2.01 (0.15)	5.62 (0.26)	0.10 (0.02)	1.39 (0.10)	4.91 (0.09)	2.67 (0.16)	0.05 (0.02)	1.39 (0.09)	7.11 (0.13)	4.57 (0.18)	0.06 (0.01)
PT-II	4.86 (0.29)	2.49 (0.15)	4.86 (0.26)	0.09 (0.02)	1.36 (0.10)	4.87 (0.09)	2.45 (0.16)	0.02 (0.02)	1.41 (0.09)	7.07 (0.13)	4.33 (0.18)	0.04 (0.02)
RF-II	5.73 (0.28)	2.25 (0.14)	4.92 (0.26)	0.11 (0.02)	1.34 (0.10)	5.05 (0.09)	2.59 (0.16)	0.06 (0.02)	1.35 (0.09)	6.97 (0.12)	4.29 (0.18)	0.08 (0.01)

Note. Higher values for disgust, valence, and arousal ratings indicate “more disgusted”, ‘‘more positive’’, and ‘‘more aroused’’, respectively. SCR is in μS. CG = control; GI = goal intention; PT-II = perspective-taking implementation intention; RF-II = response-focused implementation intention; SCR = skin conductance response.