

## DIFFERENTIAL EFFECTS OF VARIOUS TYPES OF IMPLEMENTATION INTENTIONS ON THE REGULATION OF DISGUST

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As little is known about the effectiveness of different types of implementation intentions on the regulation of emotions, the present experiments focused on the differential effectiveness of various implementation intentions on the down-regulation of disgust responses. In Experiment 1, an antecedent-focused implementation intention based on cognitive reappraisal allowed participants to rate disgusting pictures as being less unpleasant than participants in the control condition or the goal intention condition, while the reported intensity (arousal) ratings stayed unaffected. In Experiment 2, participants with a response-focused implementation intention, devised to regulate the intensity of the emotional experience, reported a lower evoked arousal after seeing the disgusting slides, while the valence ratings remained unchanged. Thus, implementation intentions were shown to exert differential effects depending on whether they targeted one or another emotional dimension (i.e., valence vs. arousal).

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Though research on emotion regulation, and specifically on adult emotion regulation, was scarce only ten years ago (Gross, 1998a), there has been a sudden rise in publications over the last few years (Koole, 2009). Due to this increase, there is now an urgent need to systematize which emotion regulation strategies can be selected and what differential effects they exert. In his approach, Gross (1998b) provides a classification of emotion regulation strategies, differentiating whether these strategies are employed before the emotional response tendencies are activated (i.e., antecedent-focused emotion regulation) or once they have become generated (i.e., response-focused emotion regulation). A taxonomy of emotion regulation strategies, however, also needs an insightful analysis of their associated benefits and costs (Gross, 1998b). In this regard, the strategies of reappraisal and suppression have received increasing attention over the last years. Studies have shown that reappraisal, an antecedent-focused emotion regulation strategy, is associated with lesser negative cognitive, affective, and social consequences than suppression, a response-focused emotion regulation strategy (overview by Gross, 2002). In line with these results, Moore, Zoellner, and Mollenholt (2008) recently observed that suppression, as compared to reappraisal, was associated with self-reported stress-related psychopathology symptoms in trauma-exposed individuals. On a social level, suppression also has been associated with adverse social outcomes in social support, closeness to others, and social satisfaction (Srivastava, Tamir, McGonigal, John, & Gross, 2009).

## EMOTION REGULATION BY IMPLEMENTATION INTENTIONS

One way of ensuring effective emotion regulation is by forming implementation intentions (Schweiger Gallo, Keil, McCulloch, Rockstroh, & Gollwitzer, 2009). Implementation intentions (Gollwitzer, 1993, 1999) are if-then plans that spell out when, where, and how a set goal is to be put into action ("*If situation  $x$  is encountered, then I will perform response  $y$ !*") thereby linking a critical situation with a goal-directed response. They are to be distinguished from goal intentions that specify a desired performance or outcome and have the format of: "*I intend to reach  $z$ !*" Goal intentions merely designate desired end-states the individual feels committed to attain, while implementation intentions refer to the realization of the goal intention and create a commitment to respond to a specified critical situation in a planned, goal-directed manner.

Whereas researchers commonly observe quite a gap between goal intentions and actual behavior, this gap can be narrowed considerably by forming implementation intentions (meta-analysis by Gollwitzer & Sheeran, 2006). Research on the processes underlying the effectiveness of implementation intentions has pointed to two processes that mediate their effects on goal attainment. First, specifying a situational cue in the if-component of an implementation intention increases the cue's mental accessibility, ensuring that the critical situation will not be missed (e.g., Aarts, Dijksterhuis, & Midden, 1999; Webb & Sheeran, 2004). More recently, Parks-Stamm, Gollwitzer, and Oettingen (2007, Study 1) found, for example, that implementation intentions exerted beneficial effects on the identification of the critical cue in a classification task, and Webb and Sheeran (2007) showed that implementation intention effects on action initiation are mediated by the accessibility of the specified cue. Second, a strong cue-behavior link is established by making

if-then plans (Webb & Sheeran, 2008), such that the presence of the specified cue automatically elicits the linked response. Consequently, action control by implementation intentions carries features of automaticity. It is immediate (Gollwitzer & Brandstätter, 1997), efficient (Brandstätter, Lengfelder, & Gollwitzer, 2001), difficult to halt (Wieber & Sassenberg, 2006), redundant of conscious intent (Bayer, Achtziger, Gollwitzer, & Moskowitz, 2009), and does not tax self-control resources (Webb & Sheeran, 2003).

Although implementation intentions have been shown to be a powerful self-regulatory tool (Gollwitzer & Sheeran, 2006), few studies have analyzed their effectiveness on modulating emotional responses. One recent exception is the experiments by Schweiger Gallo et al. (2009), which showed that both disgust and fear are amenable to self-regulation by implementation intentions. In a first experiment concerning the regulation of disgust, the results revealed that when the goal intention ("I will not get disgusted!") was furnished with an implementation intention ("And if I see blood, then I will remain calm and relaxed!"), arousal ratings of disgusting pictures were reduced, as compared to forming only a goal intention or no goal intention at all (control condition). In a second experiment, spider-fearful participants reduced their fear to the level of participants who had no fear of spiders only after forming either antecedent-focused ("And if I see a spider, then I will ignore it!") or response-focused ("And if I see a spider, then I will remain calm and relaxed!") implementation intentions. Furthermore, emotional self-regulation by antecedent implementation intentions resulted in a significantly lower positivity of the P1 component (Experiment 3)—a component which is assessed in a time window around 100 ms after stimulus presentation and seems to reflect initial and low-level processing of a presented stimulus. Thus, the differential electrophysiological activity replicated the self-report data and showed that forming implementation intentions leads to a strategic automation of the goal-directed responses.

## THE PRESENT RESEARCH

Despite these previous findings, little is known about the effectiveness of different types of implementation intentions on the regulation of emotions. Therefore, in the present research, we investigated two different types of implementation intentions, antecedent-focused and response-focused, to find out whether they differentially help in down-regulating disgust responses. Experiment 1 specifically targeted an antecedent-focused implementation intention that called for cognitive change of the disgusting pictures by activating alternative meanings of the critical situation at hand: "And if I see blood, then I will take the perspective of a physician!" In Experiment 2 we chose a strategy that according to Gross (1998a,b) can be classified as response-focused emotion regulation: "And if I see blood, then I will stay calm and relaxed!" This latter strategy was not meant to inhibit the facial expression of disgust (i.e., suppression; e.g., Gross & Levenson, 1993) but rather the bodily manifestation of this emotion. Koole (2009) suggests that emotion regulation strategies may be ordered depending on the targeted emotion-generating system (i.e., attention, knowledge, and bodily expression) and the functions of the emotion regulation (i.e., need-oriented, goal-oriented, or person-oriented emotion regulation). In this regard, the strategies employed in the present research aimed

at facilitating the accomplishment of a goal by covering the emotion-generation systems of knowledge (reappraisal) and bodily expression (relaxation).

In our two experiments, participants had to report on both the experienced arousal as well as hedonic valence (or pleasure-displeasure). These two dimensions served as basis for the assessment of the emotional experience, whereby affective valence was conceptualized as ranging from pleasant to unpleasant and arousal from calm to excited (see Lang, Bradley, & Cuthbert, 1999). Research on emotions considers these dimensions to be independent of each other (e.g., Russell & Mehrabian, 1974, 1977). A review on emotional memories by Kensington (2004) suggests that this independence has a neural basis. In the domain of emotion regulation (Gross, 1998a) it has been observed that although reappraisal participants are able to decrease their disgust experience, this was not necessarily linked to a decrease in their physiological responding; indeed, reappraisal participants did not differ in physiological responding from mere observation participants.

Stimulated by these findings, our experiments serve to explore whether implementation intentions that regulate one or the other dimension turn out to be effective with respect to the targeted dimension only, thus leaving the other dimension unaffected. This was thought to be of importance as it might not always be desirable to down-regulate the pleasantness/unpleasantness (i.e., valence) of an emotion and at the same time suffer the loss of the necessary energization to continue with the task at hand. In fact, regulating one dimension independently from the other might be important to meeting one's goals. For example, a procrastinator might want to down-regulate his arousal but not his unpleasant feelings of guilt as the latter might facilitate getting started. In the same vein, a veterinarian might maintain a certain level of arousal optimal for work-related performance in the face of severely injured animals. Moreover, in her instrumental account of emotion regulation, Tamir (2009) points out that people may be motivated to experience even unpleasant emotions if these are useful for goal attainment. Thus, in the present research we decided to focus on the emotion of disgust given the recent interest in this emotion (for example, Tybur, Lieberman, & Griskevicius, 2009) and its regulation (for example, Heilman, Crişan, Houser, Miclea, & Miu, 2010).

In line with previous research, we hypothesized that triggering both antecedent-focused (Experiment 1) and response-focused (Experiment 2) emotion regulation by implementation intentions should help self-regulate disgust, whereas mere goal intentions were expected to be quite ineffective. As the implementation intention in Experiment 1 called for cognitive change of the disgusting pictures, however, we specifically predicted that the antecedent-focused implementation intention would only change the degree of pleasantness-unpleasantness (i.e., valence)—but not the experienced arousal. In contrast, the response-focused implementation intention in Experiment 2 targeted the experienced arousal by specifying remaining calm and relaxed. Thus, this latter implementation intention was expected to be effective only in down-regulating the arousal—but not have an effect on the valence ratings.

## EXPERIMENT 1: ANTECEDENT-FOCUSED DISGUST REGULATION

Since we intended to evoke disgust, a first pilot test assessed whether the disgusting IAPS pictures which were to be employed in the two experiments actually

served to elicit this emotion. Therefore, participants were asked to rate which specific emotion was evoked by each of the presented pictures, as well as the degree to which they felt the respective emotion. A further pilot test analyzed whether the arousal and valence scales, which were to be used in our experiments, are actually tapping disgust. In Experiment 1, these measures and pictures were then used to assess the down-regulation of disgust via an antecedent-focused emotion regulation strategy. Since the content of the implementation intentions specified adopting the perspective of a physician, this strategy was expected to regulate the valence, but not the arousal of the emotional experience.

### PILOT TEST 1

In order to identify the concrete emotions activated by the "IAPS" pictures of our two experiments, 54 high school students who participated at an orientation course for future psychologists were asked to rate 60 pleasant, neutral, and unpleasant pictures. Since the students visited the university on either one of two days, 30 slides out of a total of 60 pictures were rated each day. Four practice pictures were shown before informed consent was obtained from all subjects. The pictures were presented in a randomized order with presentation times ranging from 40 to 70 s and participants were asked to report to what degree they felt sadness, fear, joy, disgust, and anger on scales ranging from 1 (little) to 7 (very). Results revealed a significant main effect for the pleasant pictures,  $F(4, 56) = 90.18, p < .001$ , with joy ( $M = 2.89, SD = .92$ ) differing significantly from the other emotions of anger ( $M = .3, SD = .4$ ), sadness ( $M = .12, SD = .2$ ), disgust ( $M = .39, SD = .39$ ), and fear ( $M = .09, SD = .13$ ). Regarding the disgusting pictures, a further highly significant main effect was observed,  $F(4, 56) = 175.42, p < .001$ . Disgust was the most prevalent emotion ( $M = 3.94, SD = .77$ ), followed by sadness ( $M = 2.14, SD = .59$ ) and fear ( $M = 1.59, SD = .46$ ), and finally anger ( $M = .56, SD = .32$ ) and joy ( $M = .03, SD = .08$ ). Thus, pleasant pictures evoked joy, while disgust was elicited by the disgusting slides.

### PILOT TEST 2

A second pilot test was run to assess whether the Self-Assessment Manikins (SAM) scales used in Experiments 1 and 2 (see below) serve to measure disgust. Twenty-seven participants volunteered to rate 46 pictures shown in Experiments 1 and 2. For each of the pictures, they were first asked to rate pleasure and arousal on the SAM scales. The SAM rating procedure consists of two 9-point scales representing different levels of pleasure and arousal, each containing five graphic figures. The first scale ranges from "happy" to "unhappy" (valence dimension) and the second one from "excited" to "relaxed" (arousal dimension). Moreover, participants had to indicate for each picture on a 9-point scale that ranged from 1 (not at all) to 9 (very) the amount of experienced disgust. Correlation analyses showed a significant association between the pleasure SAM scale and the respective 9-point disgust scale,  $r(27) = .44, p < .05$ , as well as between the arousal SAM scale and the respective 9-point disgust scale,  $r(27) = -.58, p < .01$ . These results indicate that unpleasantness (unhappy) relates positively to disgust ratings and reduced arousal

(relaxed) relates negatively. Our SAM scales can thus be assumed to tap valence and arousal associated with experiencing disgust.

## METHOD

### Participants and Design

Fifty-four female students of the University of Konstanz participated in return for 5 Euros or one hour of course credit. Only female participants took part to avoid a source of variability, as they are known to show higher scores in disgust-sensitivity (Rozin, Haidt, & McCauley, 1993, 1999), thus allowing for a more critical test of our hypothesis. The experiment followed a  $3 \times 3 \times 2$  factorial design with the between-factor self-regulation condition (control condition, goal intention condition, implementation intention condition) and the within-factors picture type (neutral, pleasant, disgusting) and emotional dimension (valence, arousal).

### Presentation of Stimuli

The picture material consisted of 45 slides, with 15 disgusting, 15 pleasant, and 15 neutral photographs. All pictures were taken from the "International Affective Picture System" (IAPS; Lang, Bradley, & Cuthbert, 1999), and selected based on pleasantness and arousal ratings. Thus, pleasant pictures had been rated high on the valence dimension and medium on the arousal dimension, while neutral pictures had medium standard emotional valence and low arousal ratings. Finally, the unpleasant pictures had low valence and high arousal scores.

As in previous research on emotion regulation via implementation intentions, after the presentation of a fixation cross for 800 ms, one of the 45 pictures was randomly presented for 100 ms. Each picture was then masked for 200 ms with a black and white pattern mask before the SAM scales (Bradley & Lang, 1994) appeared on the screen, on which subjects had to report their ratings (see below). After 2000 ms, a beeping sound for 200 ms at 500 Hz reminded participants of the limited response window. Following an inter-trial interval that varied between 3 and 8 s, the next fixation cross signaled the beginning of a new trial.

### Procedure

After entering the laboratory, it was explained to participants that they would be requested to look at slides and rate their emotional experience for each of the pictures. They were shown example slides and told that the visual material consisted of neutral (e.g., household objects), pleasant (e.g., appetizing food), and unpleasant slides such as burn victims. Informed consent was obtained and participants were randomly assigned to one of the three self-regulation conditions (control condition, goal intention condition, and implementation intention condition). Next, the SAM rating procedure was introduced to the participants. In all of the statistical analyses reported below we reverse coded these scales so that higher scores indicate higher valence and higher arousal, respectively.

Whereas control participants received no further instructions, participants in the goal intention condition were then asked to form the goal intention "I will not get

disgusted!" As implementation intentions operate in the service of a respective superordinate goal intention (Sheeran, Webb, & Gollwitzer, 2005), implementation intention participants were first asked to form this goal intention and then add the if-then plan: "And if I see blood, then I will take the perspective of a physician!" Thereafter, all participants were asked to perform four practice trials to ensure rapid responses to the SAM rating procedure.

### Post-Experimental Questionnaire

After viewing the pictures, both goal intention and implementation intention participants received a questionnaire taken from Schweiger Gallo et al. (2009) that assessed how committed they felt to meeting the goal of down-regulating disgust ("How committed did you feel to the self-regulation intention?" and "How much did you try to control negative feelings?") and their perceived performance ("How difficult was it to control negative feelings?"; "Did your self-regulation intention help you control negative feelings?"; and "How well did you succeed in realizing your self-regulation intention?"). All of these items were accompanied by 9-point answer scales ranging from 1 ("not at all") to 9 ("very"). At the end of the experiment, all participants were debriefed about the purpose of the experiment, given their monetary compensation or one hour of course credit, and thanked.

## RESULTS

### Main Analyses

Participants' rating scores were subjected to a 3 (self-regulation condition: control condition, goal intention condition, implementation intention condition)  $\times$  3 (picture type: neutral, pleasant, disgusting)  $\times$  2 (emotional dimension: valence, arousal) factorial analysis of variance (ANOVA), which yielded the predicted significant three-way interaction effect,  $F(10, 255) = 3.47, p < .01$ . To further explicate this interaction, we conducted separate 3  $\times$  3 (Self-regulation condition  $\times$  Picture Type) ANOVAs for each emotional dimension.

*Valence.* A 3 (self-regulation condition: control condition, goal intention condition, implementation intention condition)  $\times$  3 (picture type: neutral, pleasant, disgusting) factorial ANOVA yielded a significant main effect for self-regulation condition,  $F(2, 51) = 6.38, p < .01$ , partial  $\eta^2 = .20$ , and for picture type,  $F(2, 102) = 421.42, p < .01$ , partial  $\eta^2 = .89$ . Neutral pictures ( $M = 6.02, SD = 1.14$ ) were rated as being more unpleasant than the pleasant pictures ( $M = 7.15, SD = .76$ ),  $t(53) = 7.92, p < .01$ , and the disgusting pictures ( $M = 2.37, SD = 1.15$ ) were rated as much more unpleasant than the neutral pictures,  $t(53) = 18.23, p < .01$ , and the pleasant pictures,  $t(53) = 26.54, p < .01$ . With respect to the main effect of self-regulation condition we observed significant differences between control ( $M = 4.78, SD = .47$ ) and goal intention participants ( $M = 5.19, SD = .52$ ),  $t(34) = 2.48, p < .05$ , as well as control condition and implementation intention participants ( $M = 5.56, SD = .88$ ) regarding their reported valence,  $t(34) = 3.29, p < .01$ . The difference between goal intention and implementation intention participants was not significant,  $t(34) = 1.51, ns$ . As predicted, these two main effects were qualified by an interaction of the two factors,  $F(4, 102) = 2.17, p = .07$ , partial  $\eta^2 = .08$ .

**TABLE 1. Mean Ratings and Standard Deviations of Valence and Arousal Scores for Control, Goal Intention, and Implementation Intention Condition (Experiment 1)**

Condition	Picture Type					
	Pleasant		Neutral		Unpleasant	
	Valence <i>M (SD)</i>	Arousal <i>M (SD)</i>	Valence <i>M (SD)</i>	Arousal <i>M (SD)</i>	Valence <i>M (SD)</i>	Arousal <i>M (SD)</i>
C	6.83 (.71)	4.81 (1.46)	5.74 (.72)	3.41 (.82)	1.78 (.49)	7.13 (1.11)
GI	7.33 (.71)	4.02 (1.41)	6.08 (.98)	3.06 (1.33)	2.17 (.94)	6.89 (1.36)
II	7.28 (.80)	3.78 (1.34)	6.24 (1.55)	2.77 (.95)	3.15 (1.39)	6.05 (2.22)

Note. Higher valence ratings indicate higher pleasantness, while higher arousal ratings indicate higher intensity (i.e., excitement). C = control; GI = goal intention; II = implementation intention.

To elucidate this interaction effect, we computed a series of follow-up analyses: in line with our hypothesis, the one-way ANOVA for the disgusting pictures was significant,  $F(2, 51) = 8.82, p < .01$ . Planned comparisons revealed significant differences when comparing the control condition and the implementation intention condition,  $t(51) = 4.07, p < .01$ , as well as the mere goal intention condition and the implementation intention condition,  $t(51) = 2.93, p < .01$ . The difference between the control condition and the mere goal intention condition was not significant,  $t(51) = 1.14, ns$ . Analogous comparisons for neutral and pleasant slides revealed no significant differences throughout ( $ps > .10$ ). In sum, participants who formed a goal intention in tandem with an implementation intention rated the disgusting slides as less unpleasant than the control condition and mere goal intention condition, and no difference was found for neutral and pleasant slides (see Table 1).

*Arousal.* No significant interaction effect of picture type and self-regulation condition was found for arousal ratings,  $F < .1, ns$ . Only the main effects for picture type and self-regulation condition were significant,  $F(2, 102) = 163.44, p < .01$ , partial  $\eta^2 = .76$ , and  $F(2, 51) = 3.27, p < .05$ , partial  $\eta^2 = .11$ , respectively. Both neutral pictures ( $M = 3.08, SD = 1.07$ ) and pleasant pictures ( $M = 4.20, SD = 1.45$ ) were rated as less arousing than the disgusting pictures ( $M = 6.69, SD = 1.67$ ),  $t(53) = 17.87, p < .01$ , and  $t(53) = 10.88, p < .01$ , respectively. Neutral pictures were also rated as less arousing than the pleasant pictures,  $t(53) = 6.41, p < .01$ . With respect to the main effect of self-regulation condition we observed that control ( $M = 5.12, SD = .80$ ) and goal intention participants ( $M = 4.65, SD = 1.09$ ) did not differ on their reported arousal,  $t(34) = 1.46, ns$ , nor did goal intention and implementation intention ( $M = 4.20, SD = 1.30$ ) participants,  $t(34) = 1.14, ns$ . Only participants in the control condition and implementation intention condition differed significantly in their reported arousal,  $t(34) = 2.57, p < .05$ .

### Further Analyses

*Reported Goal Commitment.* Participants in the goal intention condition ( $M = 6.28, SD = 1.71$ ) and those in the reappraisal implementation intention condition ( $M = 6.39, SD = 1.50$ ) did not differ with respect to how committed they felt to the self-regulation intention,  $ts < 1$ . No differences were found, in addition, regarding how much they tried to control their negative feelings,  $ts < 1$  ( $M = 4.61, SD = 1.88$  and  $M = 4.67, SD = 2.61$ ). Therefore, the observed results do not seem to be based on a

TABLE 2. Mean Ratings and Standard Deviations of Valence and Arousal Scores for Control, Goal Intention, and Implementation Intention Conditions (Experiment 2)

Condition	Picture Type					
	Pleasant		Neutral		Unpleasant	
	Valence <i>M (SD)</i>	Arousal <i>M (SD)</i>	Valence <i>M (SD)</i>	Arousal <i>M (SD)</i>	Valence <i>M (SD)</i>	Arousal <i>M (SD)</i>
C	7.28 (.92)	4.97 (1.32)	5.28 (.78)	3.16 (1.19)	1.59 (.54)	7.38 (1.31)
GI	6.89 (1.16)	4.58 (1.70)	6.22 (1.25)	3.33 (1.15)	1.67 (.69)	7.41 (1.14)
II	7.29 (.73)	4.36 (1.81)	6.02 (1.32)	2.10 (.90)	2.07 (.71)	5.19 (2.24)

Note. Higher valence ratings indicate higher pleasantness, while higher arousal ratings indicate higher intensity (i.e., excitement). C = control; GI = goal intention; II = implementation intention.

heightened commitment to the intention to self-regulate in implementation intention participants.

*Perceived Performance.* No significant differences concerning participants' reported difficulties in controlling their negative feelings emerged between the goal intention ( $M = 4.78$ ,  $SD = 1.83$ ) and implementation intention conditions ( $M = 4.44$ ,  $SD = 2.45$ ),  $t_s < 1$ . Moreover, when asked whether the given self-regulation intention helped in controlling negative feelings, responses did not differ significantly between the goal intention ( $M = 5.22$ ,  $SD = 1.86$ ) and the implementation intention condition ( $M = 4.65$ ,  $SD = 1.87$ ),  $t_s < 1$ . Finally, no significant difference appeared for the perceived successes in self-regulation between the goal intention ( $M = 6.61$ ,  $SD = 2.12$ ) and the reappraisal implementation intention condition ( $M = 5.33$ ,  $SD = 2.59$ ),  $t(34) = 1.62$ ,  $p < .12$ . These findings on perceived performance are in line with Gollwitzer's (1993, 1999) assumption that implementation intention effects rest on automatic processes; implementation intention participants failed to consciously perceive themselves as being more successful in down-regulating disgust than goal intention participants.

## DISCUSSION

In this first experiment, we asked whether implementation intentions would be effective in regulating disgust. As assessed by valence scores, forming a goal intention furnished with a reappraisal implementation intention allowed participants to rate the disgusting pictures as being less unpleasant than did participants in the control condition or the mere goal intention condition. In contrast, there was no significant difference between control and mere goal intention participants. Also in line with our hypothesis, no differences were found between the conditions for experienced arousal; thus, implementation intention participants did not feel more relaxed after seeing the unpleasant slides. Importantly, these effects were not due to a heightened commitment to the intention to self-regulate in implementation-intention participants, as revealed by post-experimental data; a finding that is in line with a recent meta-analysis on this issue by Webb and Sheeran (2008). Moreover, participants who had formed implementation intentions did not notice their beneficial effects on the regulation of emotions, suggesting that implementa-

tion intentions unveiled these effects in an automatic manner (see Schweiger Gallo et al., 2009, Experiment 3).

## EXPERIMENT 2: RESPONSE-FOCUSED DISGUST REGULATION

In Experiment 2 we targeted the regulation of the bodily manifestation of disgust (see emotion regulation classification by Koole, 2009). Participants formed an implementation intention to stay calm and relaxed. This response-focused regulation strategy of disgust had been previously introduced by Schweiger Gallo et al. (2009), who showed that it achieved a down-regulation of arousal. However, the question remains whether it exerts its effectiveness exclusively on this dimension or also serves to regulate the valence component of disgust. As the content is aimed specifically at regulating the activation (arousal) of the emotional experience, we predicted that this strategy would be effective for this latter dimension, but not for valence.

### METHOD

#### Participants and Design

Thirty-six female students were invited to the experiment. All received 10 Euros or two hours of course credit. The present experiment uses a  $3 \times 3 \times 2$  factorial design with the between-factor self-regulation condition (control condition, goal intention condition, implementation intention condition) and the within-factors picture type (neutral, pleasant, disgusting) and emotional dimension (valence, arousal).

#### Presentation of Stimuli

Sixty-nine slides (23 pleasant, 23 neutral, 23 disgusting) from the "International Affective Picture System" (Lang et al., 1999) were selected. Each trial began with a fixation cross, which was shown for 800 ms before the slide was presented for 300 ms and then masked for 100 ms. Participants had to rate the valence and arousal of the presented slides to the "SAM" scales, which appeared after the presentation of each picture. As in the first experiment, after 2000 ms, a beeping sound for 200 ms at 500 Hz reminded participants to answer as quickly as possible. After an inter-trial interval of 3000 ms, the next trial began. All pictures were randomly presented twice, and a new presentation order was constructed for each participant.

#### Procedure

The procedure was the same as in Experiment 1. Participants in the goal intention condition were asked to form the goal intention "I will not get disgusted!" while implementation intention participants were asked to add the following if-then plan: "And if I see blood, then I will stay calm and relaxed!" Thereafter, all participants were asked to perform four practice trials. The same post-experimental questionnaire as in Experiment 1 was administered. After the experiment, the

participants were debriefed, given their monetary compensation or two hours of course credit, and thanked.

## RESULTS

### Main Analyses

As predicted, a 3 (self-regulation condition: control condition, goal intention condition, implementation intention condition)  $\times$  3 (picture type: neutral, pleasant, disgusting)  $\times$  2 (emotional dimension: valence, arousal) factorial analysis of variance (ANOVA) yielded the expected significant interaction,  $F(10, 165) = 3.29, p < .01$ . To explore this interaction effect, separate 3 (self-regulation condition)  $\times$  3 (picture type) ANOVAs for each emotional dimension were conducted.

*Valence.* A 3 (self-regulation condition: control condition, goal intention condition, implementation intention condition)  $\times$  3 (picture type: neutral, pleasant, disgusting) ANOVA revealed no significant interaction effect of picture type and self-regulation condition on valence ratings,  $F(4, 66) = 1.56, ns$ . Still, there was a significant main effect for picture type,  $F(2, 66) = 312.05, p < .01$ , partial  $\eta^2 = .90$ , indicating that neutral pictures ( $M = 5.84, SD = 1.18$ ) and disgusting pictures ( $M = 1.78, SD = .67$ ) were rated as being more unpleasant than the pleasant pictures ( $M = 7.15, SD = .95$ ),  $t(35) = 5.60, p < .01$ , and  $t(35) = 24.81, p < .01$ , respectively. Accordingly, disgusting pictures were rated as being more unpleasant than neutral pictures,  $t(35) = 17.49, p < .01$ . The main effect for the self-regulation condition was not significant,  $F(2, 33) = 1.80, ns$ .

*Arousal.* A 3 (self-regulation condition: control condition, goal intention condition, implementation intention condition)  $\times$  3 (picture type: neutral, pleasant, disgusting) factorial ANOVA yielded a marginally significant interaction of self-regulation condition and picture type,  $F(4, 66) = 2.09, p < .10$ , partial  $\eta^2 = .11$ , and significant main effects for self-regulation condition,  $F(2, 66) = 77.49, p < .01$ , partial  $\eta^2 = .70$ , and picture type,  $F(2, 33) = 5.96, p < .01$ , partial  $\eta^2 = .27$ . Again, neutral pictures ( $M = 2.86, SD = 1.19$ ) and pleasant pictures ( $M = 4.64, SD = 1.60$ ) were rated as less arousing than the disgusting pictures ( $M = 6.66, SD = 1.91$ ),  $t(35) = 12.82, p < .01$ , and  $t(35) = 5.64, p < .01$ , respectively, while neutral pictures were also rated as less arousing than pleasant pictures,  $t(35) = 6.25, p < .01$ . With respect to the main effect for self-regulation condition we observed that, overall, control ( $M = 5.17, SD = .83$ ) and goal intention participants ( $M = 5.10, SD = 1.02$ ) did not differ on their reported arousal,  $t < 1$ . In contrast, control and implementation intention ( $M = 3.88, SD = 1.19$ ) participants, as well as goal intention and implementation intention participants, differed significantly in their reported arousal,  $t(22) = 3.06, p < .01$ , and  $t(22) = 2.69, p < .05$ , respectively.

To elucidate the interaction effect, one-factorial ANOVAs revealed a significant effect for the disgusting pictures,  $F(2, 33) = 7.23, p < .01$ . As hypothesized, the differences between the control condition and the implementation intention condition,  $t(33) = 3.27, p < .01$ , as well as between the mere goal intention condition and the implementation intention condition,  $t(33) = 3.31, p < .01$ , were both significant, as indicated by planned contrasts. No significant difference was found between the control condition and the mere goal intention condition,  $t < 1$ . This pattern of results suggests that only the participants who furnished their goal intention

with an implementation intention were able to evaluate the slides as less arousing than participants in the control condition. The one-factorial ANOVA for positive pictures did not reveal a significant effect for condition,  $F < 1$ . However, a significant effect emerged for the neutral slides,  $F(2, 33) = 4.49, p < .05$ ; Scheffé post-hoc comparisons showed a significant difference between the goal intention condition and the implementation intention condition ( $p < .05$ ) and a marginally significant effect between the control condition and implementation intention condition ( $p = .07$ ), indicating that implementation intention participants rated the neutral slides as being less arousing than both control condition and goal intention condition participants. Apparently, holding arousal down with disgusting pictures by the use of implementation intentions facilitates less aroused responding to neutral slides as well.

### Further Analyses

*Reported Goal Commitment.* As in Experiment 1, no differences were found regarding the commitment to the self-regulation intention between the goal intention ( $M = 7.58, SD = 1.08$ ) and implementation intention condition ( $M = 7.50, SD = 1.88$ ),  $t < 1$ , nor how much they tried to control their negative feelings,  $t < 1$  ( $M = 5.17, SD = 2.52$  vs.  $M = 5.17, SD = 2.12$ ).

*Perceived Performance.* The same pattern was also observed for the questions regarding the difficulties in controlling their negative feelings ( $M = 4.25, SD = 2.05$  vs.  $M = 4.50, SD = 2.35$ , respectively),  $t < 1$ , whether the given self-regulation intention helped in controlling negative feelings ( $M = 5.00, SD = 2.41$  vs.  $M = 5.75, SD = 2.53$ ),  $t < 1$ , and participants' perceived success in self-regulation ( $M = 6.33, SD = 1.78$  vs.  $M = 7.08, SD = 1.08$ ),  $t(22) = 1.25, ns$ .

## DISCUSSION

In Experiment 2, participants with a response-focused implementation intention reported a lower evoked arousal after seeing the disgusting slides than control participants with no self-regulation intentions and goal intention participants, but didn't rate the pictures as being less unpleasant. Again, these results cannot be interpreted in terms of a higher commitment to the intention to self-regulate in implementation intention participants as compared to goal intention participants. Moreover, as in Experiment 1, participants seemed unaware of the beneficial effects of implementation intentions.

## GENERAL DISCUSSION

Recently, Schweiger Gallo et al. (2009) pointed to the need of research on the differential effects on emotion regulation by implementation intentions using different "then"-components. The present experiments are based on this suggestion and extend previous findings on emotion regulation by implementation intentions in an important way: by investigating how these strategies exert differential effects on specific dimensions of the emotional experience of disgust. In Experiment 1,

participants were given an implementation intention that specified the plan of taking the perspective of a physician. Since medical personnel might need to take advantage of the energization qualities of emotions (see also Bargh & Williams, 2007), this specific implementation intention allows for the cognitive reappraisal of the emotional experience of disgust without down-regulating arousal. In Experiment 2, the response-focused emotion regulation strategy was effective in regulating arousal, but not valence, as at this time regulating the intensity (arousal) of the emotional experience was targeted. Thus, the present experiments show that implementation intentions allow for selectively down-regulating only the intended emotional dimension, facilitating the flexible regulation of specific emotions. These data also complement data by Tamir and Ford (2009), which showed that people might choose an unpleasant emotion such as fear depending on the expected utility of the emotion in terms of goal attainment.

#### CONTRIBUTIONS OF THE PRESENT RESEARCH TO ACTION CONTROL BY IMPLEMENTATION INTENTIONS

Parks-Stamm, Gollwitzer, and Oettingen (2010) recently highlighted the importance of tailoring the contents of individual plans when analyzing whether two different types of implementation intentions, one temptation-inhibiting and one task-facilitating, would be effective for shielding academic goal pursuit from unwanted distractions. Results revealed that students with high test anxiety only benefited from implementation intentions to ignore distractions rather than to intensify their efforts on the ongoing test. Besides picking up on this latter research, as well as on previous research suggesting that emotional reactivity can be regulated by implementation intentions (Schweiger Gallo et al., 2009), the present research contributes to implementation intention research by focusing on the effects of different types of then-components specified in implementation intentions.

#### CONTRIBUTIONS OF THE PRESENT RESEARCH TO EMOTION REGULATION

Although the differential effectiveness of various implementation intentions was the focus of the present experiments, our findings are also relevant to understanding how ineffective strategies may be turned into effective ones. For example, previous research has shown that reappraisal is a fairly effective emotion regulation strategy that operates on emotional response tendencies before they are generated. However, recent research by Sheppes and Meiran (2007) has shown that reappraisal may be less effective than distraction if the reappraisal strategy is employed once emotional response tendencies have already unfolded. Such limitations may however be overcome by forming implementation intentions—a question to be explored in future research.

Another question debated in emotion regulation is that some strategies are very effortful and thus ego-depleting. As we know from implementation intention research, action control by if-then plans is very efficient and thus protects self-regulation resources (Webb & Sheeran, 2004). Although we cannot rule out

long-term hidden costs of emotion regulation by implementation intentions in the present research, we suspect a lack of such costs. For example, furnishing a goal with a respective suppression implementation intention to keep calm and relaxed has been found to not tax a person's self-regulatory resources (Schweiger Gallo & Gollwitzer, 2007). In fact, since the self-regulatory strategy of making if-then plans has revealed itself to lead to strategic automation of the goal-directed responses specified in their then-part (Schweiger Gallo et al., 2009), even originally effortful emotion regulation strategies should become more efficient by forming implementation intentions.

## FUTURE DIRECTIONS AND LIMITATIONS

Despite the relevance of the present findings for both emotion regulation and implementation intention research, the results from the present experiments are tempered by some of its limitations. A possible criticism is that the observed effects of implementation intentions are based on self-report measures. As self-report and physiological indices of emotion are not necessarily highly correlated (Lang, Bradley, & Cuthbert, 1998), a combination of self-report and physiological variables in future research seems desirable in order to disentangle whether self-reported arousal is comparable to physiological arousal.

One may be tempted to refer to experimenter demand as a viable alternative explanation of the observed differences between goal and implementation intentions. However, when explicitly assessing experimenter demand (Schweiger Gallo et al., 2009) no differences were found between who attempted to regulate emotions by goal intentions versus implementation intentions. The stimuli, presentation times, and measurements used in the present two experiments were very similar to those used by Schweiger Gallo et al. (2009). Accordingly, it can be assumed that participants' ratings in the present experiments were not affected by how the experimenter wanted them to respond; rather, the effects of implementation intentions relied on processes typically associated with implementation intentions (i.e., an enhanced perceptual and behavioral readiness).

Another potential criticism refers to the differences in the information provided to the participants, since the participants in the implementation intention conditions, as compared to participants in the goal intention condition, were provided with additional information on specific regulation strategies for dealing with disgust. However, this explanation does not seem viable in face of recent data reported by Bayer and Gollwitzer (2007). The authors assessed the effects of goal intentions versus goal intentions plus implementation intentions versus goal intention plus information on the behavioral strategy spelled out in the implementation intention. In this study, performance on an intelligence test was the dependent variable, and participants in the implementation intention condition not only performed significantly better than participants in the mere goal intention condition, but also better than participants in the goal intention plus information on strategy condition.

## CONCLUSION

Forming implementation intentions qualifies as an effective emotion regulation strategy which exerts differential effects depending on whether one or another emotional dimension (i.e., valence vs. arousal) is targeted. Specifically, forming an antecedent-focused implementation intention helped participants reduce their experience of unpleasantness, while a response-focused implementation intention was effective in down-regulating the evoked arousal after seeing disgusting slides. Apparently, implementation intentions that aim at a certain emotion generating system affect this very system only. The applied implications of the present research pertain to the fact that implementation intentions can be tailored to the specific needs of the individual, thus allowing for flexible down-regulation of anticipated unwanted emotional experiences.

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