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Implementation intentions: Control of fear despite cognitive load

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Implementation intentions: Control of fear despite cognitive load. The cognitive consequences of forming implementation intentions in controlling fear were addressed in the present study. Participants with an intense fear of spiders evaluated pictures of spiders, pleasant pictures, and neutral pictures under cognitive load. Regulatory control was measured by participants' self-report ratings of the pictures on the Self-Assessment Manikins Scales. Only participants given implementation intentions reported weaker negative emotional responses to the pictures of spiders as compared to participants given a goal intention and to no-goal control participants. Thus, emotional control by implementation intentions was shown not to tax a person's cognitive resources, attesting to the automatic nature of this self-regulation strategy.

Las intenciones de implementación: controlar el miedo a pesar del esfuerzo cognitivo. En el presente estudio analizamos las consecuencias cognitivas de la formación de intenciones de implementación sobre el control del miedo. Los participantes, que tenían un intenso miedo a las arañas, evaluaron imágenes positivas, neutras y de arañas bajo una carga cognitiva. El control de regulación se midió mediante la autoevaluación de las imágenes con las Self-Assessment Manikins Scales. Sólo aquellos participantes que se propusieron una intención de implementación tuvieron unas reacciones emocionales menos acentuadas en respuesta a las imágenes de arañas que aquellos que se propusieron una meta simple o los participantes que no tenían meta alguna. Así, el control de las emociones mediante intenciones de implementación no afectó a los recursos cognitivos de los participantes, lo que avala la automaticidad de esta estrategia de autorregulación.

Fear is a central emotion in our lives. Anxiety disorders, such as specific phobias, generalized anxiety disorders or posttraumatic stress disorders are the most common disorders, with a prevalence in the range of 2.4% to 18.2%, as assessed in 13 out of 14 countries by the World Health Organization (WHO) World Mental Health (WMH) Survey (2004). Although fear reactions serve to protect us when we face a potentially dangerous situation, they can be maladaptive in other situations (LeDoux, 2000). Given the relevance of fear disorders for mental health, the self-regulation of negative emotions in anxious individuals is of particular importance.

Gross's approach to emotion regulation

The regulation of emotions can take the form of controlling one's own emotions and controlling the emotions of others. Yet we will follow Gross's account (1998b), in which a person's influence on his or her own emotions is highlighted. He defines emotion regulation as «processes by which individuals influence which emotions they have, when they have them, and how they experience and express these emotions» (p. 275).

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For Gross (1998b), external and internal emotional cues are evaluated in a first step before they trigger behavioral, physiological, and experiential emotional response tendencies. Emotion regulatory strategies can be employed before emotional response tendencies are generated, or once they have been generated. Gross refers to the latter case as response-focused emotion regulation, and to the former case as antecedent-focused emotion regulation.

Based on this differentiation, Gross distinguishes in his process model of emotion regulation four antecedent-focused forms of emotion regulation (i.e., situation selection, situation modification, attention deployment, and cognitive change), and one response-focused emotion regulation strategy (i.e., response modulation). In the first antecedent-focused emotion regulation strategy, a situation may be selected by approaching people, places and objects, or by avoiding them. The second (i.e., situation modification) relates to altering the emotional impact of the situation (e.g., convincing a neighbor to stop parking his car in front of one's driveway). Third, deploying attention is utilized to choose which aspect of a situation is focused on, and includes concrete strategies such as distraction, concentration, and rumination. Distraction, for example, is used to direct attention to non-emotional features of the situation, to move attention away from the situation, or changing internal focus. Through concentration, attention can be directed to a particular task or topic, whereas rumination focuses the attention on feelings and their consequences. The fourth antecedent-focused emotion regulation strategy is cognitive change, which works by selecting

which of the possible meanings will be attached to a situation; it may both decrease and increase emotional responding, or even change the emotion itself. Finally, response modulation is a response-focused emotion regulatory strategy as it influences physiological, experiential, or behavioral response tendencies once they have been elicited.

Each of the strategies has different consequences on the cognitive, affective and social domain. In recent years, the antecedent-focused strategy of reappraisal and the response-focused emotion regulation strategy of suppression have been studied in detail (Gross, 1998a, 2002). Suppressing emotions involves inhibiting emotion-expressive behavior. Among the consequences at the cognitive level, suppression consumes cognitive resources, and thus impairs memory. Evidence was provided for example by Richards and Gross (1999), who found worse performances on both a cued-recall and cued-recognition test for participants who suppressed their emotions as compared to the no-suppression condition. In contrast, reappraisal is a form of cognitive change that interprets a potentially emotional situation in non-emotional terms and leads to reduced negative emotional experience and expression while increasing positive emotional experience and expression. From a cognitive point of view, undesirable decrements have not been found for this emotion regulation strategy (Gross, 2002; Richards & Gross, 2000).

Emotional self-regulation by implementation intentions

Implementation intentions (Gollwitzer, 1993, 1999) are if-then plans («*If situation x arises, then I will perform response y*!») that specify when, where and how a set goal has to be put into action. They are to be distinguished from goal intentions («*I intend to reach z!*») that specify a desired performance or outcome and lead to a sense of commitment to realize this outcome or behavior. In contrast, implementation intentions do not relate to the desired end-state as goal intentions do, but to the realization of the goal, and are based on the commitment to react in a planned, goal-directed manner once a previously specified critical situation is encountered.

Because implementation intentions create a mental link between the anticipated situation («if-part») and the intended goal-oriented behavior («then-part»), the mental representation of the situation becomes activated and is consequently highly accessible. This accessibility enables easy detection, effective recall, and a readiness to attend to the critical situation even if one is cognitively busy otherwise. Moreover, the control of the specified goal-directed behavior is effectively delegated to the critical situation, which leads to automatic action initiation when the specified situation arises. Thus, action instigation becomes immediate, efficient, and no longer needs conscious intent (Aarts & Dijksterhuis, 2000; Brandstätter, Lengfelder, & Gollwitzer, 2001; Gollwitzer & Brandstätter, 1997; Webb & Sheeran, 2004).

As the response-focused emotion regulation strategy of suppression has been shown to achieve emotion control in an effortful way, we (Schweiger Gallo, Keil, Mc Culloch, Rockstroh, & Gollwitzer, 2006) recently analyzed whether automating a response via a respective implementation intention could make a response-focused strategy of emotion regulation more effective and help people meet their goal of controlling negative emotions. In line with previous research, which has shown over the years that implementation intentions are a more powerful self-regulatory strategy than setting mere goals (for an overview see Gollwitzer, Bayer, & Mc Culloch, 2005; Gollwitzer, Fujita, & Oettingen, 2004), we could show that only those spider fearful participants who formed the implementation intention «And if I see a spider, then I will remain calm and relaxed!» were able to reduce their negative affect, and thus experienced the spider pictures as less unpleasant, less arousing, and feeling more in control, as compared to a non-self-regulation control condition and a goal intention condition. In fact, the implementation intention group managed to reduce their fear to the level reported by a no-fear of spiders control group.

In the present research, we examined whether the modulation of high fear of spiders by implementation intentions taxes a person's cognitive resources or is indeed void of negative cognitive consequences. If acting on implementation intentions achieves emotion control in an efficient way, automating emotion regulation via implementation intentions should not burden cognitive resources. Thus, emotion control by implementation intentions should allow people to perform simultaneously a cognitively demanding dual task.

The present research

Given that disorders in fear regulation underlie many psychopathologies such as phobias, panic, or posttraumatic disorders (LeDoux, 1995a, 1995b), the control of spider fear as indicated by self-report data was the focus of the present study. Fear can readily be elicited and measured on a variety of variables, for instance, physiological, behavioral and verbal (Lang, Bradley, & Cuthbert, 1998). Here, we examined if participants with high fear of spiders could profit from the strategic benefits of forming an implementation intention (e.g., strategic automaticity, swift and effective action initiation) and thus self-regulate their spider fear without taxing their cognitive resources in a dual task situation.

We expected that the goal intention would be quite ineffective in controlling fear, as has been shown regarding the control of reported disgust and fear in previous studies (Schweiger Gallo et al., 2006). In contrast, participants who formed an implementation intention should be able to experience the spider pictures as being more positive (valence), evoking less arousal, and as being more in control (dominance). We expected that the reduced negative emotional responses of implementation intention participants would hold true even though the pictures were evaluated under cognitive load, as forming implementation intentions should not impair self-regulatory resources. No significant differences were predicted between the groups for the ratings of the pleasant and neutral pictures.

Method

Participants

Forty-four female students at the University of Konstanz were asked to fill out 10 items from the EASI Questionnaire (Buss & Plomin, 1975), designed to assess fear of spiders with scales ranging from 0 («strongly disagree») to 4 («strongly agree»). Only those participants who scored 3 or higher on the scale «When I see a spider in the room, I can't relax until it's gone» qualified for participation in the study. All received 5 Euros or one hour of course credit. Two participants in the goal intention group had to be

excluded because one did not follow the instructions, and another reported no commitment with respect to her goal intention. The mean age of the students was 21.79 years (*SD*= 1.81).

Design

The present study used a 3 × 3 factorial design with the between factor self-regulation condition (control, goal intention, goal intention plus implementation intention) and the within-factor type of pictures (pleasant, neutral, spider pictures). The Self-Assessment Manikin («SAM»; Bradley & Lang, 1994) were used to assess the valence, arousal and dominance ratings with respect to each of the pictures presented.

Stimuli

The visual material consisted of 45 pictures taken from the «International Affective Picture System» (IAPS; Center for the Study of Emotion and Attention, 1999; Lang, Bradley, & Cuthbert, 1999): 4 of the pictures showed spiders, 15 presented pleasant material (e.g., happy infants, appetizing food), and the final 15 showed neutral material (e.g., household objects). As the IAPS-System did not have enough spider pictures, we added 11 further spider pictures that had been previously judged as highly frightening by 10 independent raters.

Procedure

All participants were told that they would be requested to see pleasant, neutral and spider pictures and rate their emotional experience for each of the pictures. In addition, they were asked to memorize four different numbers before the presentation of each picture and to report these numbers after each slide evaluation. For ethical concerns, participants were not only shown three example pictures (one of which depicted a spider) before they were asked if they wanted to participate, but also were reminded of the possibility of ending their participation at any time. After informed consent was obtained, participants were randomly assigned to one of the conditions.

First the «SAM» scales were explained to the participants. The advantage of these answer scales, as compared to other scales such as the Semantic Differential, is that they are nonverbal and allow for quick assessment of the emotional experience. Participants were told that they would be asked to estimate their emotional experience after the presentation of each picture using scales consisting of five graphic figures. These figures were Manikins that varied from «happy» (left side) to «unhappy» (right side) in the valence dimension, from «excited» to «relaxed» in the arousal dimension, and from «controlled» to «in-control» in the dominance dimension. Furthermore, participants were advised always to rate how they felt at the moment of seeing the pictures.

Participants were also told that they would be presented four different numbers in each fixation cross and that they should memorize them in order to introduce them after the picture's rating. Emphasis was made on the fact that both exercises were equally important, and that participants should try hard in both the rating and the number task. Participants in the goal intention and implementation intention condition were given further written instructions. Goal intention participants were given the goal intention «I will not get frightened!», whereas participants in the implementation intention condition were additionally required to form the implementation intention «And if I see a spider, then I will keep calm and relaxed!» Finally, participants were trained in responding rapidly to the SAM rating procedure on the basis of four practice trials before the experimental trials began.

Presentation

After the presentation of a fixation cross for 800 ms, four numbers were presented inside the fixation cross for 2000 ms. Thereafter, each of the 45 pictures was blended in a randomized order for 100 ms. The pictures were masked for 200 ms with a black and white pattern mask before the «Self-Assessment Manikin» scales (SAM; Bradley & Lang, 1994) appeared on the screen, on which subjects had to report their ratings. After 2000 ms a beeping sound for 200 ms at 500 Hz reminded participants of the limited response window. After giving their ratings, participants had to introduce the numbers previously shown. Following an inter-trial interval that varied between 3 and 8 seconds, the next fixation cross signaled the beginning of a new trial. Stimuli were shown on a 19-inch computer monitor with a refresh rate of 100 Hz. The distance between the computer screen and the participants' eyes was 80 cm.

Post-experimental Questionnaire

After the experimental trials, participants were asked to fill out a questionnaire and report their commitment to meet the goal of down-regulating their negative feelings: «How committed did you feel to the self-regulation intention?», and «How much did you try to control these negative feelings?». We also assessed their perceived control of fear in the face of spider pictures: «How difficult was it to control your negative feelings?», «Did your goal help you control your negative feelings?», and «How much did you succeed in realizing the goal?». Responses were all on 9-point 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 remuneration or one hour of course credit, and thanked.

Results

Dependent variables

Valence. In line with our hypotheses, the results of one-factorial ANOVAs yielded no significant self-regulation condition effects for the neutral pictures (M= 5.95, SD= .99) or the pleasant ones (M= 6.85, SD= .79), $Fs<1$, but a significant effect for the fear pictures (M= 3.02, SD= 1.41), $F(2, 41)= 10.19$, $p<.01$. As expected, planned comparisons revealed significant differences between the control condition and the implementation intention condition (M= 2.35, SD= .93 vs. M= 4.13, SD= 1.53; $t(41)= 4.14$, $p<.01$), and the goal intention condition and the implementation intention condition (M= 2.55, SD= .97 vs. M= 4.13, SD= 1.53; $t(41)= 3.60$, $p<.01$), but not between the control condition and the goal intention condition, $t<1$. Thus, participants who formed a goal intention in tandem with an implementation intention under cognitive load rated the fearful pictures as more positive than both the control condition and the goal intention condition under cognitive load.

Arousal. As we also anticipated, the results of one-factorial ANOVAs were not significant for the neutral (M= 3.67, SD= 1.06), F<1, and pleasant pictures (M= 4.87, SD= 1.21), $F(2,41)$= 2.24, *ns*, but for the unpleasant slides (M= 6.34, SD= 1.64), $F(2,41)$= 10.91, p<.01. As predicted, planned contrasts showed significant differences between the participants in the control condition (M= 6.96, SD= 1.24) and the implementation intention condition (M= 5.02, SD= 1.61), $t(41)$= 3.91, p<.01, as well as the goal intention condition (M= 7.11, SD= 1.17) and the implementation intention condition, $t(41)$= 4.15, p<.01. No significant differences emerged between the control condition and the goal intention condition t<1. This pattern of results indicates that those participants who had no instructions or formed a goal intention were not able to control their arousal as compared to those who formed in addition an implementation intention.

Dominance. A one-factorial ANOVA indicated a significant self-regulation condition effect for the pictures portraying spiders (M= 3.64, SD= 1.44), $F(2,41)$= 5.24, p<.01, but neither the pleasant (M= 6.12, SD= .99) nor for the neutral pictures (M= 5.94, SD= 1.21), Fs<1. Again, planned contrasts showed significant differences between the control condition (M= 3.32, SD= 1.73) and the implementation intention condition (M= 4.52, SD= .98), $t(41)$= 2.51, p<.05, as well as between the goal intention condition (M= 3.05, SD= 1.1) and the implementation intention condition, $t(41)$= 3.01, p<.01. No significant difference appeared between the control condition with spider fear and the goal intention condition, t<1. Indeed, only participants who had furnished their goal intention with a respective implementation intention felt being more in-control when looking at the unpleasant pictures than control and goal intention participants.

Further analyses

In order to analyze whether the observed effects relied on differences between the conditions, participants were asked how committed they felt to meet the goal of down-regulating their negative emotions and their perceived control of fear on scales ranging from 1 («not at all») to 9 («very»).

Reported goal commitment. Regarding the commitment to their goal, no differences were found between participants, as implementation intention participants (M= 6.93, SD= 1.58) were not more committed to their goal as those participants who formed only a goal intention (M= 5.71, SD= 2.13), $t(27)$= 2.44, *ns*. With respect to how much participants tried to control their negative feelings, participants who formed a goal intention (M= 5.14, SD= 2.25) did not differ from those forming an implementation intention (M= 5.67, SD= 1.72), t<1.

Perceived control of fear. No significant differences concerning how difficult it was to control negative feelings emerged between the goal intention condition (M= 4.36, SD= 2.31) and the implementation intention condition (M= 5.07, SD= 1.87), t<1. When asked whether their goal intention helped participants in controlling their feelings, no significant differences appeared between the goal intention (M= 5.43, SD= 2.14) and the implementation intention condition (M= 5.87, SD= 1.25), t<1. The same pattern was found regarding participants' reported success in realizing the goal between the goal intention (M= 5.93, SD= 2.37) and the implementation intention condition (M= 5.80, SD= 1.70), t<1.

General discussion

The response-focused strategy of suppression is a form of emotion regulation that demands self-monitoring and self-corrective efforts throughout an emotional event (Gross, 2002). As a consequence, it has been found to be rather ineffective in reducing negative emotions as compared to other forms of emotion regulation (e.g., reappraisal). As forming implementation intentions is a self-regulation strategy that furthers the degree of automaticity of action control (Gollwitzer, 1999; Gollwitzer & Sheeran, 2006), the present study explored whether implementation intentions are an effective emotion regulatory strategy, thereby not taxing a person's cognitive resources. Our assumption was supported that forming implementation intentions can help in controlling fear of spiders, even under cognitive load, as indicated by self-report data. In fact, the implementation intention group experienced the spider pictures as less unpleasant, less arousing, and feeling more in control. Moreover, this effect held true despite the pictures being evaluated under cognitive load. Thus, forming a goal intention furnished with an implementation intention allowed our participants to experience less fear than participants in the control condition or the goal intention condition, which indicates that emotion control by implementation intentions is also effective under cognitive load. No differences were found between goal intention and implementation intention participants on commitment to emotion regulation, demand characteristics of the instructions, and perceived emotion control.

Possible limitations of the present study

One may wonder whether the effects of implementation vs. goal intentions in the present study rest on the fact that implementation intention participants were offered additional information on how to deal with the unpleasant stimulus. Participants in the implementation intention condition were given not only more information but also more precise information about what to do when unpleasant stimuli were encountered, whereas those in the intention group were given less and more vague information. However, this explanation does not seem viable in the face of recent data by Bayer and Gollwitzer (2004). These authors assessed the effects of goal intentions vs. goal intentions plus implementation intentions vs. goal intention plus information on the behavioral strategy spelled out in the implementation intention in a study which required participants to solve Raven's Progressive Matrices. The number of correct solutions showed that participants in the implementation intention condition performed significantly better than participants in the goal intention condition. However, participants in the goal intention plus information on strategy condition did not perform at the level of implementation intention participants but at the level of goal intention participants. Apparently, it is the if-then link created by forming implementation intentions that accounts for its positive effects, presumably via automating the initiation of goal-directed efforts as spelled out by Gollwitzer (1993, 1999).

Future research might complement the present results with different cognitive load types in order to contribute to a deeper understanding of the mechanisms underlying the effectiveness of implementation intentions vs. goal intentions. For example, in order to induce another form of cognitive load, vocal random letter generation or the generation of random numbers (e.g., Robbins et

al., 1996) could be required of the participants. Furthermore, the comparison of these different types of cognitive load, such as between low and high cognitive loads, seems desirable. Thus, along with the higher cognitive load type of randomly generating either letters or numbers, participants could be required to perform an articulatory suppression task. This latter cognitive load is a lower cognitive load type consisting of asking participants to articulate continually an irrelevant sound such as «the» (Baddeley, 1983) or «one, two, three, four» (Jonides et al., 1998), being the rate of articulation indicated by a metronome beat once every second. Not least, in order to assess more precisely the cognitive consequences of emotion regulation, a graded cognitive load (no-load control group, slight, moderate and strong cognitive load) should also be included in future research. This would allow for a replication of the present findings in terms of the effectiveness of forming implementation intentions in the regulation of emotions under cognitive load.

Implications of the present findings

Implications for emotion control. More research on the self-regulation of emotions by setting goals and making plans is needed (Gross, 1998b) as different kinds of goals and plans may not only reveal distinct effects, but these effects may also be associated with unique costs. For instance, Tice and Bratslavsky (2000) argue that most attempts at emotion regulation affect other (subsequent and simultaneous) self-regulatory attempts. Research needs to examine whether the regulation of emotions by implementation intentions produces unwanted side effects in terms of increased sympathetic activation of the cardiovascular system. As Gross (2002) has observed about this negative affective consequence for suppression goals, it is important to know whether control by implementation intentions produces the same negative consequences or is void of them. To answer this question, physiological correlates need to be assessed for people who control emotions via implementation intentions vs. goal intentions. Moreover, the comparative analysis of positive emotion-expressive behavior (i.e., facial behavior; Gross, 1998a) also seems warranted, as does the comparative analysis of social costs. Again, Gross (2002) found that suppression has a negative effect on both of these variables, and therefore one wonders whether these negative consequences also hold for emotion control via implementation intentions.

Implications for applied research and clinical interventions. The implications for clinical interventions are far-reaching, as implementation intentions allow controlling fear with a simple volitional act. Moreover, no long training in forming implementation intentions is needed (Gollwitzer & Sheeran, 2006). In line with previous research, implementation intentions exert their effectiveness even in populations whose action control is hampered. Brandstätter et al. (2001) were able to show, for example, that opiate addicts in withdrawal who formed an implementation intention were more successful in writing a curriculum vitae than those who formed no implementation intention. Besides, schizophrenic patients (Brandstätter et al., 2001) and patients with frontal brain lesions (Lengfelder & Gollwitzer, 2001) were successful in promoting their goal-directed behavior after furnishing their goal intention with an implementation intention. We have replicated these findings by showing that anxious participants also profit from forming implementation intentions to control their fear (see also Schweiger Gallo et al., 2006). Thus, medical professionals, for example, can profit from implementation intentions whenever seeing blood, accident victims, etc, being able to control their disgust and paying more attention to the task at hand. In addition, participants with different fears should be able to use these strategies in order to ignore a threatening stimulus, or to keep calm and relaxed when seeing it, and rapid continuation of the work regardless of the presence of the threatening element should be ensured (see meta-analysis of psychological treatment for animal phobia by Méndez, Rosa, & Orgilés, 2005).

Conclusion

Forming implementation intentions allows spider fearful participants to control their anxiety. Our data suggests that implementation intentions do not tax a person's cognitive resources. Moreover, the forming of implementation intentions appears to be quite effortless, given that it only necessitates the simple volitional act of linking a critical situation to an intended goal-directed response.

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