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Cognitive Aspects of Emotion Regulation

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Very little is needed to make a happy life; it is all within yourself,
in your way of thinking.

Marcus Aurelius, "Meditations"

Za mamu, Sandija i tatu

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SUMMARY

The present work investigated cognitive processes that enable the individual to reduce the intensity of experienced negative emotions. In the emotion regulation literature, the inhibition and the suppression of already unfolded emotion have been extensively studied. By contrast, the present work focuses on early regulation processes in emotion generation. These are processes that are related to perception and interpretation of potentially emotion eliciting events. Specifically, four experiments were carried out to specify what kind of attentional and evaluative processes become activated, once the intention is established to regulate upcoming disgust. The first two experiments focused on attentional processes in regulation of disgust. They revealed that paying attention to the global properties of a disgust-eliciting scene will decrease its disgust-eliciting impact compared to a focus on the local aspects of that scene. The last two experiments focused on the presumably post-perceptual, evaluative processes that are associated with the attempt to regulate disgust. Given the intention to regulate disgust, disgust-related concepts were implicitly evaluated less negative, whereas contamination-implying concepts were evaluated more negative in comparison to the control group (no intention to regulate). Moreover, it was shown that the attempt to regulate disgust changes the motivational orientation of the individual by reducing its need for cleanliness. Specifically, the attempt to regulate was accompanied by a reduced accessibility of cleaning-related behavioral intentions. Altogether, these results suggest that the regulation of disgust is accompanied by a wide range of cognitive control processes, such as changes in encoding and evaluation of potentially disgust-eliciting events and changes in the motivational orientation of the regulating individual. The findings may have important implications for applied purposes.

GENERAL INTRODUCTION

You experience it daily: You restrain yourself from crying when sad, from having a tantrum when furious, remain calm in the face of danger. Instead of punching the person that drives you mad, you dampen your anger and take a deep breath. Instead of running away from the speaker's desk, terrified of failure, you smile friendly at your audience and give a talk. In everyday life, people frequently encounter situations in which they manage and control their experience and expression of emotion, especially negative ones, in order to be capable to act successfully and to respond appropriately to situational affordances. Thus, regulation of emotion is psychological "bread-and-butter work" and an important factor of everyday functioning. As these examples imply, failing to adequately regulate your emotions can have serious consequences for your well-being and your social relationships.

Given the frequency and ubiquity of exercising control over our emotions there is no doubt that we all are experts in this respect. Considering how central emotion regulation to human life is, it is astonishing that the question how exactly emotion regulation is achieved by the cognitive system has not been satisfactorily answered. Accordingly, there is still need to specify in particular the cognitive mechanisms that underlie emotional regulation. How exactly do people regulate their experience and expression of emotion? What are the cognitive mechanisms that possibly operate in emotion regulation? How do attention processes and evaluative processes (reappraisal) contribute to the modulation of the emotion response?

To highlight at least some of the relevant processes I follow two lines of research. On the one hand, the present work focuses on the role of attentional deployment in the regulation process and on the other hand, it explores what changes in the evaluation of emotion-eliciting events take place.

Before continuing to present the current work in detail, a short overview of its structure is given. First, I will introduce the construct of emotion regulation as far as relevant for the present work. Next, I will present the strategies of emotion regulation whereby the emphasis will be on so called antecedent-focused strategies that occur early in the process of emotion generation that is before the emotion is fully elicited. Using disgust as a paradigmatic example the present work further suggests the cognitive mechanisms that possibly accompany such antecedent regulation. In doing so, the role of attention processes and that of the cognitive reappraisal will be discussed in detail. The empirical part comprises of four experiments: two dealing with attentional processes and the other two focusing on the cognitive reappraisal in the antecedent regulation strategy. Finally, the main findings and the directions for future research will be discussed.

THEORETICAL BACKGROUND

In the following part, the construct of emotion regulation and the antecedent-focused strategy of emotion regulation are introduced together with possible mechanisms that enable individuals to reduce the intensity of negative emotions.

The Construct of Emotion Regulation and its Scope for the Present Work

What is meant by the relatively broad construct “emotion regulation”? As the examples above already imply, emotion regulation refers to processes that we use to influence the spontaneous unfolding of our emotions. It is important to note, however, that emotion regulation encompasses far more than a down-regulation of negative affective states. To put it more precisely, it aims at influencing distinct emotions in any direction, consciously or not, including attempts to increase, maintain, or decrease the intensity of distinct positive or negative emotions with regard to subjective experience and expression (Gross, 2001). This modulation of the emotional reaction is inasmuch apparent as the individuals influence “which emotions they have, when they have them and how they experience and express these emotions” (Gross, 1998a, pp. 275).

Even though the contemporary study of emotion regulation is a relatively recent trend and has developed rapidly within the last ten years (Gross, 2007; Koole, 2009), the conceptual interest in that topic is an old one. Psychodynamic approaches to the study of psychological defense mechanisms, such as rationalization or sublimation, were the first to deal with the issue. Likewise, interest in the nature of stress and coping strategies (Lazarus, 1966) and the developmental study of self-regulation

(Mischel, Shoda, & Rodriguez, 1989) represent further early precursors to tackle the concept of emotion regulation.

Notably, a review of the current literature reveals a number of critical issues related to this specific construct that need to be considered. First, the term *emotion regulation* turns out to be a fuzzy one. There is a tendency in the literature to use interchangeably constructs like emotion regulation, affect regulation, mood regulation, and stress coping (Gross & Thompson, 2007; Larsen & Prizmic, 2004; Russell, 2003). Even though the terms emotion, affect, and mood are often used synonymously they can and should be discriminated. In contrast to emotions (i.e. the target of emotion regulation processes), affect is typically used as a higher-level category (Scherer, 1984), whereas mood is a broader affective state, characterized by an absence of a specific elicitor and quality, and it is not accompanied by the appraisal of a distinct object (Niedenthal, Krauth-Gruber, & Ric, 2006). Coping, finally, involves mainly the decrease of negative affect (Gross & Thompson, 2007). Building on the prevalent course of the literature and given the fact that Gross' concept (1998a, 2001) focuses on discrete emotions, the present work embraces his approach to the term "emotion regulation" considering simultaneously the working character of this concept.

Second, to understand what emotion regulation is, presupposes an agreement of what an emotion is and which processes generate it. Still, there is a quite controversial debate (Lambie & Marcel, 2002; Russell, 2003). But most cognitive accounts agree that emotions are elicited and differentiated via an individual's assessment of the personal meaning of situations or events with respect to their implications for one's well-being, goals, motives, and concerns (Frijda, 1986; Ortony, Clore, & Collins, 1988; Roseman, 1991; Scherer, 1999). This appraisal process triggers a stream of response tendencies across more or less associated component systems (experiential, behavioral and physiological). Keeping the complex and controversial theoretical and

empirical perspectives in mind, the present work joins this widely accepted and shared notion that emotions involve changes across multiple response systems, as they were subjective experiential, behavioral and peripheral physiological. Conceiving of emotion in this manner, allows for providing a descriptive framework for a classification of emotion regulation strategies: emotion regulation can target at any of these components (Koole, 2009). Or to put it with Frijda (1986): “every phase in the core process is subject to regulatory intervention” (p. 456).

Third, the present work conceives emotion regulation in terms of the self-regulation of emotion, focusing though solely on the regulation of one’s own emotions. Consequently, broad emotion regulation approaches that deal with regulation of other people’s emotions (Southam-Gerow & Kendall, 2002; Thompson, 1994) or accounts that are concerned with the question what kind of interference emotions may cause in the course of information processing (Kleinsorge, 2009) are not further considered here. Moreover, the emotion regulation process of interest is situated in the normative sphere targeting the average healthy individual. Accordingly, aspects of emotion regulation that refer to clinical issues (e.g., affective disorders: Kring & Werner, 2004) are as well not a subject to this work.

Strategies of Emotion Regulation

Several approaches have been proposed to classify the enormous amount of possible emotion regulation strategies (Parkinson & Totterdell, 1999; Thayer, Newman & McClain, 1994). One approach, highly influential in the research field and relevant for the present work, is the so called “process model” of emotion regulation introduced by Gross (1998a,b, 2001). The process model structures possible regulation strategies according to the point in time at which these strategies modulate the emotion gen-

eration process. On these grounds, two different types of emotion regulation strategy are distinguished: antecedent-focused and response-focused emotion regulation. The antecedent-focused regulation affects the early stages of the emotion generation process, that is, before the emotion itself has completely unfolded. The emotional impact of a situation is modified by anticipating the situation and one's reactions and actively changing the cognitions associated with that potentially emotion eliciting situation. Imagine a psychology student who is about to take an exam in statistics. He might handle his anxiety by convincing himself that this exam is not substantial to his career since he is not into science particularly. On the other hand, the response-focused regulation occurs later and it aims at the already triggered emotional response tendencies by modulating the experiential, expressive or physiological components of the unfolded emotion (see Figure 1). It concerns mainly the expressive emotional behavior potentially visible to others. To illustrate this, imagine that you are really angry at your partner for some serious reason, but since both of you are sitting with your families at the table dinner you put a sweet smile on your face and try to track the conversation suppressing all the negative thoughts and a furious facial expression.

In the emotion regulation literature, the response-focused regulation that refers to the inhibition and the suppression of already unfolded emotion has been extensively studied (see, Gross 2002, for a review). Far less attention, though, has been paid to the antecedent-focused strategy and associated cognitive processes. The present work aims at clarifying the boundary conditions and mechanism under which the antecedent-focused emotion regulation strategy exerts its emotion-modulatory effects. Therefore, as the main topic of interest, this strategy will be described in a more detailed manner.

More precisely, the antecedent-focused regulation encompasses the anticipation and the control of emotional reactions by actively selecting and changing situa-

tions in which the emotion may occur, as well as by the way how that situation is perceived or attended to and (re)appraised (cognitive change). On these grounds, as illustrated in Figure 1, the antecedent-focused regulation strategy consists of four subtypes, each of which aims at different aspects in the timeline of the emotion generation process: (1) selection of the situation, (2) modification of the situation, (3) deployment of attention, and (4) change of cognitions.

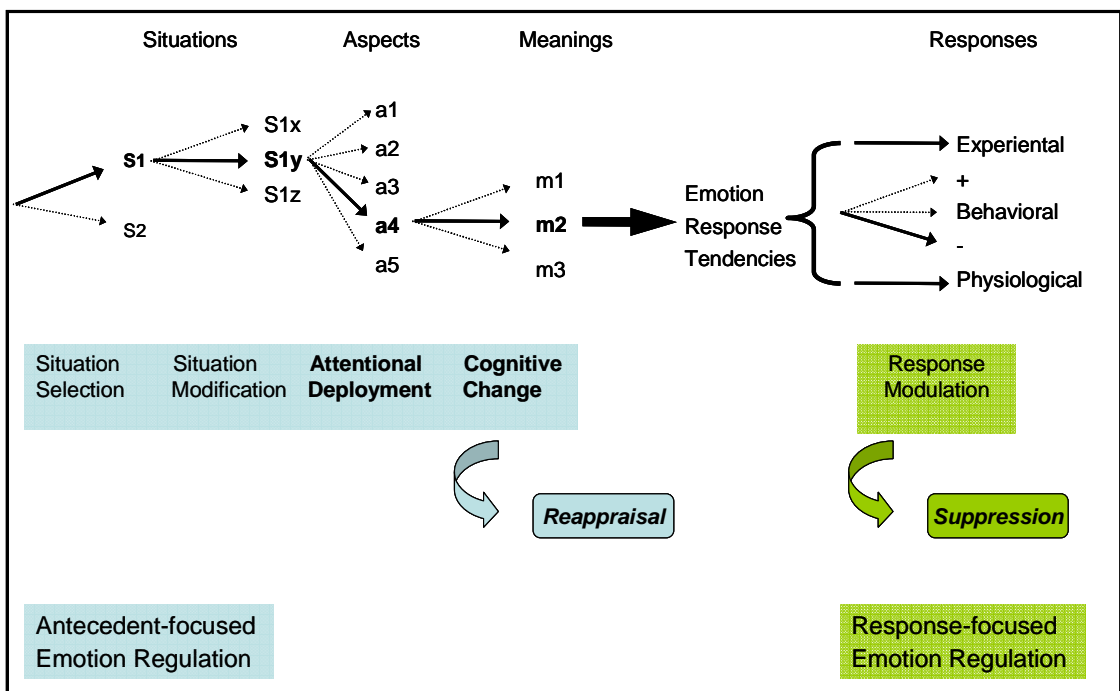


Figure 1. A process model of emotion regulation depicting how emotion regulation can have an impact on the early stages of emotion generation (emotion-inducing situation) and on the late stages in the process of emotion generation (full blown emotional response tendencies). Adapted from Gross (2001).

To illustrate and differentiate these subtypes of the antecedent-focused regulation we can use a very common example: a visit to the dentist. **(1) Selection of the situation** refers to avoiding people, objects and situations that might evoke an unpleasant emotion. At the same time, people and situations that are likely to induce a

pleasant feeling are approached. Implications for the example with the dentist could be as follows: As the visit approaches, you might feel uneasy and scared at the prospect of injections, drilling noise, blood, and pain. Thus, you decide spontaneously to ring your dentist up, cancel your appointment and go instead for a coffee with your friend. The time passes, the pain gets unbearable and you find yourself sitting on the dentist's chair. **(2) Modification of the situation** implies, once we select a situation, we can try to change it in order to reduce its emotional impact. In our example, to deal with your anxiety you can ask your dentist to offer an alternative treatment that allows you to relax as much as possible. The next possibility to alter the emotional significance of an emotion eliciting situation is the **(3) Deployment of attention**. A person can choose to redirect attention from the emotion inducing aspects of the situation and to pay attention selectively to some other (situational) features. That is, during the dental treatment you ignore the drill and the sensations as far as possible and focus on the colour of the ceiling and think of your last holiday instead. And finally, we can prevent emotions to arise by altering the way we perceive a situation, that is, via **(4) Change of cognitions or reappraisal**. We can impose a new emotional meaning on a potentially emotion-evoking situation or stimulus and reevaluate its relevance and significance for us (reappraisal). For instance, while sitting on the dentist chair and having the treatment we could prevent anxiety to unfold by assuring ourselves that this visit is, even though temporarily unpleasant, a necessary and vital intervention to maintain our personal health in the long run.

To summarize, Gross (1998a) has proposed a process model of regulation (and emotion generation) in which emotion can be modulated at different stages of its generation. In the first place, the regulation strategies can operate on the *emotion-inducing* situation before the actual emotion arises by means of situation selection and modification, attentional deployment and cognitive reappraisal (antecedent-focused strategies). Secondly, the regulation strategies can target the emotional *re-*

sponse tendencies via suppression of emotional thoughts and expressions (response-focused strategies).

Antecedent-focused Emotion Regulation

Possible Cognitive Mechanism

Experimental studies of emotion regulation have compared the response-focused regulation strategies (e.g. suppression) and antecedent-focused strategies (e.g. cognitive reappraisal) regarding their effect on emotion down-regulation (Gross, 1998a, 2001). The latter strategies presumably operate by means of deployment of attention and cognitive change in contrast to response-focused strategies that target bodily emotional behavior and responses. Response-focused and antecedent regulation strategies differ not only regarding their proposed mechanisms but also regarding their effects and possible side effects. Antecedent strategies are more effective in terms of mental and physical well-being as well as in terms of successful functioning (Cicchetti, Ackerman & Izard, 1995; Davidson, 1998, Garnefski, Kraaij, V. & Spinhoven, 2001; Gross, 1998b). Specifically, antecedent-focused regulation (reappraisal) has been shown to reduce successfully negative emotion experience without causing any apparent negative affective and physiological side effects that are typical for suppression (e.g. impairment of the memory or boosting physiological responding; Kramer, Buckhout, Fox, Widman, & Tusche, 1991; Richards & Gross, 2000).

Moreover, the use of antecedent-focused strategies (particularly reappraisal) seems to be an efficient and suitable way to decrease the negative emotional experience as well as the accompanying physiological arousal (Gross, 1998a, Koriat, Melkman, Averill & Lazarus, 1972; Lazarus & Alfert, 1964; Stemmler, 1997; Tomaka, Blascovich, Kibler, & Ernst, 1997). Not only does the antecedent-focused emotion regula-

tion strategy turn out to be a remarkably powerful regulation strategy but it is particularly easy to implement as well. Research findings, as those presented by Gross (1998a), clearly indicate that people are able to modify their emotional reactions quite easily after receiving a scarce behavioral instruction such as „try to adopt a detached and unemotional attitude – try to be objective – think about the film in such way that you do not feel nothing” while attending to disgust-evoking film sequences. Although there are many demonstrations of efficient emotion regulation, and several suggestions on how they might work, the cognitive mechanisms that mediate emotion regulation are still not well understood. The present work is meant as a step to further scrutinize these cognitive mechanisms in the antecedent-focused emotion regulation.

As already noted earlier, conceiving of emotions as multi-component processes that entail the appraisal of events as emotionally significant and a multiple set of emotional response tendencies, as they were subjective experiential, behavioral and peripheral physiological has one substantial implication for the processes of emotion regulation. This view implies that emotions can be regulated by the operation of different processes that occur at different points in time during the entire experience of emotion (Frijda, 1986; Niedenthal et al., 2006). On these grounds, Gross (1998a) developed a process model of emotion regulation (see Figure 1).

The present work explores the cognitive mechanism of the antecedent-focused regulation once the situation selection and situation modification have been established. For that reason, this work restricts itself to two relevant subtypes of the antecedent-focused strategy: the attentional deployment and cognitive change (re-appraisal). So far, attentional control and cognitive change have been subjects of brain imaging research (Ochsner, Bunge, Gross, & Gabrieli, 2002; Ochsner & Gross, 2008). This research suggests that prefrontal cortex (a neural substrate of control processes) is engaged in constructing reappraisal strategies that affect the modula-

tion of emotion responses, thus revealing the neural mechanisms that support the cognitive reappraisal.

Taken altogether, what happens once an individual has set explicitly the goal to down-regulate a negative emotional experience? One line of research tries to shed some light on changes in the attentional processing accompanying emotion regulation: Are there changes to the scope of attention? How is the emotion-evoking information processed? The other line of research explores what happens in terms of post-perceptual, cognitive changes: Does the reappraisal shape the spontaneous evaluation of emotion-eliciting events? Does reappraisal affect the occurrence of emotion specific behavioral intentions?

EMOTION REGULATION AND DEPLOYMENT OF ATTENTION

The Role of the Information Processing Style

One has not only an ability to perceive the world but an ability to alter one's perception of it; more simply, one can change things by the manner in which one looks at them.

Tom Robbins, "Even Cowgirls Get the Blues"

Attention is often referred to as one of the most basic cognitive processes that selects incoming information for further processing. No doubt, attention plays a vital role in directing the course of information processing (Broadbent, 1985; Treisman, 1969).

As suggested by Gross (1998a, 2007), individuals may regulate their emotional experience by means of attentional deployment. Attention can be directed at particular locations or objects for further processing in the appraisal process and attention can be redirected from undesired emotion-evoking stimuli within an emotion-eliciting

situation. This so called “spotlight metaphor” is one possible way to conceptualize visual-spatial attentional processes (Posner, Snyder, & Davidson, 1980).

A related idea is that visual attention does not only vary regarding the spatial location it picks out but also regarding its breadth (Eriksen & Yeh, 1985). In this view, attention is compared to a zoom lens that can expand or contract, thus resulting in a broadened or narrowed attentional scope. On the one hand, attention can be focused on detailed information of a perceived situation. On the other hand, a situation can be attended to at large with a poor resolution of details (see Derryberry & Tucker, 1994). For example, think of a student of medicine who is just about to carry out her first autopsy. Being exposed to that potentially disgust-evoking situation with a corpse in front of her, that she has to examine, she may have a rather global view of that situation and attend to “the big picture”, portraying herself as a student of medicine in a lab with the professor and other fellow students facing her first lesson in anatomy. This view is likely to be accompanied by a global deployment of visual attention that covers all the components of that particular situation. However, the student may also focus on specific isolated and possibly disgust-inducing details of that situation (e.g. the skin of the corpse, wounds, rests of blood etc.). This view is likely to go along with a local deployment of attention. Altogether, the attention can be directed either to global properties of a situation or to the analysis of the local properties. So to say, sometimes you miss the forest for the trees (local processing style), and sometimes you miss the trees for the forest (global processing style).

There is some preliminary evidence for a link between affective states and scope of attention. Importantly, the causal link between affective states and attention deployment has been considered in only one direction, namely how affective states affect the attentional deployment. The empirical evidence usually illustrates the effects of affective states on global versus local processing (and not vice versa). The results suggest that negative emotional states, especially those characterized by

high arousal, like fear or anxiety for example, narrow the scope of attention, thus producing a local bias (Basso, Schefft, Ris and Dember, 1996; Gasper & Clore, 2002; Derryberry & Tucker, 1994). The opposite is true for positive affective states as they seem to be associated with a broadened attentional scope (Fredrickson, 1998; Fredrickson & Branigan, 2005).

However, psychological theorizing and empirical evidence allow to infer a causal link in the other yet underrepresented direction, namely that from mode of attention to affective states. The review of the literature gives some clues on that link.

One of the approaches addressing the link from attentional focus to emotions can be found in the self-regulation literature (Ayduk, Mischel, & Downey, 2002; Derryberry & Rothbart, 1988; Gross, 2001; Metcalfe & Mischel, 1999; Nolen-Hoeksema, 1991). According to the prominent Hot/Cool Systems Model of Self-Regulation by Metcalfe and Mischel (1999) negative emotional experience or stimuli are mentally represented either with their emotion-eliciting, concrete and “hot” characteristics or in a more abstract and “cool” fashion. Specifically, self-regulation gets more difficult when the attentional focus lies on the arousing and “hot” characteristics of a situation. In contrast, relying on “cooling” strategies such as distancing, abstraction, distracting and reappraisal supports an efficient emotion regulation. This idea can be transferred to the example of the medical student as following: The student is able to regulate disgust easier when she psychologically distances herself from the “hot” properties of the scene (skin of the corpse, wounds, blood, death, decay) by focusing on “cool”, abstract cognitive cues of the stimulus (e.g., learning environment, her professional role, shapes, colours) or by distracting herself with nice thoughts.

One study from this research area by Kross, Ayduk & Mischel (2005) exemplifies the role of attentional deployment in self-regulation. The authors report that when individuals process their negative feelings from a self-distanced perspective

(third-person perspective) directing simultaneously their attentional focus on the reasons *why* they were experiencing those emotions they can focus on their negative experience *without* reactivating the “hot” negative affect. Under these circumstances participants displayed less anger and hostility in comparison to participants with a self-immersed perspective and the attentional focus on *what* happened to them. It is assumed that focus on *what* happened activates concrete “hot” representations, while focus on *why* something happened elicits abstract “cool” reasoning. This finding fits to an older, unrelated study by Strack, Schwarz & Gschneidinger (1985). They found out that thinking about an event which happened in the past elicits strong feelings only when the imaging of the event happens in a vividly and *in a detailed* manner as opposite to imagining in a more *general* and *abstract* fashion. In addition, intensive feelings are more pronounced when the participants describe *how* the events occurred rather than when they described *why* events occurred. Apparently, asking *how* produces thoughts linked to specific and concrete causes whereas asking *why* elicits thinking about more general and abstract causes concluded the authors. Taken altogether, the empirical evidence suggests that “cool” attentional strategies may play a causal role in the regulation of emotional and temptation-driven responses (Ayduk et al., 2002; Mischel et al., 1989).

The “hot/cool” mechanism of self-regulation with the related attentional strategies is obviously reminiscent of the attentional global-local information processing, implying that the more global attentional processing should decrease the intensity of affective reactions, whereas the local processing should result in more intense affective reactions. In a similar vein, Liberman, Trope, and Stephan (2007) identify the attentional mechanism involved in the Hot/Cool Systems as one of various dimensions of psychological distance. The term “psychological distance” is central to their Construal-Level Theory of Psychological Distance (CLT; Liberman & Trope, 2008; Liberman et al., 2007; Trope & Liberman, 2003). This account explores how psycho-

logical distance influences individual's thinking and behavior. CLT proposes that individual's judgments of events (construal level) are contingent on the psychological distance from the event (temporal, social and spatial distance). An event is psychologically distant whenever we can't experience it immediately: the more distant events are the more abstract becomes the knowledge we have about them. In line with this view, individuals represent psychologically distant events by their prototypical, abstract and global features (high-level construals) and proximal events by their peripheral, concrete and local features (low-level construals). Imagine the example of visiting the dentist. By the time you arrange the appointment you feel quite good about your behavior, since the visit is quite distant and you focus on all the long-term health benefits you gain (abstract in their nature). The closer and the more concretely represented the event gets, the more uneasiness arises with the prospect of injections, blood and pain. Empirical work demonstrated that different dimensions of psychological distance (time, space, social distance) influence mental construal of events and that these construals, in turn, influence evaluation and behavior.

Drawing on findings of the Hot/Cool Systems and their own theorizing Liberman et al. (2007) hypothesize as well that the intensity of affective reactions decreases with increasing psychological distance, since in this case the potentially emotion evoking situation is represented mentally in terms of its "cool" properties and respectively in terms of global and abstract features (high level construal). In other words, the attention deployment that is more global in its nature results in an increased psychological distance which in turn results in decreased affective reactions. For example, Liberman and Förster (2009) investigated the effect of global vs. local processing style on estimation of egocentric psychological distance. Participants were primed with either global or local processing style or both and had to estimate egocentric distances. As predicted, the global processing style (higher level construal) resulted in larger estimations of egocentric distance in time, space, social distance

and hypotheticality, whereas local processing had the opposite effect. In sum, these results suggest that psychologically distant situations and objects produced by a global oriented attention decrease the intensity of emotional responses.

Further evidence supporting the postulated assumption stems from neuropsychological research. On the one hand, research on hemispheric specialization demonstrates that the hemispheres differ in the efficiency with which they represent local or global information patterns. The left hemisphere is more adept at representing local information (analytic processing style or mode) whereas the right hemisphere is more dominant for the processing of global information (global or holistic processing style); (for a review, see Gazzaniga, Ivry, & Mangun, 1998). On the other hand, there is preliminary evidence that the encoding and the expression of disgust are linked to intact structures in the left hemisphere. For instance, Calder, Keane, Manes, Antoun and Young (2000) report a single case study of a patient who, following lesions of the left basal ganglia and the insula, was impaired in his ability to experience disgust and to recognize the facial expression of disgust. It is not too far fetched that this reduced affective responsiveness regarding disgust may be related to the strong dominance of global over local processing due to damages of left hemisphere structures.

Thus, a considerable amount of theoretical and empirical work suggests that attentional deployment may reduce the intensity of emotional reactions. The changes within the attentional deployment (local vs. global processing) may provide an answer to the question of how the emotion regulation operates. The present work explores whether the global or local deployment of attention varies with an individual's effort to regulate arising emotions in a potentially emotion-eliciting situation.

EMOTION REGULATION AND CHANGE OF COGNITIONS:***The Role of the Cognitive Reappraisal***

For there is nothing either good or bad, but thinking makes it so.

William Shakespeare, "Hamlet"

Not every potentially emotion-eliciting situation will cause an emotion. As we all know, in response to the very same event, we can have very different emotions or even no emotions at all. To give a talk in front of a huge audience may some of us view as a challenge, some as a part of the daily job routine and others may not properly sleep in horror at the mere thought of the prospect. As these examples already imply, for the elicitation of an emotion it is necessary that the individual appraises the situation as emotionally significant. Thus, in the view of so called cognitive appraisal theories, emotions are typically elicited in situations that are appraised as emotionally significant with respect to our goals, needs and possibility to cope, and our well-being, entailing a sequence of affective, cognitive and, behavioral processes (e.g. Frijda, 1986; Roseman, 1991; Scherer, 1999; Scherer, Schorr, & Johnstone, 2001).

More specifically, facing the potentially emotion-eliciting situation, the individual will try to estimate the degree to which the given situation is positive or negative, whether the situation is controllable or not, whether the situation is an obstacle or rather supportive of the individual's goals, whether the situation is familiar or completely novel, and finally whether the individual's reactions to the situation will be manageable or totally overpowering. All these evaluations can happen either unconsciously or consciously and the resulting pattern of evaluations will create a certain appraisal which in turn elicits the emotion. Importantly, the critical set of appraisal dimensions varies from theory to theory (Frijda, 1986; Roseman, 1991; Scherer, 1999,

Smith & Ellsworth, 1985). Still, some appraisal dimensions like pleasantness, novelty, and goal relevance are present in all accounts (for a review, see Scherer, 1999).

According to Gross' process model (1998a, 2007), this particular part of the emotion generation process represents one of the points where emotion regulation can operate on. Gross denotes this specific kind of the regulation strategy *cognitive change* (cf. Figure 1). In a given emotion-eliciting situation, cognitive change means that one or more appraisals are changed. This alters the emotional significance of a given event by changing either how the individual perceives the event or how the individual judges its own coping capacities.

One form of cognitive change is, as the name already implies, the so-called *cognitive reappraisal*. In his process model of emotion regulation, Gross (1998a, 2007) classifies reappraisal as an antecedent-focused emotion regulation strategy, thus a strategy that exerts its influence before an emotion becomes full-blown. Gross (2001) emphasizes that cognitive reappraisal can occur even before a negative emotion is elicited, thus as a result of the anticipation of a (negative) emotion. Think again of the student of medicine before carrying out her first autopsy: she will probably convince herself in advance before encountering the concrete situation that the main purpose of the autopsy is learning about human anatomy instead of focusing her thoughts on her emotions of fear and disgust.

Classic studies in coping by Lazarus in the 1960s were first experimental attempts to show that the reappraisal or the way we interpret or evaluate a potentially emotion-eliciting object or situation has an effect on emotional responses to it (Lazarus, 1991; Lazarus & Alfert, 1964; Lazarus, Opton, Nomikos, & Rankin, 1965). To date, studies of reappraisal especially concentrate on the decrease in negative emotion. Reappraisal was shown to attenuate participants' emotional responses regarding various emotion components, as they were less intensive emotional experience, physio-

logical arousal and expressive behavior (Gross, 1998a; Lazarus et al., 1965; Stemmler, 1997; Tomaka et al., 1997). For instance, Tomaka et al. (1997) demonstrated that the reinterpretation of the anxiety caused by an upcoming exam decreased participants' anxiety. Specifically, this was the case when the exam situation was reappraised as challenging (emphasis on personal development) rather than threatening (emphasis on evaluation).

Across many theories there is the agreement that appraisal is cognitive in nature, involving a variety of cognitive processes that operate at various levels of deliberation, automaticity and complexity. Accordingly, multiple types of processing involved in appraisal have been postulated (Lazarus, 1991; LeDoux, 2000; Ochsner & Feldmann Barrett; Smith & Kirby, 2000). Similar to Scherer (2001, pp. 92) who states that "the nature of the evaluation process has been rarely specified", Ochsner and Gross (2004, pp. 234) aptly summarize "the precise nature of component appraisal processes is not yet clear." Thus, the appraisal as a process of constantly ongoing evaluations, reactions *and* reevaluations to emotion-eliciting events against the background of the current needs and goals of the individual still needs further clarification.

The present work approaches to emotion-constituent appraisal by considering the motivational factors in the process of reappraisal. In this view, the relevance of the event to an individual's motivation may help to clarify further the question of the emotion-constituent appraisal. The role of different kinds of motivation (motives, needs, goals, desires, values, etc...) is mostly neglected as Scherer (2001) points out in his review of the appraisal research. Scherer (1999) postulates goal relevance as one of the critical dimensions in appraisal processes among other appraisal researchers. In a potentially emotion-eliciting situation the individual appraises the relevance and importance of a stimulus with respect to the given hierarchy of its own goals/needs ("goal relevance check"). According to this view, the stimulus is evaluated as relevant

if it results in outcomes that have an impact on the momentarily present goals/needs¹. Research on disgust reveals several clues about the motivational states that accompany the experience of disgust. So called “contamination or disease avoidance” are particularly applicable to explore this relationship.

These accounts postulate that disgust evolved in order to prevent the organism to incorporate or to have contact with toxic, contaminated stimuli, such as rotten meat, dirty objects, blood, feces (Rozin, Haidt, & McCauley, 2004; Rozin & Fallon, 1987.). As many disgust elicitors are potential sources of pathogens that can cause illness or even death in the end, disgust can be conceived of as an adaptive emotional response to protect people from disease (Izard, 1977; Oaten, Stevenson, & Case, 2009; Oatley & Johnson-Laird, 1987). Having in mind that, according to the appraisal accounts, the individual evaluates the potentially disgust-inducing events against the background of its current needs and goals, the following question arises: What kind of need (motivation) is connected to disgust? The contamination avoidance accounts suggest that disgust is accompanied by a fear of contamination and infection. Thus, confronted with a disgust-eliciting situation, the individual will evaluate the event against the background of its need for cleanliness and physical inviolability. When this need is violated disgust will be experienced. However, in case that the individual tries to regulate disgust experience, the reappraisal may encompass changes in the motivational orientation.

Drawing on the conception of disgust as a disease-avoidance mechanism (Oaten et al., 2009; Rozin et al., 2004), it is conceivable that in a situation where little disgust is experienced the need for cleanliness and the physical inviolability can not

¹ Scherer (2001, pp. 119) emphasizes that the term “goal” does not imply the existence of a conscious goal as criteria for this check. “Goal/need stands for any desirable state the organism is motivated to attain, without consideration of the source of this motivation or the consciousness or intentionality associated with it.”

be that particularly strong. The altered motivational state of the regulating individual should get apparent in the evaluation of the disgust-inducing situation and the evaluation of means that support or obstruct the goal of experiencing less disgust (Ferguson & Bargh, 2004). Moreover, it is assumed that the altered motivational state will also result in behavioral representations that encompass less cleanliness-related activities in comparison to a situation where disgust is fully experienced (Holland, Hendricks & Aarts, 2004).

The Emotion Disgust

The negative emotion of disgust was repeatedly induced in the reported experiments for the sake of studying the emotion regulation processes. Disgust is usually experienced as a feeling of revulsion at the sight of an offensive, potentially contaminating object, going along with a strong wish to withdraw from the eliciting stimulus and occasionally accompanied by nausea (Rozin et al., 2004). Apart from the debate over the veracity of the basic emotion concept (Ekman, 1999; Izard, 1977), disgust has consistently been listed as a basic emotion among joy, anger, fear, sadness and occasionally surprise (Niedenthal et al., 2006) and as opposite to higher cognitive emotions (e.g., jealousy or pride). For instance, Izard (1997) conceives of disgust as a basic emotion that serves the adaptive function of protecting the organism from contact with and incorporation of noxious or contaminated stimuli.

The choice to study disgust (rather than any other emotion) was motivated to some extent by practical reasons. For instance, it is extremely easy to induce a disgust reaction in the experimental laboratory setting (Gross & Levenson, 1995; Rozin, Lowery, & Ebert, 1994), especially relatively to other basic emotions, such as fear, for example (Thibodeau, Jorgensen & Jonovich, 2008). Just the mere sight of a big, shiny

cockroach crawling over a tasty pizza slice or a flesh wound covered by blood and thick yellowish purulence is automatically accompanied by a scream “yak”, an avoidant body posture and slightly narrowed brows, a curled upper lip, wrinkling of the nose and visible protrusions of the tongue – a full blown disgust reaction. As you probably notice and experience right now, you do not even need to see a picture to feel disgust. Imagination is perfectly sufficient to spontaneously elicit a full blown experience of disgust. Furthermore, having in mind the range of objects, situations and actions to which disgust is related, Power and Dalglish (1997, p. 294) consider it as “the most generalisable of the basic emotions”. Thus, the study of disgust regulation may allow to refer to general cognitive mechanisms involved in the regulation of emotion.

Apart from that theoretical perspective, the investigation of disgust regulation processes may have beneficial insights for the practical work of healthcare professionals like nurses and doctors. The medical and nursing staff is frequently confronted with situations where disgust is easily elicited. Nevertheless, the professional affordances include the necessity to regulate any upcoming disgust. The question is if this regulation happens in an appropriate way, since it is quite established that the physical health can suffer from an inappropriate regulation strategy like suppression (Gross, 1998a; Pennebaker, 1997).

And finally, in comparison to other basic emotions (e.g., fear or sadness), we can exclude that serious ethical issues will be violated by inducing disgust in participants (Rozin et al., 1994). In the present work, disgust has been elicited by presenting the participant with slides from the International Affective Picture System (IAPS; Lang, Bradley & Cuthbert, 2008; for a detailed description, see section “Empirical Part”). The chosen IAPS pictures had to meet ethical guidelines inasmuch as to induce disgust intensity that not surpasses the participants’ average daily experience. It should

be noted, that still the shown pictures are by far less harmful than the majority of scenes and images a regular TV consumer is confronted with.

EMPIRICAL PART

Some general remarks regarding the structure and general characteristics of the experiments are given before the four experiments are reported in detail. The structure of the following experiments is essentially the same. The participants were exposed to certain disgust-eliciting stimuli. The basic manipulation concerned the instruction. One group of participants received an instruction how to deal with the disgust-inducing stimuli, while another group did not receive any specific instruction. In all experiments the crucial dependent measure was reported disgust intensity. Depending on the specific research question, several variables were either manipulated or recorded, such as indices of deployment of attention, implicit evaluations of disgust-related objects or accessibility of behavioral intentions.

The structure of the experiments reported here resembles the one of Gross experiments (1998a) in many respects. For instance, the instruction how to regulate disgust was to a large extent identical to that of Gross (see Experiment 1). However, there are some procedural differences as well. For example, Gross presented the participants with two film sequences to induce disgust, obtaining two single disgust measurements of experienced disgust, whereas in the experiments reported here, disgust was induced by showing a series of eight pictures. Disgust was assessed after every single presentation. Given that the instruction worked in the present study as it did in Gross study it is unlikely that these procedural differences are of any importance.

The International Affective Picture System (IAPS; Lang et al., 2008; see Appendix) was employed in the present work to induce disgust in participants (Bradley, Codispoti, Sabatinelli, & Lang, 2001). IAPS is a stimulus set of large, normatively rated intensity-graded colour photographs for experimental investigation of emotion and

attention. The pictures that have been rated on valence and arousal dimensions may be used for emotion elicitation. The dimensional ratings allow for the possibility to select stimuli that are graded in intensity (Bradley & Lang, 2007). For ethical reasons, the participants were assured that they could finish the experiment at any time during the session if they wanted to do so for whatever reason.

All experiments controlled for influences of disgust sensitivity and sex. The Questionnaire for the assessment of disgust sensitivity (FEE; Schienle, Walter, Stark & Vaitl, 2002; see Appendix) was employed in all of the reported studies to control for the dispositional disgust sensitivity. The scale is an adaptation and translation into German of the original Disgust Sensitivity Scale developed by Haidt, McCauley, and Rozin (1994). The 8-item Short Form Scale assesses individual differences in sensitivity to disgust and samples four domains of disgust elicitors: core disgust (including food, animals, and body products), death/envelope violations, interpersonal, and sex. The gender of the participants has been assessed in every study to control for possible gender influences, since the literature reports about gender differences (Bradley et al., 2001; Hess, Sénécal, Kirouac, Herrera, Philippot & Kleck, 2000). However, gender did not have any substantial influence in the reported study and therefore, it will not be further considered.

Drawing on the process model by Gross (1998a, 2007) that proposes deployment of attention and cognitive reappraisal as two possible means of antecedent-focused emotion regulation, the empirical part of the present work is organized in the following manner: Experiments 1 and 2 are concerned with the role of attentional deployment (local vs. global processing) in the antecedent-focused emotion regulation whereas Experiments 3 and 4 focus on how the cognitions are changing when the individual has set the goal to regulate an upcoming emotion (cognitive reappraisal).

EXPERIMENT 1

Introduction

The preceding literature review suggests that affect and attention are intimately linked. One such link is that between affect and attention in terms of the global-local dimension. Conceivably, the disgust-evoking potential of certain stimulation is lower when it is processed in a distanced, global manner rather than in focused, local manner. To illustrate this issue, try to picture the following scenario that may happen in a typical behavioral therapy session: a person high in disgust sensitivity describes in detail what he finds disgusting about rats. He lists: the bulky and slippery appearance; the shiny, wet-looking fur; the large dark eyes; the abundant whiskers on the pointed muzzle; the long, naked tail; the sharp claws... What do you guess: will this focus on local aspects of the event decrease or increase disgust? All the informal tests I conducted with students revealed that the latter is more likely. So if you do not want to increase disgust but rather to decrease it, it might be a good advice to not focus on the local features of the rat rather than on its global and abstract properties. Hence, intuition and preliminary evidence as well suggest that attempts to regulate disgust might go along with, or are mediated by, attentional changes on the global-local dimension. Although there are hints in that direction in the literature (Kross et al., 2005; Liberman et al., 2007; Metcalfe & Mischel, 1999), this proposal has never been tested directly. This was done in Experiment 1 and 2.

The first purpose of Experiment 1 was to reassure that the instruction to down-regulate disgust actually results in lower disgust intensities under the experimental conditions employed here. To do so, participants were presented with a series of potentially disgust-evoking stimuli (IAPS pictures in this case). Before encountering the pictures the participants either received an instruction to down-regulate disgust

or another instruction that was neutral with respect to any disgust regulation attempts. The simple prediction was that the reported disgust intensities, prompted by the pictures, would be lower with an instruction to down-regulate disgust than without that instruction. In sum, the goal was to replicate the findings presented by Gross (1998a).

The second purpose was to test whether instructions to down-regulate disgust would spontaneously prompt a more global rather than local mode of attentional processing. To test this, participants were probed about their attention mode (either global or local) after each individual disgust-eliciting pictorial stimulus they were presented. As a measure of the attention mode a simple but established procedure by Kimchi & Palmer (1982) was employed. Participants were shown global geometric standard figures (squares and triangles) which consisted of certain local figures (squares and triangles). They then had to judge which of two comparison figures, that resembled the standard figure either regarding its local parts or its global shape was more similar to the standard figure (cf. Figure 2). Depending on whether the figure with higher similarity on the local or global level is selected, a corresponding processing mode of the observer is assumed.

Apart from computing an average measure of global vs. local processing mode, this procedure allowed me to study moment-to-moment changes of attention mode and disgust intensity. In other words, it was possible to analyze trial-to-trial effects of attention mode on disgust intensity and vice versa (cf. e.g. Gratton, Coles, & Donchin, 1992 for such trial-to-trial analyses). Specifically, two questions could be addressed (cf. Figure 4): First, does the attention mode (local or global) in a given experimental trial predict the disgust intensity evoked by an IAPS picture presented subsequently (cf. grey arrow in Figure 4)? Second, does the disgust intensity in a given trial predict the subsequent attention mode (local or global; cf. the black arrow in Figure 4)?

Method

Participants and Design

Participants were 68 visitors of the Dortmund University of Technology in Germany, who attended to University's open house event and were interested in psychological research. One participant was excluded prior to the analysis since she was not native German speaker and did not understand the given instruction entirely. The data from the remaining 67 participants were analyzed. The experiment had a single factor (emotion regulation strategy: *antecedent-focused emotion regulation instruction* or *no regulation instruction*) between-participants design.

Materials

The disgust-eliciting material consisted of 8 pictures from the IAPS (International Affective Picture System; Lang et al., 2008) that were previously chosen on the basis of being rated as disgust-eliciting relative to other presented pictures from the IAPS (see Appendix). Information processing style was assessed using an eight-item global-local visual processing task adapted from Kimchi & Palmer (1982). The global-local visual processing paradigm is usually employed to assess the scope of attention. In one such task, participants judge which of two comparison figures is more similar to a given standard figure. One comparison figure resembles the standard figure in global configuration, and the other in local, detail elements (see Kimchi, 1992).

Each item consists of a stimulus triad with a standard figure on top and two comparison figures below it. Two examples of the items used are depicted in Figure 2.

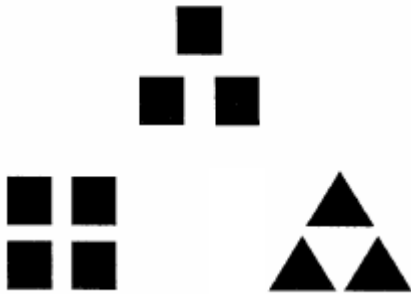

Item 1	Item 2
	
<input type="checkbox"/> left figure <input type="checkbox"/> right figure	<input type="checkbox"/> left figure <input type="checkbox"/> right figure

Figure 2. Two examples of global-local items (Kimchi & Palmer, 1982) used in Experiment 1.

The participants were asked to indicate which of the two lower comparison figures was more similar to the standard figure. The similarity choice can be determined either through focusing more on global features of the comparison figure or through comprising stronger the local details the comparison figure is made up of. For illustration, the standard figure in the Figure 2 (Item 1) represents a triangle that consists of square elements. If participants choose the left figure (a square made up of triangular elements) as being more similar to the standard figure, they display an information processing style based on local details. By contrast, if they choose the comparison figure on the right side (a triangle consisting of triangular elements) they focus more on the global appearance of the standard figure and thus, engage in global processing. Participants were assured that there were no right or false answers

and encouraged to follow their most immediate, first impression while delivering similarity judgments.

Procedure

Upon arrival, the participants were introduced to the paper and pencil procedure of the experiment: All relevant instructions and experimental steps would be presented in the booklet. The most important task would be to follow the given instructions as good as possible. Finally, all participants were told that they can finish the experiment at any time they want to and that they will get informed about the purpose of the experiment after the procedure has been completed.

Participants in the antecedent emotion regulation condition ($n = 35$) received the following instructions:

We will now be showing you a series of pictures. After each presentation of a picture, you will be asked to rate this picture. Please watch the pictures carefully until you form an impression of them and in doing so please try to adopt a detached and unemotional attitude. In other words, as you watch the pictures, try to think about what you are seeing objectively, in terms of the technical aspects.

Participants in the no regulation condition ($n = 32$) served as a control group. Thus, they were only asked to watch the presented pictures until they generated an impression of it. Importantly, no specific instruction *how* to watch the pictures was provided.

As a first step, an IAPS picture was shown on the next page followed by a disgust-rating scale as a second step. Subsequently as a third step, the participants had to render one similarity judgment in the local-global visual processing task (see Figure 2). These three steps were repeated eight times: Again, after a new IAPS picture oc-

curred, the amount of felt disgust was reported and a new item of the local-global visual processing task had to be judged etc. The session was concluded by the assessment of the dispositional disgust sensitivity and some additional questions regarding the participants' impression of the experiment. As it turned out, none of them was able to guess the experimental hypothesis. They were fully debriefed and thanked for their participation.

Measures

Subjective Experience of Disgust. Following each presented IAPS picture participants rated the amount of experienced disgust using a 9-point Likert-type scale, ranging from 0 (not disgusted) to 8 (strongly disgusted).

Information Processing Style. The internal reliability of the local-global eight-item scale (Kimchi & Palmer, 1982) used in the current study can be considered as good ($\alpha = .86$). As mentioned above, maximally eight similarity judgments could be delivered. A variable *global processing* was derived out of the judgments, indicating the number of global choices. For example, a score of 3 would mean that the participant chose a global interpretation 3 times and consequently a local interpretation 8 minus 3 which equals 5 times.

Disgust Sensitivity. To control for the dispositional disgust sensitivity the Questionnaire for the assessment of disgust sensitivity (FEE; Schienle et al., 2002) was implemented. The items were rated on a 4-point Likert-type scale, ranging from *not disgusting* to *very disgusting*. Subsequently, this variable was included as a covariate in the analyses. It had satisfactory internal consistency in the present study, with a Cronbach alpha coefficient of .75.

Results

Before reporting the results of the study in detail, two general remarks should be made. As in all following experiments, the significance level was set at $p < .05$ (two-sided). Where necessary, violations of the sphericity assumption in repeated measure analyses were accounted for by Greenhouse-Geisser corrections of degrees of freedom.

Subjective Experience of Disgust

It was predicted that the participants in the antecedent-focused emotion regulation condition would report lower scores in experienced disgust compared with the participants in the control group (“just watch” participants). It is only on this base that further analysis concerning the clarification of causal mechanism underlying the antecedent emotion regulation processes makes sense.

A multivariate analysis of variance (MANOVA) with the factor *emotion regulation instruction* including dispositional disgust sensitivity as the covariate was conducted. The dependent measures were disgust intensity and information processing style. With respect to disgust intensity, the analysis yielded the expected significant main effect of emotion regulation instruction $F(1,64) = 9.5, p = .003$, indicating reported lower amounts of subjectively experienced disgust in the regulation group ($M = 4.73, SD = 1.75$) in contrast to the control group ($M = 5.87, SD = 1.24$), as presented in Table 1. Interestingly, there was also a main effect of the covariate disgust sensitivity in this analysis $F(1,64) = 6.8, p < .01$. Disgust sensitivity was positively correlated with disgust intensity.

Information processing style

The instruction did not generally affect the mode of information processing. If anything, a global mode was more frequently employed in the control group than in

the antecedent instruction group, although this difference did not reach significance $F(1,64) = 2.9, p = .09$, (see Table 1). As with the analysis of disgust intensity, there was a noteworthy impact of the covariate disgust sensitivity on the information processing style. The higher disgust sensitivity, the more frequently a local mode of processing was chosen regardless of condition, $F(1, 64)=4.1; p<.05$.

Table 1. Disgust intensities and number of times holistic processing was selected as a function of emotion regulation instruction condition.

Measure	Emotion Regulation Instructions			
	Antecedent instruction		No instruction	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Disgust intensity	4.73	1.75	5.87	1.24
Holistic processing	4.02	2.65	5.12	2.92

Note. Means of disgust intensity are the average of 8 disgust intensity items rated on 9-point scales, with higher numbers reflecting higher disgust intensities. Means of global processing are the mean number of globally processed items (maximally 8 per subject). Thus, the higher the value the more frequently a global mode was selected.

The Information Processing Style as a Moderator Variable

To explore whether the attentional mode of processing (local vs. global) alters the impact of the instruction, a moderation analysis was conducted. Thus, in this analysis, the degree of global processing was used as a continuous predictor variable rather than as a dependent variable as it was done in the in the MANOVA above.

The moderation assumption was tested with the procedure recommended by Aiken and West (1991). Z-transformed data were submitted to a two-step hierarchical regression analysis. Beforehand, the experimentally manipulated levels of the emotion regulation instruction were coded 1 and -1. The disgust intensity was regressed on the predictor variable (emotion regulation instruction) and the moderator variable (information processing style) in the first step, with a Predictor X Moderator interaction term added in the second step. When entered in the first step in the regression equation, emotion regulation instruction was a significant predictor, $\beta = -.38$, $t(64) = -3.40$, $p = .001$, whereas processing style turned out to be a marginally significant predictor, $\beta = -.22$, $t(64) = -1.93$, $p = .06$, overall $R^2 = .17$, $F(2, 64) = 6.63$, $p = .002$. In line with the expected moderation effect, when entered in the second step, the interaction term received a significant and negative regression weight, $t(63) = -3.0$, $p = .004$, $\Delta R^2 = .10$, $\Delta F(1, 63) = 9.0$, $p = .004$, as shown in Table 2.

Table 2. Multiple Hierarchical Regression Analysis for Variables Predicting the Intensity of Experienced Disgust ($N = 67$)

Variable	<i>B</i>	<i>SE B</i>	β	<i>p</i>
Step 1				
Emotion Regulation Instruction	-.38	.11	-.39	.001
Information Processing Style	-.22	.11	-.22	.06
Step 2				
Emotion Regulation Instruction	-.37	.10	-.39	.001
Information Processing Style	-.24	.10	-.24	.03
E.R. Instruction X I.P. Style	-.32	.10	-.32	.004

Note. $R^2 = .17$ for Step 1 ($p = .002$); $\Delta R^2 = .10$ for Step 2 ($p = .004$).

Particularly those participants in the antecedent-focused regulation condition who simultaneously were engaged in the global processing style reported the lowest scores of experienced disgust, whereas the participants of the same condition who engaged more in the local processing style reported disgust scores that were almost as high as those reported from the control condition (see Figure 3). Moreover, disgust intensity was lower the more frequently participants selected a global mode of processing.

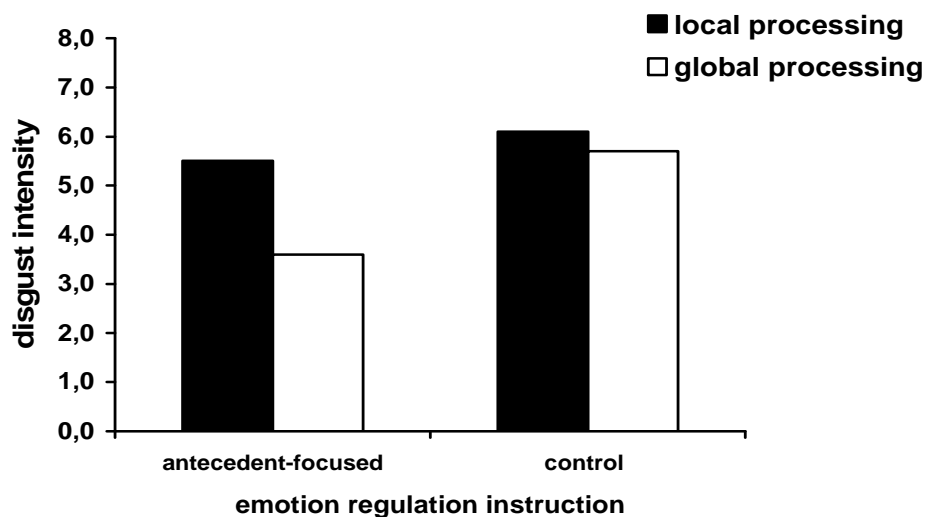


Figure 3. By means of a median split the participants were categorized into predominantly high global processors and low global processors (local processors). A basic moderator effect can be represented as an interaction between a focal independent variable and a factor that specifies the appropriate conditions for its operation (Baron and Kenny, 1986: p. 1174)

Sequential trial-to-trial analyses

The analyses up to now suggest that at least in the regulation group the attentional mode and disgust experience are associated with each other. Disgust is lower, the more frequently a lower mode is activated. Yet, two questions remain open with

regard to that analysis. First, does the attentional mode of processing determine the intensity of disgust or, vice versa, does the amount of experienced disgust determine the mode of attention? Obviously, this problem can only be avoided by the experimental manipulation of the attentional mode. This is what was done in Experiment 2. Another, yet unresolved issue, concerns the time course of the link between attention and disgust. Is this a more permanent link, so that a certain attention mode, once activated, affects disgust over a longer period of time? Or alternatively, is this link more short-lived such that the attention mode changes from time to time, and consequently changes the level of disgust from moment to moment as well?

To address these questions sequential trial-to-trial analyses were conducted. This sort of analysis has turned out to be helpful in many other instances. For example, it has been shown that the valence of stimulus in a certain trial determines very flexibly and short-termed the impact of another valent picture presented shortly later (Kunde & Mauer, 2008). Likewise, the momentarily dominant information processing style (global vs. local) may determine the disgust intensity elicited by the subsequently shown IAPS picture. To account for the possibility that the “choice” of a global item or a local item influenced the following disgust intensity rating (cf. the grey arrow in Figure 4), an additional analysis was applied. For each participant the mean disgust rating following global modes and following local modes were computed. Thus, a mean score of disgust intensity ratings that followed local choices (disgust intensity preceded by a local mode) and a mean score of disgust intensity ratings that followed global choices (disgust intensity preceded by a global mode) were computed respectively.

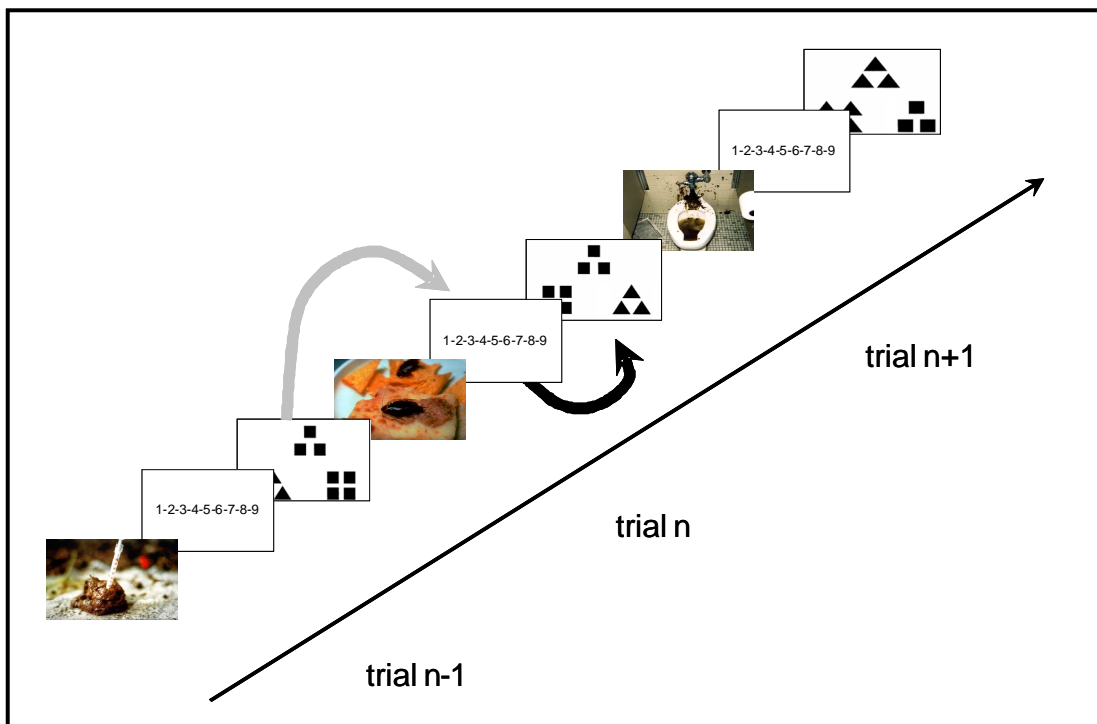


Figure 4. A part of the experimental arrangement that allowed for sequential trial-to-trial analyses. The presentation of an IAPS picture was followed by a rating of disgust intensity and a choice in local vs. global visual processing task.

Then, a paired t-test was performed to compare disgust intensities preceded either by a global or local mode of information processing within the regulation group and within the control group as well. The data show that within the regulation group the disgust intensity was significantly lower, $t(23) = 2.9$, $p = .008$, when the disgust rating was preceded by a global processing mode ($M = 4.48$ $SD = 2.36$) than when preceded by a momentary local processing mode ($M = 5.73$ $SD = 1.91$). This difference in disgust intensities following the global ($M = 5.64$ $SD = 1.9$) and local processing mode ($M = 6.37$ $SD = 1.81$) has not been observed within the control group, $t(15) =$

1.15, *ns.*² In sum, the reported analysis showed that the predominant attention mode predicted the forthcoming disgust intensity.

Table 3. The mean of disgust intensities that followed either a global or local attentional mode which were submitted to a paired t-test.

Measure	Emotion Regulation Instructions			
	Antecedent instruction		No instruction	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Disgust Intensity preceded by Global Mode	4.48	2.36	5.64	1.9
Disgust Intensity preceded by Local Mode	5.73	1.91	6.37	1.81

Note. The mean disgust following a certain attentional mode could not be computed if a participant did not use this particular mode at least once. Therefore, these participants using exclusively one mode were removed from the analysis. This applied to 11 participants from the antecedent-focused regulation group and 17 from the control condition.

A second analysis was performed to test whether the disgust intensity predicted the subsequent choice of attention mode (cf. the black arrow in Figure 4). To do so, individual logistic regressions were computed for the individual data of each

² This analysis is equivalent to a regression analysis of the individual disgust ratings as dependent variable and preceding attention mode (global vs. local) as predictor. A one-sample t-test revealed that the mean individual regression coefficient computed from the regression coefficient of individual participants deviated significantly from zero ($b = -1.25$) in the antecedent-focused emotion regulation condition, $t(23) = 2.9$, $p = .008$ but not in the control condition ($b = -.726$), $t(15) = 1.15$, *ns.*

participant across trials (Lorch & Myers, 1990; Thompson, 2007). The dependent variable was attention mode (global vs. local) and the predictor was the disgust intensity preceding the choice of attention mode. The means of the individual regression coefficients did not significantly differ from zero, neither in the emotion regulation condition ($b = .74$; $t(23) = 0.32$, *ns.*) nor in the control condition ($b = 2.90$; $t(15) = 1.87$, *ns.*)

Discussion

Experiment 1 explored the role of information processing style in the process of antecedent-focused emotion regulation of disgust. After receiving an instruction to either down-regulate or not to down-regulate disgust participants were exposed to a series of disgust-eliciting pictures. After each presentation of a picture the experienced disgust intensity and the attentional mode (global vs. local) were assessed. The experiment revealed several noteworthy results.

First, the instruction to down-regulate upcoming disgust worked. With the same set of potentially disgust-evoking pictures from the IAPS, disgust intensity was on average lower in the antecedent-focused emotion regulation condition than in the control condition (Gross, 1998a, 2007).

Second, the regulation instruction had no general effect on the preferred attentional processing style on average. Because the instruction reduced disgust nevertheless, this clearly suggests that there must be other means of emotion regulation than changes in the scope of attention or processing style. It is conceivable that there exists a sort of a “regulation tool-box” providing different means of emotion regulation. Some of these means will be considered in the remainder of the present work (Experiments 3 and 4).

Third, the regulation instruction and preferred mode of attentional processing appear to have a combined effect on disgust intensity. The instruction to regulate

disgust was more effective the more frequently participants engaged in a global mode of processing while exposed to disgust-eliciting pictures. In fact, with high frequencies of a local processing mode, the instruction was ineffective (cf. Figure 3). This observation suggests that instruction as such is not sufficient (and possibly not even necessary, cf. Experiment 2) to attenuate disgust intensity.

Fourth, the regression analyses suggest further that when controlled for the regulation instruction and its interaction with mode of processing, the global mode of processing is associated with lower intensities of disgust (cf. Table 2). Thus, basically the mode of attention seems to have an effect on the generation of disgust. This result will be further explored (and in fact confirmed) in Experiment 2. Another incidental observation supporting the assumed link between attention and disgust is that the dispositional disgust sensitivity correlates with the attentional deployment. Participants who are dispositionally prone to experience easily and quickly disgust tend to predominantly engage in local mode of processing.

Fifth, as already stated, the participants had to make a choice in the global-local visual processing task after disgust rating of every single picture. This experimental arrangement allowed for a sequence analysis. Although exploratory in nature, trial-to-trial analyses revealed that a momentary dominating global mode of processing reduces the disgust-evoking power of the IAPS pictures presented in the following, provided there is also an intention to down-regulate disgust (as it is case in the regulation condition). Contrarily, disgust intensity did not determine the processing mode of attention selected briefly afterwards. Even more, since the attention mode changed from moment to moment (from trial to trial), this clearly suggests that the attention mode can shape disgust in a highly flexible manner. No comparable difference was observed within the control condition. Altogether, the sequence analyses suggest a remarkable moment to moment flexibility of the impact of the attention mode on disgust intensity. Furthermore, results of the sequential analysis are in line

with those revealed by the moderation analysis providing further evidence for the possibility that the distribution of attention may have a more direct impact on the experienced disgust intensity.

To sum up, Experiment 1 provided some hints for the proposed link between the down-regulation of experienced disgust and global processing mode. However, attention mode served as dependent measure in some analyses, whereas it served as independent measure in other analyses. To unequivocally demonstrate a causal impact of mode of attentional processing on disgust intensity the present work can not escape to manipulate the attentional mode of processing experimentally. This was done in Experiment 2.

EXPERIMENT 2

Introduction

Experiment 2 tested whether the global and local attentional deployment has a causal impact on experienced disgust. For this purpose, the participants were primed either with the global or local processing mode or they were not primed at all (see below). One half of them received the regulation instruction whereas the other half received no specific instruction. It was expected that in the antecedent regulation group the priming of a global processing mode would result in lower intensities of disgust compared to the priming of a local processing mode. Experiment 2 clarified two additional questions that emerged in Experiment 1.

First, the sequential analyses of Experiment 1 suggest a quite flexible link between the attention mode and disgust. The question of interest is whether it is possible to establish a certain attention mode for a longer period of time? Would disgust intensity vary with that more or less permanent attention mode as well? Specifically, once activated (with the help of regulation instruction), does a global processing mode affect disgust persistently for a certain period of time, for example, across the entire experimental session? Or is this mechanism more flexible in nature, changing from moment to moment, from trial to trial, whenever needed, as the results of Experiment 1 suggest?

Second, the finding that a global deployment of attention goes along with lower disgust can raise the following objection: Possibly, with a global mode, the participants' attention is as wide-spread as it encompasses much more of the experimental situation than only the presented pictures, functionally equivalent to just looking away from the pictures. This broadened attentional focus should get revealed in a

more superficial encoding of the shown pictures and thus in poorer memory of the details of the attended pictures. To rule out this possibility all participants were performing a free recall task. This objection can be ruled out if no differences in the free recall task between the experimental conditions occur.

Finally, drawing on self-regulation theory, Barrett, Gross, Conner, and Benvenuto (2001) assumed and verified that individuals with highly differentiated emotion experience should be better able to regulate emotions than individuals with poorly differentiated emotion experience. Following this line of research, the variable Clarity of Feelings (Lischetzke, Eid, Wittig, & Trierweiler, 2001) was additionally included in this experiment. Clarity of feelings or emotional clarity reflects the individual's ability to understand, label, and identify one's specific emotions (Salovey, Mayer, Goldman, Turvey, & Palfai, 1995). The present work hypothesised that the participants with high scores in emotional clarity will particularly well implement the antecedent-focused emotion regulation instruction.

Method

Participants and Design

Participants were 91 undergraduate psychology students of the Dortmund University of Technology in Germany, who were fulfilling a research requirement in their psychology course. Three participants did not accomplish the experiment for several reasons (disturbing pictures, lacking the ability to concentrate etc.) and were excluded from further analyses. A between-participants design defined by the factors (a) "emotion regulation strategy": *antecedent-focused emotion regulation instruction vs. no regulation instruction* and (b) "priming of the information processing style": *local priming vs. global priming vs. no priming* was implemented.

Materials

Comparable to the previous study, the disgust-eliciting material comprised of eight pictures from the IAPS (Lang et al., 2008) beforehand rated as disgust evoking.

<p>T T T T TTTTTT T T T T</p>	<p>HHHHH H H H H</p>
Target “H” at the global level	Target “H” at the local level

Figure 5. The target “H” presented in the global and local configuration (Navon, 1977).

Information processing style was induced by employing the nested letter identification task, originally developed by Navon (1977). He introduced a model task for studying hierarchical structures and created stimuli that could be processed on one of two levels: either a local level or a global level (cf. Figure 5). In this experiment a modified version of the Navon Task used by Derryberry & Reed (1998) was employed.

Usually, participants are presented randomly with a series of large letters that are constructed of smaller letters. The objective is either to report the identity of the small letters (local priming condition) or that of the shown large letter (global priming condition). For example, to solve this task successfully in the local priming condition, the participants are forced to concentrate consistently on the small letters, neglecting the large letter at the same time. The repeated identification of the small letter produces after a while a corresponding local feature based processing style. The opposite

is true of the global priming condition. The participants have to neglect the small composite letters and to concentrate persistently on the large letter (see Appendix for instruction). Consequently, this results in global processing style.

Procedure

The participants arrived at the laboratory in pairs or individually and were randomly assigned to one of the six treatment conditions. The experimenter declared there is going to be a series of single, entirely unrelated tests, needed as material for future experiments.

The session began with a Navon letter task. Each trial started with a presentation of a fixation cross in the centre of the screen. 300 ms after the offset of the fixation cross, a compound letter (2.5 x 2.5 cm), the constituents of which were small mismatching letters (0.5 x 0.5 cm) was presented. Target letters were in both conditions letters “H” and “L”. In the global priming conditions the large letter were H and L that were made up of either small Fs or small Ts, whereas in the local priming condition H and L were small letters that by turns constituted either large Fs or Ts. The participants were instructed to place their index fingers on two keys of the keyboard and to identify the letter “H” by pressing the left red key and to identify the letter “L” by pressing the right green key. For example, in order to perform well the participants in the global priming condition had to focus on the global configuration (H or L) and fade out the local details (F and T) and the reverse strategy was effective for the local priming condition. Thus, four of the compound letters were global targets (an **H** consisting of Fs, an **H** consisting of Ts, a **L** consisting of Fs, a **L** consisting of Ts) and four included local targets (a **F** consisting of Hs, a **F** consisting of Ls, a **T** consisting of Hs, a **T** consisting of Ls). In total, participants in the two treatment groups completed 64 trials, in addition to 8 practicing trials that were not analyzed. In the meanwhile, the

participants in the control group accomplished filler tasks, such as pre-testing material.

Having completed the Navon letter task, the participants carried forward with another, seemingly unrelated task. They were told that a series of pictures, that needed to be rated, would be presented on the PC screen. Before the rating of the IAPS pictures the emotion regulation strategy was induced. One half of the participants were presented with the *antecedent-focused emotion regulation instruction* and the other half of the participants received a general introduction without a specified instruction how to attend to the IAPS pictures. Having read the instruction how to deal with the pictures the participants were shown eight IAPS pictures. The IAPS pictures appeared for 4 seconds on the screen, each single picture followed by a disgust-rating scale.

After that the participants were presented with a series of seemingly unrelated questionnaires. The dispositional *disgust sensitivity* and *clarity of feelings* were assessed in the next step. At the end of the experiment the participants were asked to recall and write down as many single details or single features from all the rated IAPS pictures as they could have remembered. Finally, the participants' impressions of the experiment were collected. None of the participants was able to guess the hypothesis of the experiment. In the end, they were fully debriefed and thanked for their participation.

Measures

Subjective Experience of Disgust. Participants rated the amount of experienced disgust while watching disgust-eliciting pictures from the "International Affective Picture System" (IAPS) using a 9-point Likert-type scale, ranging from *not disgusted* to *strongly disgusted*.

Clarity of Feelings. A German 6-items subscale of the Questionnaire Assessing the Attention to and the Clarity of Feelings (Lischetzke & Eid, 2003; Lischetzke et al., 2001) was used to assess affective clarity (see Appendix). The clarity scale includes items such as “*I can name my feelings*” and “*I am not sure of what I actually feel*”. The items were rated on a 4-point Likert-type scale, ranging from *almost never* to *almost always*. Cronbach’s alpha was .89 in the present study.

Disgust Sensitivity. To control for the dispositional disgust sensitivity the Questionnaire for the assessment of disgust sensitivity (FEE; Schienle et al., 2002) was implemented. It had got satisfactory internal consistency in the present study, with a Cronbach alpha coefficient .75.

Free recall of details contained in the IAPS pictures. The participants have written down all details of the presented IAPS pictures they could recall. The material was analyzed by two independent raters. Two categories of recalled details were determined: correctly recalled and errors. The subsequent recall index was obtained by subtracting the errors from the absolute number of correctly recalled details.

Results

Subjective Experience of Disgust

A 2 (emotion regulation strategy: regulation instruction vs. no regulation instruction) x 3 (priming of the information processing style: local priming vs. global priming vs. no priming) analysis of variance (ANOVA) of the reported disgust intensities revealed a significant main effect of the information processing style, $F(2,82) = 3.7, p = 0.029$. Participants in the global priming condition reported lower level of disgust ($M = 5.46$ $SD = 2.26$) than the participants in the no priming condition ($M = 5.95$ $SD = 1.72$) and the participants in the local priming condition ($M = 6.76$ $SD = 1.07$). Planned comparisons yielded significant differences between the global and

the local priming condition, $t(53) = 2.71, p = .004$ (one-tailed), as well as between the local and the no priming condition, $t(57) = 2.11, p = .02$ (one-tailed). The difference between the global and the no priming condition did not reach significance, $t < 1$. Although the disgust intensity was overall lower with antecedent regulation instruction rather than without the instruction this difference did not reach significance, $F < 1$.

In the next step, the disgust sensitivity score was included in the described analysis as a covariate. As in Experiment 1, there was also a main effect of the covariate disgust sensitivity in this analysis $F(1,81) = 16.6, p < 0.01$. Disgust sensitivity was positively correlated with disgust intensity. The reported main effect of the information processing style on the experienced amount of disgust remained significant and got even stronger, $F(2,81) = 4.31, p = 0.17$. This lowers the probability that the effect of the processing style on the experienced disgust was substantially affected by dispositionally established disgust sensitivity. As was the case above, antecedent regulation instruction still did not have an effect on the disgust intensity, $F < 1$.

Table 4. Mean reported disgust intensities across 8 IAPS pictures as a function of emotion regulation instruction and the priming of processing style

Processing Mode	Emotion Regulation Instruction					
	Antecedent instruction			No instruction		
	<i>M</i>	<i>SD</i>	<i>n</i>	<i>M</i>	<i>SD</i>	<i>n</i>
No Priming	5.80	2.08	16	6.10	1.35	17
Local Priming	6.65	1.12	13	6.87	1.04	13
Global Priming	5.27	2.08	15	5.65	2.44	14

Note. $N = 88$; Means are the average of 8 disgust intensity items rated on 9-point scales, with higher values indicating higher disgust intensities.

Free recall of details contained in the IAPS pictures

It is possible that the reduced disgust experience in global processing participants may be due to their wide spread attention and thus a more superficial encoding of the shown pictures. To rule out this possibility a one-way ANOVA was performed on the recall score of the three priming conditions. As predicted, the analyses did not reveal any differences between the different processing style priming conditions ($F < 1$), suggesting that participants in the global priming, local priming, and control priming condition did not differ regarding their memory of details contained in the presented IAPS pictures.

Table 5. The Absolute Number of Recalled Details from the IAPS Pictures

Information Processing Style					
No Priming		Local Priming		Global Priming	
<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
8.06	3.50	7.04	4.90	8.0	2.74

Note. N= 88.

Clarity of feelings.

The whole sample of participants was divided into two groups: those with low and those with high scores of clarity of feelings. Then an ANOVA with the factors clarity of feelings (low vs. high) and priming of the information processing style (global vs. local vs. no priming) and disgust intensity as dependent measure was conducted. The analysis revealed that participants with high clarity of feeling had higher disgust in-

tensities ($M = 6.43$ $SD = 1.51$) than participants with low clarity of feelings ($M = 5.67$ $SD = 1.99$; $F(1,82) = 4.19$, $p = .044$). Yet, the clarity of feeling did not interact with the experimental manipulations of the information processing style, $F < 1$. Moreover, the information processing style and antecedent regulation instruction did not have impact on the clarity of feelings, $F < 1$.

Discussion

Experiment 2 was conducted to test directly whether the attention deployment has an impact on the generation of disgust in a disgust regulation attempt. More specifically, it was expected that the global processing style along with the emotion regulation instruction would attenuate subsequent disgust experience. The analyses revealed the following results.

Consistent with the expectation and the findings of Experiment 1, participants who were primed with the global mode of processing reported the lowest disgust intensities. This relationship was even more pronounced when controlled for dispositional disgust sensitivity.

However, there was no combined effect of the regulation instruction and preferred mode of attentional processing on disgust intensity. Although there was a trend for less disgust in the antecedent regulation condition compared to controls this effect missed conventional levels of statistical significance. The finding in Experiment 1 that the instruction did not work in combination with a local processing style already evoked the suspicion that the instruction as such may not be necessary to decrease disgust. It is imaginable that the instruction to regulate usually triggers a set of various means that lead to less disgust. Global deployment of attention may be one of these means beside others like distraction or reappraisal. In this experiment the attentional mode has been primed massively. Thus, the participants were pointed to one specific regulation means. Conceivably, this made other means that are usually

prompted by the instruction less accessible. Moreover, the extensive priming may have produced a sort of habituation effect comparable, for instance, to the emergency doctors. The emergency staffs do not have to instruct themselves to regulate in every single case, since they are habitually accustomed to the disgust-evoking stimuli and therefore regulate spontaneously.

Finally, it was shown that the global processing mode can affect disgust for a longer period of time and thus, in a more persistent manner. The global deployment of attention appears to be a highly adaptive and efficient means of disgust regulation.

In the free recall memory task no differences between the conditions regarding their memory of the IAPS details were observed. Thus, the objection can be ruled out that the lower disgust scores in the global priming condition are due to a more superficial encoding of the presented disgust-inducing material. Furthermore, this result is in line with studies that demonstrate that the antecedent-focused emotion regulation strategy of reappraisal attenuates the subjective part of an emotional experience without impairing the performance on the following memory task at the same time (Kramer et al., 1991; Richards and Gross, 2000). The findings of the present work also illustrate that the antecedent-focused regulation strategy does not consume cognitive resources.

The findings concerning the variable clarity of feeling showed that participants who described themselves as highly able to understand and label their specific emotions (high emotional clarity) reported higher levels of experienced disgust in comparison to those participants with lower emotional clarity scores. The participants high and low in the clarity of feeling were equally low responsive to the instruction to regulate. However, the instruction to regulate did not work and this gives reason for a cautious interpretation of these data.

Taken altogether, Experiment 2 confirmed and extended the findings of Experiment 1. The global deployment of attention produces attenuated disgust experience and it proves to be an efficient and flexible means of emotion regulation.

EXPERIMENT 3

Introduction

While Experiments 1 and 2 focused on emotion regulation processes that occur early after an emotion-eliciting event is encountered (cf. Figure 1), Experiments 3 and 4 explored processes that step in somewhat later in the information processing stream from stimulus to emotional response. These processes are often denoted as reappraisal. What does it eventually mean to “re-appraise” something? As already stated, this means to evaluate something in a different manner than it would happen without reappraisal. This re-evaluation process is focused on in Experiment 3. Specifically, this experiment explored if and how an instruction to regulate disgust changes the evaluation of disgust-evoking stimuli (words that relate to core disgust stimuli as sweat, purulence, dirt). For reasons described below, this was done by measures that are unlikely to be subject of demand effects or other sorts of corruption.

If reappraisal truly takes place, the regulation group should evaluate disgust-inducing stimuli spontaneously (along with the self-report) less negatively in comparison to the control condition. If we want to assess the spontaneous and unbiased evaluation of disgust-inducing events we clearly need other measures than self-report, since self-report is potentially a subject to demand-effects, that is the change in the reported evaluation can occur without having a genuine change in evaluation of the disgust-inducing stimuli. One such method that allows for assessing a spontaneous evaluation is the Affective Priming Paradigm (Fazio, Sanbonmatsu, Powell, and Kardes, 1986). In a typical affective priming paradigm, certain prime stimuli (representing objects either in terms of words or pictures) are paired with positive or negative target stimuli (i.e., adjective like “tolerant” and “greedy”). Within a given trial, prime stimuli are typically presented for 200 ms and are followed either by a positive

or negative target stimulus after an inter-stimulus interval of 100 ms. Thus, the resulting stimulus onset asynchrony (SOA), that is the time interval between the onset of the prime and the onset of the target, is 300 ms. The participants are asked to evaluate the target stimuli as either “positive” or “negative”. The dependent measure of interest is the time and accuracy of classifying a target as a function of the type of preceding prime. Research on affective priming led to widely accepted evidence that the responses are faster and more accurate when prime and target share the same valence (positive - positive or negative - negative) as compared to trials when they possess opposite valence and are therefore affectively incongruent (positive - negative, negative - positive) (Fazio, 2001; Klauer & Musch, 2003). The valence of a given prime can be inferred from responses to subsequent negative and positive targets: the faster and more accurate responding is with positive rather than with negative targets, the more positive is the assumed evaluation of that prime. To sum up, numerous affective priming studies have shown that prime words can exert an influence on responses towards positive or negative target stimuli. Therefore, it can be concluded that the affective valence of the prime is processed, even though this is not the primary and obvious task for the participants (for an overview, see Klauer, 1998; Klauer & Musch, 2003).

Moreover, disgust regulation may not only refer to the evaluation of the actual emotion-eliciting events (conceivably towards less negative evaluation) but may also encompass the evaluation of *means* that are instrumental to attenuate the disgust-eliciting potential of these events. Means that obstruct the goal to attenuate the disgust should be evaluated more negatively, whereas means that support the goal to down-regulate disgust should be evaluated more positively (Kruglanski, Shah, Fishbach, Friedman, Chun, & Sleeth-Keppler, 2002). Entering a dirty and smelly toilette, we will greatly appreciate any single piece of soap and equally dislike any need

to touch any of the filthy objects. This conjecture can be considered further within the so called contamination avoidance account (Oaten et al., 2009; Rozin et al., 2004).

As described above, the main idea of this account is that disgust evolved as an adaptive emotional response to protect people from disease (Izard, 1977; Oaten et al., 2009; Oatley & Johnson-Laird, 1987, Rozin et al., 2004). A person that encounters a potentially disgust-eliciting situation is motivated to preserve his physical inviolability or purity in order to avoid damages caused to his health. The person will evaluate the given situation against the background of its current need for cleanliness and physical inviolability. When this evaluation yields that this need is violated disgust will be experienced.

But what happens when the individual faces a situation where he can not escape certain disgust-eliciting stimuli, as in the present experiments? In such a situation, activities that would be otherwise perfectly appropriate, such as search for cleaning tools or engaging in cleaning activities are futile. So, the external environment can not be changed, however the (internal) motivational orientation can. Thus, in such cases it might be a reasonable strategy to reduce the need for cleanliness and to postpone cleanliness-related behaviors such as cleaning, hand washing etc... Basically, this is not a very novel idea. Changing the evaluation of a given event has been considered for instance in the cognitive dissonance theory (Festinger, 1957). In sum, the assumption is that in this case the instruction to regulate will alter the motivational orientation in as much as the need for cleanliness will get reduced. We know that the spontaneous evaluation of the objects is linked to the motivational state in which the perceiver encounters those objects (Ferguson & Bargh, 2004). For example, a thirsty person will evaluate objects like *water* or *glass* more positive than other persons would usually do. These considerations allow for some specific inferences in the context of disgust regulation. First, cleanliness-related means that are instrumental in reducing disgust should be evaluated more positively by the control condition than by

the regulation condition (e.g. hygiene, cleanliness), since the need for cleanliness is presumably reduced in the regulation group. Second, means that obstruct the goal to feel less disgust (contamination-implying: e.g. touch, near) should be evaluated more negatively by the regulation condition.

Method

Participants and Procedure

Participants were 106 university students enrolled in an introductory psychology course. Each received course credits as compensation for their participation in the experiment. Given the language-based nature of the task, only native speakers of German were eligible to participate.

Participants were randomly assigned to the between participants conditions. After they were seated at computers they were explained that they would attend a pilot study including several unrelated tasks that served as pretests of experimental material. First of all, they were presented with eight IAPS pictures, which they rated with regard to the experienced disgust intensity (see the more detailed description above).

Afterwards, in the affective priming task the participants were instructed that they would see a pair of words on each trial. Further, they were told to concentrate on the second word that appeared after the first word and to classify it as a positive or negative word by pressing the correspondent keys on the key board as quickly and as accurately as only possible. Each trial started with a prime word presented in the center of the screen for 150 ms, followed by a blank screen for 150 ms and ending with a target adjective. The target remained as long on the screen until the participants categorized it as positive or negative by pressing one of the correspondingly marked keys or until 2000 ms elapsed. Each prime was presented eight times, four

times with a positive adjective and four times with a negative adjective. The inter-trial interval was 2000 ms. In total, participants completed 72 trials, in addition to 4 practicing trials that were not analyzed.

Following the affective priming task participants rated their dispositional disgust sensitivity. The participants were debriefed and thanked afterwards. None of the participants guessed that the prime words might affect the speed of responses to the adjectives or the purpose of the experiment in general.

Materials and Design

Eight pictures from the IAPS were chosen for the inducement of disgust in participants (see Experiments 1 and 2). In the affective priming task primes were used that have been previously rated by independent judges as relevant to a situation in which disgust is experienced. The judges rated the disgust-related concepts (words) according their relatedness to these three categories: a category of core disgust-eliciting objects, a category of cleanliness-related concepts and a category of contamination implying means. The rating resulted in 9 prime words evenly distributed across three types of primes: core disgust-eliciting objects (*purulence, dirt and sweat*), cleanliness related concepts (*hygiene, cleanliness and distance*), contamination-implying means (*contact, touch and exciting*) - (German words: *Eiter, Dreck, Schweiss; Hygiene, Reinheit, Distanz; Anfassen, Kontakt, Aufregend*). Each prime was presented eight times, four times with a positive adjective and four times with a negative adjective. The target words were explicitly valenced adjectives, e.g., *happy* and *jealous* (Hager, Mecklenbräuker, Möller & Westermann, 1985).

Thus, the experiment employed a mixed factorial design with three factors: (a) the between-participants variable “emotion regulation strategy” (*antecedent-focused regulation instruction vs. no regulation instruction*) and the within- participants vari-

ables (b) “adjective valence” (*positive vs. negative*) and (c) “type of prime” (*core disgust objects vs. cleanliness-related means vs. contamination-implying means*).

Measures

Disgust intensity. Participants rated the amount of subjectively experienced disgust after each presentation of an IAPS Picture using a 9-point Likert-type scale, ranging from 0 (not disgusted) to 8 (strongly disgusted).

Spontaneous evaluations of objects related to disgust experience were measured by using a sequential evaluative priming paradigm developed by Fazio et al. (1986). The measures of interest were the speed and accuracy with which participants responded to positive or negative adjectives as a function of the preceding disgust-related primes.

Disgust sensitivity. Comparable to the reported experiments the Questionnaire for the assessment of disgust sensitivity (Schienle et al., 2002) was employed to control for dispositional disgust sensitivity. The dispositional disgust sensitivity of the participants did not have any effect on the results reported in Experiments 3 and 4, and thus this measure is not discussed any further.

Results

Disgust intensity

An independent-samples t-test was conducted to compare the self-reported disgust intensities scores in the two experimental groups. Comparable to previous studies, the participants in the antecedent-focused emotion regulation group ($M = 5.7$ $SD = 1.60$) displayed significantly lower scores of disgust intensity, $t(104) = 4.6$, $p < .001$, than the participants in the control group ($M = 7.1$ $SD = 1.50$).

Affective Priming: Response Times

Reaction Times (RTs) below 150 ms and above 2500 ms were taken to be anticipations or late responses and excluded from further analysis. The mean response latencies of correct responses toward the adjectives were submitted to a 2 (emotion regulation strategy: antecedent instruction vs. no regulation instruction) x 2 (adjective valence: positive vs. negative) x 3 (type of prime: core disgust objects vs. cleanliness-related means vs. contamination-implying means) analysis of variance with repeated measures on the second and third variable. Greenhouse-Geisser correction of the *df* was applied whenever necessary.

There was a main effect of the type of prime, $F(1.89,195.28) = 3.27, p = .043$. Responding was generally faster for primes of the category “cleanliness-related means” ($M = 685$ $SD = 121$) than for “core disgust” primes ($M = 699$ $SD = 128$) and primes from the category of “contamination-implying means” ($M = 694$ $SD = 120$). Furthermore, there was a main effect of the adjective valence $F(1,103) = 67.64, p < .001$, reflecting the fact that the responding to positive adjectives ($M = 671$ $SD = 106$) was faster than to the negative adjectives ($M = 715$ $SD = 122$). There was a significant interaction of the type of prime and the adjective valence, $F(1.99,205.12) = 9.25, p < .001$, indicating that the effect of adjective valence differed slightly between prime types. The response time difference between negative and positive targets adjectives was 26 ms with “core disgust” primes; 37 ms with primes from “cleanliness-related means” and 69 ms with primes from “contamination-implying means”.

Table 6. Mean reaction times towards negative and positive targets, as a function of regulation condition and prime type.

Type of Prime	Target adjective	
	Positive	Negative
<i>Antecedent-focused emotion regulation strategy</i>		
Core disgust		
<i>M</i>	695	722
<i>SD</i>	149	148
Cleanliness-related means		
<i>M</i>	679	726
<i>SD</i>	129	153
Contamination-implying means		
<i>M</i>	669	733
<i>SD</i>	129	138
<i>No regulation strategy</i>		
Core disgust		
<i>M</i>	678	702
<i>SD</i>	91	114
Cleanliness-related means		
<i>M</i>	655	682
<i>SD</i>	94	96
Contamination-implying means		
<i>M</i>	651	724
<i>SD</i>	89	121

Note. Core disgust-eliciting objects (primes: purulence, dirt and sweat); cleanliness related concepts (primes: hygiene, cleanliness and distance); contamination-implying means (primes: contact, touch and exciting).

Against expectation, this analysis revealed no significant interaction between the three variables: emotion regulation strategy, target adjective valence, and type of prime, $F(1.99, 205.12) < 1$, ns. None of the other main effects or interactions reached the level of significance.

Affective Priming: Error Rates

The same analysis as for RTs was conducted for the error data. The mean error rates were subjected to a 2 (emotion regulation strategy: reappraisal instruction vs. no regulation instruction) x 2 (target adjective valence: positive vs. negative) x 3 (type of prime: core disgust objects vs. cleanliness-related means vs. contamination-implying means) analysis of variance with repeated measures on the second and third variable.

The analysis yielded a main effect of the type of prime, $F(1.73, 180.31) = 4.1$, $p = .023$. The mean error rate with primes of type “core disgust objects” amounted to 5 % ($M = 5$ $SD = 7.35$), primes of type “cleanliness-related means” to 5,1 % ($M = 5.1$ $SD = 8$) and primes of type “contamination-implying means” to 3,6 ($M = 3.6$ $SD = 5.8$) percent. There was also a main effect of the adjective valence $F(1, 103) = 12.71$, $p < .01$, with higher error rates for negative adjectives ($M = 6$ $SD = 8.68$) than for positive adjectives ($M = 3.1$ $SD = 6.13$).

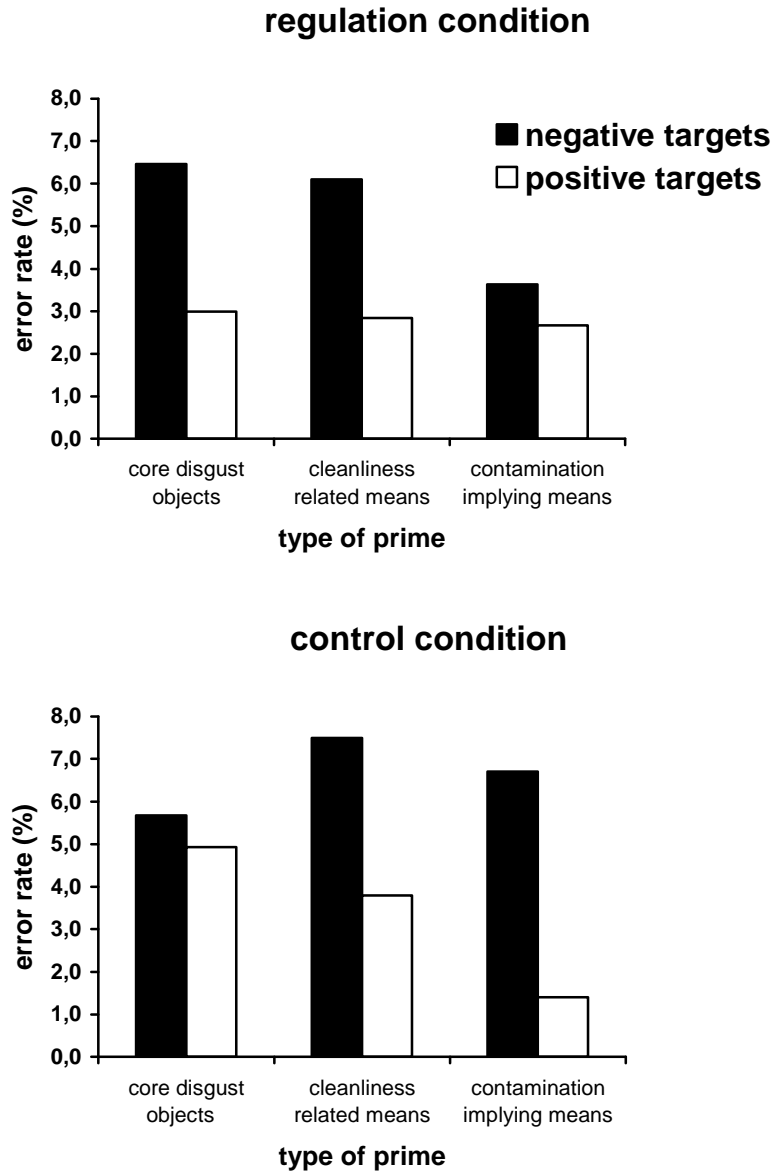


Figure 6. Differences in error rates between negative and positive targets, as a function of regulation condition and prime type.

Most important in the present context, there was a significant interaction between emotion regulation strategy, target valence and type of prime, $F(1.73,180.25)$

= 4.43, $p = .016$. This interaction is shown in Figure 6. The difference between positive and negative targets was larger in the regulation group than in the control group with primes of type “core disgust objects”, whereas the opposite pattern (a smaller difference between positive and negative targets in the regulation condition compared to the control condition) was apparent with primes of type “contamination-implying means”. Given that the implicit evaluation of the primes is more positive the larger the difference between negative and positive targets³, this result suggests that primes of type “core disgust objects” were evaluated more positively in the regulation condition than in the control condition, whereas primes of type “contamination-implying means” were evaluated more negatively in the regulation condition rather than the control condition. There were no noticeable differences between conditions for primes of type “cleanliness-related means”.

Discussion

Experiment 3 explored the reappraisal process in the emotion regulation situation. The question of interest was whether the instruction to regulate disgust affects the implicit evaluation of disgust-related concepts. Further, drawing on the contamination avoidance accounts of disgust (Oaten et al., 2009; Rozin et al., 2004) it was assumed that the instruction to regulate will not only change the implicit evaluation of disgust-eliciting stimuli (additionally to the explicit one), but will as well change the motivational orientation of the participants in the regulation condition. The contamination avoidance account suggests that disgust violates the organism’s need for cleanliness and physical violability. The present work assumed that corre-

³ RT/Error Rate negative – RT/Error Rate positive = The index for the relative positivity of the evaluation. The index was generated by subtracting the average RTs/ERs to the positive targets from the RTs/ERs to the negative targets. Therefore, larger RTs (Error Rate) differences reflect relatively more positive evaluations.

spondingly the need for cleanliness will be reduced in an attempt to regulate. The change in the motivational orientation should get revealed in a differentiated evaluation of means that support or obstruct the goal to regulate the upcoming disgust.

For this purpose participants after being exposed to certain disgust-evoking pictures were transferred to an affective priming procedure where they judged the valence of positive/negative target words that were preceded by certain prime words. The basic assumption is that responding is faster and more accurate when prime and target share the same valence. Consequently, the larger the response time (or accuracy) difference between positive and negative targets with a given prime, the more positive is the assumed evaluation of that prime. In the present study three different prime types were used: "Core disgust-eliciting objects" (purulence, dirt and sweat); "cleanliness related means" (hygiene, cleanliness and distance) and "contamination-implying means" (contact, touch and exciting).

Consistent with expectation, the instruction to down-regulate upcoming disgust worked for the explicit measure of experienced disgust. The disgust intensity was on average lower in the antecedent-focused emotion regulation condition than in the control condition.

The first observation considering the implicit evaluation of disgust-related-concepts is more interesting from a methodical rather than theoretical point of view: The impact of experimental variables showed up more clearly in response accuracy rather than response speed. This is not an uncommon observation (Draine & Greenwald, 1998). Stronger effects in error rates rather than responses times in affective priming procedures have been observed, for example, by Banaji & Greenwald (1995, Experiment 1, as cited in Musch, 2000). For a discussion of this issue confer Degner (2006, S.25).

Apart from that, a further finding was that the instruction condition impacted the implicit evaluation of primes - however, this impact depended on type of prime. In line with expectation, the regulation group judged primes of type “core disgust-eliciting objects” (purulence, dirt and sweat) more positive than the control group. Moreover, the regulation condition judged primes of type “contamination-implying means” (contact, touch and exciting), thus primes that obstruct the goal set by the instruction to regulate, more negatively than the control group. Similar differences were apparent in RTs, though as mentioned above not significantly so.

These findings demonstrate that the instruction, beyond the deployment of visual attention (Experiments 1 and 2), affects the evaluation of more abstract disgust-related cognitive representations. Specific core disgust-inducing objects (purulence, sweat, dirt) were judged more positive with regulation instruction rather than without. These changes of implicit evaluation correspond to similar changes of explicit rating events. However, the measure of implicit evaluation employed here, is not subject to demand effects that may affect explicit ratings. In other words, the present findings suggest that the instruction actually changes the evaluation of disgust-inducing events and not only the report of such evaluations. Cognitive change takes indeed place!

By contrast, primes that signal a reduced psychological distance (contamination-implying means as contact, touch, exciting) are judged more negative by the regulation group than the control group. This may indicate that these primes are interpreted as counteracting one important means to regulate disgust, namely to increase the psychological (and possibly physical) distance to disgust-inducing event⁴. Surpris-

⁴ One may argue that this should also apply to the prime “distance”. Interestingly, even though this RT-difference for this prime was not significant between groups it revealed by far the largest difference at a descriptive level.

ingly, no differences between the experimental and the control group were found for the evaluation of “cleanliness-related means”.

In sum, Experiment 3 demonstrated that genuine reappraisal took place in the regulation condition. The participants of this condition evaluated core disgust-related concepts more positively in the affective priming paradigm than the control condition. However, the result pattern considering the motivational account is yet not that clear. This will be further clarified in Experiment 4.

EXPERIMENT 4

Introduction

Experiment 3 showed that the instruction to regulate disgust changed the evaluation of disgust-inducing and disgust-related concepts. But are there any changes at the level of behavioral intentions? After all, the individual is not only a passive observer but an agent as well. For instance, Scherer (2001) identifies the motivational component of emotion as linked to the corresponding emotion function that is the function of the preparation and direction of action. Thus, any change in the motivational orientation should get revealed at the level of behavioral intention.

From the perspective of a motivational account of emotions (Frijda, 1986; Roseman, 1984) it can be inferred that an arising negative emotion interrupts the individual's current behavior by activating a goal to reduce the impact of the negative emotion. The resulting behavior is guided by this goal. For example, a natural response to a disgust-eliciting situation is to engage in some sort of activity that reduces disgust. In line with the contamination avoidance account (Oaten et al., 2009; Rozin et al., 2004), these are activities involving physical cleaning: washing the hands, cleaning, tidying up and so forth (Nemeroff & Rozin, 1994). The more intense the emotion experience, the more pronounced behavioral intentions are (cf. research on stereotypes: Devine, 1989). However, if the individual can not actively engage in such behavior, it is therefore not too far fetched to assume that the instruction to regulate one's emotions (disgust) not only changes the evaluation of disgust-related stimuli but also reduces the tendency to show behavioral intentions that aim at disgust reduction (physical cleaning). Following that logic, the less negative evaluation of disgust-related stimuli – based on a decreased subjective experience of disgust – might be accompanied by a reduced tendency to actively remove or change such stimuli.

Experiment 4 tested this proposal directly. The idea is quickly told: After being exposed to disgust-evoking stimuli (and the instruction to regulate disgust), the participants should generate a list of five activities they planned to attend to during the rest of the day. The assumption was that the participants with the emotion regulation instruction would, as a consequence of decreased experience of disgust and a changed motivational orientation, produce *less* cleanliness related behavioral activities than the participants in the control condition. The contamination avoidance account (Oaten et al., 2009; Rozin et al., 2004) allows for inferring that the decrease in experienced disgust should be accompanied by a decreased need for cleanliness and physical inviolability.

The task to list the planned activities was previously used by Holland et al. (2004) who investigated the influence of scent perception on the activation of behavior concepts of cleaning.

Methods

Participants and Design

A total of 49 undergraduate students from the University of Technology of Dortmund participated in this study. The participants were recruited on campus and received two Euros in exchange for their participation. They were all native German speakers. The experiment employed a between-participants variable “emotion regulation strategy” (*antecedent-focused emotion regulation vs. no regulation instruction*)

Materials

The disgust was induced via nine pictures from the IAPS (Lang et al. 2008; see Appendix).

Procedure

After having rated the 9 pictures from the IAPS with regard to the experienced disgust intensity, participants were asked to write down five activities they were planning to do till the end of the day. Subsequently, they indicated how much they would like to wash their hands right in that moment. In the end, participants rated their dispositional disgust sensitivity. Finally, the post-experimental assessment of awareness took place. Debriefing indicated that no one guessed the hypothesis regarding the listing of activities, but many participants related the subsequent question of hand washing to the viewing of the disgust pictures.

Measures

Disgust intensity. Participants rated the amount of experienced disgust after each presentation of an IAPS Picture using a 9-point Likert-type scale, ranging from 0 (not disgusted) to 8 (strongly disgusted).

Accessibility of the cleanliness-related behavioral intentions. The accessibility was measured twofold: First implicitly, by asking the participants to write down spontaneously five activities they were planning to attend to that very day after accomplishing the experimental session. Two independent judges rated the participants' listed activities as either cleanliness-related (such as dish washing, taken a shower, teeth brushing) or not (such as doing homework, watching TV, taking the dog for a walk). Second, a bit less implicitly, by asking the participants how urgently they would like to wash their hands on a 9-point Likert-type scale if they had the opportunity to do so in the experimental situation, ranging from 0 (*not at all*) to 8 (*very urgently*).

Disgust sensitivity was assessed (FEE; Schienle et al., 2002) as a control variable but will not be discussed any further, since it did not have any impact on the results reported in this experiment.

Results

Subjective experience of disgust

An independent-samples t-test was conducted to compare the self-reported disgust intensities scores for the reappraisal instruction group and the control group with no regulation instruction. As expected, disgust intensity varied significantly as a function of experimental manipulation of the regulation instruction, $t(47) = 2.7$, $p = 0.005$. Specifically, disgust was lower in the experimental group ($M = 5.81$ $SD = 1.50$) than in the control group ($M = 7.0$ $SD = 1.50$).

Table 7. Mean reported disgust intensities across 8 IAPS pictures as a function of emotion regulation instruction condition.

Measure	Emotion Regulation Instructions			
	Antecedent instruction		No instruction	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Disgust intensity	5.81	1.50	7.0	1.50

Note. Antecedent-focused condition: $n = 25$; No instruction condition: $n = 24$.

Accessibility of the cleanness related behavioral intentions

The employment of various measures that presumably represent the accessibility of the cleanness related behavioral concepts in the experimental groups revealed following results:

Listing of five activities. In line with the expectation, 83,3% of the participants in the control condition listed cleanness related activities whereas this was the case

for only 56,0% of the participants in the antecedent-focused emotion regulation condition, $\chi^2(1, N = 49) = 4.31, p < .05$.

The need to wash hands. In contrast to the previous measure, there was no significant difference between the two conditions regarding the urge to wash the hands in the experimental setting, $t(47) = 0.41, ns$.

Discussion

Experiment 4 investigated whether the attempt to regulate disgust has an impact on the accessibility of cleaning-related behavioral representations. Therefore, after being exposed to disgust-eliciting material the participants had to list five activities they needed to do that day and to rate their current urge to wash their hands. The crucial idea is that an emotion is accompanied by a *change in readiness for action* (Frijda, 1986; Frijda, Kuipers, & Ter Schure, 1989). Disgust specifically, is linked to cleaning related activities (Nemeroff & Rozin, 1994). Consequently, from the motivational perspective, regulation of disgust should go along with a lower accessibility of cleaning-related behavioral intentions.

The most important finding was that the accessibility of the cleaning-related behavioral intention varied as a function of the emotion regulation instruction in the activity listing task. Specifically, participants in the antecedent emotion regulation condition listed the cleaning-related activities with a significantly lower frequency than did the participants control condition. Thus, the cleaning-related behavioral intentions were less accessible in the emotion regulation group in comparison to the control group.

However, a similar observation regarding the urge to wash the hands, as a measure of a more overt cleaning-related behavior, did not occur. Since many participants (three quarters of them) suspected that the hand washing task might have

something to do with the disgust elicited by the IAPS pictures, it is very likely that the obvious purpose of the task hampered the subsequent ratings.

Taken together, these results suggest that the instruction to regulate the emotional experience, in this case disgust experience, reduces not only the experienced disgust but the accessibility of related behavioral intentions as well. Thus, the results of the Experiment 4 extend those of the previous Experiment 3 that in a similar vein demonstrated a change in the evaluation of disgust-inducing and disgust-related concepts.

GENERAL DISCUSSION

The present work studied some of the mechanisms that are involved in intentional attempts to down-regulate disgust. A framework that describes several of these mechanisms, and served as a guideline for the present work, was advocated by Gross (1998a, 2007). Unlike previous research that has primarily focused on response-related processes which aim at suppressing emotional responses (see, Gross 2002, for a review), the present work had a closer look on earlier aspects of the information processing stream from emotion-eliciting stimuli to emotional responses. Thus, the present work concentrated on the so called antecedent-focused emotion regulation strategy that primarily operates on the emotion-inducing situation, that is, before the emotion emerges in full-blown fashion. The core manipulation, employed in all four studies, was that of the antecedent-focused emotion regulation instruction. In each study one group of participants encountered certain disgust-eliciting stimuli after an instruction to adopt a detached, objective and unemotional attitude, while another group encountered the same stimuli without any specific instruction. As has been found in many previous studies (e.g. Gross, 1998a; Ochsner et al., 2002; Richards & Gross, 2000), this instruction reduced the reported disgust intensities compared to the control group. This was the case in all four studies reported here, though not significantly so in Experiment 2. Thus, the effectiveness of the instruction was largely confirmed. Yet, the present work aimed to find out the reasons for this effectiveness. The question of particular interest was: What are the cognitive processes that mediate these instruction effects?

Experiments 1 and 2 focused on relatively early, perceptual effects of the regulation instruction that relate to the deployment of visual attention. The review of the literature gave at least some indirect hints for the proposal that focusing on the

local details of a disgust-eliciting scene increases its disgust-eliciting impact and that, conversely, a stronger focus on the global (instead of local) aspects of a scene might help to reduce disgust (Kross et al., 2005; Liberman et al., 2007; Metcalfe & Mischel, 1999). Experiment 1 provided some preliminary support for that idea. Although participants in both instruction conditions appeared to employ a global instead of a local attention mode roughly equally frequently, disgust was clearly lower the more frequently a global mode was engaged, particularly so in the regulation instruction group. Moreover, sequential trial-to-trial analyses showed that the presence of current global attention mode reduced disgust evoked from a stimulus presented a short time later (i.e. in the next trial), while the experienced disgust in a given moment did not determine the global vs. local attention mode in the same trial. This observation already suggested that the causal direction is from attention mode to disgust, rather than conversely, from disgust to attention mode. This causal impact of global-local attention mode on disgust was confirmed in Experiment 2. Here, the experimental implementation of a global attention mode effectively reduced the disgust-inducing impact of corresponding pictures.

Experiments 3 and 4 focused closer on the antecedent regulation strategy of “cognitive change” or reappraisal (Gross, 1998a, 2007), that is, at post-perceptual, evaluative processes that accompany the attempt to regulate in an antecedent manner. Experiment 3 demonstrated that the instantaneous and “automatic” evaluation of certain disgust-related concepts, measured by affective priming, is changed after an instruction to regulate has been encountered (reappraisal). The core disgust concepts were evaluated more positively with the instruction. Both experiments targeted at the motivational orientation as one particularly important but frequently neglected aspect of appraisal (Scherer, 2001). Especially, Experiment 4 showed clearly that such an instruction has the power to reduce the accessibility of cleanliness-oriented behavioral intentions in comparison to the non-regulation group. These experiments pro-

vided some preliminary hints that the cognitive change in the regulation of disgust may be accompanied by changes in the motivational orientation: The default need for cleanliness and physical violability (see Oaten et al., 2009; Rozin et al., 2004) is decreased with decreasing disgust.

These results have implications for both, for psychological theorizing and possibly for applied purposes in clinical settings, which I will discuss together. I will then come to some concluding suggestions for future research.

A first issue concerns the implications of the present results for Gross' (1998a, 2007) process model of emotion regulation. Obviously, such a multifaceted model can be neither rejected nor confirmed as a whole. The present work considers it as a useful framework that allows a coherent discussion of otherwise unrelated empirical observations on emotion regulation (Koole, 2009). Still, the present results allow for specifying the model in several respects.

First, it is noteworthy, that although Gross considers the orienting of attention an important factor in emotion regulation, the research in this field has almost entirely focused on how the orienting of attention helps to ignore emotion-eliciting stimulation either by physical withdrawal of attention or internal reorienting of attention in form of distraction (e.g. Fox, 1993; van Dillen & Koole, 2007). Experiments 1 and 2 of the present work show that it is not only the orienting of attention towards emotional stimulation (or conversely the orienting away from it) that is of importance, but the way attention is distributed as well, in this case in a local or global manner. At first glance, this finding may contradict the one of Kross and colleagues (2005) and Ayduk and Kross (2008). They observed that directing attention at the reasons *why* an emotion occurred from a self-distanced perspective decreases the recalled emotional experience. This focus on the reason of the emotion generation may be construed, at first glance, as a kind of analytical processing that resembles to some extent a local attentional mode. However, the opposite interpretation is tenable as

well. Asking *why* does not necessarily induce a processing of details but rather that of abstract, global causes. Furthermore, this work addresses a level of cognitive processing that is rather different of the level explored in the present work. The global/local attention in the present studies refers to very early *perceptual* processes in the emotion generation and regulation, whereas the former study addresses higher mental states. So in the end, the two studies do not necessarily contradict each other but rather complement one another.

The observation that a global processing mode results in attenuated disgust responses might be of some relevance for applied purposes. For instance, think of an emergency doctor encountering a patient with a bloody wound. Ignoring the wound or thinking of something else in order to prevent disgust is obviously impossible. An attempt to distribute attention in a more global rather than local manner might fare better as a strategy here. As the example already implies, the first two experiments may help to generate guidelines serving applied purposes, as for example in therapeutic settings. Correspondingly, the distribution of attention can be construed in terms of an intention implementation (“And if I see blood, than I will focus on the whole situation”). For instance, Schweiger Gallo, Keil, McCulloch, Rockstroh, & Gollwitzer (2009) have demonstrated that when a goal intention (e.g. to down-regulate disgust) was further supported by an implementation intention (“And if I see blood, than I will remain calm and relaxed”) the experience of disgust was even more decreased.

Second, in a similar way, Experiment 3 might help to specify the nature of the reappraisal processes (“cognitive change”; cf. Figure 1). Reappraisal may appear as a rather slow and cognitively demanding process of re-evaluating a given situation. Yet, the priming measure I used to demonstrate such altered evaluations in Experiment 3 leave little room for cognitive effort. To the extent that this proposal is correct, Experiment 3 shows that the instruction to down-regulate disgust changes the “auto-

matic" evaluation of certain disgust-related stimuli. In fact, many authors propose that reappraisal can encompass quick and automatically operating processes (LeDoux, 2000; Ochsner & Feldmann Barrett, 2001; Smith & Kirby, 2000). The present experiment sheds some light on a further aspect of component appraisal processes and the question on what grounds is the situation evaluated. It provides some hints to the still not satisfactorily addressed question of the role that different kinds of motivation play in the process of appraisal. The findings of Experiment 4 suggest more clearly than those of Experiment 3 that emotion regulation is accompanied with changes in the motivational orientation. Clearly more research is needed to clarify whether changes in disgust specific motivations are causal factor or merely a byproduct of successful regulation attempts. To do so, a design is required that, for instance, primes such motivational states and observes changes of disgust intensity as a consequence of such priming procedures.

The present work leaves some questions unresolved, that might be addressed by future research. First of all, Gross' process model (1998a, 2007) is very helpful in classifying the processes that emotion regulation may affect. Still, one has to keep in mind that the implied temporal order of these processes is not generally supported by empirical research. Attention, appraisal, and behavior do not necessarily occur sequentially along a fixed timeline when an emotion is generated. For instance, Neumann, Förster, and Strack (2003) demonstrated that an emotional behavioral response can be elicited without being mediated by any cognitive appraisal. The mere exposition to emotional stimuli is sufficient. In a similar vein, it was shown that bodily movements activate the emotional experience directly (Niedenthal, Barsalou, Winckelman, Krauth-Gruber, & Ric, 2005; Strack, Martin & Stepper, 1988).

Apart from the implied temporal order of the processes, the process model leaves relatively unspecified possible interactions between these processes. Is it possible, for example, that a focus on global features of a scene goes together with other

attempts to down-regulate disgust, such as a reevaluation of disgust-eliciting stimuli (“Cognitive change”) or the suppression of an emotional response? The present work cannot provide an answer to this question. It might be, for example, that the participants in the instruction group in Experiment 3 did not only show an altered evaluation of certain disgust-related concepts, but changes in the local-global orienting of attention as well. Answering questions of this type would require a more complex design where several of the proposed regulation processes are manipulated with the same participants. For instance, there is evidence that some effects of reappraisal are at least partly explained by changes in visual attention (van Reekum, Johnstone, Urry, Thurow, Schaefer, Alexander, & Davidson, 2007). In a similar vein, Erber (1996) claims that manipulations of attention may not only determine what perceptual features are encoded but what kind of appraisal processes are employed, given the case that emotion arises from an quick but at least partly controllable appraisal process. Thus, at least some appraisal processes are based on attentional mechanisms rather than on alterations in knowledge representation (Ochsner & Gross, 2007). Future research will have to adopt a broader perspective considering the interactions between different means of regulation. Doubtlessly, this would also be an important project when it comes to develop a practical intervention to reduce disgust or other negative emotions in clinical or other professional settings. Such a program would have to take into account that certain regulation strategies can be combined more efficiently than others.

Another limiting aspect of the present work is the focus on one single negative emotion - that of disgust. More research is needed to clarify if instruction-based regulation effects transfer to other negative emotions, such as fear or sadness. There is, for example, research suggesting that effects on recognition and response biases to emotion-inducing pictures vary for fear and disgust and their trait-components. Specifically, disgust seems to facilitate recognition of emotional stimuli, whereas fear

induces response biases by misinterpreting neutral stimuli as threatening (Wiens, Peira, Golkar, & Öhman, 2008). It is possible that such differences may have different implications for the regulation of visual stimuli. Moreover, emotion regulation encompasses not only the reduction of negative states but also the enhancement of positive emotional responses. How to boost positive emotion is an important but still underrepresented issue of (clinical) studies.

A final restriction of the present work is the focus on visual stimulation of disgust. Obviously, visual attention processes of the type explored in Experiment 1 and 2 can only operate on visual stimulation. However, it is not the stimulation as such that evokes disgust, but the cognitive representations of a certain event (e.g. a bloody wound) activated by this stimulation that produces emotion. Such cognitive representations can be activated by other input channels than vision, such as audition, touch, etc. And of course, such representations can be endogenously activated by inferential processes (Smith & Neumann, 2005). Obviously, any regulation strategy that aims at changing visual attention must fail here. In contrast, strategies such as reappraisal might still work. In fact, Experiment 3 suggests already some degree of transfer across emotion-eliciting stimulation. After all, participants first received pictures as disgust-eliciting stimuli in the first phase of that study, while changes of affective priming were found with word stimuli. Thus, whatever processes drive these changes they must be more or less independent of the perceptual input channel.

Apart from the limiting aspects of the present work, the future research should aim to integrate research on emotion generation and research on emotion regulation. After all, the notion of emotion regulation implies being a process separable from emotion generation. The issues on emotion regulation and emotion have been usually treated in separation. However, some researchers claim that emotion and emotion regulation are two processes that are highly intertwined with each other (Davidson, 1998). In this broader view, regulation is conceived as an integral part of

the generation of emotion (Campos, Frankl, & Camras, 2004; Davidson, 1998). Thus, the research on emotion generation can certainly inform or even guide research on emotion regulation.

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Appendix

Material used in all experiments

Instructions for emotion regulation

Instruction for the antecedent-focused emotion regulation strategy

Liebe Teilnehmerin, lieber Teilnehmer,

vielen Dank, dass Du Dich bereit erklärt hast, an dieser Untersuchung teilzunehmen. Wir würden Dich gerne bitten, als Erstes die Instruktion auf dieser Seite sorgfältig zu lesen.

Das vorliegende Experiment untersucht verschiedene Aspekte visueller Informationsverarbeitungsprozesse.

Im Folgenden werden Dir für eine kurze Zeit Bilder präsentiert. Nach jeder Bildpräsentation wirst Du gebeten, eine Einschätzung hinsichtlich des Bildes auf einer Skala von 0 bis 9 abzugeben.

Betrachte die Bilder und versuch dabei, eine **unemotionale** und **sachliche** Haltung einzunehmen. Mit anderen Worten, während Du das Bild betrachtest, versuche, die **technischen Aspekte** zu beachten und **objektiv** zu sein.

Solltest Du keine Fragen haben, kannst Du mir der Leertaste fortfahren!

Instruction for the control group

Liebe Teilnehmerin, lieber Teilnehmer,

vielen Dank, dass Du Dich bereit erklärt hast, an dieser Untersuchung teilzunehmen. Wir würden Dich gerne bitten, als Erstes die Instruktion auf dieser Seite sorgfältig zu lesen.

Das vorliegende Experiment untersucht verschiedene Aspekte visueller Informationsverarbeitungsprozesse.

Im Folgenden werden Dir für eine kurze Zeit Bilder präsentiert. Nach jeder Bildpräsentation wirst Du gebeten, eine Einschätzung hinsichtlich des Bildes auf einer Skala von 0 bis 9 abzugeben.

Solltest Du keine Fragen haben, kannst Du mit der Leertaste fortfahren!

The IAPS pictures used to elicit disgust in experiments

Experiment 1

8230: swollen face of a boxer covered in blood; **7361**: raw meat; **3160**: swollen, suppurated eyes; **9301**: a dirty toilet; **9405**: injured hand covered in blood and with burned skin; **9008**: excrement and injection; **7380**: cockroach on a pizza slice; **3150**: severed hand.

Experiment 2

9320: a dirty toilette; **9405**: injured hand covered in blood and with burned skin; **9570**: a cadaver; **7360**: a fly on a cake; **3160**: swollen, suppurated eyes; **2400**: amputated arm; **9008**: excrement and injection; **2352.2**: man kissing women with face covered in blood.

Experiment 3:

3170: child with face tumor; **9301**: a dirty toilet; **3266**: child with a facial injury; **7361**: raw meat; **3150**: severed hand; **9320**: a dirty toilette; **9008**: excrement and injection; **9405**: injured hand covered in blood and with burned skin.

Experiment 4:

9140: a cadaver; **9320**: a dirty toilette; **7380**: cockroach on a pizza slice; **9008**: excrement and injection; **3150**: severed hand; **3170**: child with face tumor; **3266**: child with a facial injury; **9405**: injured hand covered in blood and with burned skin; **7360**: a fly on a cake.

Items of the Questionnaire for the assessment of disgust sensitivity (FEE) – short version.

(Schienle, Walter, Stark & Vaitl, 2002)

- Sie berühren einen toten Körper.
- Sie berühren mit einem Teil ihres Körpers die Klobrille in einer öffentlichen Toilette.
- Während Sie durch eine Bahnunterführung gehen, riechen Sie Urin.
- Versehentlich berühren Sie die Asche einer Person, die eingeäschert wurde.
- Sie sind hungrig. Vor ihnen steht ein Teller ihrer Lieblingsuppe, die mit einer benutzten, aber gründlich gewaschenen Fliegenklatsche gerührt wurde.
- Sie hören, wie ein Paar im Nebenzimmer eines Hotels Sex hat.
- Sie trinken einen Schluck Wasser und bemerken, dass Sie die falsche Dose genommen haben, aus der zuvor ein Fremder getrunken hat.
- Sie hören von einem 30 jährigen Mann, der sich eine sexuelle Beziehung mit einer 80 jährigen Frau wünscht.

Response categories: 0 = *not disgusting*, 2 = *little bit disgusting*, 3 = *moderate disgusting*, 4 = *very disgusting*.

Experiment 2

Instructions for the priming of the information processing style

Instruction to the Navon Task (Local priming conditions)

In dieser Aufgabe wird Ihnen eine Reihe von großen und kleinen Buchstaben präsentiert. Zum Beispiel können Sie dieses große „T“ sehen, das aus kleinen „Hs“ besteht.

```
  H H H H H
    H
    H
    H
    H
```

Auf jeder Seite wird solch ein großer Buchstabe bestehend aus mehreren kleinen Buchstaben zu sehen sein. Ihre Aufgabe ist es nun, so schnell wie möglich zu entscheiden, ob es sich bei den kleinen Buchstaben um ein „L“ oder „H“ handelt.

Drücken Sie bitte die rote Taste, wenn ein „H“ erscheint und die grüne Taste, wenn ein „L“ erscheint.

Instruction to the Navon Task (Global priming conditions)

In dieser Aufgabe wird Ihnen eine Reihe von großen und kleinen Buchstaben präsentiert. Zum Beispiel können Sie dieses große „H“ sehen, das aus kleinen „Ts“ besteht.

```
  T   T
  T   T
 T T T T
  T   T
  T   T
```

Auf jeder Seite wird solch ein großer Buchstabe bestehend aus mehreren kleinen Buchstaben zu sehen sein. Ihre Aufgabe ist es nun, so schnell wie möglich zu entscheiden, ob es sich bei den großen Buchstaben um ein „L“ oder ein „H“ handelt.

Drücken Sie bitte die rote Taste, wenn ein „H“ erscheint und die grüne Taste, wenn ein „L“ erscheint.

Experiment 2

Items of the Scale Clarity of Feelings

(Lischetzke, Eid, Wittig, & Trierweiler, 2001)

- Ich kann meine momentanen Gefühle benennen.
- Ich bin mir gerade im Unklaren darüber, was ich fühle. (r)
- Ich habe Schwierigkeiten, meine jetzigen Gefühle zu beschreiben. (r)
- Ich weiß, was ich gerade fühle.
- Ich habe Schwierigkeiten, momentan meinen Gefühlen einen Namen zu geben. (r)
- Ich bin mir unsicher, was ich eigentlich jetzt fühle. (r)

Response categories: 1 = *almost never*, 2 = *sometimes*, 3 = *often*, 4 = *almost always*.

(r) = items were reverse scored.

Declaration by Word of Honor

EIDESSTAATLICHE VERSICHERUNG

Ich versichere an Eides statt, dass ich die von mir vorgelegte Dissertation selbstständig angefertigt habe und alle benutzten Quellen und Hilfsmittel vollständig angegeben habe.

Kein Teil dieser Arbeit ist bereits veröffentlicht.

Eine Anmeldung der Promotionsabsicht habe ich an keiner anderen Fakultät oder Hochschule beantragt.