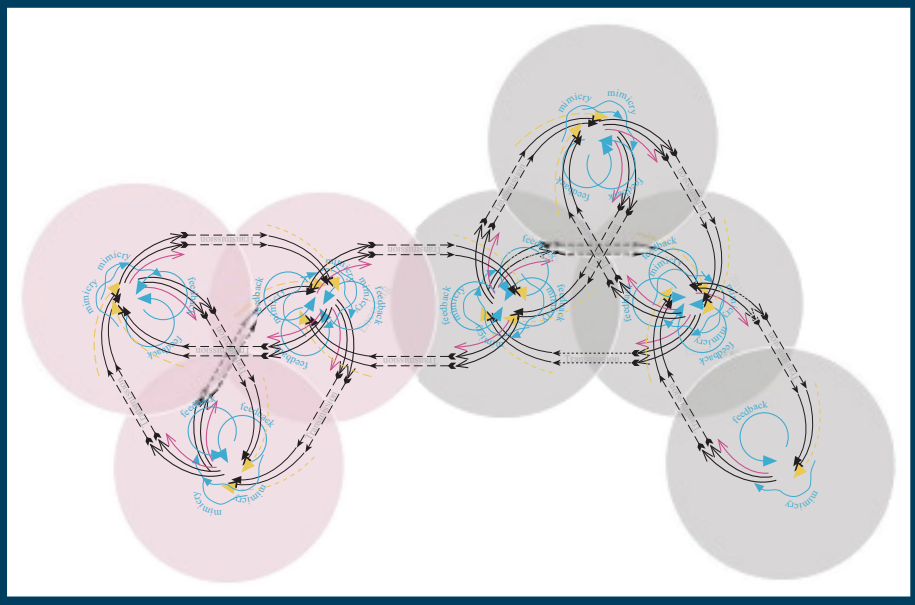
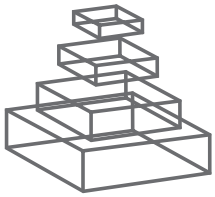
frontiers
RESEARCH TOPICS



THE SOCIAL DIMENSION OF EMOTION REGULATION

Topic Editors
Vera Shuman, Ullrich Wagner,
Henrik Walter and Klaus Scherer

frontiers in PSYCHOLOGY



frontiers

ISSN 1664-8714
ISBN 978-2-88919-219-9
DOI 10.3389/978-2-88919-219-9

ABOUT FRONTIERS

Frontiers is more than just an open-access publisher of scholarly articles: it is a pioneering approach to the world of academia, radically improving the way scholarly research is managed. The grand vision of Frontiers is a world where all people have an equal opportunity to seek, share and generate knowledge. Frontiers provides immediate and permanent online open access to all its publications, but this alone is not enough to realize our grand goals.

FRONTIERS JOURNAL SERIES

The Frontiers Journal Series is a multi-tier and interdisciplinary set of open-access, online journals, promising a paradigm shift from the current review, selection and dissemination processes in academic publishing.
All Frontiers journals are driven by researchers for researchers; therefore, they constitute a service to the scholarly community. At the same time, the Frontiers Journal Series operates on a revolutionary invention, the tiered publishing system, initially addressing specific communities of scholars, and gradually climbing up to broader public understanding, thus serving the interests of the lay society, too.

DEDICATION TO QUALITY

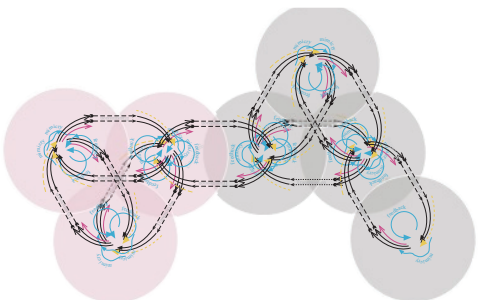
Each Frontiers article is a landmark of the highest quality, thanks to genuinely collaborative interactions between authors and review editors, who include some of the world's best academicians. Research must be certified by peers before entering a stream of knowledge that may eventually reach the public - and shape society; therefore, Frontiers only applies the most rigorous and unbiased reviews.
Frontiers revolutionizes research publishing by freely delivering the most outstanding research, evaluated with no bias from both the academic and social point of view.
By applying the most advanced information technologies, Frontiers is catapulting scholarly publishing into a new generation.

WHAT ARE FRONTIERS RESEARCH TOPICS?

Frontiers Research Topics are very popular trademarks of the Frontiers Journals Series: they are collections of at least ten articles, all centered on a particular subject. With their unique mix of varied contributions from Original Research to Review Articles, Frontiers Research Topics unify the most influential researchers, the latest key findings and historical advances in a hot research area!
Find out more on how to host your own Frontiers Research Topic or contribute to one as an author by contacting the Frontiers Editorial Office: researchtopics@frontiersin.org

THE SOCIAL DIMENSION OF EMOTION REGULATION

Topic Editors:
Vera Shuman, University of Lausanne, Switzerland
Ullrich Wagner, Charité - University Medicine Berlin, Germany
Henrik Walter, Charite Universitätsmedizin, Germany
Klaus Scherer, Centre Interfacultaire en Sciences Affectives and Swiss National Centre of Competence in Research in Affective Sciences, Switzerland



Hyperlenses. Seven hypothetical individuals interact in a communication structure that involves several dyads and triads—for example in the context of a party. The color of the context circle suggests here two different groups participating. Hence, some interactants share a more similar context than others.

Taken from: Kappas A (2013) Social regulation of emotion: messy layers. *Front. Psychology.* **4:51. doi: 10.3389/fpsyg.2013.00051**

The owner of this image is Arvid Kappas

Emotions and emotion regulation occur in social contexts. We may be unhappy when others earn more, but not admit it when they are around; we may follow our co-workers' leads in not expressing our anger towards superiors; and we may be more likely to select a movie for a date if our friends enjoyed it. Social comparisons, social adaptations, and social appraisals are just a few examples of how the emergence and regulation of emotions are shaped by the social context.

Emotion regulation entails changing if, when, and how emotions are experienced, e.g., by selecting emotional situations. From the perspective that emotions change continuously, no clear distinction between emotion emergence and emotion regulation exists. Emotion regulation in a broad sense includes situations where the social context regulates if, when, and how emotions emerge. Emotion regulation can be extrinsic (A regulates B's emotions) and/or intrinsic (A regulates A's emotion). The social context can influence both, with the latter occurring, for example, after the internalization of emotion knowledge.

The importance of the social context for children's emotional development is evident in research on attachment and family dynamics, but this research can only provide limited insight into the mechanisms underlying adult regulation because of differences in cognitive abilities and social contexts (e.g. work context). The importance of the social context for adult emotion regulation is

increasingly being examined theoretically and empirically. It is time to showcase this new research in order to discern common themes and set the ground for future research.

The aim of this Research Topic is to bring together state-of-the-art research on the mechanisms by which the social context influences emotion regulation, such as research on social comparison processes, social adaptation, emotional contagion, social stress, social situation selection, social appraisals, and neural correlates of emotion regulation in the context of social situations. Contributions will showcase research using various paradigms, ranging from highly controlled lab settings to settings with high ecological validity. Research will encompass different levels of analysis, including group emotions, individual behavior, and neural correlates, and it will highlight the significance of the social dimension of emotion regulation in many areas including social influence, conflict behavior, pro-social behavior, economic decision making, mental health, and interpersonal behavior with strangers, co-workers, and partners.

Table of Contents

frontiers in
PSYCHOLOGY

EDITORIAL
published: 05 December 2013
doi: 10.3389/fpsyg.2013.00922

Studying the social dimension of emotion regulation

Vera Shuman*

Department of Economics, University of Lausanne, Lausanne, Switzerland
**Correspondence: vsachari@umich.edu*

Edited by:
Luiz Pessoa, University of Maryland, USA

Keywords: emotion regulation, social context, emotion, anticipated emotions, social emotions, social cognition, mimicry

Emotion regulation has traditionally been studied as an individual phenomenon. Increasingly, however, researchers are developing the theoretical concepts and empirical paradigms needed to study emotions and their regulation in social contexts.

Emotion regulation is a *social* phenomenon in multiple ways: (1) Social contexts stir and steer emotions, (2) a common objective of emotion regulation is to change social situations, (3) the communication of emotions is a means to regulate emotions, and (4) emotion regulation and social cognition are linked.

Researchers who empirically study emotion regulation in social contexts use a variety of paradigms and methods, including self-report, EEG, fMRI, psychophysiological measures, voice parameters, facial action coding, and economic games. Subject populations are community samples, students, adolescents, employees, and patients. Emotions in interactions with strangers, co-workers, friends, and family members are examined.

The research topic "The social dimensions of emotion regulation" showcases the breadth of approaches to studying emotions in social contexts, discerns common themes, and proposes avenues for future research. I first provide a brief overview of the 16 articles featured in the research topic and then describe how the articles bridge traditional and future directions of emotion regulation research.

OVERVIEW

SOCIAL CONTEXTS STIR AND STEER EMOTIONS

Social contexts regulate emotions by arousing emotions and by determining the goals of emotion regulation. In their review of the cultural regulation of emotions, De Leersnyder et al. (2013) provide examples for how different social contexts give rise to distinct emotions: at the individual, relational, and structural level, cultures afford particular emotional situations and appraisal tendencies that lead to different emotions. von Scheve (2012) complements this review with a theory paper that connects psychological concepts from emotion regulation research with sociological concepts from research on emotion work. He points out that an individual's material, cultural, and social resources within a society influence the occurrence of emotional situations; additionally, framing rules guide the interpretation of a situation, which can then lead to an emotion.

Going beyond a direct "social context arouses emotion" relation, two experimental studies in this research topic demonstrate that the behavior of others interacts with an individual's current emotion regulation approach to produce emotions. Specifically, Grecucci et al. (2012) show in an economic game study how fair and unfair offers from others influence individuals' emotions differently when individuals engage in the emotion regulation strategies of mentalizing or distancing. The EEG study by Mella et al. (2012) suggests that the emotional reactions to others' pain depend on emotion regulation capacities that change between adolescence and adulthood.

Additionally, social contexts regulate emotions by determining the goals of emotion regulation. As reviewed by De Leersnyder et al. (2013) and by von Scheve (2012), this is evident in different emotion regulation goals across cultures and by different feeling rules for groups within cultures. Empirically, Snyder et al. (2013) find an association of the regulation goals in participants at a particular cultural event, "Burning Man," and the likelihood of using different emotion regulation strategies to achieve the normative emotional state in the cultural context.

A COMMON OBJECTIVE OF EMOTION REGULATION IS TO CHANGE SOCIAL SITUATIONS

Emotion regulation is also social when the goals of the emotion regulation are to influence interaction partners. As a result of the emotion regulation, individuals create or modify social situations.

Three survey studies find that individuals regulate their emotions to influence others' feelings and behavior. Simons et al. (2012) show that crying is down-regulated for interpersonal reasons. Wong et al. (2013) find that individuals who amplify their positive emotions at work are more likely to attain their goals in interactions with superiors but not with colleagues, whereas authentic expressions of positive emotions are associated with goal attainment in interactions with colleagues and superiors. Niven et al. (2012) demonstrate that higher variability in the regulation strategies that individuals use to influence others' emotions ("spin") is negatively associated with affective well-being and relationship closeness.

Additionally, emotion regulation leads to the creation of social situations when individuals choose to behave toward others in specific ways because they seek to experience or not experience anticipated emotions. Two experimental studies examine individuals' anticipated emotions and decision making. In an economic game study, van der Schalk et al. (2012) find, for example that individuals who anticipate pride (regret) after making fair (unfair) offers to others decide to subsequently share resources with others more generously. Wagner et al. (2012) adapt a lottery paradigm to differentially arouse the interpersonal emotion guilt or the intrapersonal emotion regret. They then demonstrate effects of trait and state guilt on loss aversive behavior.

THE COMMUNICATION OF EMOTIONS IS A MEANS TO REGULATE EMOTIONS

Emotion regulation is social when emotions are communicated to others and thereby changed. The communication can be accomplished by verbal, vocal, and facial expressions of emotions.

To what extent communicating emotions to others improves emotions depends on a number of factors, including how one shares the emotional event and how others react to the shared information.

In their study using self-report, voice parameters, and skin conductance, Matejka et al. (2013) find that individuals who face unpleasant stimuli believe that talking about facts is a more efficient emotion regulation strategy than talking about emotions. However, although talking about facts reduces negative valence during the emotional experience, talking about emotions reduces emotional arousal. A similar dissociation between the effects of emotional sharing on valence and arousal is observed by Seehausen et al. (2012) who study the influence of listeners' reactions on voice and psychophysiological parameters. A listener who paraphrases shared emotions induces less negative affect but more arousal in the sharer.

Facial mimicry is another way emotions are shared and regulated in social interactions. Fischer et al. (2012) observe individuals' natural tendency to mimic others in a social interaction with strangers and intimates. In support of a social contextual perspective, they demonstrate that mimicry is reserved for affiliative expressions (smiles) rather than negative expressions (disgust) when interacting with friends or family members; strangers' expressions were not mimicked in this study. How do individuals control whether or not they mimic somebody? In an fMRI study, Vrticka et al. (2013) identify the brain activity associated with expressing and suppressing mimicry when viewing dynamic facial expressions.

LINKS BETWEEN EMOTION REGULATION AND SOCIAL COGNITION

The social nature of emotion regulation is also evident in studies examining the link between social cognition abilities and emotion regulation tendencies. Rowland et al. (2012) demonstrate that in healthy adults, good social cognition is associated with the decreased use of maladaptive emotion regulation strategies. Schizophrenia and borderline personality disorder patients, however, differ from healthy controls in that they have lower mean levels of social cognition abilities and a higher likelihood for maladaptive emotion regulation strategies, and also in that they do not show the linkage between these variables, which is observed in healthy controls.

BRIDGING TRADITIONAL AND FUTURE DIRECTIONS

All but three articles in the research topic cite the conceptual emotion regulation framework by James Gross and colleagues, demonstrating the high influence of this model on subsequent research (e.g., Gross, 1998). This model distinguishes several emotion regulation processes that the present papers address: situation selection and modification (van der Schalk et al., 2012; Wagner et al., 2012; De Leersnyder et al., 2013), attention deployment (Mella et al., 2012), cognitive change (appraisal/re-appraisal; Grecucci et al., 2012; De Leersnyder et al., 2013; Snyder et al., 2013), and response modulation (emotion expression/suppression/amplification; Fischer et al., 2012; Simons et al., 2012; Matejka et al., 2013; Snyder et al., 2013; Vrticka et al., 2013; Wong et al., 2013). In the empirical studies, an emotional event is traditionally viewed as separate from the regulation of the emotion in order to examine changes in the emotion.

However, authors who theoretically examine the dependence of emotions on the cultural context or the group context question the common approach to treat emotion generation and regulation as separate processes (De Leersnyder et al., 2013; Kappas, 2013). A constructive proposition that may bring the views closer together can be seen in von Scheve's contribution, which extends the Gross model by adding sociological concepts. As a result of this exercise, the complex influences of a larger social context on emotions and their regulation are taken into account. Future work will test the value of this extension of the classical model.

CONCLUSION

The research topic brings together an exciting body of empirical research, reviews, and theoretical discussions. The papers demonstrate the significance of the social dimension of emotion regulation in many areas including social influence, conflict behavior, pro-social behavior, economic decision making, and mental health. Future research is needed to further validate and extend this work. In addition to increasing our knowledge on the four central themes outlined above, future research should tackle other topics concerning the social nature of emotion regulation, such as group emotions and emotions on the web (Kappas, 2013). The theoretical work (e.g., von Scheve, 2012) and new empirical paradigms (e.g., Wagner et al., 2012) presented in this research topic constitute valuable tools to guide future research on the social dimension of emotion regulation.

REFERENCES

De Leersnyder, J., Boiger, M., and Mesquita, B. (2013). Cultural regulation of emotion: individual, relational, and structural sources. *Front. Psychol.* 4:55. doi: 10.3389/fpsyg.2013.00055

Fischer, A. H., Becker, D., and Veenstra, L. (2012). Emotional mimicry in social context: the case of disgust and pride. *Front. Psychol.* 3:475. doi: 10.3389/fpsyg.2012.00475

Grecucci, A., Giorgetta, C., Bonini, N., and Sanfey, A. G. (2012). Living emotions, avoiding emotions: behavioral investigation of the regulation of socially driven emotions. *Front. Psychol.* 3:616. doi: 10.3389/fpsyg.2012.00616

Gross, J. J. (1998). The emerging field of emotion regulation: an integrative review. *Rev. Gen. Psychol.* 2, 271–299. doi: 10.1037/1089-2680.23.271

Kappas, A. (2013). Social regulation of emotion: messy layers. *Front. Psychol.* 4:51. doi: 10.3389/fpsyg.2013.00051

Matejka, M., Kazzer, P., Seehausen, M., Bajbouj, M., Klann-Delius, G., Menninghaus, W., et al. (2013). Talking about emotion: prosody and skin conductance indicate emotion regulation. *Front. Psychol.* 4:260. doi: 10.3389/fpsyg.2013.00260

Mella, N., Studer, J., Gilet, A.-L., and Labouvie-Vief, G. (2012). Empathy for pain from adolescence through adulthood: an event-related brain potential study. *Front. Psychol.* 3:501. doi: 10.3389/fpsyg.2012.00501

Niven, K., Macdonald, I., and Holman, D. (2012). You spin me right round: cross-relationship variability in interpersonal emotion regulation. *Front. Psychol.* 3:394. doi: 10.3389/fpsyg.2012.00394

Rowland, J. E., Hamilton, M. K., Vella, N., Lino, B. J., Mitchell, P. B., and Green, M. J. (2012). Adaptive associations between social cognition and emotion regulation are absent in Schizophrenia and Bipolar Disorder. *Front. Psychol.* 3:607. doi: 10.3389/fpsyg.2012.00607

Seehausen, M., Kazzer, P., Bajbouj, M., and Prehn, K. (2012). Effects of empathic paraphrasing - extrinsic emotion regulation in social conflict. *Front. Psychol.* 3:482. doi: 10.3389/fpsyg.2012.00482

Simons, G., Bruder, M., van der Löwe, I., and Parkinson, B. (2012). Why try (not) to cry: Intra-and inter-personal motives for crying regulation. *Front. Psychol.* 3:597. doi: 10.3389/fpsyg.2012.00597

Snyder, S. A., Heller, S. M., Lumian, D. S., and McRae, K. (2013). Regulation of positive and negative emotion: effects of sociocultural context. *Front. Psychol.* 4:259. doi: 10.3389/fpsyg.2013.00259

van der Schalk, J., Bruder, M., and Manstead, A. (2012). Regulating emotion in the context of interpersonal decisions: the role of anticipated pride and regret. *Front. Psychol.* 3:513. doi: 10.3389/fpsyg.2012.00513

von Scheve, C. (2012). Emotion regulation and emotion work: two sides of the same coin. *Front. Psychol.* 3:496. doi: 10.3389/fpsyg.2012.00496

Vrticka, P., Simioni, S., Fornari, E., Schluep, M., Vuilleumier, P., and Sander, D. (2013). Neural substrates of social emotion regulation: an fMRI study on imitation and expressive suppression to dynamic facial signals. *Front. Psychol.* 4:95. doi: 10.3389/fpsyg.2013.00095

Wagner, U., Handke, L., Dörfel, D., and Walter, H. (2012). An experimental decision-making paradigm to distinguish guilt and regret and their self-regulating function via loss averse choice behavior. *Front. Psychol.* 3:431. doi: 10.3389/fpsyg.2012.00431

Wong, E., Tschan, F., Messerli, L., and Semmer, N. K. (2013). Expressing and amplifying positive emotions facilitate goal attainment in workplace interactions. *Front. Psychol.* 4:188. doi: 10.3389/fpsyg.2013.00188

Received: 12 November 2013; accepted: 21 November 2013; published online: 05 December 2013.

Citation: Shuman V (2013) Studying the social dimension of emotion regulation. Front. Psychol. ***4****:922. doi: 10.3389/fpsyg.2013.00922*

This article was submitted to Emotion Science, a section of the journal Frontiers in Psychology.

frontiers in PSYCHOLOGY

REVIEW ARTICLE
published: 12 February 2013
doi: 10.3389/fpsyg.2013.00055

Cultural regulation of emotion: individual, relational, and structural sources

Jozefien De Leersnyder*†*, Michael Boiger*†* and Batja Mesquita

Center for Social and Cultural Psychology, Faculty of Psychology and Educational Sciences, University of Leuven, Leuven, Belgium

Edited by:
Vera Shuman, University of Lausanne, Switzerland

Reviewed by:
Igor Grossmann, University of Waterloo, Canada
Joanna Schug, The College of William and Mary, USA

****Correspondence:***
Jozefien De Leersnyder and Michael Boiger, Department of Psychology and Educational Sciences, Center for Social and Cultural Psychology, University of Leuven, Tiensestraat 102, box 3727, 3000 Leuven, Belgium.
e-mail: jozefien.deleersnyder@ppw.kuleuven.be; michael.boiger@ppw.kuleuven.be
† These authors have contributed equally to this work.

The most prevalent and intense emotional experiences differ across cultures. These differences in emotional experience can be understood as the outcomes of emotion regulation, because emotions that fit the valued relationships within a culture tend to be most common and intense. We review evidence suggesting that emotion regulation underlying cultural differences in emotional experience often takes place at the point of emotion elicitation through the promotion of situations and appraisals that are consistent with culturally valued relationships. These regulatory processes depend on individual tendencies, but are also co-regulated within relationships—close others shape people's environment and help them appraise events in culturally valued ways—and are afforded by structural conditions—people's daily lives "limit" the opportunities for emotion, and afford certain appraisals. The combined evidence suggests that cultural differences in emotion regulation go well beyond the effortful regulation based on display rules.

Keywords: emotion regulation, culture, relationships, appraisal, situation selection, structural affordances, cultural differences

In her ethnography *Never in Anger*, the anthropologist Jean Briggs describes her time with the Utku Inuit (Briggs, 1970). Adult Utku Inuit rarely express anger: The observation that gave the book its name is not hard to understand when you consider how important it is for a group without technological infrastructure to stick together in a cold and unforgiving climate. The group's closeness and harmony and, therefore, the avoidance of anger, was a central cultural goal for the Utku Inuit. Although Briggs describes a few instances of suppression and displacement of angry behavior—hitting the dogs is one such instance—most of the cultural regulation among the Inuit seemed to be focused on avoiding the occurrence of anger. Anger was rare, because there were few anger antecedents, and because few situations were interpreted as such: Utku Inuit avoided frustrating each other, and in addition, they were very slow to interpret someone else's behavior as frustrating.

The example illustrates the phenomenon of *cultural regulation*, which we understand as the combined cultural processes that result in the alignment of emotions with cultural values, ideals, goals and concerns. Particularly, we will argue (1) that emotional experiences tend to be congruent with culturally central values, ideals, goals, and concerns, (2) that regulation towards culturally congruent emotions often takes place at the point of emotion elicitation, and (3) that regulation happens at the levels of individual tendencies, relational co-regulation and structural affordances. We will support these arguments by discussing cross-cultural evidence.

PATTERNS OF EMOTIONAL EXPERIENCES ARE CONGRUENT WITH CULTURALLY VALUED RELATIONSHIPS

EMOTIONS, EMOTION REGULATION, AND SOCIAL RELATIONSHIPS

Emotions are central to social relationships (e.g., Jankowiak and Fischer, 1992; Frijda and Mesquita, 1994; Keltner and Haidt, 1999; Oatley et al., 2006; Mesquita, 2010). By having and expressing an emotion, we take a stance in the social world, express our concerns, and reveal our strategies, goals, and intentions to act (Frijda, 1986, 2007; Solomon, 2004; Griffiths and Scarantino, 2009). For instance, when Mary feels guilty, she holds herself responsible for John's unhappiness, she implies that John's well-being is important to her, and she is resolved to make up for what she did wrong. In contrast, when Mary is angry at John, she holds him responsible for something bad, she implies that he violated her individual rights or her personal autonomy, and she is intent on confronting him or taking revenge. Having a particular emotion is thus tantamount to engaging in a relationship in a particular way. When Mary feels guilty, her relationship with John is very different from when she feels angry.

To successfully manage our relationships with others, we need to have and express certain emotions. *Emotion regulation* refers to all the processes that help to attain culturally appropriate (or functional)[1] emotional experiences; appropriate are

[1]The idea that emotion regulation is functional, does not imply that regulation outcomes are adaptive in every situation. Rather, regulation shapes emotions in ways that are usually more effective within a given socio-cultural context than they would have been without regulation.

those experiences that, within a culture, are more often than not instrumental in the successful navigation of the social world. What these experiences are may differ across cultures; yet, universally, emotion regulation appears to be motivated by a person's need to establish and maintain proper and good relationships (Thompson, 1991; Gross et al., 2006).

CULTURAL DIFFERENCES IN VALUED RELATIONSHIPS

To have proper and good relationships with others means something different in different cultures (e.g., D'Andrade, 1984; Holland and Quinn, 1987; Bruner, 1990; Markus and Kitayama, 1991; Shweder and Haidt, 2000). Given these differences in the valued relationships, we can assume that the emotions that are "helpful" or functional in coordinating people's relationships may differ accordingly. The relationship ideals between European and East Asian cultural contexts may serve as an example.

In European American contexts, a "good relationship" is one in which each partner remains autonomous and partners mutually strengthen each other's individuality and independence (Triandis, 1995; Kim and Markus, 1999; Rothbaum et al., 2000). Individuality is, among others, strengthened by focusing on the positive characteristics that show each partner's uniqueness and that enable them to be self-reliant; hence there is an emphasis on high self-esteem (Hochschild, 1995; Heine et al., 1999). It is important for this kind of relationship that partners are able to take a stance or assert their desires; (constructive) conflict is not eschewed but rather considered a necessary bump in the road to strong relational ties (Canary et al., 1995). Emotions such as pride and anger appear to be functional in European American relationships since they reflect individual self-worth and personal autonomy; shame and guilt, on the other hand, are less valued since they may threaten a positive self-view.

In contrast, "good relationships" in most East Asian cultural contexts are those in which partners are interdependent and interconnected and adjust to each other's expectations (Lebra, 1992; Heine et al., 1999; Kim and Markus, 1999; Oishi and Diener, 2003). In order to meet these relational expectations, individuals need to be aware of and improve on their shortcomings; hence the focus is on negative information about oneself (Kitayama et al., 1997). In East Asian interdependent cultural contexts, emotions such as shame and guilt appear to be conducive to building strong relationships because they highlight flaws and shortcomings and thus promote alignment with social rules and relational embeddedness. In contrast, anger appears to be highly undesirable in interdependent relationships because it may threaten relational harmony; in that sense, East Asian contexts may be similar to the Inuit context described before.

CULTURALLY DIFFERENT PATTERN OF EMOTIONS

In each culture, the "endpoints" of emotion regulation are dictated by the culturally valued relationship models. In the example of the Inuit described in *Never in Anger,* anger avoidance was implicated by the ideal of social harmony. If we assume that people are reasonably successful regulators of emotion, this should result in cross-culturally different emotional experiences: Anger was rarely expressed (and rarely felt) by the Inuit. The low rate of anger feelings occurred notwithstanding the evidence that the Inuit had the potential for anger: They got angry at their dogs at times, and they also ended up being very angry at the ethnographer herself after she had violated the principles of harmony. This reflects a general pattern in ethnological and cross-cultural research: While there are impressive similarities in the potential for emotions, the actual cultural patterns of emotional experience, and thus the endpoints of emotion regulation, differ cross-culturally in meaningful ways (Mesquita et al., 1997). These differences in the actual cultural patterns can be understood from the cultural relationship ideals (e.g., Kitayama et al., 2006; Mesquita and Leu, 2007).

For instance, Kitayama and colleagues investigated the frequency and intensity of different types of emotions in US and Japanese students, using a retrospective self-report study and a diary study (Kitayama and Markus, 2000; Kitayama et al., 2006). *Socially disengaging* emotions—such as pride, anger, or irritation—were found to be more frequent and intense in European American than in Japanese cultural contexts; this is consistent with the European American emphasis on autonomy and independence. In contrast, *socially engaging* emotions—such as close feelings, shame, guilt, or indebtedness—were found to be more frequent and intense in Japanese than in European American cultural contexts; this is in line with the East Asian emphasis on relatedness and interdependence.

That cultures dictate the endpoints of emotion regulation is also suggested by recent studies on emotional acculturation (De Leersnyder et al., 2011). In these studies, we found that immigrants converge to the endpoints of regulation dictated by their host culture. Korean immigrants to the US, and Turkish immigrants to Belgium shared their host cultures' emotional patterns to the degree they had spent time in the new country; immigrants who reported more daily interactions with members of the host culture—European Americans and native Belgians respectively—reported patterns of emotional experience that were more similar to those reported by members of the host cultures. Immigrants' emotional patterns seem to change due to exposure to new relationship ideals, and to the endpoints of emotion regulation that fit these ideals.

Several studies also suggested that attaining the culturally defined endpoints of emotion regulation is rewarding. In the diary study mentioned above (Kitayama et al., 2006), European American and Japanese students reported more positive adjustment when their emotions were closest to the cultural ideal. Specifically, European Americans experiencing disengaging emotions (pride, anger), and Japanese experiencing engaging emotions (friendly, shame) reported the highest wellbeing. In a related study (De Leersnyder et al., in preparation), Belgian students reported on one of four types of situations, defined by valence (positive, negative) and engagement (engaged, disengaged). The students then rated their emotions at the time of the situation on 30 different items. These ratings resulted, for each individual, in a pattern of emotional intensity. Per situation type, we also calculated the average Belgian pattern of emotions. We found support for the idea that the cultural "endpoints" of emotion regulation are socially rewarding: The correlation between a person's

patterns and the cultural average of emotional experience was associated with that person's self-reported well-being, as indicated by fewer depressive symptoms and more satisfaction with their social relationships.

In sum, it may be inferred that the culturally valued relationship models dictate the endpoints of emotion regulation, and that attaining these endpoints is rewarding. In the remainder of this review, we discuss two types of antecedent-focused emotion regulation through which this may be achieved: situation selection and appraisal.

ANTECEDENT-FOCUSED EMOTION REGULATION AS A SOURCE OF CULTURAL DIFFERENCES

ANTECEDENT-FOCUSED EMOTION REGULATION: SITUATION SELECTION AND APPRAISAL

Emotion regulation has always been considered an important source of cross-cultural differences in emotions (e.g., Ekman, 1992). Traditionally, emotion regulation was conceived as a conscious effort to suppress or change emotions due to the salience of cultural display rules. For example, in one experiment, Japanese students as compared to European Americans showed fewer negative emotions in response to a disturbing movie when another person was present, but this was not the case when they watched the movie by themselves. Japanese display rules were thought to underlie this difference in the expression of negative emotions (Ekman and Friesen, 1969). Cross-cultural evidence of a much later date provides general support for the notion that collectivist cultures, such as Japan, have display rules of suppression, at least for certain emotions (Matsumoto et al., 2008). Yet, there is no evidence that cultural differences in suppression of emotional responses in fact underlie the culturally different emotional outcomes; it is equally questionable if suppression is the only or even the strongest force in shaping cultural differences in emotions.

In the current article we review evidence for the idea that emotion regulation often occurs during the process of emotion elicitation. Our review is organized around two constituent processes of emotion regulation, namely situation selection and appraisal, that both affect whether an emotion is elicited, and what the nature of the emotion is. "*Situation selection*" has been described as "approaching or avoiding certain people, places, or objects in order to regulate emotions" (Gross, 1998, p. 283); *appraisal* involves taking an evaluative stance (Solomon, 2004). In this review, we provide evidence that both types of emotion regulation produce cultural differences in emotional experience.

We focus on appraisal generally as a site of emotion regulation, rather than limiting the discussion to re-appraisal specifically, as most of the emotion regulation literature does (e.g., Gross, 1998, 2007). The first reason is that, with few exceptions, appraisal and re-appraisal are hard to distinguish both conceptually and empirically (Campos et al., 2004; Mesquita and Albert, 2007; Mesquita and Frijda, 2011), because these processes often occur automatically (Mauss et al., 2008). The second reason is that culture-level regulation may affect the initial appraisal rather than re-appraisal; culture renders certain appraisals more salient than others, thereby "regulating" the emotions that people are likely to experience in their culture.

DIFFERENT SOURCES OF EMOTION REGULATION

The literature on emotion regulation has primarily focused on *individual*-level emotion regulation (Gross, 1998; Gross et al., 2011)—e.g., Mary is angry at John, but she tries to reinterpret his rude behavior by telling herself that he has been under a lot of pressure, or may just have been oblivious to the consequences of his behavior. (Re-)Appraisal at this level may be subject to cultural influence when culturally prevalent ideals about how to relate to (certain) others affect the ways in which individuals appraise situations. For instance, the cultural ideal that a woman should support her husband may make Mary more likely to attribute John's behavior to external pressures—both in terms of her initial appraisal or her later re-appraisal of John's behavior. This is an example of culturally influenced individual-level regulation.

We distinguish two other sources of regulation. First, there is some evidence for *relational* co-regulation by close others, most notably the work on parents' regulation of children's emotions—e.g., a caregiver telling the child that her brother did not break the toy on purpose, and that she should get over her anger (e.g., Eisenberg et al., 1999; Campos et al., 2004; Holodynski and Friedlmeier, 2006). Furthermore, we distinguish a third source of emotion regulation, which is of a *structural* nature: The organization of everyday life affords certain types of emotional situations, and suppresses others. Our review of cultural differences in emotion regulation includes all three sources (individual, relational and structural) for the two types of antecedent-focused emotion regulation (situation selection and appraisal). **Figure 1** shows how cultural ideals provide a background against which individual tendencies, relational co-regulation and structural affordances bring about certain emotional experiences through these two types of regulation.

SITUATION SELECTION

Mary may avoid seeing John when he is stressed, because she knows his rude behavior would make her angry. This is what has been referred to as situation selection: approaching or avoiding certain people, places, or objects in order to regulate emotions. At a relational level, situation selection may take place when people structure each other's experiences by encouraging one another to avoid or seek out certain situations. For example, in an attempt to avoid anger, the Utku Inuit structured their interactions in ways to avoid confrontations at all costs. The structural organization of everyday life may fulfill a similar role: politeness rules in some societies reduce the likelihood of experiencing anger eliciting encounters (Cohen, 1999). Situation selection may thus take place at the individual, the relational, and the structural level; culture may play a role at all levels.

Individual tendencies

People's selection of situations and according emotional experience is, for example, shaped by their motivational focus. A promotion focus leads to happiness in the case of success, and to depression in the case of failure, whereas a prevention focus leads to relief in the case of success, and anxiety in the case of failure (Higgins et al., 1997; Lee et al., 2000). Research on motivational focus suggests that people from cultures that value autonomy and individuality as relationship goals (e.g. US contexts) are

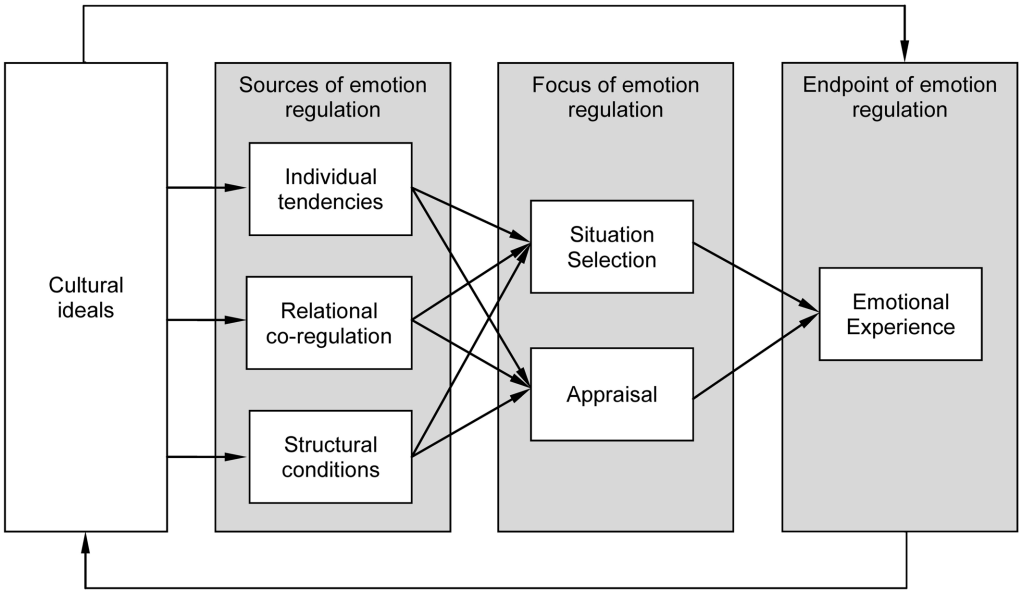


FIGURE 1 | Three sources of antecedent-focused emotion regulation in cultural context.

more focused on the *accomplishment* of positive outcomes (i.e., promotion focus), whereas people in cultures emphasizing relational harmony and obligation (e.g. East Asian, Russian) are more concerned with *avoiding* negative outcomes (i.e., prevention focus; Lee et al., 2000; Elliott et al., 2001). American respondents thus seek out situations that promise success, whereas East Asians and Russians avoid situations that are likely to lead to failure (for instance, the failure to meet social expectations). A cross-cultural vignette study on success and failure in European American and Chinese cultural contexts confirmed that these cultural differences in individual-level situation selection give rise to differences in emotional experience (Lee et al., 2000). Consistent with their cultural focus on promotion, European Americans reported a higher intensity of happiness/depressed emotions than relief/anxiety. Conversely, consistent with their cultural focus on prevention, the Chinese group reported a higher intensity of relief/anxiety than happiness/depressed emotions. This is some first evidence that the differences in situation selection at the level of approach or avoidance are related to differences in the prevalent types of emotions.

People also tend to seek out situations that elicit culturally "ideal" affect (Tsai, 2007). What is considered ideal affect differs between cultures: European Americans prefer high activation positive emotions (e.g., excitement), because these emotions foreground individual experience and prepare people for asserting themselves and influencing others (Tsai et al., 2007). In contrast, East Asians value low arousal positive states (e.g., calm, relaxed), because these emotional states facilitate attention to the context (Bradley et al., 2001 as cited in Tsai, 2007) and prepare people for adjusting their behavior to others' needs (Tsai et al., 2007). Consistently, survey research has documented cultural differences in the activities that people in the respective cultural contexts seek out: While North Americans seek out active individual activities (e.g., running or rollerblading), up-beat music, and stimulants (e.g., amphetamines, cocaine), East Asians are drawn to passive collective activities (e.g., sightseeing, picnicking), calmer music, and sedatives (e.g., opiates) (Gobster and Delgado, 1992; Tsai, 2007). By selecting certain situations over others, individuals achieve those emotional states that are functional in their respective cultural context.

Relational co-regulation

In many ways, situation selection takes place in the context our relationships with others; hence, interactions with others shape our emotional experience (Boiger and Mesquita, 2012). Although people structure each other's emotional lives throughout the lifespan (Mesquita, 2010), this phenomenon is especially apparent in the first years of life. Parents organize their children's lives almost entirely; moreover, parental efforts appear to be in the direction of promoting situations that elicit culturally valued experiences (e.g., Goodnow, 1997; Güngör et al., 2011). By shaping children's environments, parents allow for and highlight certain (emotional) experiences over others; they can thus be said to co-regulate the child's emotional life through situation selection. Across cultures, parents appear to select different situations for their children. In each case, parents' situation selection can be understood as an attempt to align their children's emotional experiences to the culturally desired endpoints of emotion regulation, thus helping their children to successfully navigate their social relationships.

Co-regulation occurs, for instance, when parents highlight or re-activate certain emotional experiences as a learning opportunity for their children. Across different cultures, parents appear to highlight the types of emotional experiences that are central to the culture's relationship ideals (Whiting and Whiting, 1975; Röttger-Rössler et al., in press). For instance, Taiwanese parents

believe it is necessary and effective to highlight shame when their pre-school children transgress social rules (Wang, 1992; Fung, 1999; Fung and Chen, 2002 as cited in Fung, 1999). Consistently, Fung (1999) observed that Taiwanese parents of 2.5 year olds engaged their child approximately three times an hour in discussions about shame episodes; the majority of which were still ongoing. Most of these discussions were playful, and served as a tool to teach children right from wrong, rather than to denigrate them. Whenever Taiwanese children were about to transgress a social norm, their parents constructed a discussion in such a way that they would experience shame—an emotional experience that would teach the children how to behave properly. The highlighting of shame is not universal. Observational studies with European American parents in the tough and dangerous lower class neighborhoods of Baltimore provide a sharp contrast to the Taiwanese example (Miller et al., 1996, 1997). The Baltimore parents actively avoided to turn their children's wrongdoings in shameful situations by rarely acknowledging their children's rule violations. In the rare cases when parents did talk about these transgressions, they did not treat them as serious wrongdoings in order to "toughen" their children.

Another way in which parents promote relevant emotional situations is by engaging their children in memory conversations. Parents frequently use these conversations to reminisce about recent emotional events (Ross and Wang, 2010). Reminiscing about these situations may in itself again give rise to culturally valued emotional experiences. In one study, European American and Chinese mothers were asked to discuss recent emotional events with their children (Wang, 2001). European American and Chinese mothers not only differed in the events they chose to discuss, but also in the way they discussed them. While European American mothers focused on personal and non-social events, Chinese mothers discussed events in which other people were involved. The European American mothers engaged in a highly elaborative style, stressing the child's own role in the emotional event. In doing so, they constructed conversational situations in which the child's own emotions and view on the situation were paramount. These situations have likely afforded the experience of disengaging emotions such as pride or anger—at the time of the conversation as well as for future events. In contrast, Chinese mothers were much less likely to elaborate on the child's experience of the event in detail. Instead, they focused on the perspective of others who were involved, as well as on the appropriate social behavior that would have been expected from their children. In doing so, the Chinese mothers conveyed the interdependent nature of emotions, thereby underlining the role of their children's emotions in social interactions and teaching them important lessons about social conventions. Moreover, they encouraged their children to experience emotions that are socially engaging such as respect or shame, both during the conversation as well as for the future.

Relatedly, differences in maternal sensitivity influence how and when mothers intervene in structuring their children's environment, and consequently their emotions. While mothers who display "reactive sensitivity" allow negative situations to happen and restrict their interventions to cases where the child experiences a full-blown emotion, "proactive" mothers monitor their child's surroundings and intervene before a negative emotional situation has had the chance to develop (cf. Trommsdorff and Rothbaum, 2008). The extent to which mothers use proactive versus reactive strategies differs between cultures; for example, German mothers were found to use more reactive strategies than Japanese mothers; the latter focus more on proactive strategies (Trommsdorff and Friedlmeier, 2010). In this study, differences in maternal sensitivity caused the children to have different emotional experiences: The proactive Japanese mothers protected their children from negative experiences by removing or distracting them; in contrast, the reactive German mothers exposed their children to negative experiences. These differences in maternal situation selection are consistent with the culture's view on negative emotions. In a German context, where children need to learn to assert themselves, experiencing and expressing negative emotions may be more acceptable and functional than it is in a Japanese context, where the expression of disengaging negative emotions is seen as a threat to close relationships.

Structural conditions

The structure of everyday life can be seen as the selection of situations that habitually happen; this selection renders the experience of certain emotions more or less likely. Everyday life differs across cultures, and prevalent emotional experiences differ accordingly. For example, European American social life is characterized by practices that make individuals feel special and unique; these practices afford happiness and feeling good about one's (independent) self (D'Andrade, 1984; Nisbett, 2003). In comparison, many of the Japanese cultural practices promote shame; this is consistent with the Japanese cultural model that emphasizes self-criticism in order to live up to the expectations of others (Heine et al., 1999). For example, at the end of each day, Japanese school children are encouraged to engage in critical self-reflection ("*hansei*"). This practice highlights shortcomings or weaknesses and encourages improvement (Lewis, 1995), thereby affording emotions such as shame.

These ethnographic observations were confirmed by a cross-cultural study in which European Americans and Japanese were asked to report on their interactions (Kitayama et al., 1997). A different group of European American and Japanese rated these interactions with regard to the self-esteem they would afford. The authors found that the European Americans had reported situations that afforded self-enhancement (in both European Americans and Japanese of the second group), which may have promoted high-activation happiness and pride. On the other hand, the Japanese situations afforded more self-criticism, which may have promoted calmer emotional states, wariness and shame. Everyday Japanese life may thus offer more opportunity to feel ashamed, whereas European American daily life may offer the opportunity to feel pride.

People's emotions appear to hinge indeed on the situations that have been "selected" to occur frequently (Boiger et al., in press, Study 1). In this study, we started from the idea that situations that elicit culturally desirable or condoned emotions should be promoted—and thus occur frequently, while situations that elicit culturally undesirable or condemned emotions should be avoided—and thus occur rarely. In line with the dominant

cultural ideals in the US and Japan, we predicted that anger is condoned in the US and condemned in Japan because it highlights personal desires and threatens relational harmony; shame is condemned in the US and condoned in Japan because it highlights personal flaws and emphasizes social conventions. North American and Japanese participants indicated for a number of situations from both cultures how frequently most students they know would encounter these situations and to what extent they would feel the associated emotion (i.e., either anger or shame). In line with our predictions, American students perceived situations as more likely to occur to the extent that they elicited stronger feelings of anger. In contrast, Japanese students, perceived situations as less likely to occur when they were highly angering. The opposite picture emerged for shame: Japanese students rated the situations that elicit stronger feelings of shame to be more likely to occur than American students, who perceived them as rather uncommon. Structural situation selection may account, at least partially, for the finding from previous research (Kitayama and Markus, 2000; Kitayama et al., 2006) that disengaging emotions (e.g., anger) are more salient in Americans' emotional lives while engaging emotions (e.g., shame) prevail in Japanese emotional lives.

We have recently replicated these findings with samples of Japanese and Turkish students (Boiger et al., in preparation). Again, participants from both cultures rated, for most students they know, the frequency of anger and shame situations that had previously been sampled in Japan and Turkey. As before, we found that anger-eliciting situations were perceived to occur rarely in Japan, while shame-eliciting situations were perceived to occur frequently; this is in line with the Japanese goals of harmony maintenance and self-improvement. In Turkey, both anger and shame situations were perceived to occur frequently. This concurrent "up-regulation" of anger and shame situations may be typical for an honor-based interdependent cultural context, such as Turkey. In honor cultures, "honor must be claimed, and honor must be paid by others. A person who claims honor but is not paid honor does not in fact have honor" (Leung and Cohen, 2011, p. 509). The need to take a stand and uphold a reputation of toughness, while at the same time having to rely upon others to confirm one's reputation may explain the concurrent promotion of anger (as an emotion that helps in claiming honor) and shame (as an emotion that helps in preventing the withdrawal of honor through others) in Turkey. In comparison, in face-cultures, such as Japan, face cannot be claimed but is obtained by social conferral only; this explains why shame-promoting, but not anger-promoting situations were perceived as frequent in Japan.

APPRAISAL

Mary may take John's rude behavior as a sign of his stress instead of blaming him for being offensive. This would be an example of emotion regulation through appraisal—in this case, down-regulation of anger. We review evidence that there are cultural differences in the prevalent types of appraisal that can be understood from the culturally valued relationships. Thus, when the Utku Inuit have a low tendency to blame, and this fact can be understood from their concern for avoiding confrontations, we assume that some kind of regulation is at play. At the level of the individual, it is often hard to know whether this regulation happens immediately (as when the Utku Inuit recognize less entitlement; Solomon, 1978), or whether it is a correction of an initially different response (as when they consider the mitigating circumstances). At the level of relationships, regulation more often takes the shape of re-appraisal, in particular when parents provide children with a different perspective on the emotional situation. Finally, structural conditions of everyday life may afford certain appraisals over others.

Individual tendencies

People's beliefs about the world will guide their appraisals. For example, whether the world is felt to be a predictable and controllable place might lead to different evaluations of events than when it is felt to be rather unpredictable and uncontrollable. Moreover, the appraisal dimension of controllability tends to be central in the appraisal patterns of anger and frustration (e.g., Frijda, 1986; Frijda et al., 1989; Stein et al., 1993; Kuppens et al., 2003): Experiencing anger implies that something has happened that is inconsistent with your goals, and that the situation is fixable and controllable. Therefore, one might expect cultural differences in the frequency and intensity of anger and frustration depending on the cultural schema of the world as controllable or uncontrollable. This expectation was confirmed by two studies in which European Americans' emotional responses were compared to those of Indians (Roseman et al., 1995) and Tahitians (Levy, 1978). Whereas the European American cultural ideals tend to emphasize control and predictability and, as such, promote a view of the world as malleable (Weisz et al., 1984; Mesquita and Ellsworth, 2001; Morling et al., 2002), Indian cultural ideals don't show this tendency (Miller et al., 1990; Savani et al., 2011). Consistently, Roseman and colleagues found that Indian college students rated self-reported emotional events to be less "incongruent with their motives" and reported lower overall intensities of anger than did their European American counterparts. Moreover, anger intensity was fully mediated by a person's perception of the event as discrepant with his or her goals. Similarly, the anthropologist Robert Levy pointed to the Tahitians' "common sense that individuals have very limited control over nature and over the behavior of others" (Levy, 1978, p. 226), and related this fact to the observation of a near absence of anger among the Tahitians. His explanation for this phenomenon was that a universe that is defined as unpredictable and uncontrollable might be "*cognitively* less frustrating than [. . .] [a universe] in which almost anything is possible to individuals" (p. 226).

Cultural contexts also differ substantially with regard to the attribution of success or failure. European Americans have a pervasive tendency to attribute success to themselves, and failure to others or the situation; the opposite is true for East Asians (e.g., Heine et al., 1999). A recent study tested the idea that cultural differences in the appraisal of causal agency are associated with different emotional experiences (Imada and Ellsworth, 2011). Japanese and European American college students were asked to remember success and failure situations, to indicate if these situations had been caused by themselves, others, or

circumstances, and to rate the intensity of their feelings. As expected, European Americans took more personal credit for success than the Japanese; Japanese credited circumstances for success. In contrast, the Japanese took more blame for failure than the European Americans; European Americans blamed others. These different appraisals were reflected in the emotions that the participants experienced: European Americans reported to feel pride when they succeeded, and anger or bad luck when they failed; Japanese reported to feel lucky after when they succeeded and shame when they failed. This pattern of success and failure attributions is consistent with the observed self-enhancing tendency that is characteristic of European American contexts and the tendency to focus on self-improvement characteristic of interdependent Japanese contexts. Moreover, the combined findings support the idea that people's habitual appraisals differ across cultures in ways that make culturally valued emotional experiences more likely.

There are also cultural differences in the perspective taken on situations: European Americans tend to take a first person perspective, but East Asians more readily emphasize the meaning of emotional situations for third others. These differences in perspective are likely to produce differences in emotional experience. For example, a first-person perspective on a situation may highlight how an event is inconsistent with one's goals, how others are responsible, and how others should accommodate to one's own wishes–all appraisals that render the experience of anger and frustration more likely (Frijda, 1986). In a comparison of European American and Japanese respondents, (Mesquita et al., unpublished) found that Japanese respondents reported indeed more appraisals that reflected an awareness of the meaning of the situation for other people. This study consisted of standardized interviews in which participants reported on their emotional experiences during a number of situations, e.g., situations of offense. Respondents reported a situation from their past, and their emotion narratives were recorded and later coded. The narratives suggested that, in the negative situations in particular, Japanese considered the meaning of the events for *other* people. This outside-in perspective on situations may be understood from the need to be socially attuned. For example, more than 40% of the Japanese, versus none of the European Americans, explained an offense situation from the perspective of a third person or a generalized other. In addition, in the offense situation, 56% of the Japanese compared to only 5% of the European Americans tried to understand or sympathize with the offender. Similarly, when Japanese adolescents were victim of another person's harmful behavior, they tended to make positive attributions of the other person's intentions or to engage in self-criticism ("She did not want to hurt me"; "Her behavior was accidental"; "I was wrong to give her the impression of my provocation"). Kornadt (2011), as reported in Trommsdorff (2012).

That cultural difference in perspective or appraisal lead to different emotional experiences is also suggested by a study in which people were asked to think about a past emotional event (Grossmann and Kross, 2010, Study 2). In this study, European American students reported more emotional distress and blame, which might give rise to more anger, than their Russian counterparts. These associations were partially mediated by cultural differences in the students' self-reflexive strategies about the event. European Americans recounted the emotionally arousing details of the past experience, thus immersing themselves in a first person perspective. In contrast, the more interdependently oriented Russians adopted a self-distancing perspective, thus imagining what the event could have meant to other people.

Whether people appraise situations to be about self-focused concerns or about their relationship with others, has implications for the types of emotions that they are likely to experience. In two studies with Belgian college students, participants described a recently experienced emotional situation and rated the intensity of a wide range of emotions during this situation (De Leersnyder and Mesquita, in preparation). They also indicated *if* and *to what extent* the situation had been either consistent or inconsistent with a number of different concerns that were based on the Schwartz value questionnaire (Schwartz, 1992). Some of these concerns were *other-focused* (e.g., Benevolence, Universalism and Conformity-Tradition), others were *self-focused* (Self-direction and Achievement). Across both studies, the concerns or values that were appraised as relevant to the situation predicted the type of emotions experienced. In situations that were relevant to other-focused values, the odds of experiencing socially engaging emotions were much higher than the odds of experiencing socially disengaging emotions. The opposite pattern of associations held for situations that were relevant to self-focused values. Moreover, the frequency with which these values were perceived as relevant to students' emotional situations exactly mirrored young Belgians' value hierarchy (i.e., most important values as "guiding principles in people's life"), as obtained from a national representative sample by the European Social Survey (ESS round 5; Norwegian social Science Data Services, 2012). This finding suggests that emotional experiences are culturally regulated to be *about* the most important cultural values: (1) culturally salient values are more readily available as standards of evaluation for emotional situations, and (2) the different types of values—self-focused vs. other-focused—translate into different patterns of emotional experience (more disengaging vs. engaging, respectively).

Relational co-regulation

Other people's appraisals are often referenced when people have to assess the meaning of situations (Parkinson and Simons, 2009). "Social referencing" is particularly evident in children, who often look at their caregivers' facial expressions when trying to appraise a situation as, for example, dangerous or safe (e.g., Campos and Stenberg, 1981); they can thus be said to construct the emotional meaning of the situation in conjunction with their caregivers (see Boiger and Mesquita, 2012). There is some evidence for cultural differences in the ways caregivers help their children (re-)appraise situations.

Different strategies for dealing with angry or frustrated children have been observed for European (American) and Japanese parents. One finding that stands out is that Japanese caregivers reason with their angry children, emphasizing how *others* feel when they hurt them (e.g., Conroy et al., 1980). Japanese parents thus helped the children adopt the outside-in perspective that is

also common for Japanese adults. Re-appraising angering situations in this way may explain the lower levels of anger in Japan (Zahn-Waxler et al., 1996). Japanese parents rarely express direct disagreement with their non-compliant children; instead, they go through cycles of mutual perspective taking (Trommsdorff and Kornadt, 2003) or express negativity indirectly, e.g., by "suffering" (DeVos, 1985) or through silence (Johnson, 1995). By not providing direct verbal cues, parents give their children reason to consider circumstantial features of the event and to adjust their emotional response accordingly. In general, many of those parental regulatory strategies may increase empathy and heighten self-conscious emotions such as shame or guilt (Zahn-Waxler et al., 1979). European American parents, on the other hand, expect their children to self-assert and to stand up for themselves (Hess et al., 1980). When dealing with a non-compliant child, they tend to use more coercion (Conroy et al., 1980; Hess et al., 1980), e.g., removing the child from the situation. Similarly, in an (independent) German context, parents' behaviors encouraged appraisals of frustration in the child, leading to high levels of anger, and possibly to an escalation of the parent-child conflict (Trommsdorff and Kornadt, 2003). In independent contexts, parents tended to emphasize a first-person perspective on situations that may intensify the child's felt emotions (Cohen et al., 2007); a first person perspective also foregrounds socially disengaging emotions, such as anger (see also Harwood et al., 2002).

Co-regulation of appraisal also happens when parents pay attention to their children's emotions, and thus validate the appraisal of the situation, or to the contrary, ignore the child's emotions and fail to endorse the child's interpretation of the event. For example, German mothers who witnessed their children's mishaps focused on the children's distress, thereby confirming that the children had a good reason for their negative emotions. By contrast, Japanese and Indian mothers ignored their child's negative emotions, thus challenging their interpretation of the situation as one of distress (Trommsdorff and Friedlmeier, 1993, 2010; Trommsdorff, 2006).

Similarly, Cole and colleagues investigated how parents respond to their children's emotions in a series of studies with children from two Nepali ethnic groups–the Tamang and Brahman (Cole and Tamang, 1998; Cole et al., 2006). Although these two ethnic Nepali groups share core cultural values of interdependence, they emphasize different relational engagements. The Tamang—Tibetan Buddhists—emphasize egalitarianism, self-effacement and social harmony. The Tamang understand anger as a forceful emotion that interferes with the social goals of sharing and compassion, while shame is seen as a valuable emotion that implies the awareness of one's actions through the eyes of others. The Brahmans, on the other hand, are members of a high-status Hindu caste which is associated with ethnic pride, social dominance, and a high level of self-control. In Brahman eyes, anger constitutes a justifiable experience of a proud high-caste member that, nevertheless, needs to be regulated. Shame, on the other hand, is seen as a sign of personal weakness. Caregivers' responses to anger and shame episodes of 3- and 5-year old children differed accordingly between the groups. While Tamang caregivers reacted to expressions of anger by distraction and reasoning, Brahman caregivers paid more positive attention to anger episodes, supporting their children's appraisal that anger is justified. During shame episodes, Tamang caregivers responded with reasoning and nurturing, while Brahman caregivers largely ignored signs of shame, thus conveying that experiencing and displaying shame is not desirable. In these studies, caregivers appeared to co-regulate their children's emotion by helping them (re)-appraise the situation in ways that reinforce those emotions that are desirable according to their prevalent cultural ideals.

To our knowledge, there is no systematic empirical evidence that adults help each other in re-appraising situations in ways that are consistent with their cultural values. However, there is some anecdotal evidence for these co-regulatory processes beyond childhood. For instance, Kitayama and Masuda (1995) describe how US friends help each other when one is feeling shameful and down: "good friends are supposed to [. . .] encourage the person by reorienting the person's attention away from his own shortcomings to external objects or events the person can reasonably blame for the impeding problem" (p. 220). These co-regulatory efforts may explain why shame is frequently transformed into anger in the American cultural context (Tangney et al., 1992, as cited in Kitayama and Masuda, 1995). By re-appraising the shameful event as caused by others rather than by oneself, the focus shifts from one's own painful shortcomings to the more empowering experience of self-integrity, and others' blameworthiness. Maintaining high self-esteem and avoiding self-critical information constitute central goals for the American independent self anger can thus be seen as a more desirable end-point of emotion regulation than shame.

Structural conditions

Finally, it is possible that an individual's environment is structured in ways that emphasize certain meanings or appraisals over others; a person's appraisal of the situation would thus depend on features of the situation that exert their influence independent of (or in interaction with) individual tendencies and relational co-regulation. Again, we would expect that these structural conditions emphasize appraisals that contribute to emotional experiences in line with the culturally defined end-points of emotion regulation.

In an impressive demonstration of the effect, Savani and colleagues (2011) have shown that participants apply another culture's interpretational schemes after having been exposed to a large number of situations from that culture. In this experiment, Savani and colleagues (2011, Study 5) exposed Indian and European American students to interpersonal situations that were sampled from both India and the US. As expected, Indian situations afforded more adjustment, whereas American situations afforded more influence. While the Indian participants reported initially more adjustment, and the US participants reported initially more influence, this pattern changed after the participants had been exposed to a large number of situations from both cultures; after 100 trials, the degree of adjustment reported by European American and Indian participants converged. Thus,

both situational affordances (i.e., Indian situations call for accommodation) and individual psychological tendencies (i.e., Indians are by default more likely to adjust) contributed to cultural differences in how people reacted. While this study did not speak to the emotions that people experience, it does make a strong case for the idea that structural conditions afford certain appraisals, which in turn should be associated with different emotional experiences.

A direct investigation of how structural conditions across cultures afford certain appraisals over others, and thus regulate emotional experiences, does not exist to our knowledge; however a few first promising results from a monocultural study point in this direction. Kuppens et al. (2008) showed that people's appraisal of angering situations depends to a large extent on the antecedent situations themselves. In two studies, situational differences were a predictor (above and beyond individual differences) of the types of appraisals used, accounting for about 20% of the variance in individual responses; in the words of the authors, "different circumstances can pull for different characteristic appraisals" (p. 10). Although their data were collected among Belgian (Dutch-speaking) participants only, these results clearly speak to the importance of situational characteristics for individual emotional experience.

CONCLUSION

Emotional experience tends to be aligned with the culturally valued ways of relating. This alignment can be attributed to emotion regulation—i.e., all processes that help to attain the culturally appropriate emotional experiences. In this article we have reviewed the evidence for antecedent-focused emotion regulation; that is regulation at the time of emotion elicitation. We focused on two types of emotion regulation that fall under this category: situation selection and appraisal. We discussed research showing cultural differences in situation selection and appraisal at the level of the individual, the relationship, and the structure of everyday life. The combined evidence suggests that much of the cultural regulation of emotions takes place at the start of the emotion process, before there even is an emotional experience. Response-focused emotion regulation, in the form of suppression of emotional experience or expression, may be only one of the many types of cultural regulation of emotions (e.g., Matsumoto et al., 2008). In fact, we submit that cultural regulation is *most likely* to target the elicitation of emotions itself, since suppression of already activated resources is much more effortful. Response-focused regulation may be "culture's last resort" for shaping emotions in a culturally normative fashion–only to be used when all other ways failed.

Our cultural perspective on emotion regulation highlights that emotion regulation is not merely an *intrapersonal* process. Rather, emotions are also regulated by others in our environment, and by the ways in which our social worlds are structured in terms of both and furthermore by adopting a cultural perspective we highlighted differences in the "endpoints" of emotion regulation, even if emotion regulation universally aims to improve the individual's social adjustment. Finally, a cultural perspective underlines that much of emotion regulation often happens outside the awareness of the individual—through the situations that are culturally promoted and the appraisals that are condoned and activated. This means that most, if not all emotional experiences are (culturally) regulated to some extent, even the ones that appear "natural" to us.

REFERENCES

Boiger, M., and Mesquita, B. (2012). The construction of emotion in interactions, relationships, and cultures. *Emot. Rev.* 4, 221–229.

Boiger, M., Mesquita, B., Uchida, Y., and Barrett, L. F. (in press). Condoned or condemned: the situational affordance of anger and shame in Japan and the US. *Pers. Soc. Psychol. Bull.*

Bradley, M. M., Codispoti, M., Cuthbert, B., and Lang, P. J. (2001). Emotion and motivation: I. Defensive and appetitive reactions in picture processing. *Emotion* 1, 276–298.

Briggs, J. L. (1970). *Never in Anger: Portrait of an Eskimo Family.* Cambridge, MA: Harvard University Press.

Bruner, J. (1990). *Acts of Meaning.* Cambridge, MA: Harvard University Press.

Campos, J. J., Frankel, C. B., and Camras, L. (2004). On the nature of emotion regulation. *Child Dev.* 75, 377–394.

Campos, J. J., and Stenberg, C. (1981). "Perception, appraisal, and emotion: the onset of social referencing," in *Infant Social Cognition: Empirical and Theoretical Considerations*, eds M. E. Lamb and L. R. Sherrod (Hillsdale, NJ: Erlbaum), 273–314.

Canary, D. J., Cupach, W. R., and Messman, S. J. (1995). *Relationship Conflict.* Thousand Oaks, CA: Sage.

Cohen, D. (1999). "When you call me that, smile!" How norms for politeness, interaction styles, and aggression work together in Southern culture. *Soc. Psychol. Q.* 62, 257–275.

Cohen, D., Hoshino-Browne, E., and Leung, A. K.-Y. (2007). "Culture and the structure of personal experience: insider and outsider phenomenologies of the self and social world," in *Advances in Experimental Social Psychology*, *Vol. 39*, ed M. P. Zanna (San Diego, CA: Elsevier Academic Press), 1–67.

Cole, P. M., and Tamang, B. L. (1998). Nepali children's ideas about emotional displays in hypothetical challenges. *Dev. Psychol.* 34, 640–646.

Cole, P. M., Tamang, B. L., and Shrestha, S. (2006). Cultural variations in the socialization of young children's anger and shame. *Child Dev.* 77, 1237–1251.

Conroy, M., Hess, R. D., Azuma, H., and Kashiwagi, K. (1980). Maternal strategies for regulating children's behavior: Japanese and American families. *J. Cross. Cult. Psychol.* 11, 153–172.

D'Andrade, R. G. (1984). "Culture meaning systems," in *Culture Theory: Essays on Mind, Self, and Emotion*, eds R. A. Shweder and R. A. Levine (Cambridge: Cambridge University Press), 88–119.

De Leersnyder, J., Mesquita, B., and Kim, H. (2011). Where do my emotions belong? A study of immigrants' emotional acculturation. *Pers. Soc. Psychol. Bull.* 37, 451–463.

DeVos, G. (1985). "Dimensions of the self in Japanese culture," in *Culture and Self,* eds A. Marsella, G. DeVos, and F. Hsu (New York, NY: Tavistock), 141–184.

Eisenberg, N., Fabes, R. A., Shepard, S. A., Guthrie, I. K., Murphy, B. C., and Reiser, M. (1999). Parental reactions to children's negative emotions: longitudinal relations to quality of children's social functioning. *Child Dev.* 70, 513–534.

Ekman, P. (1992). Are there basic emotions? *Psychol. Rev.* 99, 550–553.

Ekman, P., and Friesen, W. (1969). The repertoire of nonverbal behavior: categories, origins, usage, and coding. *Semiotica* 1, 49–98.

Elliott, A., Chirkov, V., Kim, Y., and Sheldon, K. (2001). A cross-cultural analysis of avoidance (relative to approach) personal goals. *Psychol. Sci.* 12, 505–510.

Frijda, N. H. (1986). *The Emotions.* Cambridge: Cambridge University Press.

Frijda, N. H. (2007). *The Laws of Emotions.* New York, NY: Erlbaum.

Frijda, N. H., and Mesquita, B. (1994). "The social roles and functions of emotions," in *Emotion and Culture,* eds H. R. Markus and S. Kitayama (New York, NY: APA), 51–87.

Frijda, N. H., Kuipers, P., and ter Schure, E. (1989). Relations among emotion, appraisal, and emotional action readiness. *J. Pers. Soc. Psychol.* 57, 212–228.

Fung, H. (1999). Becoming a moral child: the socialization of shame among young Chinese children. *Ethos* 27, 80–209.

Fung, H., and Chen, E. C. (2002). Across time and beyond skin: self and transgression in the everyday socialization of shame among Taiwanese preschool children. *Soc. Dev.* 10, 420–437.

Gobster, P. H., and Delgado, A. (1992). "Ethnicity and recreation use in Chicago's Lincoln Park: in-park user survey findings," in *Managing Urban and High-Use Recreation Settings, General Technical Report NC-163,* ed P. Gobster (Washington, DC: U.S. Department of Agriculture), 75–81.

Goodnow, J. J. (1997). "Parenting and the transmission and internalization of values: from social-cultural perspectives to within-family analyses," in *Parenting and Children's Internalization of Values: A Handbook of Contemporary Theory,* (New York, NY: John Wiley and Sons), 333–361.

Griffiths, P. E., and Scarantino, A. (2009). "Emotions in the wild: the situated perspective on emotion," in *Cambridge Handbook of Situated Cognition,* eds P. Robbins and M. Aydede (Cambridge: Cambridge University Press), 437–453.

Gross, J. J. (1998). The emerging field of emotion regulation: an integrative review. *Rev. Gen. Psychol.* 2, 271–299.

Gross, J. J. (ed.). (2007). *Handbook of Emotion Regulation.* New York, NY: Guilford.

Gross, J. J., Richards, J. M., and John, A. P. (2006). "Emotion regulation in everyday life," in *Emotion Regulation in Families: Pathways to Dysfunction and Health,* eds D. K. Snyder, J. A. Simpson, and J. N. Hughes (Washington, DC: APA), 13–35.

Gross, J. J., Sheppes, G., and Urry, H. L. (2011). Emotion generation and emotion regulation: a distinction we should make (carefully). *Cogn. Emot.* 25, 765–781.

Grossmann, I., and Kross, E. (2010). The impact of culture on adaptive versus maladaptive self-reflection. *Psychol. Sci.* 21, 1150–1157.

Güngör, D., Fleischmann, F., and Phalet, K. (2011). Religious identification, beliefs, and practices among Turkish-Belgian and Moroccan-Belgian muslims: intergenerational continuity and acculturative change. *J. Cross. Cult. Psychol.* 42, 1356–1374.

Harwood, R. L., Leyendecker, B., Carlson, V., Ascencio, M., and Miller, A. M. (2002). "Parenting among Latino families in the U.S.," in *Handbook of Parenting: Vol. 4: Social Conditions and Applied Parenting.* 2nd Edn. ed M. H. Bornstein (Mahwah, NJ: Erlbaum), 21–46.

Heine, S. J., Lehman, D. R., Markus, H. R., and Kitayama, S. (1999). Is there a universal need for positive self-regard. *Psychol. Rev.* 106, 766–794.

Hess, R. D., Kashiwagi, K., Azuma, H., Price, G. G., and Dickson, W. P. (1980). Maternal expectations for mastery of developmental tasks in Japan and the United States. *Int. J. Psychol.* 15, 259–271.

Higgins, E., Shah, J., and Friedman, R. J. (1997). Emotional responses to goal attainment: strength of regulatory focus as a moderator. *J. Pers. Soc. Psychol.* 72, 515–525.

Hochschild, J. L. (1995). "What is the American dream?" in *Facing Up to the American Dream: Race, Class and the Soul of the Nation*, ed J. L. Hochschild (Princeton, NJ: Princeton University Press), 15–38.

Holland, D., and Quinn, N. (1987). *Cultural Models in Language and Thought.* Cambridge: Cambridge University Press.

Holodynski, M., and Friedlmeier, W. (2006). *Development of Emotions and Emotion Regulation.* New York, NY: Springer.

Imada, T., and Ellsworth, P. C. (2011). Proud Americans and lucky Japanese: cultural differences in appraisal and corresponding emotion. *Emotion* 11, 329–345.

Jankowiak, W. R., and Fischer, E. F. (1992). A cross-cultural perspective on romantic love. *Ethnology* 31, 149.

Johnson, F. A. (1995). *Dependency and Japanese Socialization: Psychoanalytic and Anthropological Investigations in Amae.* New York, NY: NYU Press.

Keltner, D., and Haidt, J. (1999). Social functions of emotions at four levels of analysis. *Cogn. Emot.* 13, 505–521.

Kim, H., and Markus, H. R. (1999). Deviance or uniqueness, harmony or conformity? A cultural analysis. *J. Pers. Soc. Psychol.* 77, 785–800.

Kitayama, S., and Markus, H. R. (2000). "The pursuit of happiness and the realization of sympathy: cultural patterns of self, social relations, and well-being," in *Subjective Well-Being across Culture,* eds E. Diener and E. Suh (Cambridge, MA: MIT Press), 113–161.

Kitayama, S., and Masuda, T. (1995). Reappraising cognitive appraisal from a cultural perspective. *Psychol. Inq.* 6, 217–223.

Kitayama, S., Matsumoto, D., Markus, H. R., and Norasakkunkit, V. (1997). Individual and collective processes in the construction of the self: self-enhancement in the US and self-criticism in Japan. *J. Pers. Soc. Psychol.* 72, 1245–1267.

Kitayama, S., Mesquita, B., and Karasawa, M. (2006). The emotional basis of independent and interdependent selves: socially disengaging and engaging emotions in the US and Japan. *J. Pers. Soc. Psychol.* 91, 890–903.

Kornadt, H. J. (2011). *Aggression: Die Rolle der Erziehung in Europa und Ostasien*. [*Aggression: The Role of Education in Europe and East Asia*]. Wiesbaden: VS Verlag.

Kuppens, P., Van Mechelen, I., and Rijmen, F. (2008). Toward disentangling sources of individual differences in appraisal and anger. *J. Pers.* 76, 969–1000.

Kuppens, P., Van Mechelen, I., Smits, D. J. M., and De Boeck, P. (2003). The appraisal basis of anger: specificity, necessity and sufficiency of components. *Emotion* 3, 254–269.

Lebra, T. S. (1992). "Self in Japanese culture," in *Japanese Sense of Self,* ed N. E. Rosenberger (New York, NY: Oxford University Press), 105–120.

Lee, A. Y., Aaker, J. L., and Gardner, W. L. (2000). The pleasures and pains of distinct self-construals: the role of interdependence in regulatory focus. *J. Pers. Soc. Psychol.* 78, 1122–1134.

Leung, A. K.-Y., and Cohen, D. (2011). Within- and between-culture variation: individual differences and the cultural logics of honor, face, and dignity cultures. *J. Pers. Soc. Psychol.* 100, 507–526.

Levy, R. I. (1978). "Tahitian gentleness and redundant controls," in *Learning Non-Aggression: The Experience of Non-Literate Societies*, ed A. Montagu (New York, NY: Oxford University Press), 222–235.

Lewis, C. C. (1995). *Educating Hearts and Minds.* New York, NY: Cambridge Press.

Markus, H. R., and Kitayama, S. (1991). Culture and self: implications for cognition, emotion, and motivation. *Psychol. Rev.* 98, 224–253.

Matsumoto, D., Yoo, S. H., Fontaine, J., Anguas-Wong, A. M., Arriola, M., Ataca, B., et al. (2008). Mapping expressive differences around the world: the relationship between emotional display rules and individualism versus collectivism. *J. Cross. Cult. Psychol.* 39, 55–74.

Mauss, I. B., Bunge, S. A., and Gross, J. J. (2008). "Culture and automatic emotion regulation," in *Regulating Emotions: Culture, Social Necessity and Biological Inheritance,* eds M. Vandekerckhove, C. von Scheve, S. Ismer, S. Jung, and S. Kronast (London: Blackwell Publishing), 39–60.

Mesquita, B. (2010). "Emoting: a contextualized process," in *The Mind in Context,* eds B. Mesquita, L. F. Barrett, and E. R. Smith (New York, NY: Guilford Press), 83–104.

Mesquita, B., and Albert, D. (2007). "The cultural regulation of emotions," in *The Handbook of Emotion Regulation*, ed J. J. Gross (New York, NY: Guilford Press), 486–503.

Mesquita, B., and Ellsworth, P. C. (2001). "The role of culture in appraisal," in *Appraisal Processes in Emotion: Theory, Methods, Research,* eds K. R. Scherer and A. Schorr (New York, NY: Oxford University Press), 233–248.

Mesquita, B., and Frijda, N. H. (2011). An emotion perspective on emotion regulation. *Cogn. Emot.* 25, 782–784.

Mesquita, B., Frijda, N. H., and Scherer, K. R. (1997). "Culture and emotion," in *Handbook of Cross-Cultural Psychology, Vol. 2,* eds P. Dasen and T. S. Saraswathi (Boston, MA: Allyn and Bacon), 255–297.

Mesquita, B., and Leu, J. (2007). "The cultural psychology of emotions," in *Handbook of Cultural Psychology,* eds S. Kitayama and D. Cohen (New York, NY: Guilford Press), 734–759.

Miller, J. G., Bersoff, D. M., and Harwood, R. L. (1990). Perceptions of social responsibilities in India and the United States: moral imperatives on personal decisions? *J. Pers. Soc. Psychol.* 58, 33–47.

Miller, P. J., Fung, H., and Mintz, J. (1996). Self-construction through narrative practices: a Chinese and American comparison of early socialization. *Ethos* 24, 237–280.

Miller, P. J., Wiley, A., Fung, H., and Liang, C. (1997). Personal storytelling as a medium of socialization in Chinese and American families. *Child Dev.* 68, 557–568.

Morling, B., Kitayama, S., and Miyamoto, Y. (2002). Cultural practices emphasize influence in the United States and adjustment in Japan. *Pers. Soc. Psychol. Bull.* 28, 311–323.

Nisbett, R. E. (2003). *The geography of thought. How Asians and Westerners think differently … and why.* New York, NY: Free Press.

Oatley, K., Keltner, D., and Jenkins, J. M. (2006). *Understanding Emotions, 2nd Edn.* Malden, MD: Blackwell Publishing.

Oishi, S., and Diener, E. (2003). Goals, culture, and subjective well-being. *Pers. Soc. Psychol. Bull.* 29, 939–949.

Parkinson, B., and Simons, G. (2009). Affecting others: social appraisal and emotion contagion in everyday decision making. *Pers. Soc. Psychol. Bull.* 35, 1071–1084.

Roseman, I., Dhawan, N., Rettek, S., and Naidu, R. K. (1995). Cultural differences and cross-cultural similarities in appraisals and emotional responses. *J. Cross Cult. Psychol.* 26, 23–48.

Ross, M., and Wang, Q. (2010). Why we remember and what we remember: culture and autobiographical memory. *Perspect. Psychol. Sci.* 5, 401–409.

Rothbaum, F., Pott, M., Azuma, H., Miyake, K., and Weisz, J. (2000). The development of close relationships in Japan and the United States: paths of symbiotic harmony and generative tension. *Child Dev.* 71, 1121–1142.

Röttger-Rössler, B., Scheidecker, G., Jung, S., and Holodynski, M. (in press). Socializing emotions in childhood: a cross-cultural comparison between the Bara in Madagascar and the Minangkabau in Indonesia. *Mind Cult. Act. (Special issue on "Psychol. Emot. Cult. Hist. Act. Theory").*

Savani, K., Morris, M. W., Naidu, N. V. R., Kumar, S., and Berlia, N. V. (2011). Cultural conditioning: understanding interpersonal accommodation in India and the United States in terms of the modal characteristics of interpersonal influence situations. *J. Pers. Soc. Psychol.* 100, 84–102.

Schwartz, S. H. (1992). "Universals in the content and structure of values: theory and empirical tests in 20 countries," in *Advances in Experimental Social Psychology, Vol. 25,* ed M. Zanna (New York, NY: Academic Press), 1–65.

Shweder, R. A., and Haidt, J. (2000). "The cultural psychology of the emotions: ancient and new," in *Handbook of Emotions, 2nd Edn.* eds M. Lewis and J. Haviland (New York, NY: Guilford), 397–414.

Solomon, R. C. (1978). Emotions and anthropology: the logic of emotional world views. *Inquiry* 21, 181–199.

Solomon, R. L. (2004). "Back to basics: on the very idea of basic emotions," in *Not Passion's Slave*, ed R. C. Solomon (Oxford, UK: Oxford University Press), 115–142.

Stein, N. L., Trabasso, T., and Liwag, M. (1993). "The representation and organization of emotional experience: unfolding the emotion episode," in *Handbook of Emotions,* eds M. Lewis and J. M. Haviland (New York, NY: Guilford Press), 279–300.

Tangney, J. P., Wagner, P., Fletcher, C., and Gramzow, R. (1992). Shamed into anger? The relation of shame and guilt to anger and self-reported aggression. *J. Pers. Soc. Psychol.* 62, 669–675.

Thompson, R. A. (1991). Emotional regulation and emotional development. *Educ. Psychol. Rev.* 3, 269–307.

Triandis, H. C. (1995). *Individualism and Collectivism.* Boulder, CO: Westview Press.

Trommsdorff, G. (2006). Development of emotions as organized by culture. *ISSBD Newsl.* 49, 1–4.

Trommsdorff, G. (2012). Development of "agentic" regulation in cultural context: the role of self and world views. *Child Dev. Perspect.* 6, 19–26.

Trommsdorff, G., and Friedlmeier, W. (1993). Control and responsiveness in Japanese and German mother-child interactions. *Early Dev. Parent.* 2, 65–78.

Trommsdorff, G., and Friedlmeier, W. (2010). Preschool girls' distress and mothers' sensitivity in Japan and Germany. *Eur. J. Dev. Psychol.* 7, 350–370.

Trommsdorff, G., and Kornadt, H. (2003). "Parent-child relations in cross-cultural perspective," in *Handbook of Dynamics in Parent-Child Relations,* ed L. Kuczynski (Thousand Oaks, CA: Sage), 271–305.

Trommsdorff, G., and Rothbaum, F. M. (2008). "Development of emotion regulation in cultural context," in *Regulating Emotions: Culture, Social Necessity and Biological Inheritance,* eds M. Vandekerckhove, C. von Scheve, S. Ismer, S. Jung, and S. Kronast (London: Blackwell Publishing), 83–120.

Tsai, J. L. (2007). Ideal affect. Cultural causes and behavioral consequences. *Perspect. Psychol. Sci.* 2, 242–259.

Tsai, J. L., Miao, F. F., Seppala, E., Fung, H. H., and Yeung, D. Y. (2007). Influence and adjustment goals: sources of cultural differences in ideal affect. *J. Pers. Soc. Psychol.* 92, 1102–1117.

Wang, Q. (2001). "Did you have fun?" American and Chinese mother–child conversations about shared emotional experiences. *Cogn. Dev.* 16, 693–715.

Wang, X. (1992). *Resilience and Fragility in Language Acquisition: A Comparative Study of the Gestural Communication Systems of Chinese and American Deaf Children.* (Department of Education, University of Chicago, Unpublished manuscript).

Weisz, J. R., Rothbaum, F. M., and Blackburn, T. C. (1984). Standing out and standing in: the psychology of control in America and Japan. *Am. Psychol.* 39, 955–969.

Whiting, B. B., and Whiting, J. W. M. (1975). *Children of Six Cultures: A Psycho-Cultural Analysis.* Cambridge, MA: Harvard University Press.

Zahn-Waxler, C., Friedman, R. J., and Cole, P. M. (1996). Japanese and United States preschool children's responses to conflict and distress. *Child Dev.* 67, 2462–2477.

Zahn-Waxler, C., Radke-Yarrow, M., and King, R. A. (1979). Child rearing and children's prosocial initiations toward victims of distress. *Child Dev.* 50, 319–330.

Conflict of Interest Statement: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Received: 19 June 2012; accepted: 24 January 2013; published online: 12 February 2013.

Citation: De Leersnyder J, Boiger M and Mesquita B (2013) Cultural regulation of emotion: individual, relational, and structural sources. Front. Psychology ***4****:55. doi: 10.3389/fpsyg.2013.00055*

This article was submitted to Frontiers in Emotion Science, a specialty of Frontiers in Psychology.

frontiers in
PSYCHOLOGY

HYPOTHESIS AND THEORY ARTICLE
published: 16 November 2012
doi: 10.3389/fpsyg.2012.00496

Emotion regulation and emotion work: two sides of the same coin?

Christian von Scheve*

Department of Sociology and Cluster of Excellence "Languages of Emotion," Freie Universität Berlin, Berlin, Germany

Edited by:
Vera Shuman, University of Geneva, Switzerland

Reviewed by:
Michael Häfner, Utrecht University, Netherlands
Melissa Sloan, University of South Florida Sarasota-Manatee, USA

****Correspondence:***
Christian von Scheve, Department of Sociology, Freie Universität Berlin, Habelschwerdter Allee 45, 14195 Berlin, Germany.
e-mail: scheve@zedat.fu-berlin.de

This contribution links psychological models of emotion regulation to sociological accounts of emotion work to demonstrate the extent to which emotion regulation is systematically shaped by culture and society. I first discuss a well-established two-factor process model of emotion regulation and argue that a substantial proportion of emotion regulatory goals are derived from emotion norms. In contrast to universal emotion values and hedonic preferences, emotion norms are highly specific to social situations and institutional contexts. This specificity is determined by social cognitive processes of categorization and guided by framing rules. Second, I argue that the possibilities for antecedent-focused regulation, in particular situation selection and modification, are not arbitrarily available to individuals. Instead, they depend on economic, cultural, and social resources. I suggest that the systematic and unequal distribution of these resources in society leads to discernible patterns of emotion and emotion regulation across groups of individuals.

Keywords: emotion regulation, emotion work, deep acting, feeling rules, emotion norms

INTRODUCTION

Emotion research over the past decades has increasingly portrayed emotions as adaptive responses to evolutionary demands, firmly rooted in biological and psychological response mechanisms. Studies have consistently emphasized their functions in individual (Levenson, 1999) and social or cultural terms (Keltner and Haidt, 1999; Thoits, 2004). As such, emotions have been shown to contribute to cognitive processing, decision-making, and memory formation as well as to the emergence of social bonds and relationships, the coordination of social action, and the maintenance of social order. But this has not always been the case. From the Greek philosophers to the Scottish moralists and the modern counseling literature, passions and emotions have often been considered as disturbing and irritating occurrences in human life, in particular in domains requiring calm deliberation and rational thought. Therefore, and although emotions are ubiquitous to human affairs, the ability to control and manage one's emotions has become a key driving force of civilization and a hallmark of modern societies (Elias, 1939/1978). We aim at not forgetting ourselves when faced with indignity, at still being courteous at some boring dinner party, or at getting rid of that gloomy feeling. It thus seems as if there occasionally was something "undesirable" or even potentially "dangerous" to emotions, both in view of social bonds and relationships as well as with respect to subjective experience and individual behavior.

This suggests that emotions' evolutionary founded "wisdom of the ages" (Lazarus, 1991, p. 820) is not indeterminately appropriate and may in fact jeopardize one's goals and social integration (Gross et al., 2006). Clearly, changing environmental conditions alter emotion's response contingencies, and not all emotional reactions are always adaptive and individually or socially beneficial, in particular in contemporary societies. Or, as Gross (1999, p. 558) put it: "Physical and social environments have changed out of all recognition from those that shaped our emotions, and technological advances have dramatically magnified the consequences that our emotional responses may have for ourselves and others. An irritable swipe that once scarcely raised a welt, is now translated with the greatest ease into a fatal car accident or gun-related homicide." It seems that the basic architecture and some of the mechanisms that elicit emotions have remained largely unchanged over the course of evolution, whereas the social and cultural environments have changed dramatically. Part of this mismatch obviously gives rise to the desire to alter and manage existing emotional states.

Despite their evolutionary roots, emotions have proven to be highly adaptive to dominant cultural and social conditions (Hochschild, 1983; Thoits, 2004; Boiger and Mesquita, 2012). Norms, rules, values, and the social practices through which they are learned and internalized all contribute to the cultural shaping of emotion. From this perspective, it can be argued that emotions are always regulated in a longer-term understanding and in a sense that they are "calibrated" to culture and society (Vandekerckhove et al., 2008; von Scheve, 2012).

This "one-factor" view of emotion regulation holds that "emotion and regulation are one" (Kappas, 2011), and that the regulation of emotion is not limited to an actual emotion episode, but rather extends throughout ontogenetic development. In this vein, some have argued that "emotion and emotion-control are part and parcel of the same processes and any scientifically viable theory of emotion must also be a theory of emotion-control" (Kappas, 2008, p. 15; see also Campos et al., 2004; Kappas, 2011). Much like sociological and psychological one-factor views highlight the importance of the social and cultural embeddedness for emotion regulation, recent biological and physiological accounts emphasize the importance of individuals' ecological embeddedness. Beckes and Coan (2011), for example, argue that social proximity and

interaction should not only be taken into account as indicators prompting (intentional) emotion regulation in an encounter, but also as referents of the degree of embeddedness into social networks that signal a "baseline" of social integration, which in turn renders the organism more or less susceptible to emotional arousal.

Although such longer-term regulatory processes tend to operate implicitly and automatically (Mauss et al., 2008), they also clearly include instances in which existing emotions are deliberately altered to meet certain social or cultural requirements. Mostly, these instances also contribute to the adaptation and fine-tuning of emotion to a socio-cultural context, although they equally well serve individual goals. This regulation of an existing emotional state – such as when getting rid of one's anger or amplifying a good mood to outward joy – corresponds to the analytical "two-factor" perspective on emotion regulation (see Campos et al., 2004, p. 377). This perspective assumes one set of processes related to the elicitation of emotion (first factor) and a second set directed at the regulation or control of an existing emotion (second factor).

Based on these premises, issues in the regulation and management of emotion have become a lively field of inquiry in the social and behavioral sciences. Traditionally, different disciplines have been concerned with different aspects of emotion regulation. The behavioral sciences, above all psychology, have developed advanced micro-level models that focus on the individual processes and mechanisms underlying emotion regulation. In the social sciences, in particular in sociology, research is dominated by macro-level accounts of social norms and rules to which individuals refer in modulating emotional experience and expression.

In this contribution, I ask how psychological two-factor models of emotion regulation can be extended to accommodate "macro-level" social and cultural influences on the regulation of emotion, as they have been documented by sociological and cultural emotion theories. Often, research on the influence of culture and society on emotion regulation has focused primarily on one-factor models and long-term influences (Denzin, 1990; Thoits, 1990). Here, I will primarily take a two-factor perspective to highlight the impact of the social world from the standpoint of methodological individualism or situationalism. The aims of the article therefore are to link both perspectives to achieve a better understanding of the social embeddedness of emotion regulation, to show how psychological and social-cultural processes interact in emotion regulation, and to pave the way for an exchange between disciplines that have mostly attended to the regulation of emotion in disparate ways.

I will first briefly review Gross's (1999) well-established process model of emotion regulation and highlight key processes that are particularly susceptible to social influences or even require information from the social environment. In a second step, I discuss sociological approaches to emotion management and regulation, in particular the widely adopted notion of "emotion work." Here, I will emphasize the role of social norms and different institutional settings to which they belong. In a third step, I will frame these determinants of emotion regulation as emotion regulatory goals in Gross's process model. Moreover, I will argue that the possibilities of antecedent-focused emotion regulation, in particular *situation selection* and *situation modification* (Gross and Barrett, 2011), are not arbitrarily available to individuals. Instead, the ability to select and modify situations depends on different kinds of resources, in particular economic, cultural, and social resources, which affect regulatory effort.

INDIVIDUAL PROCESSES IN EMOTION REGULATION

Although two-factor theories of emotion regulation differ in their details, most of those taking an individual or dyadic perspective converge in their definitions and understandings of what emotion regulation is. According to Gross, "emotion regulation refers to the processes by which individuals influence which emotions they have, when they have them, and how they experience and express these emotions. Emotion regulatory processes may be automatic or controlled, conscious or unconscious, and may have their effects at one or more points in the emotion generative process" (Gross, 1998, p. 275; italics omitted).

According to this view, fully understanding emotion regulation requires a compatible definition of what an emotion is. Although this is constantly debated in emotion research (e.g., Kappas, 2002), recent psychological and sociological approaches converge on a *componential* definition of emotion. In this light, emotions are elicited by the evaluation or appraisal of (internal or external) cues that are in one or another way relevant for the individual. These evaluations then trigger a pattern of coordinated responses tendencies that are supposed to facilitate adaptive behavior. These responses tendencies form the basis of an emotion episode and include experiential, cognitive, behavioral, and physiological components (Gross, 1999; Scherer, 2005; Thoits, 2007).

Emotion regulation in principle extends to most of these components and involves changes in expressive behavior, subjective feeling, or physiological responses (cf. Gross, 1999, p. 557; Gross, 2002, p. 282). This definition encompasses not only negative emotions but also the processes whereby emotions are strengthened, maintained, or weakened, regardless of their valence. It also allows to make a distinction between the conscious and intentional regulation of an emotion on the one hand, such as changing the topic of conversation that is getting annoying, and automatic and unconscious regulation on the other hand, such as always appearing to be grateful when receiving a present, even if the present comes close to an offense. However, this perspective on emotion regulation largely excludes conceptions of emotion regulation that refer to the regulatory *functions* of emotions. In these cases, emotion regulation is used to indicate emotions capacity to regulate some other mental or physiological process, for example perception, memory retrieval, or decision-making (e.g., Baumeister et al., 2007). Also, this understanding highlights the intrapersonal aspects of emotion regulation and excludes the regulation of other individuals' emotions in social interaction, which is often referred to as "emotion management" (Lively, 2010).

A well-established psychological theory of emotion regulation that closely aligns with the above definitions is Gross's model of emotion regulation (e.g., Gross, 1999). Understanding emotion regulation as a process, the model assumes the existence of an emotion episode or situation and identifies five distinct stages at which this episode can be modulated. These stages can be further differentiated in "antecedent" (aiming at changes in the antecedents

of an emotion) and "response" oriented regulation (changing the emotional response-components). **Figure 1** represents the basic structure of the model.

The model is organized along a time axis representing analytically distinct phases in the elicitation of an emotion. Antecedent-oriented regulation kicks in at an early stage in the emotion generative process and focuses on changing the situational circumstances that give rise to an emotion in the very first place. Habitually avoiding unsuitable or unpleasant topics of conversation is an example of this type of regulation or dismissing an employe who is a frequent cause of anger. Response-oriented regulation, on the other hand, refers to strategies employed when an emotion, including most of its response-components, have already manifested. These strategies are directed at changing the effects or immediate consequences of an emotion, such as the suppression of a facial expression.

Antecedent-oriented regulation encompasses several possibilities: the selection and modification of the emotionally relevant situation, the deployment of attention, and the (cognitive) interpretation or appraisal of the present situation (cf. Gross, 1998, 2002, p. 282). Situation selection as the first possible step of antecedent-oriented regulation aims at seeking, creating, or avoiding situations in which actors expect certain emotions to occur, either based on experience or actual exposure. If actors are unable to actively seek or avoid a situation, the modification of a situation still allows changing its emotionally relevant constituents in such a way that a desired emotion is experienced or an undesired is avoided.

Actors can also change attentional deployment and focus on selected aspects of a situation or actively disregard others to regulate emotions. Ignorance of certain facts or persons is a well-known strategy in this regard. A closely related approach is the active and deliberate modification of one's (cognitive) evaluation of the situation or of a certain aspect thereof. This "reappraisal" or re-interpretation involves the re-framing of a situation and the re-examination of the preceding appraisal that elicited the actual emotion state (e.g., Urry, 2009). Such reappraisals or cognitive changes imbue a situation with a meaning different from an originally assigned meaning and consequently give rise to changes in the related emotion (Gross, 2002).

Response-oriented regulation taps changes in the various consequences or components of an emotion. Good examples of this type of regulation are the suppression or evocation of a facial expression or the regulation of physiological reactions, such as efforts to calm down or to curb motor reactions. The key difference between both kinds of regulatory effort is that antecedent-focused regulation usually aims at changing or producing an emotional reaction in its entirety or simply at disposing an existing emotion. Response-focused regulation rather aims at dealing with the consequences of an emotion and usually does not target the entire emotional response (although, of course, one could argue that getting rid of the phenomenal component of an emotion is pretty much the same as getting rid of an emotion in its entirety).

EMOTION REGULATION GOALS

Given the strategies of emotion regulation illustrated above, an interesting question is why and to what ends people engage in emotion regulation at all. One of the most straightforward and empirically substantiated answers is for hedonic pleasure (Rusting and Larsen, 1995; Vastfjall et al., 2001). However, there is a broad array of other things that people value that are not necessarily associated with pleasure, for instance social conformity, health, or utility (e.g., Higgins, 2006; Tamir, 2009), that might prompt emotion regulatory behavior. Nevertheless, accounts of pleasure and pain as motives of emotion regulation have dominated the literature (Tamir and Mauss, 2011) whereas the role of values and goals has been much more at the heart of self-regulation than emotion-regulation research.

Generally, understanding the goals and motives of emotion regulation also involves understanding the things people value in affective and emotional terms. The focus on hedonic pleasure in recent research is rooted in the nature of emotions as intrinsically pleasant or unpleasant experiences. In this vein, the standard view holds that people value and aim at seeking pleasant emotions and at avoiding unpleasant ones. However, it is not completely clear what makes a pleasant emotion pleasant. Tamir (2009) has questioned the assumption that people always want to feel "pleasant" emotions. Instead, she highlights the role of short-term and long-term benefits and argues that "unpleasant" emotions, such as anger, are often sought to aide long-term goal attainment. Similarly, research on esthetic emotions indicates that allegedly unpleasant emotions, for example intense sadness, are often actively sought and enjoyed (e.g., Oliver and Woolley, 2010). Clearly, the regulation of emotion is closely tied to the feelings that are preferred and valued by a person. These values and preferences for certain emotions in certain situations develop in social

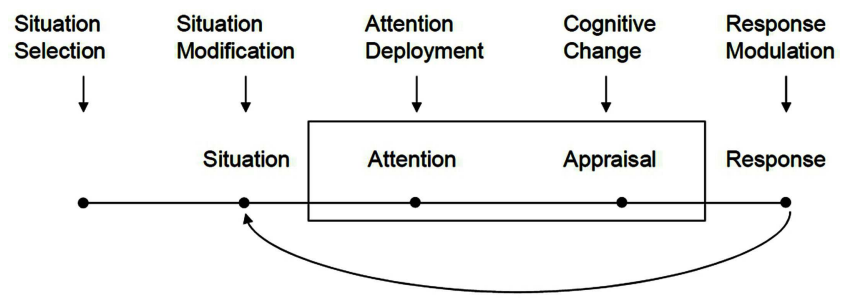


FIGURE 1 | Basic process model of emotion regulation reproduced from Gross and Barrett (2011, p. 12).

and cultural contexts and are internalized during the course of socialization. Studies have demonstrated that there are marked differences between cultures in view of which emotions are valued and which are not (Eid and Diener, 2001). These studies, however, are usually based on an understanding of "culture" as primarily depending on geopolitical location and language, such that one of the most investigated differences is that between supposedly "collectivist" Asian and "individualist" Western groups. Also, research has demonstrated robust cross-cultural differences in the valuation of what Tsai et al. (2006) term "ideal affect." Ideal affect refers to the affective states that people value, prefer, and ideally want to feel. It is at the core of what a "good feeling" actually is (Tsai, 2007).

From a sociological point of view, the question of the role of values and goals is interesting because it warrants the assumption that there are patterns and regularities in emotion regulation across large numbers of individuals. Departing from cross-cultural psychological approaches, however, sociology is more interested in cultural differences *within* societies, for example across social classes or in different institutional settings. Therefore, the following section discusses select sociological views on the regulation and social control of emotion that put social norms and institutional settings at the forefront.

SOCIAL AND CULTURAL PROCESSES IN EMOTION REGULATION

Although many sociological accounts of emotion regulation would stress the general importance of a one-factor account, a prominent line of inquiry focuses on the regulation of emotion that is in principle in accordance with the processes outlined by psychological research. Clearly, these accounts often emphasize the importance of social practices, symbolic interaction, and normative orders over individual processes (Thoits, 2004), but they still rely on assumptions on how the two interface with one another.

Interesting in this regard, Hochschild (1979) promoted two possible approaches to the "social ordering of emotive experience." The first is based on the analysis of the "social factors that induce or stimulate primary [. . .] emotions," whereas the second one is "to study secondary acts performed upon the ongoing non-reflective stream of primary emotive experience" (Hochschild, 1979, p. 552). In her now classic studies on the social regulation of emotion, she focuses on the second option and takes a two-factor perspective. She coins the "secondary acts" that are performed on primary emotive experience "emotion work" (Hochschild, 1979). Originally developed in an investigation of the emotional demands of service-sector employes, emotion work corresponds to the "act of trying to change in degree or quality an emotion or feeling" or simply "to 'work on' an emotion" (Hochschild, 1979, p. 561). It is closely related to – and in fact an extension of – Goffman's ideas on *The Presentation of Self in Everyday Life* (Goffman, 1959). As such, her account is strongly influenced by the principles of symbolic interactionism.

Hochschild assumes that emotion work in principle serves two goals: to either evoke or to suppress an emotion. Her account of the processes and mechanisms underlying emotion work is inspired by the ways in which professional actors evoke and shape emotions, and she makes explicit reference to Stanislavski's *method acting* paradigm (Hochschild, 1983) to distinguish two types of emotion regulation: "deep acting" and "surface acting" (Hochschild, 1983, p. 48). Here, "deep acting" is mainly used synonymously to "emotion work," meaning the management of a feeling or an emotional state, whereas "surface acting" is limited to modulating only the behavioral expression of an emotion. Surface acting thus equals Goffman's (1959) description of impression management in social interactions.

Empirical research has almost exclusively focused on one specific instance on emotion work, namely "emotional labor." Emotional labor denotes emotion work that is performed in organizational and economic contexts. It does not primarily pursue individual goals, but is rather seen as an instrumental strategy to increase economic success of an organization. Hochschild's classic study on emotional labor of flight attendants and employes in debt collection agencies provided an empirical illustration of the concept (Hochschild, 1983, p. 89–161) as does a body of more recent studies in the sociology and psychology of work and organization (e.g., Brief and Weiss, 2002; Fineman, 2003).

EMOTION NORMS

In contrast to much of psychological research on emotion regulation (but note the more recent studies mentioned above), the concept of emotion work does not primarily rely on individual norms and standards. Rather, its point of reference are socially shared (albeit at times latent) norms and rules that govern regulation. In analogy to "display rules" (Ekman, 1972, p. 225), Hochschild terms these socially shared norms directed at emotional experience *feeling rules*. A feeling rule "delineates a zone within which one has permission to be free of worry, guilt, or shame with regard to the situated feeling" (Hochschild, 1979, p. 565). These rules specify which emotions are regarded as appropriate and expected in particular situations. Based on this understanding, feelings rules are a subset of *prescriptive* social norms that indicate what "ought or ought not to be the case" under specific circumstances (Opp, 2002, p. 132). More specifically, these norms demarcate the intensity, direction, duration, and objects of emotions appropriate in a situation (Hochschild, 1979; Thoits, 2004).

Feelings rules thus are presumed to guide emotion regulation much in the same way as other social norms guide behavior. Although the coercive and compelling nature of social norms is a matter of debate, the desire for social conformity, maintenance of cooperation, circumvention of material sanctions or social exclusion, and averting negative emotions such as shame and embarrassment are amongst the most frequently mentioned reasons for emotion regulation (e.g., Bicchieri, 2006; von Scheve, 2010). Hochschild notes that feeling rules are effective in principle in two ways: as individual expectations of how we (and probably others) usually or "normally" feel in a specific situation (e.g., we expect to feel bored during the lecture of a certain colleague) or as social expectations how we *should* feel in this situation (probably excited; Hochschild, 1979). This view offers striking parallels to how social norms are conceptualized in social philosophy and psychology. The first is quite similar to the concept of *descriptive* norms, i.e., norms resulting from the perceptions of what most others (including the self) actually and usually do (Cialdini, 2007). This is how recurrent individual experiences solidify into emotional norms or conventions. Individuals develop expectations

about emotions based on their own experiences and experiences of others (Thoits, 2004, p. 363). The second view indicates the existence of an *injunctive* norm that prescribes a certain kind of behavior in a specific situation (ibid.). Although conceptually related, the first is based on social information and the second is based on social evaluation, both of which can equally be applied to feeling rules.

Importantly, feeling rules are conceived of as elements of an overarching ideology, a broader system of normative social order. In the same way as normative orders guide all sorts of behaviors through norms and values, for example fairness, reciprocity, or generalized trust, they guide emotions and their expression. Whereas the concept of "ideal affect" (Tsai, 2007) and the culture-specific values ascribed to different emotions are usually *not* situation-specific, feelings rules are closely tied to specific social situations. A defining criterion of values and also of moral norms is their universality within a society and across situations (Turiel, 1983). If I value freedom, honesty, and fairness, I do so regardless of a specific situation. The same can be said about certain emotions: for example, we do not value envy or rage in most modern western societies, mostly regardless of the situation. In contrast, feeling rules as instances of social norms are bound to specific situations. We are supposed to feel sad at funerals and happy on New Year's Eve.

Thus, from the perspective of emotion work, the social dimension of regulation not only stems from the social sharing of feeling rules, but also from mechanisms that establish links between feeling rules and (classes of) social situations. In sociology, these mechanisms are realized by "framing rules." Such rules govern the ways in which "we ascribe definitions or meanings to situations" (Hochschild, 1979, p. 566), for example "this conversation is just a friendly chat" vs. "this conversation is already part of a job interview." These rules for defining situations, based on certain situational cues or components, imply the validity of situation-specific feeling rules (and other social norms). These ideas have already been spelled out by symbolic interactionism, for example in Goffman's (1974) *Frame Analysis*, and by the sociology of knowledge, in particular Berger's and Luckmann's (1966) treatise on *The Social Construction of Reality*. More recently, psychological research on social and socially situated cognition has illuminated the processes and mechanisms underlying framing rules (Kunda, 1999; Bless et al., 2004). This work emphasizes the automaticity and rapidity with which individuals categorize situations according to certain perceptual cues and the fundamental impact of automatic categorizations on behavior, for instance in view of stereotype activation, person perception, and emotion (e.g., Macrae and Bodenhausen, 2000; Smith and Semin, 2004, 2006; Griffiths and Scarantino, 2009).

Importantly, framing rules and the validity of feeling rules not only depend on situational information, but also on ascribed and achieved characteristics (e.g., social roles, status, power, gender, age) relative to the situation at hand. For example, a mother and her adolescent child in a social encounter with a third person will frame the situation differently based on, for example, their age and social roles. A mother might frame the situation as an insulting one and feel justified in feeling embarrassed, whereas the child might frame the situation as a joke and feel justified in feeling amused. Likewise, an encounter between a superordinate and an employe might carry framings that allow humor for the higher status individual and preclude humorous behavior for the subordinate. In institutionalized contexts, framing and feeling rules differ for customers and employes, as demonstrated by Hochschild's (1983) classical study. This way, societies are threaded with normative orders that lead to socially differentiated patterns of emotion work.

Feeling rules not only shape emotions but also reflect the dominant views of emotion, their relative importance, and the socially accepted ways of dealing with them. Thus – in addition to valued feelings – they play a crucial role in shaping the "emotional culture" of a society, which Thoits (2004) defines as "beliefs about the nature, causes, distributions, value, and dynamics of emotions in general as well as of specific feelings" (p. 362). Social psychological research has demonstrated links between emotion cultures and social behavior in various domains (e.g., Nisbett and Cohen, 1996; Ijzerman et al., 2007; Ijzerman and Cohen, 2011). Likewise, social historical scholarship has revealed links between changing norms and values and the emotion culture of a society (Thoits, 2004, p. 360f; Cancian and Gordon, 1988; Stearns, 1993; Illouz, 1997; Reddy, 2001).

Moreover, studies in emotion work and feeling rules often adopt a "critical" stance because of the potential social, psychological, and physiological consequences of emotion work (cf. also Gross, 2002). It is frequently assumed that feeling rules create a tense relationship between socially expected emotions and actually experienced emotions. This tension gives rise to "emotional dissonance" or "emotional deviance" (Hochschild, 1983; Thoits, 1990; Jansz and Timmers, 2002), which has to be eased by means of emotion work. In the long run, the constant need for emotion work is supposed to lead to the "alienation" from one's own feelings (Hochschild, 1983).

EMOTION REGULATION AND EMOTION WORK: TWO SIDES OF THE SAME COIN?

Although many sociological and social science inquiries into emotion work are not primarily concerned with the individual components of emotion regulation, but rather with its ideological, organizational, and economic contexts (often in the sense of social criticism), there are far-reaching parallels with psychological models of emotion regulation. Investigating these parallels may not only advance our understanding of the principles of emotion work and emotion regulation, but will allow us to better (a) estimate and predict the individual consequences of emotion work in social institutional settings, (b) delineate the social and cultural embeddedness of emotion regulation, and (c) apprehend the systematic social shaping of emotion. Some of these linkages and conceptual overlaps have been described by Grandey (2000), but with an emphasis on emotional labor and organizational settings. Grandey highlights similarities between Hochschild's (1983) concepts of deep and surface acting in emotional labor on the one hand and Gross's (1999) process model of emotion regulation on the other hand. She uses this integrative view to develop a model of emotional labor that profits from an in-depth consideration of organizational processes and the demands of paid work (as outlined by the sociology and psychology of work and organizations)

as well as form detailed accounts of situational cues, individual processes, and long-term consequences of emotion regulation. Here, I will re-iterate several of her points, but instead of focusing on organizations and emotional labor aim at a more general and "large-scale" approach at understanding the social embeddedness of emotion regulation.

Process models of emotion regulation give insights into the various distinct stages of emotion regulation and regulatory processes in relation to different junctures in the phases of emotion elicitation and the components of an emotion or emotion episode. I therefore start with the basic assumptions of Gross's (1999) process model of emotion regulation illustrated above and use Hochschild's (1979) account of emotion work to locate and specify the social and cultural determinants of emotion regulation within and on top of this model. I will also draw on other theories in the sociology of emotion to further extend Gross's model in view of the social distribution of resources that are necessary to implement certain strategies of regulation. **Figure 2** illustrates the way in which *deep acting* and *surface acting* can be understood as parts of the emotion regulatory process.

The emotion antecedent strategies of attentional deployment and cognitive change – or reappraisal – largely correspond to Hochschild's concept of deep acting or emotion work in a narrower sense (Hochschild, 1979; Grandey, 2000). Because Hochschild's work has a focus on emotional labor in organizational settings, it seems obvious that she emphasizes these cognitive regulation processes over situation selection and modification, mostly because employes are limited in their capabilities to select and modify situations. According to Hochschild, emotion work may consist of three elements: cognitive, bodily, and expressive. We will deal with the bodily and expressive components later and focus on the cognitive element. Cognitive strategies in models of emotion work refer to attempts to "change images, ideas, or thoughts in the service of changing the feelings associated with them" (Hochschild, 1979, p. 562).

Most interestingly, although hidden in a footnote, Hochschild (ibid.) explicitly relates these cognitive strategies to appraisal theories of emotion, in particular Lazarus's (1966) approach, which are also foundational to process models of emotion regulation. However, emotion work is only seldom seen in this light of appraisal theory. It can be understood as an attempt at "recodifying" situations or at reclassifying them into "previously established mental categories" (ibid.). This deliberate and conscious recodification (reappraisal) acts upon previous automatic codifications and interpretations (appraisals) that gave rise to the initial emotion.

Response modulation in Gross's process model resembles the idea of surface acting in theories of emotion work. Here, Hochschild's (1979, p. 562) ideas of regulating the bodily, i.e., physiological, components, or "symptoms" of emotions (e.g., respiratory control) are in line with Gross's view of response-oriented regulation. The same holds for the expressive components which are, strictly speaking, a class of bodily reactions. Importantly, and in contrast to the process model of regulation, Hochschild is interested in bodily and expressive regulation primarily in view of the their effects on the regulation of the underlying feeling, for example trying to smile not only for "interactive" reasons, but also to change the phenomenal feeling (ibid.). In line with Gross, she acknowledges that antecedent- and response-oriented strategies often go hand in hand.

Importantly, in uncovering the social determinants of emotion regulation, both strategies have to be linked to certain norms and values that serve as emotion regulatory goals, in particular to the feeling rules outlined above. The concept of feeling rules (or emotion norms, more generally) is an important addition to the process model, because it is highly situation-specific. Whereas accounts of emotion regulation that emphasize cultural values as emotion regulation goals take a more universal approach (e.g., Tsai, 2007), feeling rules presuppose situation-specific framing rules indicating their validity. As shown in **Figure 3**, feeling rules primarily inform deep and surface acting or attentional deployment, cognitive change, and response modulation.

Feeling rules are less suited to apply to regulatory strategies that aim at situation selection or modification because they are situation-specific. This is why their influence on emotion regulation is focused on deep and surface acting in this model. By accounting for the influence of feeling rules, the process model of regulation can accommodate emotion regulatory goals that are socially shared, highly interactive, and situation-specific, and at the same time systematically evoked in accordance with institutional settings and corresponding framing rules and social cognitive processes of situation perception.

Therefore, the significance of framing rules in constituting the social dimension of regulation is closely linked to situation selection and situation modification strategies. Given that individuals

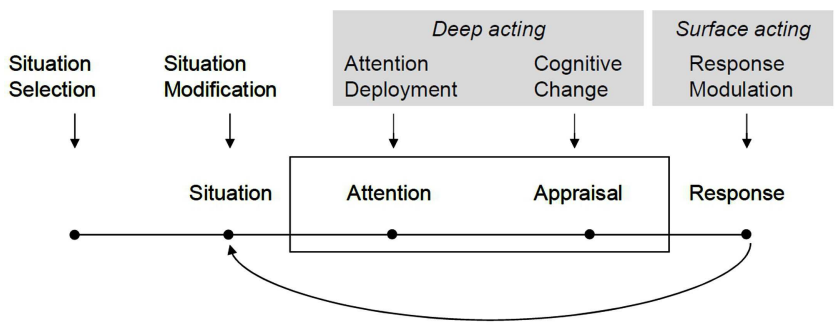


FIGURE 2 | Deep acting and surface acting in Gross's process model of emotion regulation. Based on Gross and Barrett (2011, p. 12).

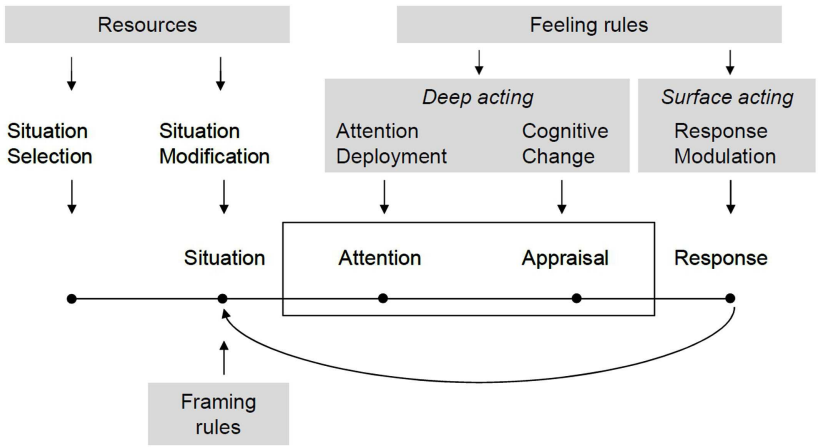


FIGURE 3 | The influence of resources, framing rules, and feeling rules on emotion regulation. Based on Gross and Barrett (2011, p. 12).

are able to actively seek or avoid situations or change certain parameters of an existing situation, they simultaneously alter the framing rules that are associated with a situation. Selecting or modifying situations usually results in different frames that are applied and different rules that go along with the new or modified situation. These in turn imply changes in situation-specific feeling rules in such a way that they are more compatible with the regulatory goals an individual actively pursues.

Importantly, framing rules and associated feeling rules are not given by nature or stand firmly without alternatives. Hochschild (1979, p. 566) emphasizes that they have an "ideological stance," that they are in fact the "bottom-side" of ideology. Conceiving of ideologies more broadly as the major competing cultural systems of meaning making, this means that there are always alternatives as to how a prevailing situation is to be framed according to which ideological stance. For example, feminist or gender mainstreaming proponents in a committee meeting will probably apply different sets of framing rules than, say, the very conservative representatives. Thus, framing rules as well as associated feeling rules always reflect a particular order of sense-making that is prevalent in a social institutional setting. However, changing the framing rules for specific situations is not an easy task. Although they may have an ideological and "socially constructed" background, framing rules become deeply embodied and ingrained into how we perceive the world that they are hardly alterable voluntarily and on a moment-to-moment basis.

Moreover, feeling rules are not only situations-specific, but their validity also depends on the individuals involved in a situation, in particular on their social roles and status positions and related social categories. For example, research has aptly documented the different feeling rules that are in place in one and the same situation for men and women (Cancian and Gordon, 1988; Brody and Hall, 2000; Simon and Nath, 2004) or people of different age (von Salisch, 2001; Hepworth, 2007). This systematic distribution of feeling rules across the social spectrum (both, vertically and horizontally) should thus lead to marked differences in emotion regulatory behavior across social groups and institutional settings.

Finally, as indicated in **Figure 3**, the possibilities for antecedent regulation, in particular for situation selection and modification, depend on individuals' capacities to actually select and change a situation. These capacities are constrained by several factors, in particular the institutional setting and available resources. Some institutional settings such as third-sector employment with frequent customer contact leave only little room for selecting situations at will. Also, situation selection aiming at emotion regulation in certain areas of the family or in educational settings may be hard to achieve. As a general rule, the more formalized an institutional setting is and the more individuals are bound to a specific social role, the less likely becomes situation selection as a strategy of emotion regulation.

Moreover, selecting and modifying situations requires adequate resources to do so. This includes cultural resources in the broadest sense, such as knowledge on how to change or select a situation; it may require economic resources as a means to actually implement selection or modification, and this strategy may also need the adequate social resources, in particular status and power (e.g., Kemper, 1978), that enable individuals vis-à-vis others to change a situation. Importantly, as social science research has repeatedly documented over the past decades, these resources are not arbitrarily distributed in society, but highly inter-correlated and associated with social structure (e.g., Massey, 2008). Systematic social differences in the available resources to implement certain strategies of emotion regulation should thus – in conjunction with norms and regulatory goals – lead to discernable social patterns in emotion regulation.

DISCUSSION

In this article I have outlined an approach to understanding the social dimension of emotion regulation by integrating micro-level process models and the concepts of emotion work and feeling rules. From a sociological perspective, two-factor process models offer insights into the regulation of emotion that are closely linked to the processes of emotion elicitation and the immediate situational context of an emotion episode. Understanding the

broader and longer-term "regulation" of emotion, as demanded by one-factor models, is more effectively accomplished by other paradigms in the sociology and psychology of emotion, such as social structural and cultural approaches (e.g., von Scheve and von Luede, 2005; Boiger and Mesquita, 2012). On the other hand, psychological process models profit from consideration of ways to incorporate the social and cultural embeddedness of regulation, as is already done in works highlighting the role of emotion values (e.g., Tamir, 2009).

In addition to these works, the various linkages discussed herein highlight situationally specific social and cultural parameters of emotion regulation. Using the concepts of deep acting and surface acting, I have outlined the ways in which feeling rules as specific instances of a broader class of emotion norms (including, for example, display rules) serve as emotion regulatory goals reflecting (injunctive) social expectations and (descriptive) personal standards. I have also highlighted the importance of framing rules which link situational context to the validity of specific feeling rules. It has become clear that emotion regulation in social contexts is also fundamentally dependent on prevailing "ideologies" or prevalent systems of meaning making that may differ across groups and categories of individuals. Finally, I have emphasized that the emotion antecedent strategies of situation selection and modification strongly depend on available resources, which in turn are systematically and unequally distributed in a society.

CONSEQUENCES OF EMOTIONAL LABOR AND EMOTION REGULATION

This specification of process models of emotion regulation may, for example, help in achieving a better understanding of the individual and social consequences of emotion regulation, a critically debated topic in sociology. Hochschild (1983), for example, has expressed concerns about the alienation from one's own feelings and the psychological and physiological strains that go along with emotional labor (see also Grandey, 2000). In this regard, studies on the consequences of emotion regulation have revealed significant differences between deep acting and surface acting and between antecedent- versus response-oriented regulation (Gross, 2002). If, in fact, theoretical assumptions made by models of emotion regulation concur sufficiently with those of emotion work and emotional labor, insights from existing research might aide in clarifying the actual consequences of emotional labor. Conversely, and based on the conjecture that emotion regulation in private and organizational settings are fundamentally different from one another – based on the corresponding situational framing rules – empirical studies could tap into these differences and, for instance, account for the situational context (private vs. organizational) as a moderating variable in assessing the psychological and physiological consequences of emotion work and emotion regulation.

INTRA-SOCIETAL VARIATION IN EMOTION REGULATION

Given the existing studies on cultural differences in emotion regulation (e.g., Mauss et al., 2008), the integrative model developed here may to help to investigate systematic differences in emotion regulation *within* societies. Sociology is classically concerned with examining social differentiation at various levels. One (vertical) approach is to conceive of differentiation as stratification and to look at the unequal distribution of and access to resources across society, for instance in different social classes. Another (horizontal) approach is to investigate social differentiation based on different tastes and preferences, as is evident in different lifestyles. Bourdieu (1984) has famously offered and account of linking both perspectives using the concept of cultural capital. Recently, there is an increased interest in these linkages in social psychology. Studies have demonstrated ways in which "class culture" impacts behavior, including emotion. For example, Piff et al. (2010) have shown that social class systematically influences prosocial behavior (see also Kraus and Stephens, 2012) and Rackow et al. (2012) show how social inequality is related to the frequency of experiencing anger and anxiety. In this vein, the proposed model may help in understanding the emotion culture – and its constitutive feeling and framing rules – of social classes and the emotion-related tastes and preferences of certain lifestyles. Just like Bernstein (1971) theorized on restricted vs. elaborated codes of language use in lower and upper classes, classes could be characterized by different patterns of emotion regulation. Empirical studies can investigate whether such differences exist at all and how they are brought about, for example by differences in feeling rules or the resources that allow for situation selection and modification in emotion regulation.

THE SOCIAL AND CULTURAL SHAPING OF EMOTION

Finally, the extended model developed in this article may provide new insights into the long-term cultural shaping of emotion. If individuals are required to adapt their emotions to prevailing feeling rules as instances of ideologies or "emotion regimes" (Reddy, 2001), then situation-specific emotion regulation is a process that clearly contributes to this shaping. Much has been speculated on the role of social norms and practices in the culture-specific shaping of emotions. Many of these macro- or discourse-level approaches fall short of recognizing that emotions are also fundamentally psychological and bodily phenomena and seldom provide elaborated models of how to link culture, cognition, and emotion in an integrative framework. A model of emotion regulation that accounts for both, the social influences and the psychological mechanisms through which these influences are mediated can enhance our understanding of how exactly culture and society shape emotion. In conjunction with the existing one-factor approaches to emotion regulation (e.g., Kappas, 2011), two-factor models that decidedly consider individuals' embeddedness into culture and social structure are instructive, for example, in empirically investigating differences between adaptive processes of socialization and internalization in relation to general emotion values and those based on explicit and situation-specific normative obligations.

AUTHOR NOTE

Christian von Scheve, Department of Sociology and Cluster of Excellence "Languages of Emotion," Freie Universität Berlin, Berlin, Germany. Supported by the Cluster of Excellence "Languages of Emotion," Freie Universität Berlin, within the Excellence Initiative of the German Research Foundation (DFG).

REFERENCES

Baumeister, R. F., Vohs, K. D., DeWall, C. N., and Zhang, L. (2007). How emotion shapes behavior: feedback, anticipation, and reflection, rather than direct causation. *Pers. Soc. Psychol. Rev.* 11, 167–203.

Beckes, L., and Coan, J. A. (2011). Social baseline theory: the role of social proximity in emotion and economy of action. *Soc. Personal. Psychol. Compass* 5, 976–988.

Berger, P. L., and Luckmann, T. (1966). *The Social Construction of Reality*. Garden City, NY: Anchor.

Bernstein, B. (1971). *Class, Code and Control, Volume 1. Theoretical Studies Towards a Sociology of Language*. London: Routledge.

Bicchieri, C. (2006). *The Grammar of Society: The Nature and Dynamics of Social Norms*. New York: Cambridge University Press.

Bless, H., Fiedler, K., and Strack, F. (2004). *Social Cognition. How Individuals Construct Social Reality*. Hove: Psychology Press.

Boiger, M., and Mesquita, M. (2012). The construction of emotion in interactions, relationships, and cultures. *Emot. Rev.* 4, 221–229.

Bourdieu, P. (1984). *Distinction: A Social Critique of the Judgement of Taste*. Cambridge, MA: Harvard University Press.

Brief, A. P., and Weiss, H. M. (2002). Organizational behavior: affect in the workplace. *Annu. Rev. Psychol.* 53, 279–307.

Brody, L. R., and Hall, J. A. (2000). "Gender, emotion, and expression," in *Handbook of Emotions*, eds M. Lewis and J. Haviland-Jones (New York: Guilford), 338–349.

Campos, J. J., Frankel, C. B., and Camras, L. (2004). On the nature of emotion regulation. *Child Dev.* 75, 377–394.

Cancian, F. M., and Gordon, S. L. (1988). Changing emotion norms in marriage: love and anger in U.S. women's magazines since 1900. *Gend. Soc.* 2, 308–342.

Cialdini, R. (2007). Descriptive social norms as underappreciated sources of social control. *Psychometrika* 72, 263–268.

Denzin, N. (1990). "On understanding emotion: the interpretive-cultural agenda," in *Research Agendas in the Sociology of Emotions*, ed. T. D. Kemper (New York: SUNY Press), 85–115.

Eid, M., and Diener, E. (2001). Norms for experiencing emotions in different cultures: inter- and intranational differences. *J. Pers. Soc. Psychol.* 81, 869–885.

Ekman, P. (1972). "Universals and cultural differences in facial expressions of emotion," in *Nebraska Symposium on Motivation*, Vol. 19, ed. J. Cole (Lincoln: University of Nebraska Press), 207–282.

Elias, N. (1939/1978). *The Civilizing Process*. Oxford: Blackwell. [Original work published 1939].

Fineman, S. (2003). *Understanding Emotion at Work*. London: Sage.

Goffman, E. (1959). *The Presentation of Self in Everyday Life*. New York: Doubleday.

Goffman, E. (1974). *Frame Analysis. An Essay on the Organization of Experience*. New York: Harper & Row.

Grandey, A. A. (2000). Emotion regulation in the workplace: a new way to conceptualize emotional labor. *J. Occup. Health Psychol.* 5, 95–110.

Griffiths, P., and Scarantino, A. (2009). "Emotions in the wild: the situated perspective on emotion," in *The Cambridge Handbook of Situated Cognition*, eds P. Robbins and M. Aydede (New York: Cambridge University Press), 437–453.

Gross, J. J. (1998). The emerging field of emotion regulation: an integrative review. *Rev. Gen. Psychol.* 2, 271–299.

Gross, J. J. (1999). Emotion regulation: past, present, future. *Cogn. Emot.* 13, 551–573.

Gross, J. J. (2002). Emotion regulation: affective, cognitive, and social consequences. *Psychophysiology* 39, 281–291.

Gross, J. J., and Barrett, L. F. (2011). Emotion generation and emotion regulation: one or two depends on your point of view. *Emot. Rev.* 3, 8–16.

Gross, J. J., Richards, J. M., and John, O. P. (2006). "Emotion regulation in everyday life," in *Emotion Regulation in Couples and Families: Pathways to Dysfunction and Health*, eds D. K. Snyder, J. A. Simpson, and J. N. Hughes (Washington, DC: American Psychological Association), 13–35.

Hepworth, M. (2007). "Ageing and the emotions. Framing old age in victorian painting," in *Emotional Geographies*, eds D. Joye, L. Bondi, and M. Smith (Aldershot: Ashgate), 177–190.

Higgins, E. T. (2006). Value from hedonic experience and engagement. *Psychol. Rev.* 113, 439–460.

Hochschild, A. R. (1979). Emotion work, feeling rules, and social structure. *Am. J. Sociol.* 85, 551–575.

Hochschild, A. R. (1983). *The Managed Heart*. Berkeley, CA: University of California Press.

Ijzerman, H., and Cohen, D. (2011). Grounding cultural syndromes: body comportment and values in honor and dignity cultures. *Eur. J. Soc. Psychol.* 41, 456–467.

Ijzerman, H., van Dijk, W. W., and Gallucci, M. (2007). A bumpy train ride: a field experiment on insult, honor, and emotional responses. *Emotion* 7, 869–875.

Illouz, E. (1997). *Consuming the Romantic Utopia. Love and the Cultural Contradictions of Capitalism*. Berkeley, CA: University of California Press.

Jansz, J., and Timmers, M. (2002). Emotional dissonance. When the experience of an emotion jeopardizes an individual's identity. *Theory Psychol.* 12, 79–95.

Kappas, A. (2002). The science of emotion as a multidisciplinary research paradigm. *Behav. Processes* 60, 85–98.

Kappas, A. (2008). "Psssst! Dr. Jekyll and Mr. Hyde are actually the same person! A tale of regulation and emotion," in *Regulating Emotions: Culture, Social Necessity and Biological Inheritance*, eds M. Vandekerckhove, C. von Scheve, S. Ismer, S. Jung, and Kronast, S. (Malden, MA: Wiley-Blackwell), 15–38.

Kappas, A. (2011). Emotion and regulation are one! *Emot. Rev.* 3, 17–25.

Keltner, D., and Haidt, J. (1999). Social functions of emotion at four levels of analysis. *Cogn. Emot.* 13, 505–521.

Kemper, T. D. (1978). *A Social Interactional Theory of Emotions*. New York: Wiley.

Kraus, M. W., and Stephens, N. M. (2012). A road map for an emerging psychology of social class. *Soc. Personal. Psychol. Compass* 6, 642–656.

Kunda, Z. (1999). *Social Cognition: Making Sense of People*. New York: Bradford.

Lazarus, R. S. (1966). *Psychological Stress and the Coping Process*. New York: McGraw-Hill.

Lazarus, R. S. (1991). Progress on a cognitive-motivational-relational theory of emotion. *Am. Psychol.* 46, 819–834.

Levenson, R. W. (1999). The intrapersonal functions of emotion. *Cogn. Emot.* 13, 481–504.

Lively, K. J. (2010). Reciprocal emotion management working together to maintain stratification in private law firms. *Work Occup.* 27, 32–63.

Macrae, C. N., and Bodenhausen, G. V. (2000). Social cognition: thinking categorically about others. *Annu. Rev. Psychol.* 51, 93–120.

Massey, D. (2008). *Categorically Unequal: The American Stratification System*. New York: Russell Sage Foundation.

Mauss, I. B., Bunge, S. A., and Gross, J. J. (2008). "Culture and automatic emotion regulation," in *Regulating Emotions: Culture, Social Necessity and Biological Inheritance*, eds M. Vandekerckhove, C. von Scheve, S. Ismer, S. Jung, and S Kronast (Malden, MA: Wiley-Blackwell), 39–60.

Nisbett, R. E., and Cohen, D. (1996). *Culture of Honor: The Psychology of Violence in the South*. Boulder, CO: Westview Press.

Oliver, M. B., and Woolley, J. K. (2010). "Tragic and poignant entertainment: the gratifications of meaningfulness," in *The Routledge Handbook of Emotions and Mass Media*, eds K. Döveling, C. von Scheve, and E. Konijn (New York: Routledge), 134–147.

Opp, K.-D. (2002). When do norms emerge by human design and when by the unintended consequences of human action? The example of the no-smoking norm. *Ration. Soc.* 14, 131–158.

Piff, P. K., Kraus, M. W., Cote, S., Cheng, B., and Keltner, D. (2010). Having less, giving more: the influence of social class on prosocial behavior. *J. Pers. Soc. Psychol.* 99, 771–784.

Rackow, K., Schupp, J., and von Scheve, C. (2012). Angst und Ärger. Zur Relevanz emotionaler Dimensionen sozialer Ungleichheit. [Anger and Anxiety: Affective Dimensions of Social Inequality]. *Z. Soziol.* 41, 391–409.

Reddy, W. M. (2001). *The Navigation of Feeling: A Framework for the History of Emotions*. New York: Cambridge University Press.

Rusting, C. L., and Larsen, R. J. (1995). Moods as sources of stimulation: relationships between personality and desired mood states. *Pers. Individ. Dif.* 18, 321–329.

Scherer, K. R. (2005). What are emotions? And how can they be measured? *Soc. Sci. Info.* 44, 695–729.

Simon, R. W., and Nath, L. E. (2004). Gender and emotion in the U.S.: do men and women differ in self-reports of feelings and expressive behavior? *Am. J. Sociol.* 109, 1137–1176.

Smith, E. R., and Semin, G. R. (2004). Socially situated cognition:

cognition in its social context. *Adv. Exp. Soc. Psychol.* 36, 53–117.

Smith, E. R., and Semin, G. R. (2006). "Socially situated cognition as a bridge," in *Bridging Social Psychology*, ed. P. A. M. van Lange (Mahwah, NJ: Erlbaum), 145–150.

Stearns, P. N. (1993). "History of emotions: the issue of change," *in Handbook of Emotions*, eds M. Lewis and J. M. Haviland (New York: Guilford), 17–28.

Tamir, M. (2009). What do people want to feel and why? Pleasure and utility in emotion regulation. *Curr. Dir. Psychol. Sci.* 18, 101–105.

Tamir, M., and Mauss, I. B. (2011). "Social-cognitive factors in emotion regulation: implications for well-being," in *Emotion Regulation and Well-Being*, eds I. Nyklicek, A. Vingerhoets, M. Zeelenberg, and J. Denollet (New York: Springer), 31–47.

Thoits, P. A. (1990). "Emotional deviance: research agendas," in *Research Agendas in the Sociology of Emotions*, ed. T. D. Kemper (Albany, NY: State University of New York Press), 180–203.

Thoits, P. A. (2004). "Emotion norms, emotion work and social order," in *Feelings and Emotions: The Amsterdam Symposium*, eds A. S. R. Manstead, N. H. Frijda, and A. Fischer (New York: Cambridge University Press), 359–378.

Thoits, P. A. (2007). Extending Scherer's conception of emotion. *Soc. Sci. Info.* 46, 429–433.

Tsai, J. L. (2007). Ideal affect. Cultural causes and behavioral consequences. *Perspect. Psychol. Sci.* 2, 242–259.

Tsai, J. L., Knutson, B., and Fung, H. H. (2006). Cultural variation in affect valuation. *J. Pers. Soc. Psychol.* 90, 288–307.

Turiel, E. (1983). *The Development of Social Knowledge: Morality and Convention*. Cambridge: Cambridge University Press.

Urry, H. (2009). Using reappraisal to regulate unpleasant emotional episodes: goals and timing matter. *Emotion* 9, 782–797.

Vandekerckhove, M., von Scheve, C., Ismer, S., Jung, S., and Kronast, S. (2008). "Regulating emotions: culture, social necessity and biological inheritance," in *Regulating Emotions: Culture, Social Necessity and Biological Inheritance*, eds M. Vandekerckhove, C. von Scheve, S. Ismer, S. Jung, and S. Kronast (Malden, MA: Wiley-Blackwell), 1–12.

Vastfjall, D., Garling, T., and Kleiner, M. (2001). Does it make you happy feeling this way? A core affect account of preferences for current mood. *J. Happiness Stud.* 2, 337–354.

von Salisch, M. (2001). Children's emotional development: challenges in their relationships to parents, peers, and parents. *Int. J. Behav. Dev.* 25, 310–319.

von Scheve, C. (2010). "Emotionen, Normkonformität und das Problem sozialer Ordnung [Emotions, norm compliance, and social order]," in *Regel, Norm, Gesetz: Eine interdisziplinäre Bestandsaufnahme [Rules, Norms, and Laws. An Interdisciplinary Review]*, eds M. Iorio and R. Reisenzein (Frankfurt/Main: Lang.), 285–308.

von Scheve, C. (2012). The social calibration of emotion expression: an affective basis of micro-social order. *Sociol. Theory* 30, 1–14.

von Scheve, C., and von Luede, R. (2005). Emotion and social structures: towards an interdisciplinary approach. *J. Theory Soc. Behav.* 35, 303–328.

Conflict of Interest Statement: The author declares that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Received: 02 July 2012; accepted: 25 October 2012; published online: 16 November 2012.

*Citation: von Scheve C (2012) Emotion regulation and emotion work: two sides of the same coin? Front. Psychology **3**:496. doi: 10.3389/fpsyg.2012.00496*

This article was submitted to Frontiers in Emotion Science, a specialty of Frontiers in Psychology.

frontiers in
PSYCHOLOGY

ORIGINAL RESEARCH ARTICLE
published: 21 January 2013
doi: 10.3389/fpsyg.2012.00616

Living emotions, avoiding emotions: behavioral investigation of the regulation of socially driven emotions

***Alessandro Grecucci*[1]*, Cinzia Giorgetta*[1,2]*, Nicolao Bonini*[3] *and Alan G. Sanfey*[4,5]**

[1] *Department of Psychology and Cognitive Science, University of Trento, Trento, Italy*
[2] *Institute of Cognitive Science and Technology, CNR – Consiglio Nazionale delle Ricerche, Trento, Italy*
[3] *Department of Economics and Management, University of Trento, Trento, Italy*
[4] *Behavioural Science Institute, Radboud University Nijmegen, Nijmegen, Netherlands*
[5] *Donders Institute for Brain, Cognition and Behavior, Radboud University Nijmegen, Nijmegen, Netherlands*

Edited by:
Ullrich Wagner, Charité – University Medicine Berlin, Germany

Reviewed by:
Leonie Koban, University of Colorado Boulder, USA
Job Van Der Schalk, Cardiff University, UK

****Correspondence:***
Alessandro Grecucci, Department of Cognitive Science and Education, University of Trento, Corso Bettini 31, Rovereto, 38068 Trento, Italy.
e-mail: alessandro.grecucci@unitn.it

Emotion regulation is important for psychological well-being. Although it is known that alternative regulation strategies may have different emotional consequences, the effectiveness of such strategies for socially driven emotions remains unclear. In this study we investigated the efficacy of different forms of reappraisal on responses to the selfish and altruistic behavior of others in the Dictator Game. In Experiment 1, subjects *mentalized* the intentions of the other player in one condition, and *took distance* from the situation in the other. Emotion ratings were recorded after each offer. Compared with a baseline condition, *mentalizing* led subjects to experience their emotions more positively when receiving both selfish and altruistic proposals, whereas *distancing* decreased the valence when receiving altruistic offers, but did not affect the perception of selfish behavior. In Experiment 2, subjects played with both computer and human partners while reappraising the meaning of the player's intentions (with a human partner) or the meaning of the situation (with a computer partner). Results showed that both contexts were effectively modulated by reappraisal, however a stronger effect was observed when the donor was a human partner, as compared to a computer partner. Taken together, these results demonstrate that socially driven emotions can be successfully modulated by reappraisal strategies that focus on the reinterpretation of others' intentions.

Keywords: dictator game, emotion regulation, mentalizing

INTRODUCTION

Recent experimental evidence suggests that emotion regulation strategies play a key role in helping individuals to adapt to and master social interactions (Gross, 2002; Ochsner et al., 2002; Gross and John, 2003). Indeed, our ability to regulate emotions when interacting with others is considered to be a crucial dimension of both emotional intelligence (Mayer and Salovey, 1997; Lopes et al., 2011), and good mental health (Gross, 2002). Broadly speaking, emotion regulation refers to a set of processes by which "individuals influence which emotions they have, when they have them, and how they experience and express these emotions" (cf. Gross, 1999). Previous studies have examined the processes that individuals use to influence the emotions they generate, when they do so, and how these emotions are experienced or expressed (Gross, 1998). Despite the extensive literature on emotion "self regulation," which focuses primarily on the regulation of basic emotions such as fear and disgust in relation to visual stimuli (see Ochsner and Gross, 2005), evidence of emotion regulation in social interactive situations is still poorly understood. An important experimental question is whether emotion regulation can be applied to social interactive contexts, and in particular whether the same regulatory strategies that are useful in self regulation can also be applied in interpersonal situations. This information may provide deeper understanding of psychiatric disorders characterized by serious disturbances in social functioning such as borderline personality disorder (Gunderson, 2007), avoidant personality disorder (Leising et al., 2006), or schizotypic spectrum disorders (Ballon et al., 2007).

These socially driven emotions have been recently explored by asking about the emotional regulation of subjects when looking at pictures depicting social scenes (Koenigsberg et al., 2011; Vrtickaa et al., 2011). While the methodology was similar to the "standard" studies, here the researchers employed a subset of International Affective Pictures depicting scenes with social features (e.g., people in situations of abuse, aggression...) rather than general emotional pictures. Participants were asked to reappraise emotions elicited by these social scenarios, but importantly they were not exposed to the actual emotions which stem from real social situations. Studying the regulation of actual social situations is particularly important given the failure to regulate interpersonal responses often seen in clinical disorders (Phillips et al., 2003; Ochsner and Gross, 2008).

To study real interactive situations, one popular approach has been to examine emotion regulation strategies applied to tasks derived from Game Theory. Game theory explores situations of conflict and cooperation between decision-makers (Myerson, 1997), offers well-specified models for the investigation of social exchange (Sanfey and Dorris, 2009), and can assess how social

factors such as reciprocity, equity, and bargaining can affect our emotions and subsequent decisions. Several studies have used game theoretic approaches to study emotion regulation in interactive contexts (e.g., van'tWout et al., 2010). In one other example, Grecucci et al. (2012) asked subjects to reappraise their emotions when interacting with a partner who was making fair or unfair monetary offers, utilizing the classic Ultimatum Game task (Guth et al., 1982). Here, subjects' decisions were strongly modulated by the reappraisal strategy used, with fewer rejections of unfair offers when down-regulating emotions and increased rejections when up-regulating emotions. Using fMRI demonstrated that this affective modulation was correlated with activity in the insula, a brain region previously shown to be involved in the aversive reactions elicited by unfair offers (Sanfey et al., 2003). Specifically, the posterior part of the insula showed a similar pattern of activation as was observed behaviorally (less activity for down-regulation and more for up-regulation, as compared to a neutral baseline).

Here, we aim to extend the above study by testing how social norms (such as fairness, equality, and prosocial behavior), and in particular their violations, affect our emotional reactions in an interactive context. The Grecucci et al. (2012) study showed that emotion regulation can successfully modulate economic decision-making, but an open question is what emotions are actually being regulated? In the present study we use the Dictator Game with participants in the role of receiver in order to explore how we react emotionally to social norms, both when these norms are and are not violated. The Dictator Game (Kahneman et al., 1986) involves two players, one of whom is asked to divide up a specified sum of money (usually €10 or the equivalent). The first player (Allocator) is free to make any possible division of this amount, and the second player (Recipient) simply receives whatever is proffered by the Allocator. Importantly therefore, the emotional reactions of the Recipient take place in the absence of any decision. Theories on social preference argue that people display "inequity aversion" (Fehr and Gächter, 2002) when exposed to unfair divisions of money, as are often demonstrated in the Dictator Game when the Allocator keeps more money than he/she gives away. Even though there is no commonly agreed standard for what constitutes "fair" behavior (Cornelissen et al., 2011), people expect others to balance self-interest with prosocial tendencies, resulting in approximately fair divisions. But what if our partners violate such expectations? Do we feel disappointed in such behaviors? Do we get angry at them? And more importantly, are emotion regulation strategies effective in modulating such complex socially induced emotions? These questions will be addressed in this study.

A further issue to examine here is whether different strategies have similar effects on the regulation of socially driven emotions. Of the set of strategies studied in the experimental literature of self regulation, the most well-characterized is that of reappraisal. This strategy involves reinterpreting the meaning of a stimulus in order to change one's emotional response to it (Gross, 1999), with subjects typically asked to build an interpretation of the emotional stimulus in such a way as to decrease their emotional response. Behavioral studies have shown that reappraisal is one of the most flexible, adaptive, and commonly employed strategies for regulating negative emotional responses (Gross, 2002). Importantly, this strategy has been linked to the maintenance of well-being (Gross and John, 2003), and a recent study from our group (Grecucci et al., 2012) showed that this strategy is also effective in modulating social decision-making (in the context of Ultimatum Game behavior). In particular, we showed that *reappraisal of the intentions of the other player,* or mentalizing-reappraisal, was effective in changing interpersonal reactions (punishment behaviors) toward unfair behaviors. Making sense of social interactions requires inferring intentions, beliefs, and desires (i.e., mentalizing; see Frith et al., 1991; Frith and Frith, 2003), and this concurs with a recent study that demonstrated mentalizing abilities at work when making value-based decisions (Evans et al., 2011). Importantly, mentalizing has an effect of regulating our emotions (Sharp et al., 2011). The question here then is if this version of reappraisal can regulate socially driven emotions in the absence of a decision. Though there are also other strategies that people often use when facing emotion-eliciting situations, not all strategies are equally effective in producing healthy emotion regulation. For example, "emotional suppression," a strategy by which individuals suppress every expression of the ongoing emotion by limiting awareness of the emotional experience (Gross, 2002), can result in diminished control of emotion, interpersonal functioning, memory, well-being, and greater depressive symptomatology (Gross and John, 2003). Another strategy that, although perhaps effective in the short-term, may be detrimental in social-interpersonal contexts is "distancing," whereby subjects detach themselves from feelings and behave as neutral observers. Distancing has proven to be effective in reducing self-reported simple negative emotions (Gross, 2002; Ochsner et al., 2002, 2004; Kalisch et al., 2005; Eippert et al., 2007). However, distancing may also reduce positive emotions (Beauregard et al., 2001; Kim and Hamann, 2007), leading subjects to flatten their emotional reactivity in a maladaptive way, in a similar way to schizoid or avoidant personality disorders (Leising et al., 2006). Even if there is some evidence that distancing can be an effective strategy in modulating emotions when looking at emotional pictures (Kalisch et al., 2005; Koenigsberg et al., 2011), it may not be useful or healthy when interacting directly with people. Suppression is a qualitatively different strategy, as it focuses on the "expression of emotions" (Gross, 2002), whereas both mentalizing and distancing are strategies focused on "reappraising" the events when the emotion is generated but not yet expressed. Both mentalizing and distancing can be defined as interpersonal strategies that "focus on the other," whereas suppression is a more self-focused strategy. For these reasons we selected distancing as a control strategy for one of particular interest, mentalizing.

A final unresolved issue is whether emotion regulation acts upon valence, upon arousal, or on both, and more importantly, if arousal can be decreased or increased according to the valence of the experienced emotion. The vast majority of previous studies (Ochsner et al., 2002, 2004) have used simple emotional ratings regarding the pleasantness of the experienced emotion, without trying to separate these two relevant dimensions according to current theories of emotion (Lang and Bradley, 2010). The particular task used in the present study will permit us to explore these issues by using a continuum of offers that may elicit emotions from unpleasant to pleasant, tested for both their valence and

arousal effects. We predict that if the strategy is able to increase the valence (e.g., increasing positivity), arousal will be increased as well, making subjects experience a positive emotion at its most vivid. However, in case of a decrease of valence (when negative emotion is experienced), arousal should decrease to prevent a painful experience of the emotion itself. Therefore, in the present study we will first test the notion that interpersonal emotion regulation is possible. While previous studies used only pictures of social scenes (Koenigsberg et al., 2011), emotions elicited in real social interactions may well be of a qualitatively different nature than those experienced while watching unpleasant images. We have previously explored social interactive emotions elicited by the Ultimatum Game (Grecucci et al., 2012), however the effect of emotion regulation was indirectly assessed by the effect produced on socioeconomic decisions ("regulated decisions") and not on the emotions elicited themselves. Here, we will use the Dictator Game to elicit pleasant and unpleasant social emotions, without giving players the possibility to punish the proposers' unfair behavior. We predict an effect of emotion regulation on both the valence and arousal of the experienced emotions as compared to a baseline condition.

Secondly, we examine whether different strategies are equally effective in promoting emotion regulation. Therefore, we will test two different emotion regulation strategies: mind-of-another-reappraisal, or *mentalizing*, and *distancing*. We predict a positive effect of the mentalizing strategy on emotional ratings for which the valence becomes less unpleasant, whereas we expect that distancing is not effective in decreasing the unpleasantness of negative emotions. An additional hypothesis is that distancing will also have an effect of flattening emotional reactivity more generally. These first two aims are tested in Experiment 1.

Thirdly, we will test whether emotion regulation when interacting with a human partner is different when interacting with a non-human partner. In both contexts the strategy is the same, applied to monetary offers from both human and computer donors respectively. We expect that interpersonal emotion regulation is superior when reappraising the emotions elicited from a human as opposed to a non-human partner due to the "mentalistic" nature of the strategy used. If this is the case, this will be further confirmation of the importance of interpersonal abilities on emotion regulation of socially driven emotions, as predicted by theory (Fonagy, 2006). This aim will be tested in Experiment 2.

Fourthly, across both experiments we will examine both arousal and valence dimensions, examining differences in how alternative emotion regulation strategies (Experiment 1) and alternative contexts (Experiment 2) can affect our emotional experience. Previous experiments did not make a clear distinction between valence and arousal effects of emotion regulation. In addition to the effect of strategy on the perceived valence we also expect an effect on arousal, as it is an important dimension of the emotional experience. In particular, we predict different effects on valence and arousal according to the specific strategy used. As mentalizing involves the reinterpretation of the event, we expect a strong change on the perceived valence, but less on arousal. On the contrary, as distancing is more focused on putting oneself in a detached perspective, here we expect a stronger effect on the arousal dimension, and less on valence, as no cognitive operation is required for the evaluation of the event.

EXPERIMENT 1

This experiment will examine the effect of regulation on socially driven emotions by employing two strategies, those of mentalizing and distancing.

METHODS

Participants

Twenty-two participants (11 males) from the local area participated in the study, with a mean age of 23.95 (SD ± 1.43) years. The local ethics committee approved the study and all participants provided written informed consent after the procedures had been fully explained.

Dictator game

After providing informed consent, participants were first instructed as to the nature and rules of the Dictator Game. Participants were told that they would play this game as recipient with a different player in the role of the allocator on each trial. Sixty trials were presented, though participants were not informed of the total number of rounds in advance. Each round involved receiving a proposal concerning a 10€ amount. The offers included four repetitions of five possible offers (1€, 2€, 3€, 4€, and 5€ out of 10€), for a total of 20 offers for each of the three conditions (look, mentalizing, and distancing). The emotion regulation conditions were blocked and counterbalanced across participants. This was done to prevent any substantial task switching and carry over effects from one strategy to another. The offer types and pictures of Allocators were completely randomized inside each block. The task instructions emphasized that the different partners in the game would play the game independently of each other, and participants were led to believe the offers were previously recorded from real partners. Participants played the game using a computerized version of the task. The timeline of each run involved the presentation of a fixation point for 500 ms, then the instruction of the regulation strategy to be applied appeared for 2000 ms, followed by the face of the proposer and the proposal itself for 8000 ms, leaving the time to apply the strategy. After this, they were asked to rate their emotions separately on two scales (one for arousal and one for valence) using a visual analog scale known as the Self Assessment Manikin (Lang, 1994). No time constraints were given for these two events, and participants were told they would be paid a percentage of what they received during the game. See **Figure 1** for a timeline.

Emotion regulation instructions

Before beginning the game, participants were instructed that they would have to use specific cognitive strategies upon the receipt of an offer. A written protocol describing each of the two strategies was provided. Following Gross (1998), a general reappraisal definition was given as "interpreting potentially emotion-relevant stimuli in unemotional terms," in particular to make them less negative. An example was presented showing a picture depicting a crying woman. Participants were told that the way they interpret an event will affect the way they feel. For example, if they think that the woman is in great pain because she is mourning a loved one's death they may feel upset, but if they think that the woman is merely tired or suffering from a headache they may feel less distressed by that event. After this example, participants were told to

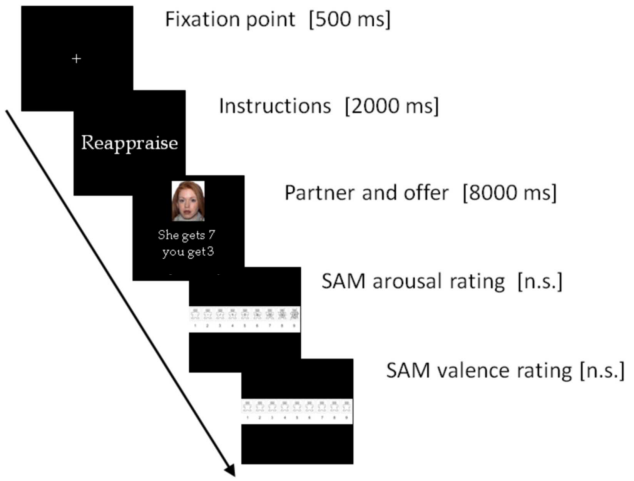


FIGURE 1 | A timeline of the events presented on each trial. Subjects' responses on valence and arousal ratings were recorded.

make an effort to reinterpret the event as less negative. They were then given the instructions of the Dictator Game and told they had to translate this strategy into the context of this game. To apply reappraisal to the Game they were asked to focus on the mind of the Allocator in order to build an interpretation of the intentions behind players' behavior. This reinterpretation of their intentions was meant to be less negative. Some examples were given ("*he is not that stingy, probably does not have so much money to give me*," "*this is the best he can do*" etc.). We define this kind of reappraisal focused on others' minds as "mentalizing," in other words an effort of generating possible explanations of the intentions of others.

For the other strategy, distancing, they were told that how involved they feel in a situation will affect their perceived distress. A picture was then presented depicting a bloody fight between police and terrorists, and they were told that if they feel themselves affected by this situation they probably will feel scared and worried, whereas if they think that that situation is far from their lives and not connected at all with them, they will feel quite neutral in relation to that event. After this, subjects were told how to apply this strategy to the context of DG. Some examples were given, such as ("*this proposal won't affect me*," "*I don't care*").

Importantly, distancing was meant to be an avoidance-based strategy, meaning that subject had to put themselves in a detached perspective, whereas mentalizing was meant to be an effort of connection with the others. Finally, for the "look" condition, they were to simply allow themselves to respond naturally, without any effort of interpretation.

Before beginning the first block of DG, we verified that participants understood the respective emotion regulation instructions by asking each to verbalize what they would do when confronted with different offers. A practice session proceeded every block.

Questionnaires

At the conclusion of the experiment, participants were asked to rate their emotional state on a 9-point Likert scale when they received the prototypical example of a very unfair offer (1€ out of 10€), and fair (5€ out of 10€). Moreover, effectiveness of change of emotional responses for both strategies was rated again on a 9-point Likert scale. Thinking strategies adopted during the experiment were also recorded for both strategies. This was done to ensure that participants understood the instructions and then applied them in a coherent manner according to the training instructions.

RESULTS

Emotion ratings in the dictator game

We first examined if the affective ratings were different across the emotion regulation and baseline conditions. We computed two separate ANOVAs, one for valence and one for arousal, each with Strategies (mentalizing vs. distancing vs. look), and Offers (1€, 2€, 3€, 4€, and 5€) as factors. Analysis on valence returned a significant main effect of Strategy [$F(2, 42) = 41.309$, $p < 0.0001$], and of Offers [$F(4, 84) = 101.513$, $p < 0.0001$], as well as a significant interaction [$F(8, 168) = 5.817$, $p < 0.0001$]. Next, Bonferroni-corrected *post hoc* tests with participants' subjective ratings as dependent variables were computed, comparing each strategy for every offer. Three comparisons were significant for mentalizing as compared with look: for €1: ($p < 0.05$), diff: −2, 45; for €2: ($p < 0.05$), diff: −2, 17; for €3: ($p < 0.05$), diff: −1, 55; suggesting that mentalizing decreased the unpleasantness of the unfair offers (€1, €2, and €3). One comparison was significant for distancing as compared with look €5: ($p < 0.05$), diff: 1.07, suggesting that distancing decreased the valence of the most fair offer (e.g., perceived as less positive). The differences between mentalizing and distancing were all significant (all $p < 0.05$; see **Figure 2**).

Then, we computed ANOVA on arousal ratings. This returned a significant main effect of Strategy [$F(2, 42) = 5.810$, $p < 0.01$], and of Offer [$F(4, 84) = 7.203$, $p < 0.0001$]. However, the interaction failed to reach significance [$F(8, 168) = 1.376$, $p = 0.21$]. No further analyses were run on arousal ratings. See **Figure 2**.

To further explore the effect produced by each strategy, we computed the effect size of each strategy, calculated as the difference between the strategy and the baseline look condition, collapsing for all offers. In terms of valence, the mentalizing strategy returned a strong effect of 1.51 points toward more positive perception of the interaction with the partner, whereas distancing was less effective, producing a small effect of −0.19 in the direction of perceiving the events as less positive. In terms of arousal, the mentalizing produced an effect of 0.8 points in the direction of perceiving the emotions as more vivid, whereas the distancing strategy returned an effect of −0.51 points toward a more blunted perception of emotion. As expected, mentalizing had a stronger effect on valence as compared to distancing. When considering arousal, both strategies were effective in altering the ratings, however, they acted in opposite directions. Mentalizing increased arousal, whereas distancing decreased it. See **Figure 2** and **Table 1**.

Questionnaires

Emotional ratings when receiving both very fair (€5) and very unfair (€1) offers were entered into an ANOVA for each of the six emotions inquired about (anger, disgust, surprise, sadness, happiness, and disappointment). Analysis returned a significant main effect of offer [$F(2, 21) = 28.487$, $p < 0.0001$], and

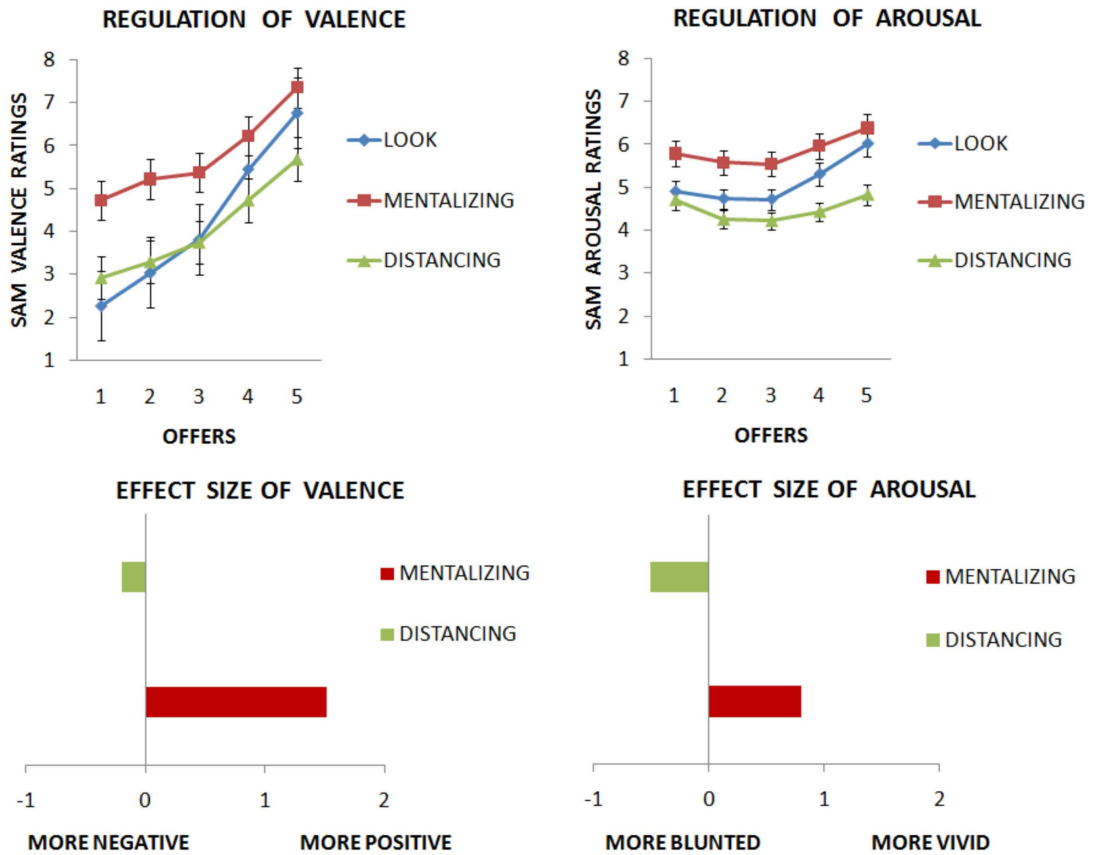


FIGURE 2 | Results from Experiment 1 are presented. (Upper part) Valence (graph on the left) of emotions associated with both altruistic and selfish behaviors is increased when subjects mentalized the intentions of players, but not when they took the distance from them. Arousal (graph on the right) was affected by strategies. (Lower part) Results from size effects of valence and arousal are shown. See text for further information.

of emotion [$F(5, 105) = 9.071$, $p < 0.0001$], as well as a significant interaction [$F(5, 105) = 50.349$, $p < 0.0001$]. Bonferroni-corrected *post hoc* tests were then computed with participants' subjective ratings as dependent variables, comparing for each emotion and every offer. For the unfair offer, the strongest emotion elicited was disappointment (score: 6.28), followed by anger (5.45), sadness (5.09), disgust (5.04), surprise (4.54), and happiness (2.22). Disappointment, anger, disgust, sadness, and surprise differed from happiness ($p < 0.05$), though not from each other ($p > 0.05$).

For the fair offer, the strongest emotion elicited was happiness (7.09), followed by surprise (5.9) disgust (1.77), sadness (1.72), disappointment (1.5), and anger (1.45). Happiness and surprise differed from all other emotions ($p < 0.05$), but not from each other. When comparing between fairness levels, the emotions of anger, disgust, happiness, sadness, and disappointment significantly differed ($p < 0.05$), whereas surprise did not ($p > 0.05$).

We can therefore conclude that the main emotions elicited by the interpersonal context of the Dictator Game when treated unfairly was primarily disappointment, with disgust, sadness, and anger invoked to a lesser extent. These emotions may be the ones regulated during the strategy of mentalizing. We can also conclude that the main emotion elicited by fair treatment was mainly happiness, but also surprise was invoked by the altruistic behavior. See **Figures 3A,B** and **Table 1**.

After the experiment, participants were also asked to evaluate on a 9-point Likert scale how much they felt their emotions changed as a function of the two emotion regulation strategies. In the mentalizing condition they rated their emotion change with strength of 5.54 (SD ± 2.17) when confronted with selfish behavior, and 5.41 (SD ± 2.30) when confronted with altruistic behavior. In the distancing condition they felt their emotions changed with a strength of 4.59 (SD ± 2.30) when confronted with selfish behavior, and 4.22 (SD ± 2.24) when confronted with altruistic behavior. Emotional ratings when applying the two strategies to both fair (€5) and unfair (€1) offers entered an ANOVA. Analysis returned a significant main effect of strategy [$F(1, 21) = 6.34$, $p < 0.05$], however the effect of offer failed to reach significance [$F(1, 21) = 0.245$, $p = 0.626$], as well as the interaction [$F(1, 21) = 0.122$, $p = 0.731$]. Importantly, the mentalizing strategy had a significantly stronger effect as compared with distancing for altruistic behavior [$t(1, 21) = -2.5$, $p < 0.05$], but failed to reach significance for selfish behavior [$t(1, 21) = -1.617$, $p = 0.121$]. See **Figure 3C**.

Table 1 | Experiment 1: results from the experiment and from the questionnaires.

Experiment ratings

	Regulation of valence		
	Look	**Mentalizing**	**Distancing**
€1	2.27 (1.19)	4.72 (1.75)*	2.92 (1.51)
€2	3.04 (1.29)	5.21 (1.58)*	3.29 (1.38)
€3	3.81 (1.37)	5.37 (1.60)*	3.75 (1.27)
€4	5.45 (1.77)	6.22 (1.72)	4.72 (1.49)
€5	6.76 (2.15)	7.35 (1.94)	5.68 (1.70)*
Effect size of valence		+1.51*	−0.19*

	Regulation of arousal		
	Look	**Mentalizing**	**Distancing**
€1	4.89 (2.48)	5.78 (1.98)	4.70 (2.78)
€2	4.72 (2.12)	5.57 (1.84)	4.25 (2.23)
€3	4.71 (1.89)	5.54 (1.75)	4.21 (1.99)
€4	5.30 (2.01)	5.96 (1.97)	4.43 (2.08)
€5	6.02 (2.31)	6.38 (2.11)	4.82 (2.22)
Effect size of arousal		+0.8*	−0.51*

Questionnaires

1€ Offer		**5€ Offer**	
Anger	5.45 (2.80)	Anger	1.45 (0.91)
Disgust	5.04 (2.53)	Disgust	1.77 (1.19)
Surprise	4.54 (2.38)	Surprise	5.90 (2.18)**
Happiness	2.22 (1.65)**	Happiness	7.09 (1.63)**
Sadness	5.09 (2.58)	Sadness	1.72 (1.24)
Disappointment	6.27 (2.31)	Disappointment	1.5 (0.74)

**Indicates a significant difference.*

***Indicates a significant difference from the other emotions inside every offer.*

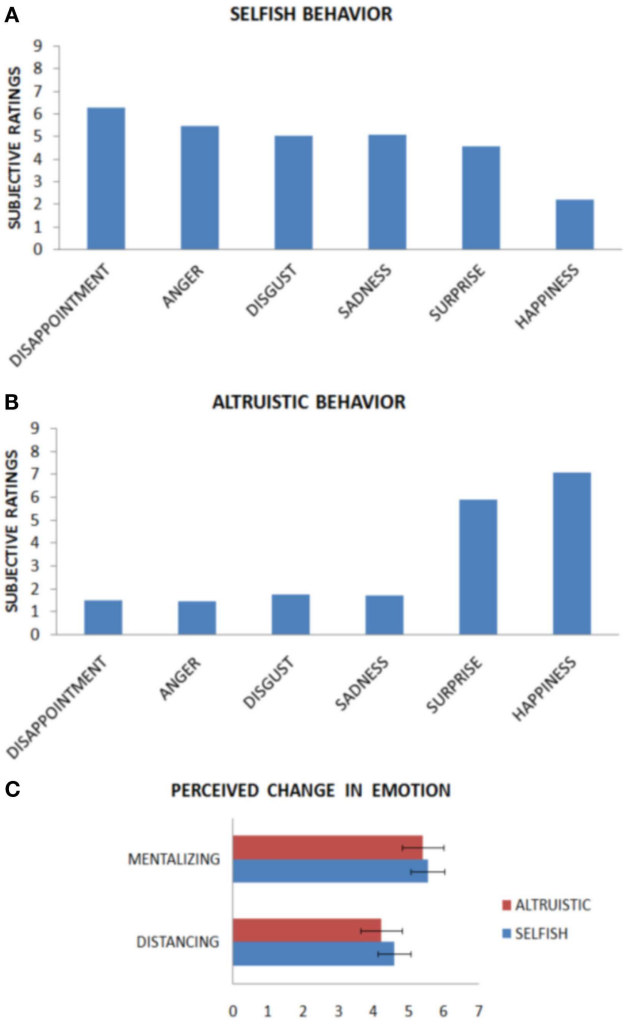


FIGURE 3 | Results from questionnaires after Experiment 1 are presented. Subjective ratings when observing a selfish behavior **(A)** and an altruistic behavior **(B)** indicate that emotion regulation involved specific emotions. Moreover, subjects experienced large changes in their emotions when applying the strategies **(C)**, with mentalizing being superior to distancing.

DISCUSSION

The aim of this first experiment was twofold. Firstly, we wanted to test whether emotion regulation can be applied in an interpersonal context to complex social emotions, as opposed to the simple visual stimuli used in previous studies. Secondly, we examined whether two different emotion regulation strategies, mentalizing and distancing, can affect emotion perception in an interactive context in which people observed selfish and altruistic behavior regarding the splitting of a pot of money. Our data demonstrate that interpersonal emotion regulation is possible, and indeed strongly affects our perception of both selfish and altruistic behaviors. Importantly, mentalizing (e.g., reinterpretation of the intentions of the players in a way to make them less negative) increased the valence (more positive) of selfish economic offers (in the range of €1–€3 out of 10). Conversely, distancing (e.g., considering events with a detached perspective) did not affect the negative emotions elicited by selfish offers, but paradoxically decreased the valence of emotions elicited by the altruistic offer of €5. Questionnaires confirmed this observation, and suggested that the emotion regulated by the strategies was disappointment (higher values) but also other unpleasant emotions when treated selfishly, and happiness and surprise when treated altruistically. Interestingly, analyses on arousal revealed that mentalizing not only increased the valence of the offers leading recipients to consider them as more positive, but also increased the arousal associated with them (size effect of valence of **Figure 2**). This result may be in apparent contradiction with a previous experiment (Grecucci et al., 2012), in which authors found that arousal decreased when reappraising IAPS pictures. However, the stimuli used in this other study were very unpleasant, and even when reappraised they remained quite negative images, whereas in the DG subjects changed the valence of selfish proposals, actually considering them as more positive (SAM

valence ratings were on the positive range, from 5 to 9 points, except for €1 euro offers).

On the contrary, distancing failed to increase the valence for negative emotions (elicited by selfish proposals), but also decreased the valence of positive emotions elicited by altruistic proposals (offer 5€). In other words, recipients failed to alter the meaning of the proposals. Notably this also affected arousal, but this time decreasing the strength of emotions (size effect of arousal – **Figure 2**), as they were perceived as still unpleasant (contrary to mentalized trials). Last but not least, the perceived change of emotional strength was stronger when using mentalizing than when using distancing, indicating that mentalizing is a more powerful way to regulate one's emotions.

EXPERIMENT 2

The aim of Experiment 2 was to test whether emotion regulation is different when applied in social and non-social situations. Participants played the Dictator Game, but with both human (in a similar fashion to Experiment 1) and computer partners. Participants were trained to apply reappraisal when facing human and computer partners. The strategy was the same (cognitive reinterpretation of the event in a way to make it less negative) but with a focus on the intentions in case of a human partner, and a focus on situation when the partner was a computer. We predicted both strategies are effective in altering the emotional experience. However, we expected a stronger effect for interpersonal regulation (greater differences between human and computer in reappraisal condition than in look condition).

METHODS

Participants

Twenty-four participants (10 males) from the local population participated in the study, with a mean age of 22.91 years (SD ± 4.77). The local ethics committee approved the study and all participants provided written informed consent after the procedures had been fully explained.

Dictator game

The Dictator Game as described above was used, with the only difference that a computer image was presented in the computer condition instead of a face. Participants were told that proposals in the computer condition were randomly generated. Again, each round involved receiving monetary proposals, with each trial dividing 10€. The offers included four repetitions of five possible offers (1€, 2€, 3€, 4€, and 5€ out of 10€), for 20 offers for each of the four conditions (Look vs. Reappraisal, Human vs. Computer), for a total of 80 trials. Type of offers and partners (Computer vs. Human) were completely randomized inside each block, whereas the strategies were separated into two blocks. To encourage engagement in the task it was emphasized that they would be paid a percentage of what they received during the game. Again participants rated their emotions separately on two scales (arousal and valence).

Emotion regulation instructions

Before beginning the game, participants were told that they would use a specific cognitive strategy upon receipt of any offer. A written protocol describing reappraisal was provided, very similar to that of Experiment 1, with the exception that the distancing strategy was omitted and also that examples were given as to how to apply reappraisal in both contexts (human vs. computer). To apply reappraisal to a human partner they were asked to focus on the mind of the player, building an interpretation of the intentions behind their behavior. This reinterpretation of their intentions was meant to be less negative. Some examples were then given ("*he is not that stingy, probably does not have so much money to give me*," "*this is the best he can do*"). To apply reappraisal to a computer partner (non-social regulation) they were asked to focus on the situation, building an interpretation of the event. This reinterpretation was meant to be less negative. Some examples were then given ("*what bad luck*," "*next time will be better*"). Finally, for the "look" condition, they were to simply allow themselves to respond naturally without any effort of interpretation.

Before beginning the first block of DG, we verified that participants understood the respective emotion regulation instructions by requiring them to verbalize what they would do when confronted with different offers. A practice session proceeded every block.

Questionnaires

At the conclusion of the experiment, participants were asked to rate their emotional state when they received the prototypical example of a very unfair (€1 out of €10), and fair offer (€5 out of €10) separately for computer and human partners. Moreover, we asked the strength of perceived emotions when receiving the unfair offer for all conditions (Human vs. Computer, Look vs. Reappraisal). To check for differences on perceived effect of reappraisal between the human and computer partners, at the end of the experiment we asked for ratings on a 9-point Likert scale as to how much they felt their emotion change, for both interacting with a human and with a computer partner. An example of the precise strategies adopted during the experiment was also recorded for every participant (for both strategies) after the experiment.

Additionally, participants completed the Interpersonal Reactivity Index (IRI, Davis, 1980), to test for their ability to take others' perspective and empathic abilities, and the Emotion Regulation Questionnaire (ERQ, Gross and John, 2003) as a measure of the frequency of reappraisal usage in daily life.

RESULTS

Emotion ratings in the dictator game

We first examined if the affective ratings were different across regulation strategies. We computed two separate ANOVAs, one for valence and one for arousal each with reappraisal Strategies (reappraisal vs. look), Partner (human vs. computer), and Offer type (1€, 2€, 3€, 4€, and 5€) as factors. Analysis on valence returned a significant main effect of Strategy [$F(1, 23) = 39.724$, $p < 0.0001$], of Partner [$F(4, 84) = 12.363$, $p < 0.005$], and of Offers [$F(4, 92) = 122.299$, $p < 0.0001$], as well as a significant Partner × Strategy interaction [$F(1, 23) = 4.357$, $p < 0.05$], Partners × Offers [$F(4, 92) = 2.792$, $p < 0.05$], and Strategy × Offers [$F(4, 92) = 5.390$, $p < 0.001$]. However, the triple interaction was not significant [$F(4, 92) = 0.101$, $p = 0.982$]. Next, we ran Bonferroni-corrected *post hoc* tests with participants' subjective

ratings as dependent variables, comparing between human and computer partner to explore the above 2-way interactions.

Partner × Strategy contrasts were all significant (computer-look vs. human-look, computer-reappraisal vs. human-reappraisal; computer-look vs. human-reappraisal, computer-reappraisal vs. human-look, $p < 0.05$). Partner × Offer contrast showed significant effects for 4€, and 5€ offers ($p < 0.05$). Strategy × Offer contrasts were all significant (look 1€ vs. reappraising 1€; look 2€ vs. reappraising 2€; look 3€ vs. reappraising 3€; look 4€ vs. reappraising 4€; look 5€ vs. reappraising 5€). These analyses clarified that the strategies affected the valence ratings in different ways when interacting with either a human or a computer partner. Reappraisal had a stronger effect for human partners than for computer partners, whereas in the look condition there was little difference between human partners and computer partners. Moreover, an effect of specific offers made by human and computer partners was visible, being fair offers made by humans perceived as more positive than when made by computers. Last but not least, reappraised offers were rated as more positive than offers simply attended to (see **Figure 4**), however the strongest effect of reappraisal was found for selfish offers.

Then, we computed ANOVA on arousal that returned a significant main effect of Partner [$F(4, 84) = 22.275$, $p < 0.0001$], and of Offer [$F(4, 92) = 4.502$, $p < 0.005$], but not of Strategy [$F(1, 23) = 2.714$, $p = 0.113$]. Moreover, there was an interaction between Strategy × Offer [$F(4, 92) = 3.617$, $p < 0.01$], but not of Partner × Strategy [$F(1, 23) = 0.141$, $p = 0.711$], nor Partner × Offer [$F(4, 92) = 1.835$, $p = 0.129$]. The same applied for the triple interaction [$F(4, 92) = 0.741$, $p = 0.566$]. To explore the Strategy × Offer interaction, we ran Bonferroni-corrected *post hoc* tests on arousal ratings between strategies, for every offer. These returned a significant difference for the most fair offer (€5: $p < 0.05$). In other words, arousal was stronger when the €5 offer was reappraised rather than when it was simply attended to. See **Figure 5**.

To test the hypothesis of a stronger effect of reappraisal in changing the perceived valence for human as compared to computer offers, we computed the effect size of valence change separately for each condition. This measure was calculated as the difference between perceived valence when attending a human vs. a computer on one hand, and when reappraising a human vs. a computer on the other. We predict larger differences when applying the reappraisal strategy than when simply looking at different partners. While the difference in the look condition between playing with a computer compared with a human was 1.11 points, the difference between partners in the reappraisal condition was of 2.53 points, meaning that reappraisal doubled the difference between playing with a human or with a computer (see **Figure 4** and **Table 2**).

Questionnaires

Subjective ratings when receiving the most fair (€5) and unfair (€1) offers were entered into an ANOVA for each of the six

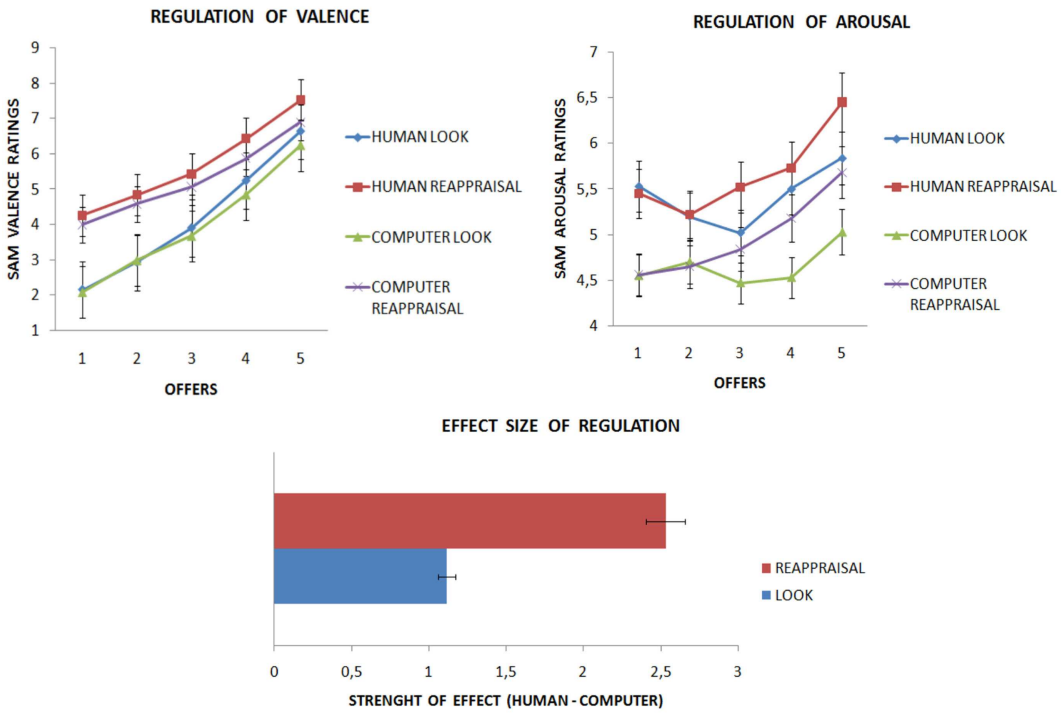


FIGURE 4 | Results from Experiment 2 are presented. (Upper part) Subjects were successful in regulating when both interacting with human and computer partners. However, reappraisal was stronger for human than computer partner. Analyses on arousal returned an effect of strategy on offers, according to which only the altruistic offer €5 was perceived in the reappraisal condition stronger than the look condition (independently from partner). (Lower part) Valence change was larger when interacting with human relative to computer partners.

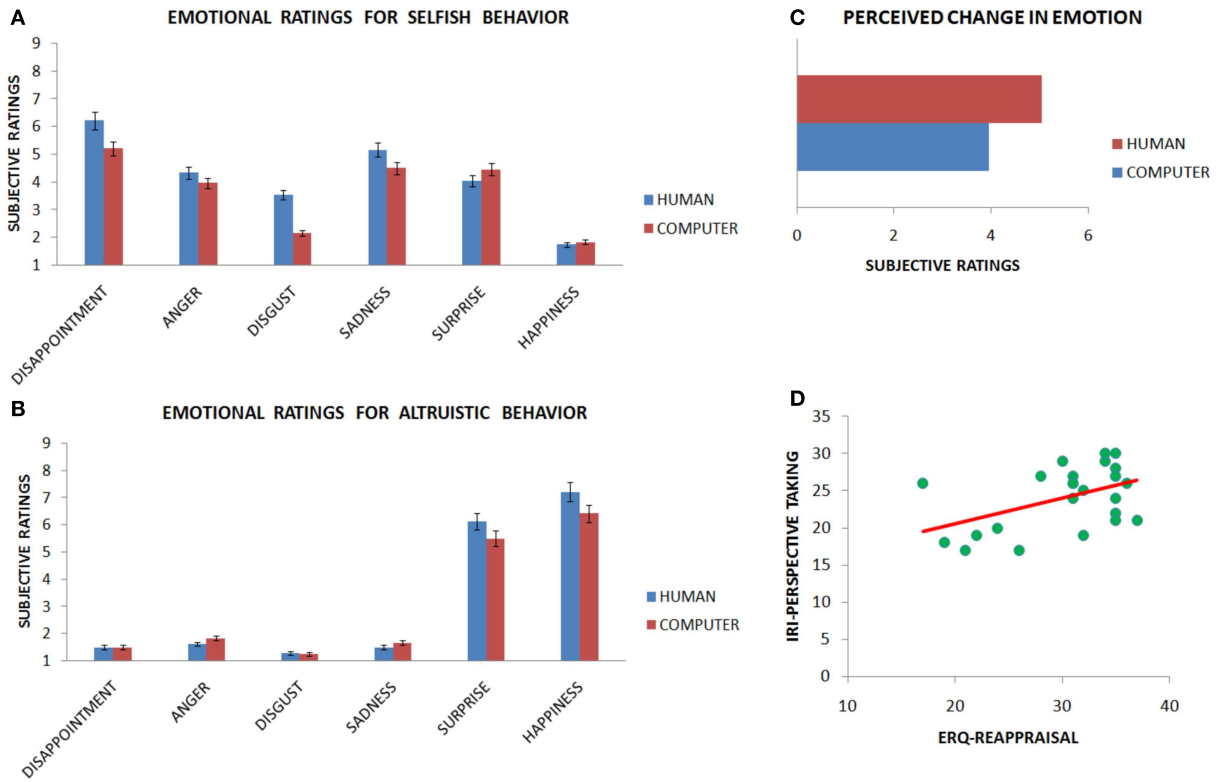


FIGURE 5 | Questionnaires after Experiment 2 is presented. Subjects were more disappointed and disgusted when observing a selfish behavior (1€ offer) from human rather than computer partners **(A)**. When receiving altruistic offer (5€ offer) subjects were happier when the donator was a human partner **(B)**. Subjects perceived a change in the strength of emotions when applying the strategies with both partners. However the human condition showed larger effects **(C)**. Lastly, a correlation was observed between the ability to take the perspective of others (IRI questionnaire) and the ability to apply reappraisal **(D)**.

queried emotions (anger, disgust, surprise, sadness, happiness, and disappointment) for both human and computer partners. Analyses returned a significant main effect of Partner [$F(1, 23) = 4.385$, $p < 0.05$], of Offer [$F(1, 23) = 16.314$, $p < 0.001$], and of Emotion [$F(1, 23) = 24.356$, $p < 0.0001$], as well as a significant Offer × Emotion interaction [$F(5, 115) = 101.034$, $p < 0.0001$], and the triple interaction [$F(5, 115) = 3.856$, $p < 0.005$].

Next, we ran Fisher-corrected *post hoc* tests with participants' subjective ratings as dependent variables to compare between human and computer partners for each emotion and every offer. For the selfish unfair offers, disgust, and disappointment elicited when playing with a human were stronger than when playing with a computer partner ($p < 0.05$, respectively: score = 3.54 vs. 2.16, score = 6.2 vs. 5.2). The other emotions were not statistically significant (all $p > 0.05$).

For the altruistic fair offers, only happiness was stronger for human than computer partners ($p < 0.05$, score = 7.21 vs. 6.41). The other emotions were not statistically significant (all $p > 0.05$). See **Figures 5A,B** and **Table 2**. Participants felt their emotions change more strongly when interacting with a human rather a computer partner [respectively, 5.04 and 3.95, $t(1, 23) = -3.137$, $p < 0.005$]. See **Figure 5C**.

Analysis of questionnaires revealed a positive correlation between the reported frequency of reappraisal usage in daily life (ERQ-reappraisal subscale) and the ability to take the psychological point of view of others (IRI-perspective taking subscale; rho = 0.471, $p < 0.01$). See **Figure 5D**.

DISCUSSION

The aim of this study was to test for differences in the regulation of emotions stemming from interaction with human and non-human partners respectively. Results indicated that even though reappraisal can be successfully applied to both contexts, participants showed a stronger effect on their perceived valence when playing with a human partner. Therefore, it seems that reappraisal leads participants to change the valence of their emotions to make them more positive for selfish offers, but also stronger and more vivid for fair offers. Moreover, emotional ratings indicated that on one hand, participants were more disappointed and disgusted when recipients of selfish behavior from human rather than computer partners, however when receiving altruistic offers participants were happier when the Allocator was a human partner.

Last but not least, there was a positive correlation between IRI and ERQ questionnaires, indicating that the ability to take

Table 2 | Experiment 2-results from the experiment and from the questionnaires.

Experiment ratings

	Valence ratings			
	Computer-look	**Computer-reappraisal**	**Human-look^**	**Human-reappraisal^**
€1*	2.11 (1.17)	4.06 (1.41)	2.36 (1.18)	4.55 (1.50)
€2*	3.02 (1.29)	4,77 (1.53)	3.06 (1.35)	5.01 (1.25)
€3*	3.67 (1.19)	5.05 (1.17)	3.94 (1.24)	5.48 (1.48)
€4*§	4.86 (1.11)	5.77 (1.26)	5.25 (1.22)	6.44 (1.15)
€5*§	6.26 (1.30)	6.71 (1.51)	6.56 (1.16)	7.39 (1.37)
	Arousal ratings			
	Computer-look	**Computer-reappraisal**	**Human-look**	**Human-reappraisal**
€1	4.60 (2.11)	4.65 (1.79)	5.43 (2.16)	5.76 (1.74)
€2	4.76 (1.69)	4.69 (1.53)	5.07 (1.72)	5.43 (1.80)
€3	4.53 (1.46)	4.94 (1.58)	5.07 (1.68)	5.72 (1.92)
€4	4.55 (1.57)	5.06 (1.77)	5.55 (1.48)	5.69 (1.91)
€5§	4.97 (1.75)	5.43 (2.01)	5.81 (1.66)	6.14 (2.20)

Questionnaires

	Offer 1€		**Offer 5€**	
	Human	**Computer**	**Human**	**Computer**
Disappointment	6.20 (2.22)**	5.20 (2.37)	1.5 (0.78)	1.5 (1.02)
Anger	4.33 (2.07)	3.95 (2.29)	1.62 (1.34)	1.83 (1.40)
Disgust	3.54 (2.26)**	2.16 (1.85)	1.29 (0.85)	1.25 (0.67)
Sadness	5.16 (1.97)	4.5 (2.53)	1.5 (0.83)	1.66 (0.81)
Surprise	4.04 (2.42)	4.45 (2.35)	6.12 (2.13)	5.5 (2.39)
Happiness	1.75 (1.18)	1.83 (1.01)	7.20 (1.35)**	6.41 (2.18)

**Indicates a significant difference at the level of Strategy × Offer interaction.*

^ Indicates a significant difference at the level of Partner × Strategy interaction.

§ Indicates a significant difference at the level of Partner × Offer interaction.

***Indicates a significant difference between partners inside every offer.*

the psychological point of view of others and emotion regulation abilities are related. Indeed, the IRI (perspective taking subscale) addresses one's tendency to take another's point of view, akin to "theory of mind" (Davis, 1983; Frías-Navarro, 2009). This ability is essential when reappraising the intentions of the other players (mentalizing).

GENERAL DISCUSSION

Our ability to regulate emotions when interacting with others is considered to be a crucial dimension of both emotional intelligence (Mayer and Salovey, 1997; Lopes et al., 2011), and of good mental health (Gross, 2002; van'tWout et al., 2010). Despite the extensive literature on emotion "self regulation" (see Ochsner and Gross, 2008), evidence of emotion regulation in social interactive situations is still poorly understood. In the present study, we examined whether emotion regulation strategies can be successfully applied to socially driven emotions. This is especially important when considering that emotion regulation typically occurs in social contexts (Rottenberg et al., 2005). Previous research has demonstrated that emotion regulation strategies based on the reinterpretation of an event as less negative are powerful tools to allow us to reduce the subjective experience toward emotional unpleasant pictures. However, few attempts have been made to extend these findings to the domain of interpersonal emotions. To elicit these kind of emotions we exposed participants to altruistic and selfish behaviors while playing the Dictator Game as Recipients (Kahneman et al., 1986). Prior to both experiments, participants were trained to apply different forms of reappraisal strategies (mentalizing vs. distancing in Experiment 1), and toward human and non-human partners (Experiment 2).

Firstly, our data demonstrate that emotion regulation can be successfully applied to socially driven emotions. Across both experiments participants reported an increase in valence (that is, less unpleasant emotions) when reappraising the intentions behind both selfish and altruistic behavior. More importantly, Experiment 1 showed that not all emotion regulation strategies are equally

good at altering our emotional responses. While mentalizing-based reappraisal (defined as the "*reinterpretation of the intentions of the player in a way to make them less negative*," Grecucci et al., 2012) was effective in increasing the valence of the emotions experienced, distancing-based reappraisal ("*putting oneself in a detached perspective*") was not. Paradoxically, avoiding emotions (as a consequence of a distancing strategy), not only failed to decrease the unpleasantness of experienced emotions when treated selfishly, but interestingly also decreased the pleasantness of emotions elicited by altruistic behaviors. Because psychiatric disorders are largely characterized by excessive negative emotions (Werner and Gross, 2010), this strategy may therefore lead to emotional disturbance rather than emotional relief.

Experiment 2 tested whether reappraisal can also be used when the emotion elicited comes from a non-human partner. This is important to appreciate differences in emotional regulation when applied to social and non-social contexts. Even though both conditions showed a modulation of emotional valence when receiving selfish proposals, there was a difference of partner type. Valence change was stronger when participants regulated their emotions in response to human offers. In fact, when comparing human and computer in the baseline condition, this difference was doubled in the reappraisal condition. Arousal analyses showed interesting differences in increasing the strength of vividness of experienced emotions when they were associated with an altruistic behavior.

Both experiments showed interesting results regarding the perception of the strength of the emotional experience, i.e., arousal. When using reappraisal based on cognitive reinterpretation, both experiments showed that once unpleasant (and at a lesser extent also positive) emotions are changed in terms of their valence (perceived as less unpleasant) arousal is increased (evident for €5 offer in experiment 2), meaning that emotion regulation strategies that are effective in reframing the events in a more positive way let us experience our emotions more vividly. In contrast, Experiment 1 showed that distancing-based reappraisal did not change the experienced emotion (unpleasant emotions in response to selfish offers are still perceived as unpleasant, and pleasant emotions in response to fair offers are even less pleasant). One conclusion is therefore that not all strategies are effective to the same extent in regulating our emotions. Even though distancing may mitigate individuals' experience of their emotions by avoiding them, in the long run it can lead individuals to progressively detach from others and from situations. This in turn may lead to anhedonia and isolation as shown by many psychiatric disorders (Leising et al., 2006; Ballon et al., 2007; Gunderson, 2007). By definition, emotion regulation is maladaptive "*when it does not change the emotional response in the desired way (e.g., decrease negative affect) or when the long term costs (decreased work, social functioning, vitality) outweigh the benefits of short-term changes in emotion (relief, temporary decrease in anxiety)*" (cfr. Werner and Gross, 2010). From our results, distancing may have a temporary relieving effect by decreasing arousal, but at the cost of not changing or even increasing their unpleasantness.

Psychological studies have shown that cognitive reappraisal is one of the most flexible and adaptive strategies for regulating negative emotions (Gross, 2002). The present study confirms previous findings, but also extends these results into the domain of interpersonal emotion regulation. In particular, Grecucci et al. (2012) proposed a variation of reappraisal, called mentalizing-reappraisal that merges previous work on the importance of building a mental representation of others' minds (Frith and Frith, 2003), and its effect on the regulation of the interpreter's emotional state (Fonagy, 2006). In practical situations, mentalizing strategies are commonly implemented in psychological treatment of anxiety disorders, borderline personality disorders, eating disorders, and childhood problems (Clarkin et al., 2006; Fonagy, 2006; Bateman and Fonagy, 2011; Lemma et al., 2011).

The present experiment also extends previous findings on decision-making. Broadly speaking, emotion regulation strategies applied to decision-making have one notable advantage as compared to basic emotion regulation studies: they have the opportunity to study complex emotions that cannot be elicited in simple visual stimuli tasks. Emotions elicited by the outcome of our decisions are of a qualitatively different nature than those experienced while simply watching disturbing images, and so it was an open question whether these strategies can be effective in regulating such emotions and influencing decision behavior in real-life. In everyday life we are typically confronted with a variety of emotions directly induced by decisions, by the evaluation of risks and possible losses, and last but not least by social interactions, and emotion regulation seems particularly useful in such contexts. Therefore, investigating whether emotion regulation strategies can have an effect in decision-making contexts has the opportunity to extend emotion regulation research beyond affective responses to simple emotional pictures into more complex scenarios. Social norms, such as fairness, equality, and cooperation, play a fundamental role in societies (Deutsch, 1975; Coleman, 1990), with these norms influencing not only our decisions when balancing self-interest with others' interest, but also our perception of the decisions of others that affect us. Indeed, people tend to select the most cooperative individuals, and those who contribute less than others are generally left out of social exchanges (Barclay, 2004; Coricelli et al., 2004; Barclay and Willer, 2007; Cornelissen et al., 2011). Using the Recipient role of the Dictator Game permits exploration of how we react to social norm violations. In both experiments we were able to show that when receiving selfish offers participants reacted to them with unpleasant emotions, linearly increasing with the unfairness of the monetary offer. The detection of violations from social norms (Montague and Lohrenz, 2007) may be of great importance for future interactions with and eventual punishment of self-interested individuals. This is shown by the comparison between human and computer partners' offers, where fair offers are perceived as more pleasant when the partner was a human, whereas unfair offers elicited more negative emotions.

On the same line, when reappraising, the identity of the player matters: we are more prone to "excuse" the selfishness of a human rather than a non-human donor. The justification of occasional violations of social norms may be functional in keeping cooperation high between individuals belonging to the same group.

In recent years, progress in understanding the neural mechanisms of emotional regulation has used functional imaging to identify the neural signatures of regulation (Ochsner and Gross, 2005). The neural bases of different strategies have been outlined,

as well as how these processes act on target regions responsible for the specific emotion involved. For example, imaging studies have shown that reappraisal activates systems appearing to modulate activity in neural systems associated with emotional responding, such as the amygdala (Beauregard et al., 2001; Ochsner et al., 2002, 2004; Levesque et al., 2003; Kalisch et al., 2005; Ochsner and Gross, 2005; Phan et al., 2005; Urry et al., 2006; Banks et al., 2007; Kim and Hamann, 2007). However, the role of emotion regulation for socially driven emotions remains quite poorly explored. Just two studies have explored the neural mechanisms behind social emotion regulation (Koenigsberg et al., 2011; Grecucci et al., 2012). However, these studies used pictures with social content but not emotions stemming from real social situations (Koenigsberg et al., 2011), or the effect of emotion regulation was observed indirectly (Grecucci et al., 2012). Future experiments based on the paradigm developed in this study can be fruitfully transferred to neuroimaging experiments to uncover the brain bases of the regulation of socially driven emotions, or more importantly try to use physiological measure of emotion regulation such as galvanic skin responses to test for implicit indexes of emotion regulation abilities. These implicit measures do not suffer from the expectations participants develop following the instructions and thus can be more reliable then subjective ratings.

In conclusion, we investigated the effect of reappraisal based emotion regulation strategies, and further looked at the effects of playing with a human or a non-human (computer) partner. We believe these results are important as they shed light on two points: the possibility of regulating socially driven emotions on one hand, and the effect of different strategies themselves on the other. Our results show that emotional reappraisal specifically influences emotions stemming from the interaction with altruistic and selfish proposers. Both emotions elicited by altruistic and selfish offers showed an effect of regulation for the two main dimensions of emotional experience: valence and arousal. These results extend previous findings on this topic and hold the promise of shedding light on the understanding of interpersonal problems shown by psychiatric populations due to poor emotion regulation (Werner and Gross, 2010).

ACKNOWLEDGMENTS

This research was supported by a Provincia Autonoma di Trento (PAT) Researcher Grant to Alan G. Sanfey. We would like to thank Sara Lorandini for her help during the acquisition of the data.

REFERENCES

Ballon, J. S., Kaur, T., Marks, I. I., and Cadenhead, K. S. (2007). Social functioning in young people at risk for schizophrenia. *Psychiatry Res.* 151, 29–35.

Banks, S. J., Eddy, K. T., Angstadt, M., Nathan, P. J., and Phan, K. L. (2007). Amygdala frontal connectivity during emotion regulation. *Soc. Cogn. Affect. Neurosci.* 2, 303–312.

Barclay, P. (2004). Trustworthiness and competitive altruism can also solve the "tragedy of the commons." *Evol. Hum. Behav.* 25, 209–220.

Barclay, P., and Willer, R. (2007). Partner choice creates competitive altruism in humans. *Proc. Biol. Sci.* 274, 749–753.

Bateman, A. W., and Fonagy, P. (2011). "Borderline personality disorder," in *Handbook of Mentalizing in Mental Health Practice*, eds A. W. Bateman and P. Fonagy (Arlington: Amer Psychiatric Pub), 273–288.

Beauregard, M., Levesque, J., and Bourgouin, P. (2001). Neural correlates of conscious self-regulation of emotion. *J. Neurosci.* 21, RC165.

Clarkin, J. F., Yeomans, F. E., and Kernberg, O. F. (2006). *Psychotherapy for Borderline Personality. Focusing on Object Relations.* Washington, DC: American Psychiatric Press.

Coleman, J. S. (1990). *Foundations of Social Theory*. Cambridge, MA: Harvard University Press.

Coricelli, G., Fehr, E., and Fellner, G. (2004). Partner selection in public goods experiments. *J. Conflict Resolut.* 48, 356–378.

Cornelissen, G., Dewitte, S., and Warlop, L. (2011). Are social value orientations expressed automatically? Decision making in the dictator game. *Pers. Soc. Psychol. Bull.* 37, 1–11.

Davis, M. H. (1980). A multidimensional approach to individual differences in empathy. *JSAS Catalog Sel. Doc. Psychol.* 10, 85.

Davis, M. H. (1983). Measuring individual differences in empathy: evidence for a multidimensional approach. *J. Pers. Soc. Psychol.* 44, 113–126.

Deutsch, M. (1975). Equity, equality, and need: what determines which value will be used as the basis of distributive justice? *J. Soc. Issues* 31, 131–149.

Eippert, F., Veit, R., Weiskopf, N., Erb, M., Birbaumer, N., and Anders, S. (2007). Regulation of emotional responses elicited by threat-related stimuli. *Hum. Brain Mapp.* 28, 409–423.

Evans, S., Fleming, S. M., Dolan, R. J., and Averbeck, B. B. (2011). Effects of emotional preferences on value-based decision-making are mediated by mentalizing not reward networks. *J. Cogn. Neurosci.* 23, 2197–2210.

Fehr, E., and Gächter, S. (2002). Altruistic punishment in humans. *Nature* 415, 137–140.

Fonagy, P. (2006). "The mentalization-focused approach to social development," in *Handbook of Mentalization-Based Treatment*, eds J. G. Allen, P. Fonagy (Chichester: John Wiley & Sons Ltd), 53–100.

Frías-Navarro, D. (2009). *Davis' Interpersonal Reactivity Index (IRI).* Valencia: Valencia Universidad de Valencia. [Manuscript not published].

Frith, U., and Frith, C. D. (2003). Development and neurophysiology of mentalizing. *Philos. Trans. R. Soc. Lond. B Biol. Sci.* 358, 459–473.

Frith, U., Morton, J., and Leslie, A. M. (1991). The cognitive basis of a biological disorder-autism. *Trends Neurosci.* 14, 433–438.

Grecucci, A., Giorgetta, C., Van'tWout, M., Bonini, N., and Sanfey, A. G. (2012). Reappraising the ultimatum: an fMRI study of emotion regulation and decision making. *Cereb. Cortex.* [Epub ahead of print].

Gross, J. J. (1998). The emerging field of emotion regulation: an integrative review. *Rev. Gen. Psychol.* 2, 271–299.

Gross, J. J. (1999). Emotion regulation: past, present, future. *Cogn. Emot.* 13, 551–573.

Gross, J. J. (2002). Emotion regulation: affective, cognitive, and social consequences. *Psychophysiology* 39, 281–291.

Gross, J. J., and John, O. P. (2003). Individual differences in two emotion regulation processes: implications for affect, relationships, and well-being. *J. Pers. Soc. Psychol.* 85, 348–362.

Gunderson, J. G. (2007). Disturbed relationships as a phenotype for borderline personality disorder. *Am. J. Psychiatry* 164, 1637–1640.

Guth, W., Schmittberger, R., and Schwarz, B. (1982). An experimental analysis of ultimatum bargaining. *J. Econ. Behav. Organ.* 3, 376–388.

Kahneman, D., Knetsch, J. L., and Thaler, R. H. (1986). Fairness and the assumptions of economics. *J. Business* 59, 285–300.

Kalisch, R., Wiech, K., Critchley, H. D., Seymour, B., O'Doherty, J. P., Oakley, D. A., et al. (2005). Anxiety reduction through detachment: subjective, physiological, and neural effects. *J. Cogn. Neurosci.* 17, 874–883.

Kim, S. H., and Hamann, S. (2007). Neural correlates of positive and negative emotion regulation. *J. Cogn. Neurosci.* 19, 776–798

Koenigsberg, H. W., Fan, J., Ochsner, K. N., Liu, X., Guise, K., Pizzarello, S., et al. (2011). Neural correlates of using distancing to regulate emotional responses to social situations. *Neuropsychologia* 48, 1813–1822.

Lang, P. J. (1994). Measuring emotion: the self-assessment manikin and the semantic differential. *J. Behav. Ther. Exp. Psychiatry* 25, 49–59.

Lang, P. J., and Bradley, M. M. (2010). Emotion and the motivational brain. *Biol. Psychol.* 84, 437–450.

Leising, D., Sporberg, D., and Rehbein, D. (2006). Characteristic interpersonal behavior in dependent and avoidant personality disorder can be observed within very short interaction sequences. *J. Pers. Disord.* 20, 319–330.

Lemma, A., Target, M., and Fonagy, P. (2011). *Brief Dynamic Interpersonal Therapy: A Clinician's Guide*. Oxford University Press.

Levesque, J., Eugene, F., Joanette, Y., Paquette, V., Mensour, B., Beaudoin, G., et al. (2003). Neural circuitry underlying voluntary suppression of sadness. *Biol. Psychiatry* 53, 502–510.

Lopes, P. N., Nezlek, J. B., Extremera, N., Hertel, J., Fernandez-Berrocal, P., Schutz, A., et al. (2011). Emotion regulation and the quality of social interaction: does the ability to evaluate emotional situations and identify effective responses matter? *J. Pers.* 79, 429–467.

Mayer, J. D., and Salovey, P. (1997). "What is emotional intelligence?" in *Emotional Development and Emotional Intelligence: Educational Implications*, eds P. Salovey and D. J. Sluyter (New York: Basic Books), 3–31.

Montague, P. R., and Lohrenz, T. (2007). To detect and correct: norm violations and their enforcement. *Neuron* 56, 14–18.

Myerson, R. B. (1997). *Game Theory: Analysis of Conflict. P. 1*. Harvard University Press.

Ochsner, K. N., Bunge, S. A., Gross, J. J., and Gabrieli, J. D. (2002). Rethinking feelings: an fMRI study of the cognitive regulation of emotion. *J. Cogn. Neurosci.* 14, 1215–1229.

Ochsner, K. N., and Gross, J. J. (2005). The cognitive control of emotion. *Trends Cogn. Sci. (Regul. Ed.)* 9, 242–249.

Ochsner, K. N., and Gross, J. J. (2008). Cognitive emotion regulation: insights from social cognitive and affective neuroscience. *Curr. Dir. Psychol. Sci.* 17, 153–158.

Ochsner, K. N., Ray, R. D., Cooper, J. C., Robertson, E. R., Chopra, S., Gabrieli, J. D., et al. (2004). For better or for worse: neural systems supporting the cognitive down- and up-regulation of negative emotion. *Neuroimage* 23, 483–499.

Phan, K. L., Fitzgerald, D. A., Nathan, P. J., Moore, G. J., Uhde, T. W., and Tancer, M. E. (2005). Neural substrates for voluntary suppression of negative affect: a functional magnetic resonance imaging study. *Biol. Psychiatry* 57, 210–219.

Phillips, M. L., Drevets, W. C., Rauch, S. L., and Lane, R. (2003). Neurobiology of emotion perception II: implications for major psychiatric disorders. *Biol. Psychiatry* 54, 515–528.

Rottenberg, J., Gross, J. J., and Gotlib, I. H. (2005). Emotion context insensitivity in major depressive disorder. *J. Abnorm. Psychol.* 114, 627–639.

Sanfey, A. G., and Dorris, M. (2009). "Games in humans and non-human primates: scanners to single unit," in *Neuroeconomics*, eds P. W. Glimcher, C. F. Camerer, E. Fehr, and R. A. Poldrack (London: Elsevier), 63–80.

Sanfey, A. G., Rilling, J. K., Aronson, J. A., Nystrom, L. E., and Cohen, J. D. (2003). The neural basis of economic decision-making in the ultimatum game. *Science* 300, 1755–1758.

Sharp, C., Pane, H., Ha, C., Venta, A., Patel, A. B., Sturek, J., et al. (2011). Theory of mind and emotion regulation difficulties in adolescents with borderline traits. *J. Am. Acad. Child Adolesc. Psychiatry* 50, 563–573.

Urry, H. L., van Reekum, C. M., Johnstone, T., Kalin, N. H., Thurow, M. E., Schaefer, H. S., et al. (2006). Amygdala and ventromedial prefrontal cortex areinversely coupled during regulation of negative affect and predict the diurnalpattern of cortisol secretion among older adults. *J. Neurosci.* 26, 4415–4425.

van'tWout, M., Chang, L. J., and Sanfey, A. G. (2010). The influence of emotion regulation on social interactive decision-making. *Emotion* 10, 815–821.

Vrtickaa, P., Sandera, D., and Vuilleumiera, P. (2011). Effects of emotion regulation strategy on brain responses to the valence and social content of visual scenes. *Neuropsychologia* 49, 1067–1082.

Werner, K., and Gross, J. J. (2010). "Emotion regulation and psychopathology. A conceptual framework," in *Emotion Regulation and Psychopathology: A Transdiagnostic Approach to Etiology and Treatment*, eds A. M. Kring and D. M. Sloan (New York: The Guilford Press), 13–37.

Conflict of Interest Statement: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Received: 31 July 2012; accepted: 22 December 2012; published online: 21 January 2013.

Citation: Grecucci A, Giorgetta C, Bonini N and Sanfey AG (2013) Living emotions, avoiding emotions: behavioral investigation of the regulation of socially driven emotions. Front. Psychology ***3****:616. doi: 10.3389/fpsyg.2012.00616*

This article was submitted to Frontiers in Emotion Science, a specialty of Frontiers in Psychology.

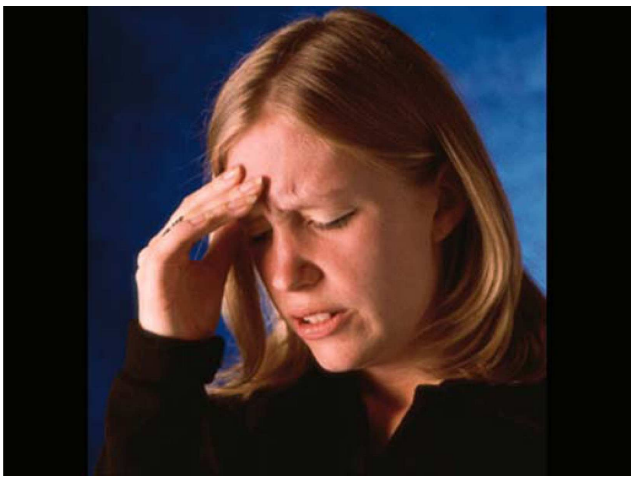
APPENDIX

SIMPLIFIED VERSION OF THE EMOTION REGULATION STRATEGIES

Mentalizing strategy

The way we perceive an event may alter the perception of the event in a way to make it more or less negative.

See for example the following image:



One interpretation can be that this woman is suffering because of the death of a beloved one. Another interpretation is that she is simply tired. Both are plausible interpretations, but the effect of these instructions may be different. The first increases the perceived negativity of the event, the second decreases it. We are asking you to make an effort of reinterpretation of the event in a way to decrease its negativity. . .

Can you generate another example of how to reinterpret that picture as less negative?. . .

Now we will teach you how to apply this strategy to the domain of the Dictator Game.

In the following part of the experiment you are asked to reinterpret the intentions of your partner in a way to consider them as less negative. . .

Subjects were given some examples on how to apply this strategy to DG:

"You can think that this person has no money to give you," "He/she is in troubles," "In another situation he/she may be more generous"

Distancing strategy

Another useful strategy that people can use to decrease the negativity of an event, is to take the distance from it.

See for example the following image:

Such a situation is undoubtedly unpleasant. However, the fact that we are more or less involved in this situation determines how negative we perceive that situation. Someone can think that this situation has great relevance for himself/herself and perceive it as very negative. Someone else may in turn think it does not affect his/her life.

These two ways of thinking, in touch or detached from the situation, alter the way we perceive that situation. . .

Can you generate another example of how to think in a detached way that picture?. . .

Now we will teach you how to apply this strategy to the domain of the Dictator Game.

When asked to apply such a strategy you should put yourself in a detached perspective and think that this situation is not relevant for you.

Subjects were then given some examples on how to apply this strategy to DG:

"This offer won't affect your economic situation," "I don't care of your money," "I don't even know you"

Baseline "look" condition

Look at the offers and make your response in a spontaneous way without applying any strategy.

frontiers in
PSYCHOLOGY

ORIGINAL RESEARCH ARTICLE
published: 26 November 2012
doi: 10.3389/fpsyg.2012.00501

Empathy for pain from adolescence through adulthood: an event-related brain potential study

***Nathalie Mella*[1]*, *Joseph Studer*[1,2,3], *Anne-Laure Gilet*[1,4] *and Gisela Labouvie-Vief*[1]**

[1] *University of Geneva, Geneva, Switzerland*
[2] *Alcohol Treatment Center, Lausanne University Hospital CHUV, Lausanne, Switzerland*
[3] *Division of Old Age Psychiatry, Lausanne University Hospital CHUV, Lausanne, Switzerland*
[4] *Laboratoire de Psychologie des Pays de la Loire (LPPL EA 4638), University of Nantes, Nantes, France*

Edited by:
Vera Shuman, University of Geneva, Switzerland

Reviewed by:
Claus Lamm, University of Vienna, Austria
Shihui Han, Peking University, China

***Correspondence:**
Nathalie Mella, University of Geneva, Boul du Pont d'Arve, 40, 1211 Geneva 4, Switzerland.
e-mail: nathalie.mella-barraco@unige.ch

Affective and cognitive empathy are traditionally differentiated, the affective component being concerned with resonating with another's emotional state, whereas the cognitive component reflects regulation of the resulting distress and understanding of another's mental states (see Decety and Jackson, 2004 for a review). Adolescence is a critical period for the development of cognitive control processes necessary to regulate affective processes: it is only in young adulthood that these control processes achieve maturity (Steinberg, 2005). Thus, one should expect adolescents to show greater automatic empathy than young adults. The present study aimed at exploring the neural correlates of affective (automatic) and cognitive empathy for pain from adolescence to young adulthood. With this aim, Event Related Potentials (ERPs) were recorded in 32 participants (aged 11–39) in a task designed to dissociate these components. ERPs results showed an early automatic fronto-central response to pain (that was not modulated by task demand) and a late parietal response to painful stimuli modulated by attention to pain cues. Adolescents exhibited earlier automatic responses to painful situations than young adults did and showed greater activity in the late cognitive component even when viewing neutral stimuli. Results are discussed in the context of the development of regulatory abilities during adolescence.

Keywords: adolescence, empathy, emotion regulation, pain perception

INTRODUCTION

Empathy is a complex emotion that plays a critical role in promoting successful social relationships (Batson and Shaw, 1991). The ability to empathize is likely to be particularly important during early adolescence when maintaining peer relationships becomes central to well-being. Empathic skills have for example been shown to be involved in the good perception of socially relevant cues to interpret a message (van den Brink et al., 2012). While there have been a great number of studies exploring empathic abilities in adolescents with psychiatric disorders, such as autism (Demurie et al., 2011) or schizophrenia (e.g., Shamay-Tsoory et al., 2007), or in adolescents showing aggressive conduct (see Lovett and Sheffield, 2007 for a review), little is known about the development of empathic skills in normal adolescence, and still less concerning its neural underpinnings. The present research aims at exploring age-related differences in the neural response of empathy for pain assessed in adults and adolescents using electroencephalography (EEG).

Empathy refers to the ability to share and understand others' emotion or feeling (Decety and Lamm, 2006). Experiencing empathy relies on the integration of two components: a phylogenetically and ontogenetically early emotional contagion system and a more advanced cognitive system that allows self-regulation and elaboration of the situation (Preston and De Waal, 2002; Decety and Jackson, 2004). The former system entails an automatic affective resonance with the others' emotional experience thought to be mediated by shared neural representations (Gallese, 2003; Gallese et al., 2004). Resonance between other and self may lead to personal distress (i.e., feelings of discomfort and anxiety; Lamm et al., 2007a). In contrast, mature forms of empathy require that one understand the others' need and can trigger sympathy. The primary affective response needs therefore to be modulated by self-regulation processes, beginning with basic forms of self-other distinction and leading to more advanced forms of perspective-taking abilities. Eventually, mature empathy is characterized by elaborated conscious forms of emotion regulation. All of these conscious regulatory processes tend to be costly in terms of the investment of effort and should depend on the maturation of cortico-limbic connections.

In line with this theoretical argument, developmental research has widely demonstrated this progression from more automatic forms of empathy to ones that are better regulated. For example babies show emotional contagion in response to the distress of another individual without being able to separate their own and the other's distress (Thompson, 1987). Self-other differentiation begins later in childhood and develops through adolescence (Hoffman, 1985; Harter, 1998). Recent evidence also suggests a continued development of the ability to understand other's emotions and mental states between adolescence and adulthood (Blakemore, 2008). Adolescence is also marked by heightened emotional reactivity and immature top-down prefrontal control systems (Steinberg, 2005; Hare et al., 2008). Using fMRI,

Hare et al. (2008) showed that adolescents displayed heightened activity in subcortical emotional processing systems and less functional fronto-limbic connectivity when viewing emotional pictures. According to Steinberg (2005) this dissociation between heightened emotional arousability and the late maturation of brain regions involved in the cognitive abilities necessary to down-regulate emotions renders adolescents more vulnerable emotionally. Since brain networks mediating cognitive empathy are not fully mature in early adolescents, they should therefore be less efficient in down-regulating the primary affective response in the experience of empathy.

Neuroimaging research in the field of empathy has mostly been interested in empathy for pain because of the universality and automaticity of the affective response elicited when witnessing another's pain. A number of studies have shown that the cognitive and affective components do rely on distinct neural networks (see Decety and Meyer, 2008, for a review). For example, studies have reported an overlap between the neural regions underlying the personal experience of pain (affective component) and those activated while observing another expressing pain. More specifically, activation is consistently observed in the anterior insula and anterior medial cingulate cortex (aMCC; Morrison et al., 2004; Singer et al., 2004; Lamm et al., 2007a, 2011; Singer and Lamm, 2009), and to a lesser extent in the somatosensory cortex and the cerebellum (see Lamm et al., 2011 and Singer and Lamm, 2009, for a review). In contrast, the cognitive components of empathy have been shown to rely on a network of regions that are associated with emotion regulation, such as prefrontal dorsolateral and median prefrontal cortices (Lamm et al., 2007b) or with mentalizing, such as the temporo-parietal junction, the temporal poles, and the precuneus/posterior cingulate cortex (PCC; Jackson et al., 2006). FMRI studies of empathy for pain hence provide arguments in support of the assumption that empathy is a two-component process. Investigating the temporal dynamics of perception of pain with the ERP method, Fan and collaborators (Fan and Han, 2008; Han et al., 2008) dissociated in an elegant way the affective component from the cognitive component of empathy by manipulating attention to pain cues. The authors reported a dissociation between an early automatic emotional sharing component (double fronto-central negativity, N110 and N340) and a late cognitive component (centro-parietal LPP; Fan and Han, 2008; Han et al., 2008). Some ERPs studies have shown that these two components are modulated by several factors such as medical expertise (Decety et al., 2010), gender (Han et al., 2008), or cognitive strategies (Sheng and Han, 2012). From a developmental perspective, one should also expect a modulation of these automatic and cognitive aspects of emotional processing (Labouvie-Vief et al., 2010). In the present research, we used the same paradigm than Han and collaborators to test age-related differences between adolescents and adults' ERPs reflecting affective and cognitive empathy for pain. We hypothesized that adolescents will exhibit stronger automatic affective responses when witnessing another in a painful situation than adults. Moreover, regarding the assumed immaturity of brain networks involved in down-regulation and mentalizing abilities in adolescence, we also expected age-related differences in the cognitive component of empathy.

MATERIALS AND METHODS

PARTICIPANTS

Sixteen adolescents (mean age: 13.1 years) and 16 adults (mean age: 33.8 years) with no history of neurological or psychiatric disorder volunteered for this study. All participants were female. Fluid abilities, crystallized abilities, and depression were assessed in all participants. One adult and two adolescents had to be excluded from data analyses because of excessive artifact in the EEG signal. The participants' characteristics are detailed in **Table 1**. The study was approved by the local ethical committee and all participants gave their informed consent.

MATERIALS

All participants completed a measure of dispositional empathy, the French version of the Empathy Quotient (EQ; Berthoz et al., 2008), which allows distinguishing cognitive aspects of empathy from affective ones. But in order to ensure that our measure was well adapted to younger participants, adolescents also completed the Basic Empathic Scale (BES, French version; D'Ambrosio et al., 2009), which is specifically designed for adolescents and also taps cognitive and affective aspects of empathy. In addition, participants completed the Stroop Colour task (Stroop, 1935) in order to provide a measure of individual ability of inhibitory control.

Experimental stimuli were presented using E-prime 1.2 on a DELL computer (Schneider et al., 2002). The stimuli were the same as those used by Fan and collaborators (Fan and Han, 2008; Han et al., 2008) and consisted in 40 digital color pictures showing one hand or two hands in painful and neutral situations. The pictures were shot from the first-person perspective and described accidents that may happen in everyday life, such as a hand trapped in a door or cut by scissors. Twenty pictures showed hands in painful situation (one hand in eight painful pictures and two hands in 12 painful pictures). Each painful picture was matched with a neutral picture that showed one or two hands in situations that, although similar in contexts, did not imply any pain.

Subjective measures regarding the stimuli were assessed using the Face Pain Scale-Revised (FPS-R; Bieri et al., 1990), which

Table 1 | Participants' characteristics.

	Adolescents ($N = 16$)	Adults ($N = 16$)
Age *M* (SD), age spread	13.1[a] (1.13), 11–14.6	33.8[b] (4.69), 26.1–39.2
Depression *M* (SD)	13.1 (6.98)	12.4 (10.53)
Speed of processing *M* (SD)	64.06[a] (7.76)	84.94[b] (11.23)
Vocabulary *M* (SD)	35 (6.22)	37.25 (2.74)

[a,b] *Means with different superscripts differed significantly ($p < 0.001$) between age groups.*

Depression was measured by the French version of the CES-D (Fuhrer and Rouillon, 1989). Speed of processing was measured by the subtest digit symbol substitution of the WISC (Wechsler, 2003) for the adolescents and the WAIS (Wechsler, 1997) for the adults. Vocabulary was measured by the subtest Vocabulary (WISC, Wechsler, 2003) for the adolescents and the Mill Hill (Deltour, 1993) for the adults.

contains six faces showing neutral to extremely painful expression. Both the intensity of pain supposedly felt by the person on the picture (others' pain) and the intensity of personal discomfort felt by the participants (self-unpleasantness) were measured.

PROCEDURE AND DESIGN

Participants completed the behavioral part of the experiment first, the order of tests, and questionnaires being pseudo-randomly assigned to participants. The EEG session was completed within 2 weeks after the behavioral part. At the beginning of the EEG session, participants were equipped with a 64 electrodes cap and comfortably installed on a chair, in a quiet room dedicated to EEG recording.

The task consisted eight blocks of 80 trials in which pictures were presented for 200 ms, which is very fast and allows controlling for attention in order to dissociate automatic from cognitive responses to pain. In half of the blocks, participants had to judge whether the situation was painful or not (attention to pain) and in the four other blocks, they had to decide whether there were one or two hands on the picture (attention withdrawn from painful indices). The stimulus was immediately followed by a fixation cross lasting 1500 ms, during which participants gave their response with their right and left fingers on a response-pad. The assigned response-buttons were counterbalanced across participants. After 1500 ms, the color of the cross changed during a varying interval between 300 and 450 ms to indicate a new trial was beginning.

After the task, pictures were presented for 2000 ms and participants were asked to evaluate (1) the intensity of the pain supposedly felt by the model on the picture (other's pain evaluations) and (2) the degree of their self-unpleasantness.

ERP DATA RECORDING AND ANALYSIS

The EEG was recorded from 64 scalp electrodes that were mounted on an electrocap in accordance to the extended 10–20 system. EEG signal was continuously recorded at a 2048 Hz sampling rate using a Biosemi system (Amsterdam, Netherlands). Electrodes were referenced offline using average signal (Picton et al., 2000). It is noteworthy that the use of average reference does not allow age group comparisons, as they certainly differ in many aspects that can affect that average potential (e.g., the maturation of cortical tissue). Accordingly, higher ERPs amplitudes are traditionally observed with adolescents than with adults (e.g., Segalowitz et al., 2010). However, this should affect neither main effects of Pain and Task, nor interactions with Age group. EEG signal was then resampled at 256 Hz, filtered (high-pass: 0.4 Hz; low-pass 40 Hz, notch: 50 Hz). Eye blinks and vertical eye movements were then removed using an Independent Component Analysis (ICA) with Brain Vision Analyzer Software (Brain Products GmBH). The ERPs were then computed in each condition separately with an epoch beginning 200 ms before stimulus onset (baseline) and continuing for 1000 ms. ERPs were averaged for each electrode, each experimental condition, and each subject. Lastly, grand averages were computed for each electrode, each experimental condition, and each age group.

Statistical analyses were conducted at electrodes selected from the frontal-central (FCz, FC3–FC4), and parietal (Pz, P3–P4) regions. ANOVAs were run with Age as a between-subjects factor and Electrode position, Task and Pain as within-subjects factors. When needed, Tukey tests were used for *post hoc* analyses.

RESULTS

BEHAVIORAL RESULTS

Response times and response accuracies

The mean RTs and response accuracies in each condition are shown in **Table 2**. ANOVAs conducted on RTs showed significant main effects of Task $F(1,30) = 177.28$, $p < 0.001$, $\eta^2 = 0.86$ and Pain, $F(1,30) = 18.77$, $p < 0.001$, $\eta^2 = 0.38$. The Task × Pain interaction was also significant, $F(1,30) = 19.54$, $p < 0.001$, $\eta^2 = 0.39$. *Post hoc* analyses indicate that painful pictures were associated to significantly lower RTs when participant attended to pain, while there was no effect of Pain when participants attended to the number of hands.

ANOVAs conducted on response accuracies showed a significant main effect of Age, $F(1,30) = 24.33$, $p < 0.001$, $\eta^2 = 0.45$, indicating that adolescents had less correct responses than adults. Main effect of Task was also significant, $F(1,30) = 122.77$, $p < 0.001$, $\eta^2 = 0.80$: participants were more accurate when counting hands than when judging pain. Neither other main effects nor interactions were significant.

Self-assessed dispositional empathy (BES and EQ)

To verify that the EQ was also appropriated to assess dispositional empathy in our adolescent sample, correlations were computed between scores obtained for the BES, specifically designed for adolescents, and scores obtained with the EQ. Overall, correlations were high and significant. Global scores correlated at $r = 0.64$ ($p < 0.01$), and both scores assessing cognitive empathy and affective empathy were significantly correlated ($r = 0.60$, $p < 0.05$ and $r = 0.63$, $p < 0.01$, respectively). Therefore, only scores assessed by the EQ were analyzed.

Table 2 | Mean response times (RT in ms) and accuracy (mean percentage of correct responses, CR) by condition and age group.

	Adolescents		Adults	
	Counting	Pain judgment	Counting	Pain judgment
CR neutral stimuli	91.23 (6.61)	80.39 (10.84)	98.18 (1.56)	89.53 (7.12)
CR painful stimuli	90.76 (5.87)	78.31 (12.22)	98.16 (1.28)	88.65 (4.45)
RT neutral stimuli	644.46 (100.52)	866.57 (101.33)	603.70 (69.73)	835.12 (108.50)
RT painful stimuli	646.23 (90.15)	823.69 (95.58)	600.53 (73.64)	773.29 (109.78)

Standard deviations are given in brackets.

T tests computed on the global scores and on both cognitive and affective scores did not reveal any significant age-related difference (all *p*s > 0.05).

Measure of inhibitory control (Stroop-color word test)

Interference scores (*I*) were computed as follows: $I = \text{CW} - \textit{predicted}$ CW; where *predicted* $\text{CW} = (C \times W)/(C + W)$; $C =$ score for the color denomination, $W =$ score for the word denomination, and CW = score for the denomination of the colored words. A negative score then indicates a high level of interference.

T tests conducted on interference scores did not show any significant difference between adults' scores and adolescents' scores, $t(30) = -0.42$, $p = 0.674$, even if adolescents displayed lower mean scores ($M = 1.77$, SD = 6.47) than adults ($M = 2.17$, SD = 6.16).

ERP RESULTS

Inspection of the ERPs (grand means) showed, in all conditions and in agreement with previous studies using this paradigm (e.g., Han et al., 2008) a negative component between 90 and 130 ms (N110) over the frontal–central area, followed by a positive deflection and another negative wave peaking at 340 ms (N340). This wave was followed by a late positive potential between 360 and 800 ms (LPP) with the maximum amplitude over the parietal area. ERPs over the occipito-temporal area were characterized with a positivity wave between 80 and 140 ms (P1), a negative wave between 140 and 200 ms (N170), and a positive wave between 200 and 450 ms (P320). **Figures 1** and **2** show the temporal course of each ERP component.

Previous studies having used this paradigm suggest that the N110, N340, and LPP are particularly related to pain judgment (Fan and Han, 2008; Han et al., 2008; Decety et al., 2010). Analyses were therefore conducted over the peak of amplitude on these components (see **Table 3** for mean and standard deviation of each component's amplitude).

N110

The ANOVA conducted over fronto-central electrodes (FCz, FC3–FC4) indicated a significant main effect of Age, $F(1,27) = 27.62$, $p < 0.001$, $\eta^2 = 0.52$, as well as a significant main effect of Electrode position, $F(1,27) = 9.91$, $p < 0.001$, $\eta^2 = 0.28$. The Pain × Age interaction was also significant, $F(1,27) = 5.38$, $p < 0.05$, $\eta^2 = 0.18$. The *Post hoc* analyses showed that the Pain effect was only significant in the group of adolescents (see **Figure 1**). The main effect of Pain and the PainxAge interaction were also significant, $F(1,27) = 5.38$, $p < 0.05$, $\eta^2 = 0.17$.

N340

The ANOVA conducted over fronto-central electrodes (FCz, FC3–FC4) showed a significant main effect of Age, $F(1,27) = 23.93$, $p < 0.001$, $\eta^2 = 0.48$, as well as a significant main effect of Electrode position, $F(1,27) = 28.63$, $p < 0.001$, $\eta^2 = 0.52$. The main effect of Pain was also significant, $F(1,27) = 5.57$, $p < 0.05$, $\eta^2 = 0.18$, indicating that painful stimuli generated less negative amplitude than neutral ones. As there were no significant interaction between Age and Pain, this suggests that the effect of Pain was similar for adults and adolescents (see **Figure 1**).

Late positive potential

The ANOVA conducted over parietal electrodes (Pz, P3, and P4) showed a significant main effect of Age, $F(1,27) = 91.60$, $p < 0.001$, $\eta^2 = 0.78$ and Electrode position, $F(1,27) = 5.31$, $p < 0.01$, $\eta^2 = 0.20$. Results also displayed a significant Pain × Task

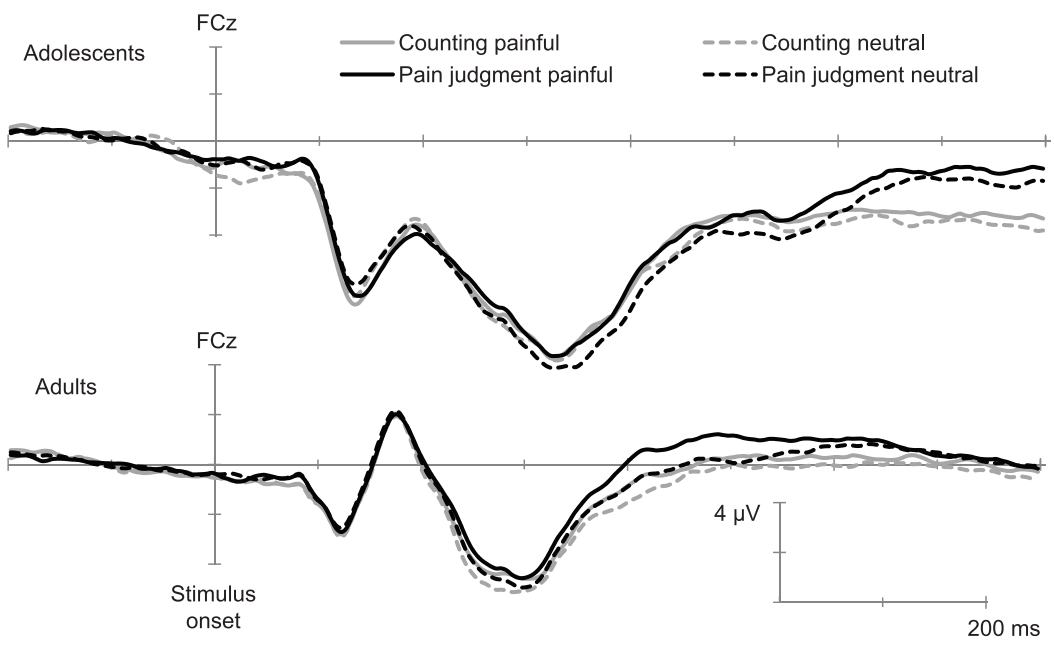


FIGURE 1 | Temporal course of early ERPs elicited by painful and non-painful pictures in the pain judgment task and in the counting task (Grand mean of 15 adults and 14 adolescents). This illustration shows the N110 and N340 recorded over FCz.

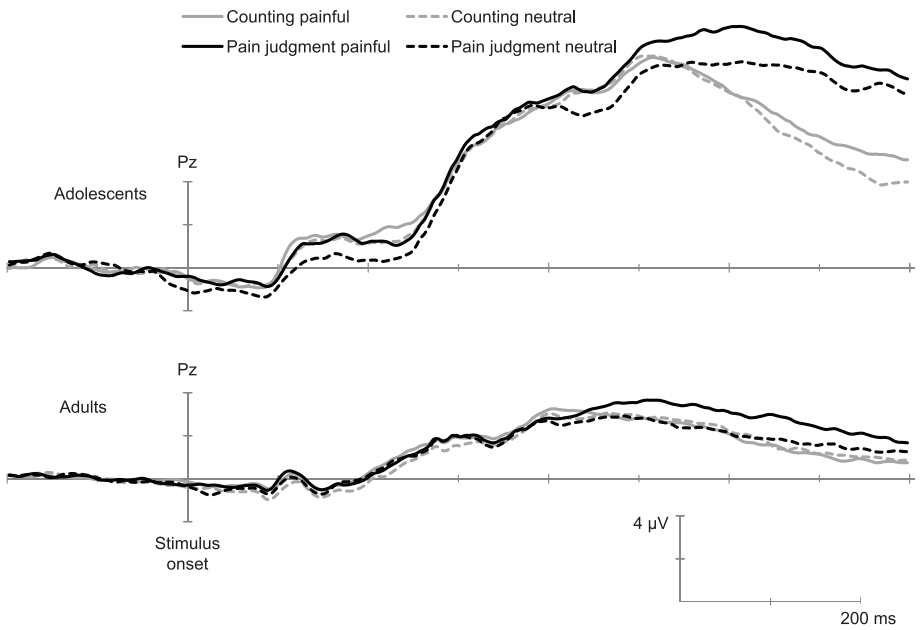


FIGURE 2 | Temporal course of late ERPs elicited by painful and non-painful pictures in the pain judgment task and in the counting task (Grand mean of 15 adults and 14 adolescents). This illustration shows the LPP recorded over Pz.

Table 3 | Mean amplitudes (SD) of the N110, N340, and LPP, in each experimental condition, for adolescents and adults.

	N110	N340	LPP
ADOLESCENTS			
Counting-*P*	−6.75 (0.56)	−8.52 (0.71)	10.44 (0.67)
Counting-*N*	−6.51 (0.54)	−8.64 (0.61)	10.42 (0.63)
Pain judgment-*P*	−6.63 (0.52)	−8.43 (0.69)	12.27 (0.83)
Pain judgment-*N*	−6.15 (0.57)	−8.85 (0.69)	10.94 (0.75)
ADULTS			
Counting-*P*	−2.64 (0.52)	−4.18 (0.66)	4.19 (0.63)
Counting-*N*	−2.77 (0.50)	−4.52 (0.57)	4.16 (0.59)
Pain judgment-*P*	−2.71 (0.48)	−3.92 (0.64)	4.46 (0.78)
Pain judgment-*N*	−2.58 (0.53)	−4.16 (0.65)	3.85 (0.70)

Counting-P, Counting task with painful stimuli; Counting-N, Counting task with neutral stimuli; Pain Judgment-P, Pain judgment task with painful stimuli; Pain Judgment-N, Pain judgment task with neutral stimuli.

For the N110 and N340, mean amplitudes are presented as a mean of FCZ, FC3, and FC4.

For the LPP, mean amplitudes are presented over Pz only, as the Pain × Task interaction was only significant over Pz.

interaction, $F(1,27) = 7.49$, $p < 0.01$, $\eta^2 = 0.22$. *Post hoc* analyses suggested that the Pain effect was significant only in the pain judgment condition, i.e., when attention was directed toward pain indices (**Figure 2**). The Electrode position × Pain × Task interaction was also significant, $F(1,27) = 3.37$, $p < 0.05$, $\eta^2 = 0.12$. *Post hoc* analyses showed that the Pain × Task interaction was significant only over Pz. Results further showed a significant Task × Age interaction, $F(1,27) = 5.94$, $p < 0.05$, $\eta^2 = 0.19$, indicating that in adolescents amplitudes were higher when they had to judge for pain than when they had to count hands, while no task effect was significant in adults. This suggests that the mere fact of orienting attention toward pain indices generated enhanced amplitudes on this late positive potential.

Correlations between brain potentials and behavioral measures

To investigate whether the electrophysiological activity elicited by the painful stimuli was correlated with subjective evaluation of other's pain and self-unpleasantness, with self-assessed empathic abilities, and with resistance to interference, we computed correlations between the mean amplitudes of ERPs elicited by painful stimuli for each component (N110, N340, and LPP), over electrodes displaying the stronger Pain effect (FCz, for N110 and N340 and Pz for LPP).

In addition, correlations between the mean amplitudes elicited in the pain judgment task in P4 (showing the stronger Task × Age interaction) and behavioral measures (subjective evaluation of other's pain and the self-unpleasantness, self-assessed empathic abilities, and resistance to interference) were computed to characterize the Age × Task interaction observed over the LPP on the right electrode.

Lastly, correlations between subjective ratings and self-assessed empathic abilities were analyzed.

In order to better describe differences between age-related processes, correlations were assessed for each age group separately (see **Table 4**).

Analyses carried out on the N110 amplitudes showed, for the adults, high correlations between ERPs' amplitudes and subjective ratings of other's pain on the one hand ($r = -0.61$, $p < 0.05$), and subjective ratings of self-unpleasantness on the other hand

Table 4 | Correlations between ERPs amplitudes and behavioral measures in adults and adolescents.

	EM	EMC	EMA	INT	Other	Self
ADOLESCENTS						
N110 painful	0.36	0.66_c**	0.41	0.48	-0.02_f	−0.18
N340 painful	0.15	0.29	0.27	0.42	−0.15	−0.36
LPP painful	−0.21	−0.27	-0.32_e	−0.19	0.07	−0.09
LPP pain judgment	−0.22	−0.46	−0.37	−0.72***	−0.01	0.18
Other	0.69_a***	0.50*	0.40			
Self	0.61_b**	0.38_d	0.44			
ADULTS						
N110 painful	0.32	0.17_c	0.33	0.38	-0.61_f**	−0.49*
N340 painful	−0.05	−0.24	0.15	0.27	−0.49*	−0.34
LPP painful	0.05	−0.01	0.35_e	−0.20	−0.14	0.31
LPP pain judgment	−0.05	0.12	0.02	−0.45	0.43	0.31
Other	-0.08_a	0.03	−0.20			
Self	-0.13_b	-0.26_d	−0.04			

EM, empathy; EMC, cognitive empathy; EMA, affective empathy; INT, Stroop interference; Other, other's pain evaluations; Self, self-unpleasantness ratings. Correlations coefficients with same subscripts differ significantly (comparison via Fisher's Z transformation, $p < 0.07$).

**$p < 0.07$.*

***$p < 0.05$.*

****$p < 0.01$.*

($r = -0.49$, $p = 0.06$). While adolescents' ERP displayed quasi-null correlations with subjective ratings, they were significantly and inversely related to cognitive empathy abilities ($r = 0.66$, $p < 0.05$).

For the N340, correlations between ERPs' amplitudes and subjective ratings of other's pain were still high and not far for significance in the group of adults ($r = -0.49$, $p = 0.06$).

Analyses carried out over the LPP amplitudes showed interesting correlations between P4 amplitudes and interference scores ($r = -0.72$, $p < 0.01$) in adolescents.

Results also showed strong positive correlations between empathic abilities and subjective ratings in adolescents, but not in adults.

DISCUSSION

This study aimed at investigating the neural correlates of affective and cognitive empathy in adolescents compared to that of young adults. This was achieved by constraining attention to or away from pain cues, in order to dissociate the automatic response to other's pain from the cognitive empathic response. Consistently with previous studies (Fan and Han, 2008; Han et al., 2008; Decety et al., 2010), our results showed the expected responses: an early fronto-central automatic response to others' pain that was independent of top-down attention to pain cues, and a late parietal cognitive response to pain that was modulated by task demand. Age-related differences in ERPs associated with painful stimuli consisted in, on the one hand, an earlier automatic response to others' pain in adolescents than in adults and, on the other hand, a task effect on the late cognitive component only in adolescents.

Consistently with previous studies (Fan and Han, 2008; Han et al., 2008; Decety et al., 2010), our results showed a main effect of pain that was independent of top-down attention to pain on early fronto-central components. These early ERPs associated to painful stimuli were positively related to subjective ratings of both self-unpleasantness and judgment of other's pain in adults, which underlies the affective dimension of early automatic brain response to others' pain (note that such relation was not observed in adolescents, this will be discussed further). This finding confirms previous assumptions of an automatic emotional sharing component of empathy. Interestingly, our results showed that the pain effect was significant only in adolescents on the N110, and in both adults and adolescents on the N340, suggesting an earlier differentiation between neutral and painful stimuli in adolescents than in adults. It may be assumed that affective stimuli are more salient to adolescents and therefore earlier detected. Some studies have for example shown that merely viewing emotional pictures generated enhanced activity of the amygdala in adolescents as compared to adults or young children (Hare et al., 2008); this may be interpreted as a sign of higher relevance of emotional information in adolescence (Sander et al., 2003). During this especially vulnerable period, it is likely that emotional indices have a particular significance in the growing importance of social interactions. The earlier affective sharing mechanism in adolescence, as compared to young adults, may then be linked to higher motivational tendencies toward social interactions. It may also be imputed to immature cognitive regulation processes (Steinberg, 2008), which would not be efficient enough to down-regulate a heightened automatic affective response. Such a view is consistent with a neurobiological model of competition between enhanced activity in subcortical emotional processing systems and less mature top-down prefrontal systems (Hariri et al., 2002, 2003; Decety and Lamm, 2006).

Contrary to adults, this heightened emotional reactivity to other's pain was not related to subsequent subjective ratings of both self-unpleasantness and judgments of others' pain, but rather to self-reported cognitive empathic abilities. Specifically, the lower the cognitive empathic abilities, the greater the brain response

to painful stimuli. In adolescents then, the early automatic brain response to observing someone else's pain seems to be linked to social emotion regulation abilities, and especially to perspective-taking abilities, which the cognitive empathy scale of EQ mostly address. This finding is consistent with prior research reporting a linear increase in social perspective-taking from childhood to adulthood (Selman, 1980; Davis and Franzoi, 1991), and suggests that emotion regulation mechanisms play a crucial role in the adolescent affective empathic response. Theoretical and empirical links have been made between the development of perspective-taking abilities and higher levels of moral reasoning (Kohlberg and Candee, 1984; Eisenberg et al., 2005). Kohlberg and Candee (1984) argued that moral reasoning increases with age because of age-related structural changes in reasoning (i.e., the development of qualitatively new ways of thinking). In their view, as adolescent mature, moral judgment develops as a consequence of advances in perspective-taking abilities. Consistently, in a longitudinal study following mid-adolescents (15 years) until adulthood (26 years), Eisenberg et al. (2005) report a decrease in personal distress and increased perspective-taking and prosocial moral reasoning. In addition, changes in conceptions of the self from childhood into adolescence likely are associated with moral and prosocial development. By late adolescence, the self is defined in terms of social and psychological aspects, with the consequence that morality constitutes a major regulator of social interactions (e.g., Harter, 1999). In line with this literature, our results point to the importance of social cognitive competencies in very automatic aspects of prosocial abilities in early adolescence. More specifically, it may be assumed that the link between an earlier automatic processing of pain, as compared to young adults, and cognitive abilities reflects a developing integration of both affective and cognitive aspects of empathy. Interestingly, self-assessed dispositional empathy was strongly correlated with both ratings of others' pain and judgment of self-unpleasantness in adolescents only. On the one hand, this observation comforts the idea that the task used in the present experiment calls to empathic processes. On the other hand, the absence of such correlations in adults raises question. It might be assumed that emotional processes are more related in adolescence that in adulthood. A "differentiation hypothesis" has been proposed concerning changes in the functional organization of cognitive abilities during child development (Garrett, 1946). It postulates that the structure of intelligence develops from a relatively unified, general ability in childhood to more differentiated, specific cognitive abilities by early adulthood (see Shing et al., 2010, for recent evidence). As cognitive abilities are thought to become more involved in emotional processes during childhood (Labouvie-Vief et al., 2010, in press), a similar functional reorganization might occurs with emotional processes. This hypothesis however needs further empirical evidence.

Our results also showed a late effect of pain that was modulated by task demand over central parietal areas both in adults and adolescents, i.e., the dissociation between painful and neutral stimuli was observed only when attention was oriented toward pain cues. This finding is consistent with results of a previous fMRI study showing that neural underpinnings of affective and cognitive empathy are already at place in pre-adolescence (Decety et al., 2008). This late parietal component observed in empathy for pain has been proposed to reflect the evaluation process of stimuli showing others in painful situations (Fan and Han, 2008). Accordingly, painful stimuli would require a higher attentional demand than neutral ones in the pain judgment task, thus inducing deeper evaluation of the situation. Interestingly, results showed, over the right parietal region, a main effect of the task in adolescents but not in adults. That is, adolescents displayed enhanced amplitudes when they had to judge other's pain as compared to the simple counting task. In other words, the mere fact of orienting attention to pain cues induced heightened amplitudes in ERPs reflecting the process of evaluation of the situation. Results further show a correlation between amplitudes of this ERP and the interference level observed in the Stroop task in adolescents: the higher the interference displayed by adolescents, the higher the amplitudes. Thus, it seems that judging others' pain requires the recruitment of additional resources by adolescents and that this additional activity is linked to lower inhibition abilities. ERP studies on emotion processing suggest that the amplitude of the LPP is mostly determined by emotional arousal (Schupp et al., 2000). Moreover, it has been recently suggested that this ERP represent a relevant neural marker for emotion regulation, the lower the amplitude the better the regulation (Dennis and Hajcak, 2009; Hajcak and Dennis, 2009).

Increased amplitude of the LPP observed in young adolescents when attended to pain may then reflect a lack of emotion regulation abilities, leading to enhanced emotional arousal when attention is drawn to pain cue. This interpretation is in line with earlier reports of lower inhibitory functions involved in self-regulation in early adolescence (Leon-Carrion et al., 2004; Steinberg, 2008). More specifically, the development of empathy as a complex response to someone else's distress is thought to rely upon the maturation of the fronto-limbic emotion regulation system, although regulation processes involved in social *versus* basic emotions (such as fear) may substantially differ. It may indeed be assumed that the regulation of personal distress underlying mature empathy calls more to emotion understanding mechanisms or theory of mind abilities (ToM; e.g., Singer, 2006) rather than simply to reappraisal processes. In this sense, developmental differences have been reported in affective ToM task performances of adolescents and adults, adolescents making more errors than adults (Sebastian et al., 2012). Furthermore, fMRI studies suggest that the neural substrates of ToM continue to develop during adolescence, long after children are able to perform complex cognitive and affective ToM tasks (see Blakemore, 2008 for a review).

One limitation of our study is that participants are only women. Nevertheless, gender differences in empathy are well documented in the literature (e.g., Davis, 1980; Eisenberg and Fabes, 1998; Han et al., 2008; Yang et al., 2009). Most research indeed report higher scores of empathy in women. Furthermore, using a similar paradigm than the one we used, Han et al. (2008) showed that women displayed an enhanced effect of pain over the late cognitive component of empathy in comparison to men, suggesting that women intend to undergo more intensive evaluation of painful stimuli. Gender differences have also been reported in the development of prosocial competencies during adolescence (Eisenberg and Fabes, 1998; Eisenberg et al., 2005). Eisenberg and collaborators have for example shown that gender differences in empathic and moral reasoning abilities increased from adolescence through adulthood,

which according to the authors is related to increased emphasis on gender-related norm. Future studies will therefore be necessary to better investigate the integration of affective and cognitive aspects of empathy during adolescence.

With this limitation in mind, our results point to the importance of self-regulation abilities in the development of social emotion like empathy during adolescents. Moreover, they are consistent with the idea of continuously developing interrelations between cognitive and emotional processes in childhood and adolescence (Lewis, 2007; Lewis et al., 2010).

ACKNOWLEDGMENTS

We would like to thank Nicole Guichard-Jeanneret, Claudia Steinhauer, and Sandrine Weil for their help in collecting the data.

REFERENCES

Batson, C. D., and Shaw, L.-L. (1991). Evidence for altruism: toward a pluralism of prosocial motives. *Psychol. Inq.* 2, 107–122.

Berthoz, S., Wessa, M., Kedia, G., Wicker, B., and Grezes, J. (2008). Cross-cultural validation of the empathy quotient in a French-speaking sample. *Can. J. Psychiatry* 53, 469–477.

Bieri, D., Reeve, R. A., Champion, G. D., Addicoat, L., and Ziegler, J. B. (1990). The faces pain scale for the self-assessment of the severity of pain experienced by children: development, initial validation, and preliminary investigation for ratio scale properties. *Pain* 41, 139–150.

Blakemore, S. J. (2008). The social brain in adolescence. *Nat. Rev. Neurosci.* 9, 267–277.

D'Ambrosio, F., Olivier, M., Didon, D., and Besche, C. (2009). The basic empathy scale: a French validation of a measure of empathy in youth. *Pers. Individ. Dif.* 46, 160–165.

Davis, M. H. (1980). A multidimensional approach to individual differences in empathy. *JSAS Catalog of Selected Documents in Psychology* 10, 85.

Davis, M. H., and Franzoi, S. (1991). Stability and change in adolescent self-consciousness and empathy. *J. Res. Pers.* 25, 70–87.

Decety, J., and Jackson, P. L. (2004). The functional architecture of human empathy. *Behav. Cogn. Neurosci. Rev.* 3, 406–412.

Decety, J., and Lamm, C. (2006). Human empathy through the lens of social neuroscience. *ScientificWorldJournal* 6, 1146–1163.

Decety, J., and Meyer, M. (2008). From emotion resonance to empathic understanding: a social developmental neuroscience account. *Dev. Psychopathol.* 20, 1053–1080.

Decety, J., Michalska, K. J., and Akitsuki, Y. (2008). Who caused the pain? An fMRI investigation of empathy and intentionality in children. *Neuropsychologia* 46, 2607–2614.

Decety, J., Yang, C. Y., and Cheng, Y. (2010). Physicians down-regulate their pain empathy response: an event-related brain potential study. *Neuroimage* 50, 1676–1682.

Deltour, J. J. (1993). *Echelle de vocabulaire de Mill Hill de J. C. Raven. Adaptation française et normes européennes du Mill Hill et du Standard Progressive Matrices de Raven (PM 38)* [Mill-Hill Vocabulary Scale of J. C. Raven. French Adaptation and European Norms]. Braine-le-Château: Editions L'application des techniques modernes.

Demurie, E., Roeyers, H., Baeyens, D., and Sonuga-Barke, E. (2011). Common alterations in sensitivity to type but not amount of reward in ADHD and autism spectrum disorders. *J. Child. Psychol. Psychiatry* 52, 1164–1173.

Dennis, T. A., and Hajcak, G. (2009). The late positive potential: a neurophysiological marker for emotion regulation in children. *J. Child. Psychol. Psychiatry* 50, 1373–1383.

Eisenberg, N., Cumberland, A., Guthrie, I. K., Murphy, B. C., and Shepard, S. A. (2005). Age changes in prosocial responding and moral reasoning in adolescence and early adulthood. *J. Res. Adolesc.* 15, 235–260.

Eisenberg, N., and Fabes, R. A. (1998). "Prosocial development," in *Handbook of Child Psychology, Vol. 3, Social, Emotional and Personality Development*, 5th Edn, eds N. Eisenberg and W. Damon (New York: Wiley), 701–778.

Fan, Y., and Han, S. (2008). Temporal dynamic of neural mechanisms involved in empathy for pain: an event-related brain potential study. *Neuropsychologia* 46, 160–173.

Fuhrer, R., and Rouillon, F. (1989). La version française de l'échelle CES-D (Center for Epidemiologic Studies-Depression Scale). Description et traduction de l'échelle d'auto-évaluation. *Psychiatrie et Psychobiologie* 4, 163–166.

Gallese, V. (2003). The roots of empathy: the shared manifold hypothesis and the neural basis of intersubjectivity. *Psychopathology* 36, 171–180.

Gallese, V., Keysers, C., and Rizzolatti, G. (2004). A unifying view of the basis of social cognition. *Trends Cogn. Sci. (Regul. Ed.)* 8, 396–403.

Garrett, H. E. (1946). A developmental theory of intelligence. *Am. Psychol.* 1, 372–378.

Hajcak, G., and Dennis, T. A. (2009). Brain potentials during affective picture processing in children. *Biol. Psychol.* 80, 333–338.

Han, S., Fan, Y., and Mao, L. (2008). Gender difference in empathy for pain: an electrophysiological investigation. *Brain Res.* 1196, 85–93.

Hare, T. A., Tottenham, N., Galvan, A., Voss, H. U., Glover, G. H., and Casey, B. J. (2008). Biological substrates of emotional reactivity and regulation in adolescence during an emotional go-nogo task. *Biol. Psychiatry* 63, 927–934.

Hariri, A. R., Mattay, V. S., Tessitore, A., Fera, F., and Weinberger, D. R. (2003). Neocortical modulation of the amygdala response to fearful stimuli. *Biol. Psychiatry* 53, 494–501.

Hariri, A. R., Tessitore, A., Mattay, V. S., Fera, F., and Weinberger, D. R. (2002). The amygdala response to emotional stimuli: a comparison of faces and scenes. *Neuroimage* 17, 317–323.

Harter, S. (1998). "The development of self-representations," in *Handbook of Child Psychology*, eds W. Damon and N. Eisenberg (New York: Wiley), 553–617.

Harter, S. (1999). *The Cognitive and Social Construction of the Developing Self*. New York: Guilford Press.

Hoffman, M.-L. (1985). "Interaction of affect and cognition in empathy," in *Emotions, Cognition, and Behavior*, eds C. E. Izard, J. Kagan, and R. B. Zajonc (New York, NY: Cambridge University Press), 103–131.

Jackson, P. L., Brunet, E., Meltzoff, A. N., and Decety, J. (2006). Empathy examined through the neural mechanisms involved in imagining how I feel versus how you feel pain. *Neuropsychologia* 44, 752–761.

Kohlberg, L., and Candee, D. (1984). "The relationship of moral judgment to moral action," in *Morality, Moral Behavior, and Moral Development*, eds W. M. Kurtines and J. L. Gewirtz (New York: John Wiley and Sons), 52–73.

Labouvie-Vief, G., Gilet, A.-L., and Mella, N. (in press). "The dynamics of cognitive-emotional integration: complexity and hedonics in emotional development," Chapter to appear in *Emotion, Social Cognition and Everyday Solving Problems during Adulthood*, eds P. Verhaegen and C. Hertzog (Oxford University Press).

Labouvie-Vief, G., Grühn, D., and Studer, J. (2010). "Dynamic integration of emotion and cognition: equilibrium regulation in development and aging," in *The Handbook of Life-Span Development, Vol. 2, Social and Emotional Development*, eds R. M. Lerner, M. E. Lamb, and A. M. Freund (Hoboken, NJ: Wiley), 79–115.

Lamm, C., Batson, C. D., and Decety, J. (2007a). The neural substrate of human empathy: effects of perspective-taking and cognitive appraisal. *J. Cogn. Neurosci.* 19, 42–58.

Lamm, C., Nusbaum, H. C., Meltzoff, A. N., and Decety, J. (2007b). What are you feeling? using functional magnetic resonance imaging to assess the modulation of sensory and affective responses during empathy for pain. *PLoS ONE* 2, e1292. doi:10.1371/journal.pone.0001292

Lamm, C., Decety, J., and Singer, T. (2011). Meta-analytic evidence for common and distinct neural networks associated with directly experienced pain and empathy for pain. *Neuroimage* 54, 2492–2502.

Leon-Carrion, J., Garcia-Orza, J., and Perez-Santamaria, F. J. (2004). Development of the inhibitory component of the executive functions in children and adolescents. *Int. J. Neurosci.* 114, 1291–1311.

Lewis, M. (2007). "Self-conscious emotional development," in *The Self-Conscious Emotions: Theory and Research*, eds J. L. Tracy, R. W. Robins, and J. P. Tangney (New York: Guilford Press), 134–149.

Lewis, M. D., Todd, R., and Xu, X. (2010). "The development of emotion regulation: a neuropsychological perspective," in *The Handbook of Life-Span Development, Vol. 2, Social and Emotional Development*, eds R. M. Lerner, M. E. Lamb, and A. M. Freund (Hoboken, NJ: Wiley), 51–78.

Lovett, B. J., and Sheffield, R. A. (2007). Affective empathy deficits in aggressive children and adolescents: a critical review. *Clin. Psychol. Rev.* 27, 1–13.

Morrison, I., Lloyd, D., Di Pellegrino, G., and Roberts, N. (2004). Vicarious responses to pain in anterior cingulate cortex: is empathy a multisensory issue? *Cogn. Affect. Behav. Neurosci.* 4, 270–278.

Picton, T. W., Bentin, S., Berg, P., Donchin, E., Hillyard, S. A., Johnson, R., et al. (2000). Guidelines for using human event-related potentials to study cognition: recording standards and publication criteria. *Psychophysiology* 37, 127–152.

Preston, S. D., and De Waal, F. B. (2002). Empathy: Its ultimate and proximate bases. *Behav. Brain Sci.* 25, 1–20.

Sander, D., Grafman, J., and Zalla, T. (2003). The human amygdala: an evolved system for relevance detection. *Rev. Neurosci.* 14, 303–316.

Schneider, W., Eschman, A., and Zuccolotto, A. (2002). *E-Prime Reference Guide.* Pittsburgh: Psychology Software Tools, Inc.

Schupp, H. T., Cuthbert, B. N., Bradley, M. M., Cacioppo, J. T., Ito, T., and Lang, P. J. (2000). Affective picture processing: the late positive potential is modulated by motivational relevance. *Psychophysiology* 37, 257–261.

Sebastian, C. L., Fontaine, N. M. G., Bird, G., Blakemore, S.-J., De Brito, S. A., McCrory, E. J. P., et al. (2012). Neural processing associated with cognitive and affective theory of mind in adolescents and adults. *Soc. Cogn. Affect. Neurosci.* 7, 53–63.

Segalowitz, S. J., Santesso, D. L., and Jetha, M. K. (2010). Electrophysiological changes during adolescence: a review. *Brain Cogn.* 72, 86–100.

Selman, R. L. (1980). *The Growth of Interpersonal Understanding: Developmental and Clinical Analysis.* New York: Academic Press.

Shamay-Tsoory, S. G., Shur, S., Harari, H., and Levkovitz, Y. (2007). Neurocognitive basis of impaired empathy in schizophrenia. *Neuropsychology* 21, 431–438.

Sheng, F., and Han, S. (2012). Manipulations of cognitive strategies and intergroup relationships reduce the racial bias in empathic neural responses. *Neuroimage* 61, 786–797.

Shing, Y. L., Lindenberger, U., Diamond, A., Li, S. C., and Davidson, M. C. (2010). Memory maintenance and inhibitory control differentiate from early childhood to adolescence. *Dev. Neuropsychol.* 35, 679–697.

Singer, T. (2006). The neuronal basis and ontogeny of empathy and mind reading: Review of literature and implications for future research. *Neurosci. Biobehav. Rev.* 30, 855–863.

Singer, T., and Lamm, C. (2009). The social neuroscience of empathy. *Ann. N. Y. Acad. Sci.* 1156, 81–96.

Singer, T., Seymour, B., O'Doherty, J., Kaube, H., Dolan, R.-J., and Frith, C.-D. (2004). Empathy for pain involves the affective but not sensory components of pain. *Science* 303, 1157–1162.

Steinberg, L. (2005). Cognitive and affective development in adolescence. *Trends Cogn. Sci. (Regul. Ed.)* 9, 69–74.

Steinberg, L. (2008). A social neuroscience perspective on adolescent risk-taking. *Dev. Rev.* 28, 78–106.

Stroop, J. R. (1935). Studies of interference in serial verbal reactions. *J. Exp. Psychol.* 18, 643–662.

Thompson, R. A. (1987). "Empathy and emotional understanding: the early development of empathy," in *Empathy and Its Development*, eds N. Eisenberg and J. Strayer (New York: Cambridge University Press), 119–146.

van den Brink, D., Van Berkum, J. J., Bastiaansen, M. C., Tesink, C. M., Kos, M., Buitelaar, J. K., et al. (2012). Empathy matters: ERP evidence for inter-individual differences in social language processing. *Soc. Cogn. Affect. Neurosci.* 7, 173–183.

Wechsler, D. (1997). *Wechsler Adult Intelligence Scale–Third Edition.* San Antonio: The Psychological Corporation.

Wechsler, D. (2003). *Wechsler Intelligence Scale for Children-Fourth Edition. Administration and Scoring Manual.* San Antonio: Harcourt Assessment, Inc.

Yang, C. Y., Decety, J., Lee, S., Chen, C., and Cheng, Y. (2009). Gender differences in the mu rhythm during empathy for pain: an electroencephalographic study. *Brain Res.* 1251, 176–184.

Conflict of Interest Statement: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Received: 13 July 2012; accepted: 26 October 2012; published online: 26 November 2012.

Citation: Mella N, Studer J, Gilet A-L and Labouvie-Vief G (2012) Empathy for pain from adolescence through adulthood: an event-related brain potential study. Front. Psychology ***3****:501. doi: 10.3389/fpsyg.2012.00501*

This article was submitted to Frontiers in Emotion Science, a specialty of Frontiers in Psychology.

frontiers in PSYCHOLOGY

ORIGINAL RESEARCH ARTICLE
published: 03 July 2013
doi: 10.3389/fpsyg.2013.00259

Regulation of positive and negative emotion: effects of sociocultural context

Sara A. Snyder[1,2], S. Megan Heller[3], Daniel S. Lumian[4] and Kateri McRae[2]*

[1] *Department of Clinical and Counseling Psychology, Teachers College, Columbia University, New York, NY, USA*
[2] *Department of Psychology, University of Denver, Denver, CO, USA*
[3] *Department of Anthropology, University of California Los Angeles, Los Angeles, CA, USA*
[4] *Department of Psychology, University of California Los Angeles, Los Angeles, CA, USA*

Edited by:
Vera Shuman, University of Lausanne, Switzerland

Reviewed by:
Katherine K. Chen, City University of NY, USA
Mary H. Burleson, Arizona State University, USA

****Correspondence:***
Kateri McRae, Department of Psychology, University of Denver, 2155 S. Race St., Denver, CO 80209, USA
e-mail: kateri.mcrae@du.edu

Previous research has demonstrated that the use of emotion regulation strategies can vary by sociocultural context. In a previous study, we reported changes in the use of two different emotion regulation strategies at an annual alternative cultural event, Burning Man (McRae et al., 2011). In this sociocultural context, as compared to typically at home, participants reported less use of expressive suppression (a strategy generally associated with maladaptive outcomes), and greater use of cognitive reappraisal (a strategy generally associated with adaptive outcomes). What remained unclear was whether these changes in self-reported emotion regulation strategy use were characterized by changes in the regulation of positive emotion, negative emotion, or both. We addressed this issue in the current study by asking Burning Man participants separate questions about positive and negative emotion. Using multiple datasets, we replicated our previous findings, and found that the decreased use of suppression is primarily driven by reports of decreased suppression of *positive* emotion at Burning Man. By contrast, the increased use of reappraisal is not characterized by differential reappraisal of positive and negative emotion at Burning Man. Moreover, we observed novel individual differences in the magnitude of these effects. The contextual changes in self-reported suppression that we observe are strongest for men and younger participants. For those who had previously attended Burning Man, we observed lower levels of self-reported suppression in both sociocultural contexts: Burning Man and typically at home. These findings have implications for understanding the ways in which certain sociocultural contexts may decrease suppression, and possibly minimize its associated maladaptive effects.

Keywords: emotion regulation, cognitive reappraisal, expressive suppression, Burning Man, social context, cultural context, positive affect, negative affect

INTRODUCTION

Functionalist approaches emphasize that emotions can promote quick, adaptive responses. However, sometimes our emotions are not appropriate for the environment that we are in, and consequently require active management. Emotion regulation refers to the various ways that individuals can manage, or control their emotional responses. The process by which we influence the type of emotions we have and how we express them is termed emotion regulation (Gross, 1998b; Gross et al., 2011). Emotion regulation helps us to match our environment and respond in more socially and contextually appropriate ways to enhance social acceptability and desirability (Szczurek et al., 2012). Successful use of emotion regulation is generally linked to adaptive functioning, and there are several strategies that individuals can deploy when attempting to use emotion regulation to change their emotion (Gross, 2002). Below, we review the literature on two strategies: expressive suppression and cognitive reappraisal. First, we will examine their short-term effects in experimental settings, as well as the long-term outcomes associated with their use. We then discuss the use of these strategies as they pertain to positive and negative emotion. Finally, we will outline the known effects of sociocultural context on strategy use.

EXPRESSIVE SUPPRESSION

Expressive suppression is defined as the inhibition of emotion expression, such that an outside observer would be unaware of an individual's internal emotional experience (Gross, 1998a). Suppression can be used in interpersonal communication as a self-protective tool. By concealing negative expressions, for example, an individual can avoid unwanted questions or concern from other communicators on a daily basis (Butler et al., 2007). Unfortunately, suppression does not always lead to the desired changes in emotional experience. For example, experimental studies of suppression demonstrate that a negative emotional experience is only moderately diminished, or not changed at all, by the use of suppression (Stepper and Strack, 1993; Gross and Levenson, 1997; Egloff et al., 2006). Physiologically, suppression of negative emotion leads to paradoxical *increases* in central, peripheral, and sympathetic cardiovascular activation (Gross, 1998a; Goldin et al., 2008). Therefore, suppression is thought

to lead to poor long-term health outcomes (Mauss and Gross, 2004; Nezlek and Kuppens, 2008). Those who use suppression frequently report lower levels of both positive affect and subjective well-being, along with greater levels of negative affect, and more depressive symptoms (Gross and John, 2003; Moore et al., 2008; Aldao et al., 2010). Long-term maladaptive effects of using suppression are also evident in individuals working in specific industries who are expected to display a certain countenance as part of their job responsibilities. Previous scholars have referred to the need for suppression as "face work," referring to the act of expressing oneself in ways that work to maintain a positive social image and story of oneself (Goffman, 1955), and used the term "emotional labor" to describe the demands on individuals working in specific industries who are expected to express and suppress emotion as part of their job (Hochschild, 1983; Pierce, 1995). Considering this convergent evidence, expressive suppression is generally thought to be a relatively maladaptive emotion regulation strategy.

COGNITIVE REAPPRAISAL

Unlike suppression, *cognitive reappraisal* uses active thinking to change emotion expression and experience (Gross, 1998b). Reappraisal refers to the reinterpretation or reframing of an emotional event in a way that changes the emotional meaning of the situation, and therefore can change emotions by changing how an individual is thinking (Lazarus, 1991; Gross and Levenson, 1997). Experimentally, reappraisal has been used to both increase and decrease an individual's subjective experience of both positive and negative emotion (Gross, 1998a; Ochsner and Gross, 2004; Kim and Hamann, 2007; Giuliani et al., 2008). Reappraisal can also be used to impact both peripheral and central measures of physiological responding in accordance with the desired goal of regulation (Jackson et al., 2000; Hajcak et al., 2006; Ray et al., 2010; Kim and Hamann, 2012). Frequent use of reappraisal has also been associated with more adaptive outcomes, including greater levels of positive affect and well-being, lower levels of negative affect, and fewer depressive symptoms (Gross and John, 2003; Aldao et al., 2010). Therefore, reappraisal is thought to be a relatively successful and adaptive regulation strategy.

EMOTION REGULATION OF POSITIVE AND NEGATIVE EMOTIONS

There is a fair amount of convergent evidence about the experimental effects and long-term consequences of suppression and reappraisal. However, there is reason to believe that the outcomes of these regulation strategies, particularly suppression, may differ when used to change positive and negative emotion. Suppression appears to operate somewhat differently on positive and negative emotion. Inhibiting the expression of positive emotion results in decreased subjective experience of positive emotion, whereas inhibiting the expression of negative emotion does not have this effect and, paradoxically, results in additional increases in some measures of negative emotion (Gross, 1998a; Butler et al., 2003; Goldin et al., 2008). Therefore, the use of suppression on positive and negative emotion may have undesirable consequences, but operate through different mechanisms (decreased positive emotion experience vs. undiminished negative emotion experience).

Taking a look at reappraisal, recent work has begun to distinguish between using reappraisal to change the experience of negative emotion or positive emotion (Shiota and Levenson, 2009, 2012; McRae et al., 2012). There are different experiential and physiological effects of using reappraisal to decrease negative emotion compared with increasing positive emotion (McRae et al., 2012). In addition, there is some evidence that the ability to use reappraisal to increase positive emotion is more closely linked with adaptive outcomes than using it to decrease negative emotion (Troy et al., 2010). Despite these potentially important differences, few studies have examined the use of suppression and reappraisal to regulate positive and negative emotion separately.

SOCIOCULTURAL CONTEXT AND EMOTION REGULATION

Because the use of suppression and reappraisal is generally associated with maladaptive and adaptive outcomes, respectively, it is important to identify the situations in which individuals use suppression and reappraisal less and more frequently. One important contributor to the use of these strategies may be an individual's sociocultural context. Research on cultural differences in emotion regulation has demonstrated that individuals in Eastern cultures tend to use suppression more frequently than those in Western cultures (Matsumoto et al., 2008). Interestingly, this relatively increased use of suppression does not appear to be associated with maladaptive outcomes in Eastern cultures (Butler et al., 2007; Soto et al., 2011). One potential mechanism for this cultural difference may be the relative stability of social hierarchies in these different cultures. Individuals who find themselves in relatively stable, long-term oriented hierarchies are more likely to adaptively utilize suppression to maintain their position in the social order—more so than individuals operating in a context where an individual must advance more quickly than others in order to maintain his or her social status (Matsumoto et al., 2008). Less work has been done on cultural differences that are associated with changes in reappraisal use.

While broad characteristics of cultural variation in emotion regulation patterns may be somewhat informative, it is also important to examine how swift or dramatic *changes* in sociocultural context may demand that a person alters, or is flexible with, his or her emotion regulation strategies (Bonanno et al., 2004; Westphal et al., 2010). One study examined how students in the United States (US) regulate emotion during a stressful social transition, from high school to college. This study found that students reported using suppression more frequently during their first term of college than during their last term of high school, likely due to the destabilizing transition from familiar to unfamiliar. In addition, self-reported suppression use was a predictor for adverse social outcomes during the transition (Srivastava et al., 2009). No differences in self-reported reappraisal were observed during the transition to college.

Another study examined changes in emotion regulation brought about by a dramatic, temporary change in sociocultural context for individuals attending the Burning Man event (McRae et al., 2011). Burning Man is an annual art festival and alternative cultural gathering held for 1 week every summer in a Nevada desert. The organizers of the event actively encourage "radical

self expression" from the 50,000 plus participants (Burning Man Organization, 2011). Some choose to wear elaborate costumes or colorful body paint, and often nothing at all. Hardworking participants often express themselves and contribute to the creative culture by producing elaborate art, sculptures, and shade structure, music, and dance (Chen, 2009, 2012a,b). This art is often interactive, and some is burned in massive fires at the end of the week as a form of group catharsis, including the iconic Burning Man figure himself. The event constitutes an alternative sociocultural context in that it is de-commercialized, operating without corporate sponsorship and running on a gift economy; meaning that goods and services are neither sold nor bartered, but shared freely among participants without expectations of a return gift (Kozinets, 2002; Kozinets and Sherry, 2005). Over the past quarter century, Burning Man's alternative cultural setting has been a site for social experimentation. Many participants view Burning Man as a social movement, not just a vacation destination, and they endeavor to export the values and traditions of Burning Man into their workplaces and local communities (Turner, 2009; Chen, 2011). The movement explicitly promotes a more creative culture of experimentation, not just in the artistic sense, but also by encouraging people to reinvent themselves and reimagine what it is to be an active participant in a social community.

Comparing these two contextual changes in terms of emotion regulation, it is important to note the ways that a transition from typical home life to Burning Man is unlike that from high school to college. Simply stated, both transitions entail removing oneself from the larger society for a time. The primary differences are that college is usually a setting for acquiring stable characteristics that will improve one's opportunities in an extant hierarchical society over an extended duration (typically 4 years), while Burning Man is a short-term setting (the event lasts 1 week) that fosters individual creativity, cultural experimentation, and collective reconstructing of society in alternative forms.

In the previous study, we identified Burning Man as a sociocultural context in which emotion regulation becomes more adaptive (McRae et al., 2011). We found that self-reported suppression was decreased at Burning Man compared to home, while self-reported reappraisal was increased at Burning Man compared to home. However, our previous study did not address whether these differences in emotion regulation strategy use were characterized by changes in the regulation of positive emotion, the regulation of negative emotion, or both. In addition, we did not previously test for differences in emotion regulation by age, gender, or previous experience at Burning Man (McRae et al., 2011).

PRESENT STUDY

The primary purpose of the current study was to test for possible valence asymmetries underlying the changes in self-reported emotion regulation observed in the sociocultural contexts of Burning Man and typically at home, as well as examine individual differences in these changes. In the present study, we wanted to know whether the decreased use of suppression at Burning Man is characterized by decreased suppression of positive emotion, negative emotion, or both. In addition, we wanted to know whether the increased use of reappraisal at Burning Man is characterized by increased reappraisal of positive emotion, negative emotion, or both. We predicted decreased suppression and increased reappraisal at Burning Man, both with differential effects for the regulation of positive and negative emotion. Because the suppression of negative emotion is more prevalent than the suppression of positive emotion in everyday life (Gross and John, 2003), we predicted stronger decreases in suppression of negative emotion compared to the decreases in suppression of positive emotion at Burning Man. For reappraisal, based on the limited literature separating the reappraisal of positive and negative emotion, we had the prediction that participants at Burning Man would use reappraisal with the goal of creating or maintaining a high arousal emotional state (McRae et al., 2012), and therefore predicted greater increases in the reappraisal of positive emotion compared with increases in the reappraisal of negative emotion. Finally, we wanted to examine whether these context and valence interactions are comparable for individuals with differences in gender, age, and experience at Burning Man, because previous research has found differences in the use of suppression and reappraisal by age and gender (Gross and John, 2003).

METHOD

PARTICIPANTS

Participants for Studies 1–4 were recruited at the annual Burning Man event during four consecutive years: Study 1 (August 25th–September 1st, 2008; population 49,599), Study 2 (August 31st–September 7th, 2009; population 43,558), Study 3 (August 30th–September 6th, 2010; population 51,525), and Study 4 (August 29th–September 5th, 2011; population capped at 50,000) (Burning Man Organization, 2011). Institutional review boards at The University of California, Los Angeles (Studies 1–4), Stanford University (Studies 1–3), and The University of Denver (Studies 3 and 4) approved the collection and analysis of data for these four studies. This study is part of a collaboration among several researchers from the US and Canada who all work on an annual survey that is managed by the Burning Man organization and offered during the event. Each year's survey is different, but questions usually focus on basic demographic characteristics, participation in Burning Man, as well as our questions on emotion regulation. Participants were included if they provided answers for all of the items listed below. In addition, for Studies 2–4, participants were only included if they responded correctly to an item designed to ensure conscientious responding. This item read: "If you are reading this form carefully, please leave the response options below blank, but draw a circle around the first instance of the word "carefully" in this sentence." Only participants who correctly omitted the response and circled the correct word were included. The final samples were comprised of 3472 participants for Study 1 (45.3% women, age not available), 2459 participants for Study 2 (45% women, mean age = 36.72, SD = 12.04), 3990 participants for Study 3 (46.5% women, mean age = 37.07, SD = 11.40), and 6306 participants for Study 4 (47.4% women, mean age = 35.17, SD = 11.50).

MEASURES

To measure emotion regulation use, we used modified core items from the Emotion Regulation Questionnaire (ERQ; Gross and

John, 2003). For Study 1, we used one item from the suppression scale ("I can control my emotions by not expressing them") and another from the reappraisal scale ("I can control my emotions by changing the way I think about the situation"). Study 2 consisted of three emotion regulation questions, two suppression ("When I want to feel less negative emotion, such as sadness or anger, I make sure not to express them" and "When I am feeling positive emotions, such as joy or amusement, I am careful not to express them") and one reappraisal ("I control my emotions by changing the way I think about the situation"). For Study 3, we asked about the use of regulation strategies for positive and negative emotion separately: suppression of positive and negative emotion ("When I am feeling positive emotions, I am careful not to express them" and "When I am feeling negative emotions, I make sure not to express them," respectively) as well as reappraisal of positive and negative emotion ("When I want to feel more positive emotion (such as joy or amusement) I change what I am thinking about" and "When I want to feel less negative emotion (such as sadness or anger) I change what I am thinking about," respectively). For Study 4 we asked about the use of regulation strategies for positive and negative emotion separately and with slightly different wording from Study 3. We asked about suppression of positive ("When I am feeling positive emotions, I am careful not to express them.") and negative emotion ("When I am feeling negative emotions, I am careful not to express them") as well as reappraisal of positive ("When I want to feel more positive emotion, I change the way I'm thinking about the situation") and negative emotion ("When I want to feel less negative emotion, I change the way I'm thinking about the situation"). We have previously reported strong item-scale correlations using variations on these items before (McRae et al., 2011), and we were confident that, given time and space limitations, these single-item measures would be effective (like other single-item measures; see Robins et al., 2001; Gosling et al., 2003).

To assess the degree to which participants used each emotion regulation strategy in the four studies we used a 9-point Likert scale. The lowest score, a 1, was labeled "Not at all like me" and the highest score, a 9, was labeled "Very much like me" with a 5 labeled "Neutral." Participants were instructed to write in the appropriate response in the two provided columns labeled "Off Playa" and "On Playa." ("The Playa" is a common term referring to Black Rock City or Burning Man.) In multiple previous studies using the full ERQ (Gross and John, 2003; John and Gross, 2004) suppression and reappraisal were essentially unrelated, with correlations close to 0 and not significantly exceeding 0.11. We replicated this effect in Studies 1–4 at Burning Man ($r = 0.04$, $r = 0.06$, $r = 0.002$, $r = 0.06$; respectively) and for typical use at home ($r = 0.03$, $r = 0.04$, $r = 0.04$, $r = 0.07$; respectively).

PROCEDURE

Participants were individuals who attended the Burning Man event during 2008, 2009, 2010, or 2011 and completed the survey voluntarily. Blank survey forms were left in centralized, well-trafficked locations, and instructions on the top of the page invited participants to fill them out voluntarily. Participants returned the completed survey to marked receptacles in the same locations. In addition to the emotion regulation questions, the survey also included demographic questions (age, gender, place of residence, income, etc.) included for use by the event organizers. After the event, responses from the paper forms were entered into either a spreadsheet (Studies 1–3) or a data entry website (Study 4) by a team of researchers.

ANALYSIS

Values on individual items were transformed to percent of maximum possible (POMP) scores, which range from 0 to 100 to facilitate comparison with previous results (Cohen et al., 1999). POMP scores are always expressed as a percentage of the highest response option, and therefore facilitate the comparison of survey data when the scale is not consistent. For Studies 1–4, POMP scores for suppression and reappraisal were entered into a repeated measures general linear model (GLM) in SPSS with regulation strategy (suppression vs. reappraisal) and context (home vs. Burning Man) as repeated measures. For Studies 3 and 4, GLMs also included valence (positive vs. negative) as a repeated measure. Follow-up analyses investigated the effect of context separately for each valence and regulation strategy. For secondary analyses, we conducted separate analyses considering gender (men or women) as a between-subjects factor, age as a continuous covariate, and previous Burning Man experience (those who were there for the first year or those who had previously attended) as a between-subjects factor.

RESULTS

DIFFERENCES IN EMOTION REGULATION BY CONTEXT

First, we examined differences in self-reported strategy use in the two contexts for Studies 1–4. We observed a replication of our previous findings (McRae et al., 2011)—a significant interaction between self-reported strategy use and context for Study 1, $F_{(1,\ 3471)} = 354.26$, $p < 0.001$ Cohen's $d = 0.67$; Study 2, $F_{(1,\ 2458)} = 38.21$, $p < 0.001$, Cohen's $d = 0.25$; Study 3 $F_{(1,\ 3989)} = 154.79$, $p < 0.001$, Cohen's $d = 0.40$; and Study 4, $F_{(1,\ 6305)} = 846.90$, $p < 0.001$, Cohen's $d = 0.78$. Follow-up tests indicated that these interactions were characterized by individuals reporting using suppression less frequently at Burning Man than typically at home for Study 1, $t_{(3471)} = 19.28$ $p < 0.001$, Cohen's $d = 0.33$; Study 2 $F_{(1,\ 2458)} = 126.73$, $p < 0.001$, Cohen's $d = 0.47$; Study 3, $F_{(1,\ 3989)} = 150.55$, $p < 0.001$, Cohen's $d = 0.40$; and Study 4, $F_{(1,\ 6305)} = 311.09$, $p < 0.001$, Cohen's $d = 0.46$.

By contrast, self-reported reappraisal use was greater at Burning Man compared with typically at home in Study 1, $t_{(3471)} = 5.29$, $p < 0.001$, Cohen's $d = 0.09$; Study 3, $F_{(1,\ 3989)} = 31.61$, $p < 0.001$, Cohen's $d = 0.18$; and Study 4, $F_{(1,\ 6305)} = 618.45$, $p < 0.001$, Cohen's $d = 0.66$. This is the same pattern we observed previously. In Study 2, we observed a relatively weak reversal of this effect indicating that participants reported using reappraisal less at Burning Man than typically at home, $t_{(2458)} = 2.09$, $p < 0.04$, Cohen's $d = 0.04$. For means, see **Table 1** and **Figure 1**.

REGULATION OF POSITIVE AND NEGATIVE EMOTION

Next, we investigated the role of valence in the previously reported interaction between self-reported strategy and context. Because changes in suppression at Burning Man are more prominent than changes in reappraisal, we began by examining the suppression of

Table 1 | Group means for the primary analyses.

Strategy	Context	Valence	Study 1	Study 2	Study 3	Study 4
Suppression	Burning Man	Positive	38.29 (30.99)	14.38 (22.23)	15.88 (24.52)	16.65 (25.26)
		Negative		43.73 (30.74)	49.81 (31.07)	50.85 (30.68)
	Typical Use at Home	Positive	46.03 (32.80)	18.86 (24.88)	23.08 (27.55)	22.62 (27.44)
		Negative		46.23 (30.57)	49.04 (29.33)	51.58 (28.89)
Reappraisal	Burning Man	Positive	70.01 (26.39)	62.95 (28.43)	67.15 (30.13)	81.60 (20.80)
		Negative		43.73 (30.74)	67.73 (28.91)	82.02 (21.18)
	Typical Use at Home	Positive	68.43 (26.50)	63.69 (27.70)	65.81 (28.44)	77.57 (22.72)
		Negative		46.23 (30.57)	65.43 (27.63)	77.84 (23.10)

Means for each POMP score is presented for each strategy, context (at Burning Man or typical use at home), and valence. For the years in which questions did not specify emotional valence, only a single mean is shown. Standard deviations appear in parenthesis.

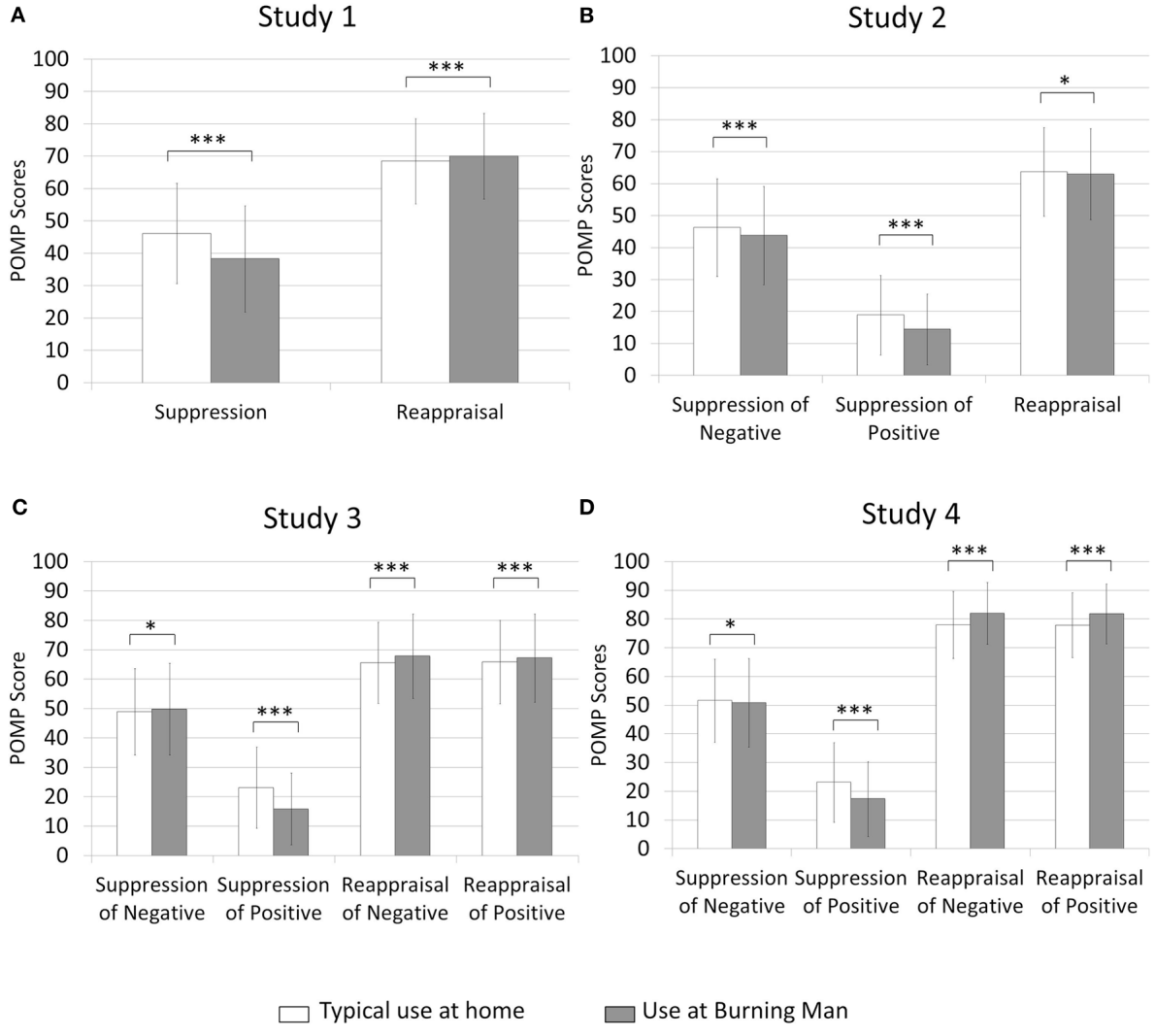


FIGURE 1 | Percentage maximum possible (POMP) scores indicating frequency of self-reported suppression and reappraisal use typically at home and at Burning Man in Studies 1–4 (panels A–D, respectively). For Studies 2–4 (panels **B–D**), suppression of positive and negative emotion was measured separately. For Studies 3–4 (panels **C–D**), reappraisal of positive and negative emotion was measured separately. Error bars indicate 1/2 the standard deviation from the mean in each direction. $*p < 0.05$; $***p < 0.001$.

positive and negative emotion separately at home and at Burning Man in Study 2. We observed an interaction between context and valence for suppression, $F_{(1,\ 2458)} = 12.21$, $p < 0.001$, Cohen's $d = 0.14$. Self-reported suppression decreased, both for positive, $t_{(2458)} = 11.76$, $p < 0.001$, Cohen's $d = 0.24$; and negative emotion, $t_{(2458)} = 5.50$, $p < 0.001$, Cohen's $d = 0.11$, at Burning Man compared to typically at home, but the magnitude of this decrease (as a difference score) was greater for the suppression of positive emotion compared with negative emotion, $t_{(2458)} = 3.49$, $p < 0.001$, Cohen's $d = 0.07$.

To examine whether the differential regulation of positive and negative emotion was also evident for reappraisal, we asked about the use of suppression and reappraisal to change positive and negative emotion separately for Studies 3 and 4. We observed a three-way interaction between self-reported strategy, context and valence for Study 3, $F_{(1,\ 3989)} = 137.55$, $p < 0.001$, Cohen's $d = 0.38$; and Study 4, $F_{(1,\ 6305)} = 166.27$ $p < 0.001$, Cohen's $d = 0.34$. This three-way interaction was characterized by an interaction between valence and context for suppression, for Study 3 $F_{(1,\ 3989)} = 273.94$, $p < 0.001$, Cohen's $d = 0.54$; and Study 4, $F_{(1,\ 6305)} = 223.26$, $p < 0.001$, Cohen's $d = 0.38$. Follow up analyses of this interaction between context and valence for suppression were consistent with the pattern observed in Study 2, indicating strong decreases in self-reported suppression of positive emotion at Burning Man compared to home in Study 3, $t_{(3989)} = 22.54$, $p < 0.001$, Cohen's $d = 0.36$; and Study 4, $t_{(6305)} = 27.56$, $p < 0.001$, Cohen's = 0.35. By contrast, contextual changes in self-reported suppression of negative emotion were not as strong in Study 4, $t_{(6305)} = 2.48$, $p < 0.02$, Cohen's $d = 0.03$, and even showed a weak reversal in Study 3, $t_{(3989)} = 1.98$, $p < 0.05$, Cohen's $d = 0.03$.

For reappraisal, we observed an interaction between context and valence in Study 3, $F_{(1,\ 3989)} = 7.39$, $p < 0.008$, Cohen's $d = 0.09$, but this was still a substantially smaller effect than the comparable interaction for suppression. Follow-up tests showed that participants reported increased reappraisal in order to *both* increase positive emotion, $t_{(3989)} = 3.65$, $p < 0.001$, Cohen's $d = 0.06$, and decrease negative emotion, $t_{(3989)} = 6.27$, $p < 0.001$, Cohen's $d = 0.10$, at Burning Man compared with typically at home. The difference in effect size for the self-reported reappraisal of positive and negative emotion (difference in Cohen's $d = 0.04$) was markedly smaller than any of the differences in the self-reported suppression of positive and negative emotion (smallest difference in Cohen's $d = 0.13$). We did *not* observe an interaction between context and valence for reappraisal in Study 4, $F_{(1,\ 6305)} = 0.75$, $p = 0.39$, Cohen's $d = 0.02$. Consistent with this, individuals reported using reappraisal more at Burning Man than typically at home, for both increasing positive emotion, $t_{(6305)} = 21.26$, $p < 0.001$, Cohen's $d = 0.27$, and decreasing negative emotion, $t_{(6305)} = 22.36$, $p < 0.001$, Cohen's $d = 0.28$, to similar extents. See **Table 1** and **Figure 1**.

SECONDARY ANALYSES

To examine whether the interactions we report between context, self-reported regulation strategy, and valence were moderated by demographic and group variables, we examined separate models that tested for interactions with gender, age, and previous experience at Burning Man.

Gender

Consistent with previous results, we consistently observed an interaction between self-reported strategy use and gender in Study 1, $F_{(1,\ 3472)} = 86.66$, $p < 0.001$, Cohen's $d = 0.32$; Study 2, $F_{(1,\ 2457)} = 59.90$, $p < 0.001$, Cohen's $d = 0.32$; Study 3, $F_{(1,\ 3988)} = 186.32$, $p < 0.001$, Cohen's $d = 0.44$; and Study 4, $F_{(1,\ 6304)} = 193.05$, $p < 0.001$, Cohen's $d = 0.36$. This interaction was characterized by greater use of suppression in men than women in Study 1, $t_{(3470)} = 10.63$, $p < 0.001$, Cohen's $d = 0.36$; Study 2, $t_{(2457)} = 8.85$, $p < 0.001$, Cohen's $d = 0.36$; Study 3, $t_{(3988)} = 10.09$, $p < 0.001$, Cohen's $d = 0.32$; and Study 4, $t_{(6304)} = 11.00$, $p < 0.001$, Cohen's $d = 0.28$, and greater use of reappraisal in women than men in Study 2, $t_{(2457)} = 2.88$, $p < 0.05$, Cohen's $d = 0.12$; Study 3, $t_{(3988)} = 9.45$, $p < 0.001$, Cohen's $d = 0.30$; and Study 4, $t_{(6304)} = 9.25$, $p < 0.001$, Cohen's $d = 0.23$.

In Studies 1 and 2, this was the only significant effect of gender[1]. In Studies 3 and 4, we observed several two- and three-way interactions with gender, all of which were qualified by a four-way interaction between self-reported regulation strategy, context, valence and gender as a trend for Study 3, $F_{(1,\ 3988)} = 3.75$, $p = 0.05$, Cohen's $d = 0.06$; and Study 4, $F_{(1,\ 6304)} = 4.94$, $p < 0.03$, Cohen's $d = 05$. In both studies, this is best characterized as a three-way interaction between context, valence and gender for suppression, as a trend in Study 3, $F_{(1,\ 3988)} = 3.43$, $p = 0.06$, Cohen's $d = 0.06$; and Study 4, $F_{(1,\ 6304)} = 10.79$, $p = 0.001$, Cohen's $d = 0.08$. More specifically, this three-way interaction for suppression was characterized by the largest contextual change in suppression in men while suppressing positive emotion. In other words, the interaction between context and valence (greater contextual decreases in the self-reported suppression of positive than negative emotion) is true of both men in Study 3, $F_{(2134)} = 163.77$, $p < 0.001$, Cohen's $d = 0.57$; and Study 4, $F_{(3318)} = 164.99$, $p < 0.001$, Cohen's $d = 0.46$, and women in Study 3, $F_{(1854)} = 110.39$, $p < 0.001$, Cohen's $d = 0.50$; and Study 4, $F_{(2986)} = 65.57$, $p < 0.001$, Cohen's $d = 0.30$, but appears stronger in men than women. By contrast, we did not observe such a three-way interaction for reappraisal, all ps > 0.13. Means split by gender are in **Table 2**.

Age

We had access to age in three of the four studies. We did not observe any significant interactions with age in Study 2 (all ps > 0.37). We observed an interaction between valence and age in Study 3, $F_{(1,\ 3988)} = 10.18$, $p < 0.002$, Cohen's $d = 0.10$;

[1]A trend for a context by gender interaction was observed for Study 1, $F_{(1,\ 3470)} = 3.12$, $p = 0.08$, Cohen's $d = 0.06$; and Study 2, $F_{(1,\ 2457)} = 3.16$, $p = 0.08$, Cohen's $d = 0.07$. For both studies, this interaction was characterized by greater use of emotion regulation in men than women both at Burning Man in Study 1, $t_{(3470)} = 5.90$, $p < 0.001$, Cohen's $d = 0.20$; and Study 2, $t_{(2457)} = 2.06$, $p < 0.001$, Cohen's $d = 0.08$, and typically at home in Study 1, $t_{(3470)} = 6.99$, $p < 0.001$, Cohen's $d = 0.24$; and Study 2, $t_{(2457)} = 3.28$, $p < 0.001$, Cohen's $d = 0.13$, but the gender difference tends to be more pronounced typically at home.

Table 2 | Impact of gender on emotion regulation usage at Burning Man and at home.

Strategy	Context	Gender	Valence	Study 1	Study 2	Study 3	Study 4
Suppression	Burning Man	Women	Positive	32.92 (29.82)	10.74 (20.24)	12.46 (23.09)	12.58 (23.45)
			Negative		39.94 (30.91)	47.24 (31.70)	49.81 (30.56)
		Men	Positive	42.74 (31.24)	17.35 (23.33)	18.86 (25.34)	20.31 (26.25)
			Negative		46.82 (30.26)	52.04 (30.34)	51.78 (30.76)
	Typical Use at Home	Women	Positive	39.83 (32.77)	14.43 (23.00)	18.34 (26.26)	17.19 (25.32)
			Negative		42.69 (31.33)	46.12 (29.59)	50.39 (28.68)
		Men	Positive	51.16 (31.93)	22.48 (25.77)	27.20 (27.98)	27.50 (28.33)
			Negative		49.13 (29.63)	51.58 (28.87)	52.64 (29.04)
Reappraisal	Burning Man	Women	Positive	70.83 (25.92)	65.01 (28.10)	71.48 (28.39)	83.97 (18.79)
			Negative		39.94 (30.91)	72.01 (27.33)	84.27 (19.43)
		Men	Positive	69.32 (26.77)	61.27 (28.60)	63.40 (31.08)	79.46 (22.24)
			Negative		46.82 (30.26)	64.00 (29.72)	80.00 (22.44)
	Typical Use at Home	Women	Positive	69.11 (25.89)	65.05 (27.29)	69.33 (27.01)	79.85 (21.36)
			Negative		42.69 (31.33)	68.63 (26.37)	80.29 (21.60)
		Men	Positive	67.88 (26.98)	62.57 (28.00)	62.74 (29.21)	75.51 (23.70)
			Negative		49.13 (29.63)	62.65 (28.39)	75.63 (24.15)

Mean POMP scores are shown for each gender based on strategy, context, and emotional valence (when available). For the years in which questions did not specify emotional valence, only a single mean is shown. Standard deviations appear in parenthesis. The sample sizes for the studies are: Study 1—1,572 women and 1,900 men; Study 2—1,106 women and 1,353 men; Study 3—1,855 women and 2,135 men; and Study 4—2,987 women and 3,319 men.

and Study 4, $F_{(1,\ 6304)} = 25.01$, $p < 0.001$, Cohen's $d = 0.13$. This was qualified by several three-way interactions that were quite small in effect size, but significant, and consistent across Studies 3 and 4. Specifically, we observed a significant interaction between self-reported regulation strategy, context, and age in Study 3, $F_{(1,\ 3988)} = 4.30$, $p < 0.039$, Cohen's $d = 0.07$; and Study 4, $F_{(1,\ 6304)} = 38.84$, $p < 0.001$, Cohen's $d = 0.16$. We also observed an interaction between self-reported regulation strategy, valence, and age as a trend in Study 3, $F_{(1,\ 3988)} = 3.81$, $p = 0.05$, Cohen's $d = 0.06$; and Study 4, $F_{(1,\ 6304)} = 36.26$, $p < 0.001$, Cohen's $d = 0.15$. Finally, we also observed an interaction between context, valence and age in Study 3, $F_{(1,\ 3988)} = 4.78$, $p < 0.03$, Cohen's $d = 0.07$; and Study 4 $F_{(1,\ 6304)} = 4.59$, $p < 0.04$, Cohen's $d = 0.05$. In all cases, the interactions we describe in the main analysis section above became weaker as age increases. More specifically, these interactions were primarily characterized by the greatest decreases in suppression at Burning Man for the youngest individuals (but no age differences for changes in reappraisal), relatively less suppression (but not reappraisal) of positive compared to negative emotion for the youngest individuals, and relatively less regulation of positive compared to negative emotion at Burning Man (compared to typically at home), for the youngest individuals.

For Study 4, these same three-way interactions were qualified by a four-way interaction between self-reported regulation strategy, context, valence, and age, $F_{(1,\ 6304)} = 11.28$, $p = 0.001$, Cohen's $d = 0.08$. This interaction was in the same direction as findings from Study 3: youngest individuals showed the lowest levels of suppression of positive emotion at Burning Man. More specifically, this interaction was characterized by a three-way interaction between context, valence and age for suppression, $F_{(1,\ 6304)} = 9.58$, $p = 0.003$, Cohen's $d = 0.08$, but there was no such significant interaction for reappraisal, $F_{(1,\ 6304)} = 1.73$, $p = 0.189$, Cohen's $d = 0.03$. For suppression, this three-way interaction was driven by an interaction between context and age for the suppression of positive emotion, $F_{(1,\ 6304)} = 29.17$, $p < 0.001$, Cohen's $d = 0.14$, but not negative emotion ($p = 0.78$). This interaction was characterized by greater decreases in self-reported suppression of positive emotion at Burning Man for younger, $t_{(3238)} = 21.91$, $p < 0.001$, Cohen's $d = 0.74$, compared to older, $t_{(3066)} = 16.90$, $p < 0.001$, Cohen's $d = 0.61$, participants. Means split by median age are listed in **Table 3**.

Previous experience with Burning Man

Because Burning Man is considered a relatively unique environment, we were interested in whether the relationships we previously reported are similar whether this was the participant's first year at the event, or if they had attended previously. In our samples, there were 1389 first-year participants for Study 1 (40%), 930 for Study 2 (37.8%), 1801 for Study 3 (45.1%), and 2709 for Study 4 (43%). We observed an interaction between self-reported strategy and previous experience with Burning Man in Study 2, $F_{(1,\ 2457)} = 17.09$, $p < 0.001$, Cohen's $d = 0.17$; Study 3, $F_{(1,\ 3988)} = 5.27$, $p < 0.03$, Cohen's $d = 0.07$; and Study 4, $F_{(1,\ 6304)} = 15.05$; $p < 0.001$, Cohen's $d = 0.10$. This interaction was characterized by lower levels of self-reported suppression in those with previous experience at Burning Man compared to those who were attending for the first time in Study 2, $t_{(2457)} = 4.80$, $p < 0.001$, Cohen's $d = 0.19$;

Table 3 | Impact of age on emotion regulation usage at Burning Man and at home.

Strategy	Context	Age	Valence	Study 2	Study 3	Study 4
Suppression	Burning Man	Young	Positive	14.34 (22.13)	14.33 (23.13)	15.17 (24.05)
			Negative	43.97 (30.56)	49.90 (30.73)	51.75 (30.74)
		Old	Positive	14.42 (22.35)	17.74 (25.98)	18.21 (26.38)
			Negative	43.51 (30.93)	49.70 (31.48)	49.89 (30.59)
	Typical Use at Home	Young	Positive	19.39 (25.19)	21.92 (26.69)	22.06 (26.94)
			Negative	46.42 (30.55)	49.31 (29.19)	52.44 (28.88)
		Old	Positive	18.35 (24.58)	24.46 (28.48)	23.21 (27.94)
			Negative	46.07 (30.60)	48.71 (29.50)	50.67 (28.88)
Reappraisal	Burning Man	Young	Positive	63.59 (28.43)	66.71 (29.99)	82.10 (20.84)
			Negative		67.81 (28.63)	82.13 (21.54)
		Old	Positive	62.32 (28.44)	67.68 (30.30)	81.06 (20.74)
			Negative		67.63 (29.24)	81.90 (20.79)
	Typical Use at Home	Young	Positive	64.29 (27.75)	65.29 (28.09)	77.08 (23.42)
			Negative		64.95 (27.42)	77.14 (23.99)
		Old	Positive	63.09 (27.67)	66.42 (28.85)	78.08 (21.95)
			Negative		66.01 (27.87)	78.56 (22.10)

Mean POMP scores are shown for median-split age groups based on strategy, context, and emotional valence (when available). Age was not collected for Study 1. For the years in which questions did not specify emotional valence, only a single mean is shown. Standard deviations appear in parenthesis. The median age and sample sizes for each study are: Study 2—median age is 34.06 with 1,229 participants under that age and 1,229 participants older; Study 3—median age was 34, with 2,171 younger participants and 1,819 older participants; and Study 4—median age was 32 with 3,239 younger participants and 3,067 older participants. Statistical values reported in the text are based on age as a continuous variable; use of a median split for groups is done here for clearer presentation.

Study 3, $t_{(3988)} = 3.29$, $p < 0.002$, Cohen's $d = 0.10$; and Study 4, $t_{(6304)} = 3.87$, $p < 0.001$, Cohen's $d = 0.10$. Indeed, those who had previously attended Burning Man reported suppressing less than first year attendees both at Burning Man in Study 2, $t_{(2457)} = 5.17$, $p < 0.001$, Cohen's $d = 0.16$; Study 3, $t_{(3988)} = 3.98$, $p < 0.001$, Cohen's $d = 0.13$; and Study 4 $t_{(6304)} = 3.62$, $p < 0.001$, Cohen's $d = 0.09$, and typically at home in Study 2, $t_{(2457)} = 3.82$, $p < 0.001$, Cohen's $d = 0.15$; Study 3, $t_{(3988)} = 2.15$, $p < 0.05$, Cohen's $d = 0.07$; and Study 4 $t_{(6304)} = 3.63$, $p < 0.001$, Cohen's $d = 0.09$. For self-reported reappraisal, we saw no differences between those with previous experience and first year attendees, all ps > 0.07.

In Study 3 alone, we observed a three-way interaction between self-reported strategy, context, and previous experience, $F_{(1,\ 3988)} = 7.98$, $p < 0.006$, Cohen's $d = 0.09$. This was characterized by an interaction between context and previous experience for suppression, $F_{(1,\ 3988)} = 4.91$, $p < 0.03$, Cohen's $d = 0.07$. The suppression interaction indicated that for Study 3, the differences reported above between previous and first-year attendees was slightly stronger at Burning Man than typically at home. There was only a trend for a context by previous experience interaction for reappraisal, $F_{(1,\ 3988)} = 3.01$, $p = 0.08$, Cohen's $d = 0.05$; and no comparisons between those with previous experience and first-year attendees were significantly different for reappraisal (all ps > 0.36). Also, previous experience did not interact with valence for self-reported suppression or reappraisal (all p's > 0.23). Means split by previous experience are in **Table 4**.

DISCUSSION

To more fully describe changes in emotion regulation in different sociocultural contexts, we measured the self-reported use of expressive suppression and cognitive reappraisal in an alternative context (Burning Man; an annual week-long art festival) to see how sociocultural context influences the regulation of positive and negative emotion. This was an extension of a previous study that observed an interaction between emotion regulation strategy and sociocultural context (McRae et al., 2011). We replicated these findings and also observed a novel interaction between context, self-reported regulation strategy, and the valence of the emotion being regulated. In addition, we report differences in self-reported emotion regulation strategy use by gender, age, and previous experience with Burning Man.

CHANGES IN EMOTION REGULATION

Self-reported suppression of both positive and negative emotion decreased among participants who were in an alternative, temporary, rapidly changing, and openly expressive sociocultural context, filled with novel stimuli; however, decreases in the self-reported suppression of positive emotion were much stronger than those for negative emotion. Based on previous results alone (McRae et al., 2011), it was plausible that the adaptive decrease in suppression that occurs at Burning Man is primarily due to the decreased suppression of negative emotion, which would have relieved individuals from the paradoxical, maladaptive consequences of using suppression to attempt to decrease negative emotion (Gross, 1998a; Goldin et al., 2008). However, we

Table 4 | Strategy use by previous Burning Man experience.

Strategy	Group	Study 1	Study 2	Study 3	Study 4
Suppression	First-Year	43.62 (29.82)	33.24 (20.39)	35.61 (20.43)	36.55 (20.22)
	Previous Attendee	41.19 (29.48)	29.31 (19.29)	33.50 (19.88)	34.57 (20.21)
Reappraisal	First-Year	70.04 (24.73)	62.29 (26.86)	66.40 (23.77)	79.26 (19.76)
	Previous Attendee	68.68 (25.09)	63.95 (26.56)	66.63 (24.44)	80.12 (18.75)

Mean POMP scores for the two regulation strategies, reappraisal and suppression, are shown for first year Burning Man attendees and previous attendees. Standard deviations are shown in parentheses. The sample sizes for the studies are: Study 1—1,398 first-years and 2,083 previous attendees; Study 2—930 first-years, 1,529 previous attendees; Study 3—1,801 first-years, 2,189 previous attendees; and Study 4—2,709 first-years, 3,597 previous attendees.

observed more prominent decreases in the suppression of *positive* emotion at Burning Man. Individuals also reported suppressing negative emotion less often at Burning Man than typically at home, but the difference between the contexts is greater for positive emotion. This valence specificity increases our understanding of the precise ways that a sociocultural context can influence emotion regulation.

One of the benefits of decreased suppression usage in the Burning Man context is the allowance for increased positive emotion, which is likely to have individual, social, and cultural benefits. Individually, increased suppression of positive emotion is associated with decreased *experience* of positive emotion (Nezlek and Kuppens, 2008) so decreased suppression of positive emotion may lead to longer-lasting positive experiences. Socially, decreased suppression of positive emotion may facilitate the formation of new friendships and romantic relationships, as well as strengthen existing ones (Gross and John, 2003). Culturally, decreases in suppression of positive emotion may in turn facilitate the creation of a cultural environment that supports joyful experimentation among adults, like that which is enjoyed by children on playgrounds. The increased expression of positive emotion might encourage adults to play, by experimenting with new identities, emotional repertoires, senses of self, and cultural tools more than they would in other situations.

Previous research indicates that reappraisal has different properties when it is used to increase positive and decrease negative emotion (Shiota and Levenson, 2009, 2012; McRae et al., 2012), which would prove interesting if reappraisal were used more for one of these emotional goals than the other at Burning Man. However, we did not observe consistent differences in the change of self-reported reappraisal use between positive and negative emotion, even with a very large sample size. Therefore, people may enjoy the general benefits associated with using reappraisal more in this alternative sociocultural context, but we did not see changes that would suggest benefit increases related specifically to reappraising positive or negative emotions.

EFFECTS OF A TEMPORARY SOCIOCULTURAL CONTEXT

Only a couple of studies have looked at changes in emotion regulation by relatively local sociocultural context. One examined a standard transition between high school and college, a common transition between two typical social environments (Srivastava et al., 2009). The other study looked at Burning Man, a temporary social context and an alternative culture that thousands of people have visited, many of whom have an explicit countercultural intent to participate in the creation of a different kind of society, one that is less hierarchical and more joyful (McRae et al., 2011). The study on the transition to college found an *increased* use of suppression following the transition, whereas the previous Burning Man study found *decreases* in suppression and increases in reappraisal usage at Burning Man. Knowing that reduced suppression of positive emotion is the most prominent change in emotion regulation in this alternative context might help us better understand what aspects of this alternative sociocultural context contribute most strongly to changes in emotion regulation.

The social milieu at Burning Man is one environment that offers people an alternative model for emotion regulation. Everyday life in the US can be serious and subdued, infused with a Protestant work ethic promising that hard work will lead to salvation (Durkheim, 1933; Weber, 2008) and the need to express oneself in ways that work to maintain a positive image and story of oneself (Goffman, 1955; Wellington, 2001). Therefore, the consequences of transparent emotional expression may be unfavorable in everyday contexts in the US, including during the transition to college and in certain industries with expressive demands (Hochschild, 1983; Pierce, 1995; Srivastava et al., 2009). There are occasionally times and places for expressing oneself more freely, such as church revivals, spring break, Mardi Gras, Greek life parties, funerals, weddings, and other spiritual or religious mass gatherings. In these contexts, a person may feel that they can suspend normal emotional display rules and express emotions—perhaps even loudly. However, these opportunities can be short and/or infrequent, many occur in private spaces, and forms of expression are constrained by custom. In contrast, spontaneous, creative, and boisterous expressions of emotion are common in public spaces at Burning Man, even those that cause discord and interpersonal conflicts. A person may feel that they are able to express emotion more openly in this setting than typically, where it may be more likely that a person could be harshly judged for expressing emotion in ways that defy established norms. At Burning Man, where there are fewer rigid norms and new customs are still emerging, self-expression has become cherished as a public good, which encourages people to explore and experiment with many types of emotional expression. Unexpected, joyful outbursts are especially appreciated at Burning Man. This is not to say that everyone feels joyful at Burning Man all week long, in fact, grief and sorrow are openly expressed at the Temple, where participants inscribe messages on the walls about death, illness

and potential trauma (Pike, 2005; Gilmore, 2010). But the data reported here demonstrate that if and when people feel positive emotion, they are more likely to express it publicly. The alternative environment provides a sociocultural context where expression is encouraged and reputational costs are lower, resulting in decreased suppression for all emotion, but especially for positive emotion.

As we have previously postulated, an alternative sociocultural context allows many participants to view their everyday lives from a broader, distanced perspective, which is a key ingredient in reappraisal (McRae et al., 2011). The novel social structure, including new social relationships, the gift economy, and focus on art may all encourage increased reappraisal of both positive and negative emotion. Along with previous findings, our findings show that sociocultural context can influence emotion regulation more quickly than originally thought. Though it is unclear what factors (e.g., radical self-expression, emphasis on artistic expression, etc.) at Burning Man account for these changes, it is possible that similar emotion regulation changes occur in other celebratory sociocultural contexts (e.g., Mardis Gras). It is still uncertain which types of contexts are more or less conducive to quick changes in emotion regulation. Through this particular social experiment, people seem to have discovered a way to increase their use of adaptive strategies for regulating both positive and negative emotion.

EFFECTS OF GENDER, AGE, AND PREVIOUS EXPERIENCE AT BURNING MAN

The consequences for expressing emotion may be unfavorable for everyday life in the US, more so for men than women, and more so for younger people than older individuals. Our examination of demographic variables indicated that contextual effects of self-reported suppression and reappraisal used to regulate positive and negative emotion are slightly different in different groups. Although these interactions were much smaller than those reported for the contextual effects, they hint at how this sociocultural context might influence individuals in different ways. Most prominently, the decreased suppression of positive emotion at Burning Man is strongest in men and younger adults. Previous work has demonstrated that men use suppression more than women in everyday life, and younger individuals use suppression more than older individuals in everyday life (John and Gross, 2004). Therefore, these groups might enjoy the greatest relative benefit of an alternative environment like Burning Man. In Studies 2–4, those who had attended Burning Man previously showed decreased suppression regardless of context. As the culture of Burning Man is spreading through regional events, Burning Man is indeed a social movement—and may indicate a resurgence of emotional expression in public. We observed the lasting impact of this movement when observed that individuals with previous experience at Burning Man reported decreased use of suppression—not only when at the event, but also at home in their typical lives. This means that although the event itself is temporary, the changes in self-reported emotion regulation we observed begin to take hold outside of the event as well. Future research should examine (1) if this is only true of those who choose to return to the event, or if these changes last even if someone has not visited Black Rock City for some time; and (2) the effects of experience at Burning Man on emotion regulation in a variety of other sociocultural contexts.

LIMITATIONS AND FUTURE DIRECTIONS

The present study replicated and extended previous findings with four separate samples of considerable size, but was not without limitations. Although Burning Man provides an excellent opportunity for the study of an alternative sociocultural context, the environment presented several challenges for data collection. First, because our items were on a longer survey, we were restricted by length, and could only add single self-report items to examine the use of each regulation strategy to influence each type of emotion, and strategy use for the typical home context was reported retrospectively. Though previous research indicates that single items can be reliable (Robins et al., 2001; Gosling et al., 2003), we plan to ask participants to make these ratings on multiple items, in each context in future years. Participants' reporting their use of these regulation strategies at home retrospectively presents two potential problems. The first is that the explicit culture of "radical self-expression" at Burning Man might contribute to demand effects, wherein participants report using suppression less often at Burning Man than at home. However, we feel that the distinction we observed between self-reported suppression of positive and negative emotion is still of interest. Additionally, the effects of reappraisal that we report are much less likely to be influenced by the demand of the Burning Man environment in the same way, as there are no explicit cultural values surrounding reappraisal. Second, because participants were estimating their strategy use typically at home retrospectively, these reports might be influenced by failures of memory or other biases. Until we measure self-reported regulation strategy use in both the Burning Man and typical home contexts, we are unable to rule out this potential source of error.

In addition, it is possible that the responses to the emotion regulation questions reported here were influenced by the presence of other questions that were asked on the questionnaire given each year. However, because the specific questions asked every year were not identical, we are confident that the effects we report are consistent across studies and reflect changes in self-reported emotion regulation as opposed to changes in the surrounding questions. Also, because our sample was one of volunteers (a convenience sample) we cannot ensure that they represent the population of Burning Man. In future years we plan on collecting a representative sample and using weighting techniques to adjust this data to be able to speak for the population as a whole. Finally, participants at Burning Man are exposed to a variety of challenges, including a hostile living environment, extreme weather, sleep deprivation, and dehydration, all of which have the potential to influence their state of mind and ability to fill out questionnaires accurately and conscientiously. In the present study, we excluded participants that did not demonstrate careful reading and responding to a quality control item, but it is possible that not all questions were answered thoughtfully.

For future studies it will be valuable to examine not only self-reported use of emotion regulation strategies but also direct reports of emotion experience. This will capture a broader picture, not of *attempts* to change positive and negative emotion, but

the relative *success* of those efforts (for a discussion of emotion regulation frequency vs. success, see McRae, 2013). Previous studies have also shown that suppression and reappraisal can be used to both up- and down-regulate emotion. In future studies, it will be valuable to consider how successfully both positive and negative emotion can be up- and down- regulated by the strategies reported here.

CONCLUSION

The present study extends previous research by showing that sociocultural context differentially influences how individuals regulate positive and negative emotion. According to participants' self report of emotion regulation at home and at Burning Man, an alternative sociocultural context that explicitly encourages "radical self-expression" is associated with decreased use of self-reported suppression of positive and negative emotion; but this is most strongly driven by the decreased suppression of positive emotion. By contrast, reappraisal increases comparably for both positive and negative emotion at Burning Man. These findings enhance our understanding of the effects of sociocultural context on the use of emotion regulation strategies that are known to be differentially adaptive. There are likely to be other contexts and occasions where cultural and social norms influence how individuals regulate emotion. These findings have implications for understanding the sociocultural contexts in which suppression, especially the suppression of positive emotion, and its associated maladaptive effects, may be minimized.

ACKNOWLEDGMENTS

The authors would like to thank Black Rock City, LLC, especially Ray Allen and Rosalie Barnes, for their support of the Black Rock Census. We would also like to thank James J. Gross, Bethany G. Ciesielski, Erik K. Wing, and all the dedicated volunteers and research assistants who helped with data collection and entry.

REFERENCES

Aldao, A., Nolen-Hoeksema, S., and Schweizer, S. (2010). Emotion-regulation strategies across psychopathology: a meta-analytic review. *Clin. Psychol. Rev.* 30, 217–237. doi: 10.1016/j.cpr.2009.11.004

Bonanno, G. A., Papa, A., Lalande, K., Westphal, M., and Coifman, K. (2004). The importance of being flexible: the ability to both enhance and suppress emotional expression predicts long-term adjustment. *Psychol. Sci.* 15, 482–487. doi: 10.1111/j.0956-7976.2004.00705.x

Burning Man Organization. (2011). *Frequently Asked Questions: General Information*. Available online at: http://www.burningman.com/whatisburningman/about_burningman/faq_what_is.html

Butler, E. A., Egloff, B., Wlhelm, F. H., Smith, N. C., Erickson, E. A., and Gross, J. J. (2003). Thesocial consequences of expressive suppression. *Emotion* 3, 48–67. doi: 10.1037/1528-3542.3.1.48

Butler, E. A., Lee, T. L., and Gross, J. J. (2007). Emotion regulation and culture: are the socialconsequences of emotion suppression culture-specific. *Emotion* 7, 30–48. doi: 10.1037/1528-3542.7.1.30

Chen, K. K. (2009). *Enabling Creative Chaos: The Organization Behind the Burning Man Event.* Chicago, IL: University of Chicago Press.

Chen, K. K. (2011). Lessons for creative cities from Burning Man: how organizations can sustain and disseminate a creative context. *City Cult. Soc.* 2, 93–100. doi: 10.1016/j.ccs.2011.05.003

Chen, K. K. (2012a). Artistic prosumption: cocreative destruction at Burning Man. *Am. Behav. Sci.* 56, 570–595. doi: 10.1177/0002764211429362

Chen, K. K. (2012b). Laboring for the man: augmenting authority in a voluntary association. *Res. Sociol. Organ.* 34, 135–164. doi: 10.1108/S0733-558X,(2012)0000034008

Cohen, P., Cohen, J., Aiken, L. S., and West, S. G. (1999). The problem of units and the circumstance for POMP. *Multivariate Behav. Res.* 34, 315–346. doi: 10.1207/S15327906MBR3403_2

Durkheim, E. (1933). *The Division of Labor in Society.* New York, NY: Macmillan

Egloff, B., Schmukle, S. C., Burns, L. R., and Schwerdtfeger, A. (2006). Spontaneous emotionregulation during evaluated speaking tasks: associations with negative affect, anxiety expression, memory, and physiological responding. *Emotion* 6, 356–366. doi: 10.1037/1528-3542.6.3.356

Gilmore, L. M. (2010). *Theater in a Crowded Fire: Ritual and Spirituality at Burning Man.* Berkeley, CA: University of California Press.

Giuliani, N. R., McRae, K., and Gross, J. J. (2008). The up- and down-regulation of amusement: experiential, behavioral, and autonomic consequences. *Emotion* 8, 714–719. doi: 10.1037/a0013236

Goffman, E. (1955). On face-work: an analysis of ritual elements in social interaction. *J. Study Interpers. Process.* 18, 213–231. doi: 10.1162/15241730360580159

Goldin, P. R., McRae, K., Ramel, W., and Gross, J. J. (2008). The neural bases of emotion regulation: reappraisal and suppression of negative emotion. *Biol. Psychiatry* 63, 577–586. doi: 10.1016/j.biopsych.2007.05.031

Gosling, S. D., Rentfrow, P. J., and Swann, W. B. (2003). A very brief measure of the Big-Five personality domains. *J. Res. Pers.* 37, 504–528. doi: 10.1016/S0092-6566(03)00046-1

Gross, J. J. (1998a). Antecedent- and response-focused emotion regulation: divergentconsequences for experience, expression, and physiology. *J. Pers. Soc. Psychol.* 74, 224–237. doi: 10.1037/0022-3514.74.1.224

Gross, J. J. (1998b). The emerging field of emotion regulation: an integrative review. *Rev. Gen. Psychol.* 2, 271–299. doi: 10.1037/1089-2680.2.3.271

Gross, J. J. (2002). Hiding feelings: the acute effects of inhibiting negative and positive emotion. *Psychophysiology* 39, 281–291. doi: 10.1037/0021-843X.106.1.95

Gross, J. J., and John, O. P. (2003). Individual differences in two emotion regulation processes: implications for affect, relationships, and well-being. *J. Pers. Soc. Psychol.* 85, 348–362. doi: 10.1037/0022-3514.85.2.348

Gross, J. J., and Levenson, R. W. (1997). Hiding feelings: the acute effects of inhibitingnegative and positive emotion. *J. Abnorm. Psychol.* 106, 95–103. doi: 10.1037/0021-843X.106.1.95

Gross, J. J., Sheppes, G., and Urry, H. L. (2011). Cognition and emotion lecture at the 2010 SPSPEmotion Preconference: emotion generation and emotion regulation: a distinctionwe should make (carefully). *Cogn. Emot.* 25, 765–781. doi: 10.1080/02699931.2011.555753

Hajcak, G., Moser, J. S., and Simons, R. F. (2006). Attending to affect: appraisal strategies modulate the electrocortical response to arousing pictures. *Emotion* 6, 517–522. doi: 10.1037/1528-3542.6.3.517

Hochschild, A. R. (1983). *The Managed Heart: Commercialization of Human Feeling.* Los Angeles, CA: University of California Press.

Jackson, D. C., Malmstadt, J. R., Larson, C. L., and Davidson, R. J. (2000). Suppression and enhancement of emotional responses to unpleasant pictures. *Psychophysiology* 37, 515–522. doi: 10.1017/S0048577200990401

John, O. P., and Gross, J. J. (2004). Healthy and unhealthy emotion regulation: personality processes, individual differences, and lifespan development. *J. Pers.* 72, 1301–1334. doi: 10.1111/j.1467-6494.2004.00298.x

Kim, S., and Hamann, S. (2007). Neural correlates of positive and negative emotion regulation. *J. Cogn. Neurosci.* 19, 776–798. doi: 10.1162/jocn.2007.19.5.776

Kim, S., and Hamann, S. (2012). The effect of cognitive reappraisal on physiological reactivity and emotional memory. *Int. J. Psychophysiol.* 83, 348–356. doi: 10.1016/j.ijpsycho.2011.12.001

Kozinets, R. V. (2002). Can consumers escape the market. Emancipatory illuminations from burning man. *J. Consum. Res.* 29, 20–38. doi: 10.1086/339919

Kozinets, R. V., and Sherry, J. F. (2005). "Welcome to the black rock cafe," in *AfterBurn: Reflections on Burning Man*, eds L. Gilmore and

M. Van Proyen (Albuquerque, NM: University of New Mexico Press), 87–106.

Lazarus, R. S. (1991). Progress on a cognitive-motivational-relational theory of emotion. *Am. Psychol.* 46, 819–834. doi: 10.1037/0003-066X.46.8.819

Matsumoto, D., Yoo, S., and Nakagawa, S. (2008). Culture, emotion regulation, and adjustment. *J. Pers. Soc. Psychol.* 94, 925–937. doi: 10.1037/0022-3514.94.6.925

Mauss, I. B., and Gross, J. J. (2004). "Emotion suppression and cardiovascular disease: is hiding your feelings bad for your heart?" in *The Expression of Emotion and Health,* eds L. R. Temoshok, A. Vingerhoets, and I. Nyklicek (London: Brunner-Routledge), 62–81.

McRae, K. (2013). Emotion regulation frequency and success: separating constructs from methods and timescale. *Soc. Personal. Psychol. Compass* 7, 289–302. doi: 10.1111/spc3.12027

McRae, K., Ciesielski, B., and Gross, J. J. (2012). Unpacking cognitive reappraisal: goals, tactics, and outcomes. *Emotion* 12, 250–255. doi: 10.1037/a0026351

McRae, K., Heller, S., John, O. P., and Gross, J. J. (2011). Context-dependent emotion regulation: suppression and reappraisal at the Burning Man festival. *Basic Appl. Soc. Psychol.* 33, 346–350. doi: 10.1080/01973533.2011.614170

Moore, S. A., Zoellner, L. A., and Mollenholt, N. (2008). Are expressive suppression and cognitive reappraisal associated with stress-related symptoms? *Behav. Res. Ther.* 46, 993–1000. doi: 10.1016/j.brat.2008.05.001

Nezlek, J. B., and Kuppens, P. (2008). Regulating positive and negative emotions in daily life. *J. Pers.* 76, 561–579. doi: 10.1111/j.1467-6494.2008.00496.x

Ochsner, K. N., and Gross, J. J. (2004). "Thinking makes it so: a social cognitive neuroscienceapproach to emotion regulation," in *Handbook of Self-Regulation: Research, Theory, and Applications,* eds R. F. Baumeister and K. D. Vohs (New York, NY: Guilford Press), 229–255

Pierce, J. L. (1995). *Gender Trials: Emotions in Contemporary Law Firms*. Los Angeles, CA: University of California Press.

Pike, S. M. (2005). "AfterBurn: reflections on Burning Man," in *No Novenas for the Dead: Ritual Action and Communal Memory at the Temple of Tears,* eds A. Gilmore and M. Van Proyen (Albuquerque, NM: University of New Mexico Press), 174–195

Ray, R. D., McRae, K., Ochsner, K. N., and Gross, J. J. (2010). Cognitive reappraisal of negativeaffect: converging evidence from EMG and self-report. *Emotion* 10, 587–592. doi: 10.1037/a0019015

Robins, R. W., Tracy, J. L., Trzesniewski, K., Potter, J., and Gosling, S. D. (2001). Personality correlates of self-esteem. *J. Res. Pers.* 35, 463–482. doi: 10.1006/jrpe.2001.2324

Shiota, M. N., and Levenson, R. W. (2009). Effects of aging on experimentally instructed detachedreappraisal, positive reappraisal, and emotional behavior suppression. *Psychol. Aging* 24, 890–900. doi: 10.1037/a0017896

Shiota, M. N., and Levenson, R. W. (2012). Emotional effects of detached versus positive reappraisal. *J. Pers. Soc. Psychol.* 103, 416–429. doi: 10.1037/a0029208

Soto, J. A., Perez, C. R., Kim, Y., Lee, E. A., and Minnick, M. R. (2011). Is expressivesuppression always associated with poorer psychological functioning. A cross-culturalcomparison between European Americans and Hong Kong Chinese. *Emotion* 11, 1450–1455. doi: 10.1037/a0023340

Srivastava, S., Tamir, M., McGonigal, K. M., John, O. P., and Gross, J. J. (2009). The social costsof emotional suppression: a prospective study of the transition to college. *J. Pers. Soc. Psychol.* 96, 883–897. doi: 10.1037/a0014755

Stepper, S., and Strack, F. (1993). Proprioceptive determinants of emotional andnonemotional feelings. *J. Pers. Soc. Psychol.* 64, 211–220. doi: 10.1037/0022-3514.64.2.211

Szczurek, L., Monin, B., and Gross, J. J. (2012). The stranger effect: the rejection of affective deviants. *Psychol. Sci.* 23, 1105–1111. doi: 10.1177/0956797612445314

Troy, A. S., Wilhelm, F. H., Shallcross, A. J., and Mauss, I. B. (2010). Seeing the silver lining: cognitive reappraisal ability moderates the relationship between stress anddepressive symptoms. *Emotion* 10, 783–795. doi: 10.1037/a0020262

Turner, F. (2009). Burning Man at Google: a cultural infrastructure for new media production. *New Media and Society* 11, 73–94. doi: 10.1177/1461444808099575

Weber, M. (2008). *The Protestant Ethic and the Spirit of Capitalism with Other Writings of the Rise on the West*, ed S. Kalberg (New York, NY: Oxford Press University).

Wellington, C. (2001). At face value. Image consultancy, emotional labour and professional work. *Sociology (Oxford)* 35, 933–946. doi: 10.1017/S0038038501009336

Westphal, M., Seivert, N. H., and Bonanno, G. A. (2010). Expressive flexibility. *Emotion* 10, 92–100. doi: 10.1037/a0018420

Conflict of Interest Statement: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Received: 24 June 2012; accepted: 19 April 2013; published online: 03 July 2013.

*Citation: Snyder SA, Heller SM, Lumian DS and McRae K (2013) Regulation of positive and negative emotion: effects of sociocultural context. Front. Psychol. **4**:259. doi: 10.3389/fpsyg.2013.00259*

This article was submitted to Frontiers in Emotion Science, a specialty of Frontiers in Psychology.

frontiers in PSYCHOLOGY

HYPOTHESIS AND THEORY ARTICLE
published: 14 January 2013
doi: 10.3389/fpsyg.2012.00597

Why try (not) to cry: intra- and inter-personal motives for crying regulation

Gwenda Simons[1], Martin Bruder[2]*, Ilmo van der Löwe[1] and Brian Parkinson[1]

[1] Department of Experimental Psychology, University of Oxford, Oxford, UK
[2] Zukunftskolleg/Department of Psychology, University of Konstanz, Konstanz, Germany

Edited by:
Vera Shuman, University of Lausanne, Switzerland

Reviewed by:
Agneta H. Fischer, University of Amsterdam, Netherlands
Ad Vingerhoets, Tilburg University, Netherlands
Randy Cornelius, Vassar College, USA

***Correspondence:**
Martin Bruder, Zukunftskolleg/Department of Psychology, University of Konstanz, Box 216, 78457 Konstanz, Germany.
e-mail: martin.bruder@uni-konstanz.de

This article discusses inter- and intra-personal motives for the regulation of crying, and presents illustrative findings from an online survey ($N = 110$) exploring why and how people regulate crying in their everyday lives. In line with current theorizing on emotion regulation and crying (e.g., Vingerhoets et al., 2000), we propose that emotional crying is regulated using both antecedent-focused techniques targeting the underlying emotion and response-focused techniques targeting the act of crying itself. Indeed, our survey respondents reported having used both antecedent- and response-focused strategies to either up-regulate or down-regulate their crying. Motives for crying regulation may be both inter- and intra-personal and may serve both immediate, pleasure motives, and future, utility motives (Tamir, 2009). Our findings suggest that down-regulation attempts are often driven by inter-personal motives (e.g., protecting the well-being of others; impression management) in addition to intra-personal motives such as maintaining subjective well-being, whereas up-regulation attempts are mostly driven by intra-personal motives. Further progress requires methodologies for manipulating or tracking regulation motives and strategies in real-time crying episodes.

Keywords: crying, emotion regulation, inter-personal motives for regulation, intra-personal motives for regulation, emotion regulation strategies

Crying marks some of the most consequential and intensely emotional events in many people's lives (Lombardo et al., 2001; Miceli and Castelfranchi, 2003) and may play a role in helping people to cope with such events (Vingerhoets and Scheirs, 2000). Besides its relevance for the individual, crying is also one of the most powerful inter-personal emotional signals showing that someone is "moved to an unusual depth" (Katz, 1999, p. 175). Although crying may "sometimes be used purposefully to manipulate people" (Vingerhoets and Scheirs, 2000, p. 144), it is usually seen as an authentic outburst of pure emotion. Despite being notoriously difficult to control, most people try to regulate their crying in at least some situations.

The causes of crying itself include situations involving rejection, personal inadequacy, pain and injury, separation, and criticism/rebuke (see Vingerhoets et al., 2001, for a brief overview) as well as certain positive events (e.g., birth of children, weddings). And although sadness, anger, anxiety, and frustration are the emotions most strongly associated with crying across a range of cultures (Vingerhoets et al., 2001), crying is also possible when people feel positive emotions such as relief, happiness, or joy (e.g., Miceli and Castelfranchi, 2003).

Some researchers argue that crying is not (necessarily) linked to emotional experiences. According to the behavioral ecology view, we might cry purely in order to communicate social motives to others, (e.g., because we perceive another person to be a likely source of comfort or help or because we want to draw attention to the injustice that has been done to us; Fridlund, 1991). Despite our focus in the present article on crying associated with emotions such as sadness and distress, we do not exclude the possibility of communicative crying. Indeed, it seems possible that communication is part of the function of the emotions associated with crying (e.g., Parkinson, 1996).

Although there has been some previous research into adult crying and its effects on health and well-being, little is yet known about the reasons for, and effects of, withholding tears or indeed encouraging them. Although numerous studies have investigated the regulation of (emotional) expressions and its effects in a great variety of contexts (e.g., Gross, 1998; Gross and John, 2003; Soto et al., 2011), there has been little systematic research of either direct regulation of crying or the regulation of emotions associated with crying (indirect crying regulation). Even less attention has been devoted to the motives underlying crying regulation.

In general, people regulate their experience and expression for a variety of reasons, such as increasing productivity at work, improving relations with others, and maintaining subjective well-being (Gross and Muñoz, 1995). Thus it appears that emotion regulation attempts serve to achieve both intra-personal and inter-personal effects (e.g., Evers et al., 2011; Parkinson and Simons, 2012). People do not always want to improve how they feel, and might sometimes be motivated to experience unpleasant emotions (e.g., for instrumental reasons, when those emotions promote the attainment of longer-term goals, Tamir, 2009). Correspondingly, crying and the emotions associated with it, might be down-regulated (inhibited) or up-regulated (increased) in line with either intra- or inter-personal motives.

This paper discusses potential strategies for the regulation of crying, perceived effects of crying, and the inter- and intra-personal motivations underlying crying regulation. Where relevant we will present initial evidence from an online survey which assessed crying and crying regulation in sad or upsetting situations in 31 male and 79 female respondents aged between 18 and 74 ($M = 30.81$, SD = 12.29). Most respondents resided in the UK (37%), the USA (31%), or another English-speaking country (9%). Sixteen percent of respondents resided in another European country and the rest (7%) lived elsewhere in the world.

The survey asked respondents to describe a situation in which they either felt the urge to cry or actually did cry. Respondents completed the survey in either the no-regulation of crying condition ($n = 29$); the up-regulation condition ($n = 27$), where they were asked about situations in which they encouraged crying; or the down-regulation of crying condition ($n = 54$), where they were asked to describe a situation in which they tried to inhibit their crying or prevent themselves from crying. All respondents indicated a medium to high urge to cry ($M = 79.15$, SD = 20.43 on a 100-point scale running from 0 = *not at all* to 100 = *extremely*). The extent to which respondents actually cried was lower ($M = 48.88$, SD = 37.96) and varied considerably across conditions. In both the no-regulation and up-regulation condition all respondents indicated crying during the event, whereas 12 of the down-regulation respondents managed to avoid crying altogether. The main reported causes of crying were: different types of loss [illness/death (19%); separation (20%); other loss (5%)]; conflict (26%); witnessing suffering (7%); movies; or music (7%), and the person's psychological state (e.g., depression; 7%). Respondents also reported on their motivations for up-regulating, down-regulating, or not regulating their crying. Participants in the two crying regulation conditions (up-regulation and down-regulation) were additionally asked to describe how they regulated their crying and the emotions associated with crying (strategies). The event description and the description of methods of regulation were both open-ended questions (using an autobiographical narrative approach; e.g., Baumeister et al., 1990). Responses were coded by trained judges, and supplemented by quantitative self-report data (using rating scales and multiple choice questions) relating to regulation strategies and motivations for regulating – or not regulating – crying as well as questions about the social context in which crying occurred.

HOW IS CRYING REGULATED?

The regulation of crying associated with emotional experiences is perhaps best understood using the model of emotion regulation proposed by Gross and Muñoz (1995) which distinguishes two types of strategy: antecedent-focused regulation, in which the input to the emotional system is targeted (e.g., by situation selection) and response-focused regulation, in which the emotion program has been activated and the response tendencies which have been generated are modified by "strategies that intensify, diminish, prolong, or curtail on-going emotional experience, expression or physiological responding" (Gross, 1998, p. 225).

Consistent with Gross and colleagues' approach, Vingerhoets and colleagues (Vingerhoets et al., 2000; Bekker and Vingerhoets, 2001) argue that crying can be regulated at both input and output stages of the emotional system. At the input stage, people might try to regulate their crying by regulating the emotions associated with crying. For example, an antecedent-focused strategy for crying regulation might entail avoiding situations that elicit the affective reactions that cause crying (situation selection), trying to change such situations (situation modification), shifting attention away from events that cause crying (attention deployment), or finding a different interpretation of these events (reappraisal). Similarly, people might use antecedent strategies to up-regulate crying, for example by focusing on the negative aspects of the situation or selecting a situation which they know will make them cry. For example, actors are commonly instructed to think of a sad memory in order to help them cry when required. By contrast, response-focused regulation strategies target crying directly either to down-regulate (*expressive suppression*, e.g., swallowing tears, trying to appear cheerful despite feeling sad, or trying to breathe normally) or to up-regulate (e.g., actors also sometimes make their tears flow by rubbing their eyelids with menthol or other irritants).

Bekker and Vingerhoets (2001) argue that person-related variables such as gender, personality, psychopathology, and socialization influence whether or not there is antecedent- or response-focused regulation of crying and which specific techniques are used. In addition, research has shown that reappraisal and other antecedent-focused regulation techniques are effective in decreasing emotional experience and expressive behavior without significant cognitive, physiological, or indeed inter-personal costs, whereas suppression and other response-focused techniques can lead to less satisfying social interactions (Gross et al., 2006). This suggests that antecedent-focused regulation serves inter-personal functions best.

Supporting the arguments from Vingerhoets and colleagues (Vingerhoets et al., 2000; Bekker and Vingerhoets, 2001), respondents in our survey reported having used both antecedent- and response-focused strategies to regulate their crying. Open-ended data from the survey revealed that they used strategies such as leaving or changing the situation (e.g., "I stepped into another room"), trying to reappraise the situation (e.g., "I focused on the positive aspects"), distracting themselves (e.g., "Tried to think of something else and concentrate on not being upset"), focusing on the situation's negative or positive aspects (e.g., "I tried to increase crying by remembering happy times with her and thinking how I would never be with her again"), and actively suppressing (e.g., "I took deep breaths"; "I tried to get my face into shape") or enhancing their crying (e.g., "I intensified my facial expression which made me feel even more sad and devastated").

Quantitative survey data further confirmed that both types of strategy were used. For down-regulation, the mean ratings for response-focused strategies ($M = 2.36$, SD = 0.45) and antecedent-focused strategies ($M = 2.38$, SD = 0.82) were comparable (both rated on 5-point rating scales ranging from 1 = *not at all* to 5 = *a great deal*). For up-regulation, although the mean rating for response-focused strategies ($M = 3.18$, SD = 0.71) was significantly greater than for antecedent-focused strategies ($M = 2.60$, SD = 0.92), $t(27) = 4.74$, $p < 0.001$, both types of regulation strategies were reported by our respondents.

These preliminary findings need to be substantiated and extended in a more in-depth study of the strategies used to regulate crying. The survey relied entirely on retrospective self-reports about crying episodes. Although using such measures brings clear advantages when investigating crying and the strategies used to regulate crying (e.g., it allows the sampling of a wide range of personally involving, real life situations), there are also considerable disadvantages (Bylsma et al., 2011). Given the retrospective nature of these self-reports, people may, for example, report stereotyped memories, rather than giving an account of the actual events. In addition, given the sometimes very intense emotions experienced at the time of the crying event, memories might be distorted (e.g., Levine and Edelstein, 2009). The emotional nature of the original episodes might further cause respondents to either choose not to report certain events to protect themselves from remembering or even reliving the negative emotions associated with them. They may also alter their account to make it more socially desirable and as a result there might be unwillingness to report Machiavellian regulation (e.g., up-regulating of crying to get back at a partner). At the same time, there are problems in investigating crying regulation in more controlled settings, such as in the laboratory. First of all, eliciting crying in controlled settings raises important ethical concerns. Research must not expose participants to undue risk of harm (British Psychological Society, 2009; American Psychological Association, 2010); and exposure to potentially distressing events in order to elicit crying may indeed be harmful. Second, there are practical problems in devising induction techniques that elicit crying across a wide range of participants (Bylsma et al., 2011). However, notwithstanding these issues, it is recommended that future research supplements self-report data with more direct measures (for example real-time observation) in more controlled contexts. Diary methodology is also useful since event-contingent or daily reports on crying episodes are less likely to be affected by memory biases (e.g., Parkinson et al., 1995; Bylsma et al., 2011).

Drawing in part on Bekker and Vingerhoets' (2001) adaptation of the regulation model (Gross and Muñoz, 1995), we propose that the extent to which crying is regulated and which strategy is selected to regulate it depend on the perceived effects of crying and regulation of crying, the salience of particular relational goals, regulation motives, and social norms concerning crying, the intensity of the underlying emotion, and person characteristics such as gender and personality.

INTRA-PERSONAL AND INTER-PERSONAL EFFECTS OF CRYING

To understand the inter- and intra-personal motivations for the deliberate regulation of crying and crying-related emotions, we first need to explore the functions of crying and especially what people believe the effects of crying to be. Our motivations to regulate or not regulate our crying are directly linked to our perceptions of the effects of crying on ourselves and the people around us, immediately and in the future. We regulate crying in order to achieve certain anticipated personal and inter-personal effects or to prevent or dampen effects that we anticipate would occur if we did not regulate. For example, research by Timmers et al. (1998) showed that women both cried more and anticipated more cathartic effects of crying than men. These authors also found that women were more likely to seek comfort when expressing sadness. This latter finding suggests that women may anticipate more positive inter-personal effects of crying than men do and consequently are less likely to inhibit their crying.

The effects of crying are also context-dependent. Crying occurs more frequently in some contexts, such as a funeral, compared to others, for example the office (e.g., Cornelius and Labott, 2001). People perceive there to be different consequences when crying whilst alone than with others and similarly, whether crying is up-regulated, down-regulated, or not regulated at all, depends in part on the presence or absence of others (e.g., Vingerhoets et al., 2001). Our survey showed that respondents were equally likely to be alone or with people that they knew when they up-regulated their crying or refrained from regulation. By contrast, down-regulation mainly occurred in the presence of person(s) known to respondents, but rarely when respondents reported being on their own. It follows that we should consider the effects that people perceive crying to have both for themselves and for those around them in order to understand the underlying motives for regulation.

INTRA-PERSONAL EFFECTS

Many people believe that it is good to cry, at least in certain circumstances and that holding back tears can have negative consequences for personal well-being (see Cornelius, 1986, for an informative review of articles in popular magazines). It is widely believed that crying can help people to recover from certain (emotional) events. "Sometimes it's better to get it all out," as one of our respondents put it. Indeed, it is widely assumed that crying can be healthy and restorative (e.g., Efran and Spangler, 1979; Kraemer and Hastrup, 1988). A similar intra-personal function of crying is to alleviate depression. Relatedly, crying is often observed during psychotherapy, and is generally seen by therapists as a potentially cathartic discharge of affect (e.g., Cornelius, 2001; Nelson, 2008).

The reported benefits of crying for affect, when they occur, appear to depend on the mood characteristics of the person crying (dispositional positive and negative mood) and the social context in which crying occurs. In their diary study involving 97 women, Bylsma et al. (2011) found that those women who were high on dispositional negative mood (i.e., average negative mood across the whole diary period) and low on dispositional positive mood, reported more crying episodes, and a higher urge to cry. They further found that in their study one person being present during the crying episode improved the mood of the crier afterward whereas the presence of multiple others had a negative impact. In other words, there is evidence that the intra-personal effects of crying regulation, like its inter-personal effects, are variable rather than fixed.

If crying releases or purges negative affect, then its inhibition may correspondingly worsen mood, well-being, and (mental) health (in contrast to potential positive effects of up-regulation). Indeed, there is evidence that the routine down-regulation of emotions (and of crying in particular) undertaken by health professionals and police officers may ultimately lead to burnout (e.g., Bakker and Heuven, 2006). However, it is important to distinguish between the immediate effects of the inhibition of a single crying episode and the long-term effects of the chronic inhibition of crying (Vingerhoets and Bylsma, 2007), and it might be the latter

in particular, which has negative effects for well-being (Bakker and Heuven, 2006). It is also possible that these effects depend on the individual, organizational, and environmental factors that lead workers to engage in regular down-regulation in the first place rather than down-regulation itself.

Crying is further thought to be associated with the reduction of accumulated tension and physiological arousal (e.g., Efran and Spangler, 1979; see Vingerhoets et al., 2000, for an overview). Thus, inhibition of crying may lead to increased autonomic activation (Gross, 1998), bringing adverse consequences for physical health in the longer-term (Vingerhoets et al., 2000). These adverse consequences may depend on the strategies deployed to regulate crying. Prior research suggests that response-focused regulation of emotions in particular is accompanied by increased sympathetic nervous system arousal, due to regulatory effort as well as disruption of the usual tension-reduction process (Gross, 1998). It follows that when a response-focused technique is used to inhibit crying, there should be a marked increase in sympathetic nervous system arousal. Response-focused regulation can also bring cognitive costs such as interference with processing of emotional stimuli (e.g., Richards and Gross, 2000). To the extent that these cognitive consequences reduce the emotional power of perceived events, suppression of crying may bring beneficial as well as detrimental consequences for affect.

Finally, crying can influence how criers perceive themselves. Crying is often associated with being weak or incompetent and people might sometimes down-regulate their crying to be able to see themselves as competent. On the other hand, in certain circumstances people associate crying with being a warm person, who is not afraid of showing their emotions. Thus people may refrain from regulating crying or even up-regulate in order to achieve or maintain a warm self-image. Relatedly, as we will see in the next section, people might want others to perceive them as a warm or competent person and regulate their crying to manage the image that others have of them since this in turn may affect how they feel about themselves.

Although the above review is by no means exhaustive, the documented intra-personal effects of crying clearly suggest that the regulation of crying can have effects on mood, as well as direct and long-term effects on physical and mental health (Gross, 1998; Vingerhoets et al., 2000). It further can affect people's image of themselves. However, the regulation of crying is not only driven by intra-personal motives relating to improvement in well-being and mood or future outcomes related to self-concept concerns (see also Tamir, 2009). People may regulate their crying in order to achieve certain inter-personal effects, even if they believe that the regulation of crying may have negative intra-personal consequences.

INTER-PERSONAL EFFECTS

As discussed above, people may regulate crying because of their beliefs about and experiences of the consequences of crying and not crying. Some of the anticipated consequences of crying that motivate regulatory efforts are effects that mainly operate on other people rather than on the self. However, it is also worth noting that one of the reasons for caring about inter-personal effects is that other people's reactions have effects on the crying person too. As discussed in the next section, people may regulate crying because they anticipate immediate rewards or less direct instrumental benefits (Tamir, 2009) and some of these rewards and instrumental benefits may be provided by other people's reactions to crying. Thus, inter-personal effects may mediate intra-personal effects as well as vice versa, so that the two may become inextricably interlinked.

Our main focus in the present section is on inter-personal effects that depend on the perceived emotional meaning of crying. Perceivers tend to see crying as an outpouring of authentic emotion which may or may not be appropriate in a particular situation. Many inter-personal effects of crying depend on other people's interpretations of its emotional implications. In particular, people may believe that others will suffer as a consequence of seeing that they are upset enough to cry. For example, one respondent in our survey indicated that she feared that her crying would cause those around her to become sad or upset as well ("if the others see me crying it will possibly make them feel even worse") or that their tears might induce contagious crying ("if my daughter saw me crying, she would start as well"). Hendriks et al. (2008) found that participants experienced more negative emotions (but offered increased support) when imagining a crying person than a non-crying person. Recent research has also shown that one person's sadness displays can lead to convergent responses in another person (Bruder et al., 2012).

One model that might help explain why crying can lead to different possible behavioral and affective responses from others was proposed by Goubert et al. (2005) to account for people's affective and behavioral responses to observing pain in other people. According to these authors, the empathic sense of another's pain and associated affective responses depends on features of the incoming stimulus (including the observed person's facial or verbal expressions and cues from the environment), and features of the observer, such as the observer's learning experiences and shared knowledge. The observer's affective responses may be either oriented toward the observers themselves (e.g., distress or anxiety) or oriented toward the observed person (e.g., sympathy with the person in pain), and these affective responses will in turn affect the observer's behavioral responses. Similarly we might expect corresponding factors to influence the empathic sense of another's distress or sadness at the sight of someone crying and as a result the person observing the crier might become distressed themselves or might experience sympathy with the crier.

Crying can influence other people's impressions of the crier's personal characteristics as well as their emotions. For example, criers may be perceived by others as weak, sensitive, or powerless. Consequently, people might anticipate being seen as more competent (e.g., *capable*, *confident*; Cuddy et al., 2008) by others when down-regulating or avoiding crying. Indeed, one explanation for our respondents reporting being relatively more likely to down-regulate rather than up-regulate crying when with others is that they believed that their crying would negatively affect other people's impressions of them. People might worry about these social reactions that in turn can make them feel bad. Correspondingly, they may feel ashamed about crying in front of others, or expect to be taken less seriously if they do cry. This provides another example of how intra-personal effects may depend on real or anticipated

inter-personal ones. On the other hand, people might anticipate being seen as a warmer, more emotional person when they do cry in particular circumstances (e.g., when witnessing suffering) and might allow crying or even up-regulate their crying as a result.

Several of our respondents indicated that they tried not to cry in a class/work situation because they felt it might give others a negative view of them. Indeed, research suggests that crying can come with unwanted inter-personal consequences in many social contexts (Hendriks and Vingerhoets, 2002). According to Efran and Spangler (1979), although crying is considered a healthy behavior there are social taboos related to the crying of specific people in specific situations. There appears to be a stigma attached to crying, particularly for people who are in charge of others or who occupy positions of responsibility (Efran and Spangler, 1979). For example, Wagner et al.'s (1997) found that medical students reported being ridiculed or shouted at when they cried during their hospital shift.

More generally, negative social consequences may result from failing to abide by so-called display rules, which specify when and where it is appropriate to express certain emotions (e.g., Fischer et al., 2004). The nature of these display rules depends on the cultural environment (Matsumoto et al., 2008) and on the position a specific person occupies in it (Becht et al., 2001). For example, Van Hemert et al. (2011) argue that crying, like other forms of expressiveness, is influenced by cultural norms prescribing how, when, and where it is appropriate to express the associated emotion. In their research, they found that individuals living in countries that allow more freedom of expression of individual feelings (i.e., democratic and individualistic countries) cry more often than individuals in more restrictive countries. However, some cultures also actively encourage crying by certain people in certain public situations. For example at Iranian funerals it is very much expected that the mourners, especially women, weep, and wail at the home of the deceased, at the funeral, and during various services at the mosque (Chosky, 2006).

These display rules depend on social roles as well as culture. For example, from an early age, boys are often told that they should not cry across a wide variety of situations (Big boys don't cry!; e.g., Camras, 1986; Simons and Bruder, 2012). In addition to familial socialization, gender differences in the expression of sadness and distress through crying may arise from differential peer socialization histories where the expression of sadness and pain is encouraged among girls through supportive inter-personal reactions from their peers but in boys is met with discouraging peer responses (e.g., Zeman and Shipman, 1996). Thus, showing tears may lead to more negative social consequences among men than women. More generally, the appropriateness of crying depends on a range of personal attributes (including gender) and their relation to the surrounding context, including one's particular relationship with the other person(s) present.

It is important to remember here that crying's inter-personal effects do not only depend on its emotion-expressive aspects. As mentioned above, crying may serve a number of inter-personal or social functions, including communicating vulnerability and appealing for help (e.g., Fridlund, 1994; Parkinson, 2005), that do not necessarily depend on others' perceptions of underlying emotions. For example, crying can be seen as a form of attachment behavior designed to elicit care-giving responses from important others (e.g., Nelson, 2008). Thus, people who down-regulate crying may receive less social support than those whose crying remains unregulated or those who up-regulate their crying. Indeed, participants in a vignette study by Hendriks et al. (2008) reported that they would give more emotional support and express less negative affect to a crying person compared to a non-crying person.

As the above discussion shows, the inter-personal effects of crying are varied. Crying might cause other people to experience distress. It might also affect how other people view us, elicit certain social reactions (e.g., being pitied), or induce disapproval because it conflicts with display rules. Alternatively, crying might communicate our need for help. Given the wide range of actual and perceived effects of crying and crying regulation discussed above, it seems likely that the motivations behind crying regulation will be correspondingly diverse.

MOTIVES FOR CRYING REGULATION

The previous section showed that crying may have immediate and cumulative inter- and intra-personal effects. We now turn to the motives behind crying regulation, many of which may be understood by reference to anticipation of these effects. In other words, crying regulation may serve the function of achieving immediate or future intra- and inter-personal effects.

Tamir's (2009) instrumental theory of intra-personal emotion regulation provides a useful framework that may be extended to the understanding of the motives behind crying regulation. Her basic distinction is between pleasure and utility motives. The pleasure motive concerns the immediate situation and aims to achieve more positive affective states, whereas the utility motive focuses on future outcomes and promotes emotions which further the individual's goals but are not necessarily immediately pleasurable. Based on this distinction, **Table 1** gives examples of potential intra- and inter-personal motives for both the down- and up-regulation of crying classified according to whether the focus is on either the immediate situation or the (near) future. We discuss the motives fitting the resulting eight cells of the table in the following sections.

INTRA-PERSONAL MOTIVES FOR DOWN-REGULATION

People may inhibit crying in an attempt to avoid or diminish the experience of negative emotions. Our survey respondents frequently endorsed intra-personal motives focusing on the immediate situation (see **Table 1**, cell a) for the down-regulation of crying (e.g., "I did not want to increase the negative feelings I was experiencing"; 57% of respondents, see also **Table 2**). An intra-personal motive for crying down-regulation which focuses more on future outcomes is the wish to see oneself as a competent person (**Table 1**, cell b). For example, in our survey 41% of respondents endorsed the statement (**Table 2**) that they down-regulated because "I felt that I would think of myself as weak."

INTER-PERSONAL MOTIVES FOR DOWN-REGULATION

Despite the possible intra-personal motives discussed above, our survey suggests that down-regulation of crying occurs mainly when people are in the presence of others, thus implying that anticipated inter-personal effects of crying may be more relevant

Table 1 | Examples of motives for intra- and inter-personal regulation of crying classified according to their dependence on the pleasure or utility motive.

	Down-regulation		Up-regulation/no-regulation	
	Focus on immediate situation/pleasure	**Focus on future outcomes/utility**	**Focus on immediate situation/pleasure**	**Focus on future outcomes/utility**
Intra-personal	(a) Avoid or diminish experience of negative emotion	(b) Self-concept concern: see oneself as a competent person	(e) Vent feelings, achieve catharsis	(f) Self-concept concern: see oneself as a warm person
Inter-personal	(c) Avoid attention, avoid social reactions that make one feel bad (e.g., pity or ridicule)	(d) Reputational concerns/elicit appraisals of competence	(g) Attract attention, elicit positive social reactions (e.g., help provision)	(h) Reputational concerns/elicit appraisals of warmth

Table 2 | Frequencies of motivations endorsed in the survey.

Why did you down-regulate your crying? (*N* = 54)		**(%)**	
Intra-personal	Because I did not want others to know how I felt	59	
	Because I did not want to increase the negative feelings I was experiencing	57	
	Because I felt it was inappropriate for me to cry	50	
	Because I felt that the experience of crying would increase my distress	44	
	Because I did not want to cause additional distress to myself	44	
	Because I felt that I would think of myself as weak	41	
	Because I felt that I would think of myself as overly emotional	28	
Inter-personal	Because I felt that others' reactions would increase my distress	54	
	Because I did not want to cause distress to others	48	
	Because I felt that others would think of me as overly emotional	42	
	Because I felt that others present would consider it inappropriate for me to cry	39	
	Because I felt that others would think of me as weak	37	
	Because I did not want to increase negative feelings others were experiencing	33	
Why did you up-regulate (*N* = 29)/did not regulate your crying (*N* = 27)?		**Up (%)**	**No (%)**
Intra-personal	Because my feelings were so strong that I could not avoid shedding tears/tearing up	72	96
	Because I felt it was appropriate for me to cry	66	52
	Because I felt that the experience of crying might decrease my distress	62	56
	Because I felt that I needed a good cry	59	41
	Because I wanted to increase the negative feelings I was experiencing	24	4
	Because my attempts to prevent myself from shedding tears failed	14	41
	Because I felt that I would think of myself as non-emotional if I did not	6	7
Inter-personal	Because I wanted others to know how I felt	34	22
	Because I needed support from other people	24	26
	Because I felt that others would think of me as non-emotional if I did not	21	4
	Because I felt that others present would consider it appropriate for me to cry	17	11
	Because I wanted to increase negative feelings others were experiencing	14	4
	Because I felt that others' reactions would decrease my distress	10	15

to down-regulation motives. For example, people might inhibit their crying to avoid attention and social reactions that increase bad feelings such as being ridiculed or pitied (**Table 1**, cell c). For understandable reasons, medical students in Wagner et al.'s (1997) study who reported more negative social consequences of crying also reported less actual crying, probably because of their attempts to inhibit it. In our own research, more than half (54%) of our respondents indicated that they down-regulated "Because I felt that others' reactions would increase my distress" (see also **Table 2**).

Another set of inter-personal motives relates to concerns about how crying might affect other people's perceptions of the person crying and focuses on future outcomes (self-presentation/reputational concerns; **Table 1**, cell d). In our survey, 42% of respondents reported that they down-regulated crying "Because I felt that others would think of me as overly emotional"

(see also **Table 2**). One respondent gave the following account of crying down-regulation in the workplace:

> I was at work and received news that my grandmother had been diagnosed with cancer. I was due to meet clients immediately after, so tried to focus on the task at hand as I felt that if I was to start crying it would be difficult to stop. I absorbed myself in my work as a means of distraction and then cried when I got home and saw my family.

She further states: "I did not want clients to see me cry as it would interfere with work and may seem unprofessional."

INTRA-PERSONAL MOTIVES FOR UP-REGULATING OR NOT REGULATING CRYING

Crying up-regulation or unregulated crying seems to occur mainly when the focus is on achieving catharsis in the immediate situation (**Table 1**, cell e). Those reporting up-regulation of crying or absence of regulation in the survey (see also **Table 2**) chiefly endorsed intra-personal motives (e.g., "I felt that I needed a good cry"; 59 and 41% of respondents, respectively) or referred to their inability to stop crying (e.g., "Because my feelings were so strong that I could not avoid shedding tears/tearing up"; 72 and 96% respectively), although unbridled crying or up-regulating of crying may also be motivated by future outcomes such as wanting to see ourselves as a warm or emotional person (**Table 1**, cell f). For example, a small proportion of respondents (6% in the up-regulation and 7% in the unregulated crying condition) endorsed the statement "Because I felt that I would think of myself as non-emotional if I did not" (see also **Table 2**).

INTER-PERSONAL MOTIVES FOR UP-REGULATING OR NOT REGULATING CRYING

However, unregulated or up-regulated crying may also occur for inter-personal reasons, both when the focus is on the immediate situation (e.g., "Because I wanted others to know how I felt"; endorsed by 22 and 34% of respondents respectively, see also **Table 2**) and when the focus is on the future e.g., "Because I felt that others present would consider it appropriate for me to cry" endorsed by 11 and 17% of respondents respectively, see also **Table 2**). For example, one respondent described how he urged himself to cry in order to show his girlfriend how upset she made him (inter-personal motive focused on the immediate situation; **Table 1**, cell g). Another respondent described how he could not cry during the funeral of his mother-in-law and how he actively tried to think of it as his own mother being dead so he would have the appropriate emotions when doing a reading at the funeral (Reputational concerns, **Table 1**, cell h).

OTHER INTER-PERSONAL MOTIVES FOR CRYING REGULATION

An inter-personal motive which follows from the inter-personal effects discussed in the previous sections is to modify the effects of our emotional displays on others. Concern for others' well-being does not fit neatly into the categories of motives listed in **Table 1**, as the focus is not so much on achieving positive affective state or specific future outcomes for oneself. However, survey respondents endorsed motives to reduce or change the effects of crying on what other people (might) experience (e.g., "I did not want to cause distress to others"; 48%). It appears that, in the case of crying at least, Tamir's (2009) classification can be extended to include motives to attain reward and instrumentality for other people (although these too may indirectly be intra-personally motivated). One of our male respondents indicated that upon the death of the husband of a cousin "I did not allow myself to cry because it would have been no help for them. They needed some stability, solace and help – not even more tears."

Another respondent also talks about the effect his crying would have on other people and how in the circumstances it was not appropriate for him to cry:

> Usually I have healthy barriers between myself and people who come to me with their difficulties (it is part of my job) and am aware enough of my own trigger points to not be affected by others' emotions, but about a month ago a man (section redacted to retain participant confidentiality) was talking to me about his daughter and started to cry and I found myself welling up with him. It is not appropriate for me to sit there weeping with the people I support so I had to suppress the tears and get myself back to a neutral place to be better able to support him.

This latter example appears to include concerns both for the other person and the respondent himself (reputational concerns).

MULTIPLE MOTIVES POSSIBLE

Although we have given frequencies of respondents from our survey endorsing particular motives for each of the cells, this should not be interpreted as evidence that people always have only a single motive for regulating their crying. In fact, someone might be motivated to down-regulate their crying for both inter- and intra-personal motives focused on the immediate situation as well as the future and thus endorse a number of different motives (including: "Because I did not want to cause distress to others" and "Because I did not want to increase the negative feelings I was experiencing" – a combination seen in 33% of down-regulation cases). Similarly, certain motives belong in more than one of the different cells. For example, down-regulation motivated by the desire to avoid ridicule serves both to make ourselves feel better and to improve our image in the eyes of onlookers.

CONCLUSION

In the present article we have discussed the motives for crying regulation, the (perceived) effects of crying and crying regulation, and the potential strategies used for the regulation of crying. We have presented some initial findings suggesting that crying is indeed regulated both by antecedent- and response-focused techniques as suggested by Vingerhoets and colleagues (Vingerhoets et al., 2000; Bekker and Vingerhoets, 2001). Future research should establish more conclusively what kinds of strategies are used in crying regulation and which factors influence the choice of strategy. We propose that the extent to which crying is regulated and which strategy is selected depend on the presence or absence of specific individuals, the salience of particular relational goals, regulation motives, cultural, and social norms concerning crying, the intensity of the underlying emotion, and person characteristics such as gender and personality (see Bekker and Vingerhoets, 2001 for a discussion of some of these factors). Given

the potential negative consequences of response-regulation for inter-personal interactions (e.g., Gross et al., 2006), we predict that inter-personal motives for crying regulation will be more strongly associated with antecedent-focused strategies (e.g., reappraisal), and that intra-personal motives will be more strongly associated with response-focused strategies such as suppression. We also assume that these relationships will be moderated by the nature of the activated social goals for regulating crying. Unfortunately, the data from our survey do not permit direct exploration of these hypotheses because many participants reported both inter- and intra-personal motives, or stated that they had used both antecedent- and response-focused regulation strategies. Either a survey using a larger sample or an experimental study would be needed to examine these hypotheses.

Further, more research is needed to gain insight into the underlying motivations for crying regulation, including the expected effects of crying on factors such as own and others' well-being, self-concept, and self-presentation. The effects of crying and crying regulation discussed in this article indicate that crying regulation might occur to modify both inter- and intra-personal consequences and that we can distinguish between pleasure and utility motives (immediate and future effects; Tamir, 2009). On an inter-personal level, people are not only concerned with how crying affects how they are seen by others around them but also how their crying affects other people, in terms of how it makes these other people feel. Further, whereas down-regulation of crying appears to result from both inter- and intra-personal motives, the up-regulation of crying is very much done for the benefit of the crier, although there are exceptions, for example when people think that crying is expected (e.g., at funerals). Importantly, it may depend on the situation and the social norms governing the situation whether, for example, reputational concerns lead one to down- or up-regulate crying.

Although this article has mainly addressed crying from an emotion expression view, the behavior ecology view (Fridlund, 1991) should also be considered when interpreting present and future findings. According to this account, social motivational variables should determine whether there is an impulse to cry in the first place. Thus, rather than there being an "impulse" to cry which is subsequently modified by regulation, such an account would hold that inter-personal concerns enter the picture more directly. Since our survey asked participants about situations where they felt the urge to cry or actually cried, the instructions pre-supposed an emotion expression view of crying and our data therefore cannot be used to fairly distinguish between these two accounts in the context of crying behavior. However, our survey data did include respondents who reported up-regulating or not regulating their crying in order to communicate their pain to others, to manipulate the situation to their advantage, or – in the case of one respondent who was angry with his partner for not taking care of him – to use crying as a sort of revenge: "as soon as I get angry with her, she often starts crying, and in this situation, I encouraged myself to cry."

The evidence we have presented in this paper is based on people's retrospective self-reports, which, as we have discussed, may be distorted by memory, self-protective motives, and self-presentational biases. Additional research using a wider range of methods is needed to gain insight into underlying motivations for crying regulation, including the expected effects of crying on factors such as own and others' well-being, self-concept, and self-presentation. It is also important to clarify how these motivations vary across situations and persons. Future studies should combine the use of self-reports with other methodologies such as manipulating or tracking of regulation motives and strategies in real-time crying episodes in reaction to specific stimuli (e.g., crying-inducing films or vignettes) in more controlled settings. In this way, the effect of certain variations in social context (such as who is present) can be controlled. However, as discussed above, the use of controlled settings such as laboratories also comes with disadvantages, not least ethical considerations that restrict the possibilities to induce crying and other problems related to their ecological validity (e.g., awareness of being watched or videotaped while crying). Further, in order to obtain records of crying and crying regulation in daily life, the use of diaries to record crying and crying regulation episodes as they happen should help to avoid retrospective biases and memory errors (e.g., Parkinson et al., 1995; Bylsma et al., 2011).

The regulation of crying and its underlying motives is relatively unchartered terrain, which, given the perceived and actual substantial effects of crying, needs to be urgently explored. We believe that the initial empirical evidence and the theoretical outline presented here can help guide the next steps in this exciting research area.

ACKNOWLEDGMENTS

The survey research mentioned in this article was partly supported by the Economic and Social Research Council (UK) as part of the EROS (Emotion Regulation of Others and Self, RES-060-25-0044) project. The authors further wish to thank Prof. Agneta Fischer for her input in the project and Irene Mateos Rodriguez, Radka Jersakova, Swati Kanoi, and Talia Bolnick for their help with running and analyzing the survey.

REFERENCES

American Psychological Association. (2010). *Ethical Principles of Psychologists and Code of Conduct. With the 2010 Amendments.* Available at: http://www.apa.org/ethics/code/principles.pdf (accessed November 7, 2012).

Bakker, A. B., and Heuven, E. (2006). Emotional dissonance, burnout, and in-role performance among nurses and police officers. *Int. J. Stress Manag.* 13, 423–440.

Baumeister, R. F., Stillwell, A., and Wotman, S. R. (1990). Victim and perpetrator accounts of interpersonal conflict: autobiographical narratives about anger. *J. Pers. Soc. Psychol.* 59, 994–1005.

Becht, M. C., Poortinga, Y. H., and Vingerhoets, A. J. J. M. (2001). "Crying across countries," in *Adult Crying: A Biopsychosocial Approach*, eds A. J. J. M. Vingerhoets and R. R. Cornelius (Hove: Brunner-Routledge), 135–158.

Bekker, M. H. J., and Vingerhoets, A. J. J. M. (2001). "Male and female tears: Swallowing versus shedding? The relationship between crying, biological sex and gender," in *Adult Crying: A Biopsychosocial Approach*, eds A. J. J. M. Vingerhoets and R. R. Cornelius (Hove: Brunner-Routledge), 91–113.

British Psychological Society. (2009). *Code of Ethics and Conduct Guidance Published by the Ethics Committee of the British Psychological Society.* Available at: http://www.bps.org.uk/what-we-do/ethics-standards/ethics-standards (accessed November 8, 2012).

Bruder, M., Dosmukhambetova, D., Nerb, J., and Manstead, A. S. R. (2012). Emotional signals in nonverbal interaction: dyadic facilitation and convergence in expressions, appraisals, and feelings. *Cogn. Emot.* 26, 480–502.

Bylsma, L. M., Croon, M. A., Vingerhoets, A. J. J. M., and Rottenberg, J. (2011). When and for whom does crying improve mood? A daily diary study of 1004 crying episodes. *J. Res. Pers.* 45, 385–392.

Camras, L. A. (1986). "Judgement of emotion from facial expression and situational context," in *Measuring Emotions in Infants and Children*, eds C. E. Izard and P. B. Read (Cambridge: Cambridge University Press), 75–89.

Chosky, J. K. (2006). "Funerary practices: Iran and Afghanistan," in *Encyclopedia of Women and Islamic Cultures, Volume 3: Family, Body, Sexuality and Health*, ed. S. Joseph (Leiden, NL: Koninglijke Brill NV), 119–122.

Cornelius, R. R. (1986). "Prescience in the pre-scientific study of weeping? A history of weeping in the popular press from the Mid-1800's to the present," in *Proceeding of 57th Annual Meeting of the Eastern Psychological Association*, New York.

Cornelius, R. R. (2001). "Crying and catharsis," in *Adult Crying: A Biopsychosocial Approach*, eds A. J. J. M. Vingerhoets and R. R. Cornelius (Hove: Brunner-Routledge), 199–212.

Cornelius, R. R., and Labott, S. M. (2001). "The social psychological aspects of crying," in *Adult Crying: A Biopsychosocial Approach*, eds A. J. J. M. Vingerhoets, and R. R. Cornelius (Hove: Brunner-Routledge), 159–176.

Cuddy, A. J. C., Fiske, S., and Glick, P. (2008). "Warmth and competence as universal dimensions of social perception: The stereotype content model and the BIAS map," in *Advances in Experimental Social Psychology*, Vol. 40, ed. M. P. Zanna (San Diego, CA: Academic Press), 61–149.

Efran, J. S., and Spangler, T. J. (1979). Why grown-ups cry: a two-factor theory and evidence from the miracle worker. *Motiv. Emot.* 3, 63–72.

Evers, C. A. M., Fischer, A. H., and Manstead, A. S. R. (2011). "Gender and emotion regulation: A social appraisal perspective on Anger," in *Emotion Regulation and Well-Being*, eds I. Nyklicek, A. Vingerhoets, and M. Zeelenberg (New York, NY: Springer), 211–222.

Fischer, A. H., Manstead, A. S. R., Evers, C., Timmers, M., and Valk, G. (2004). "Motives and norms underlying emotion regulation," in *The Regulation of Emotion*, eds P. Philippot and R. S. Feldman (Mahwah, NJ: Erlbaum), 187–212.

Fridlund, A. J. (1991). Evolution and facial action in reflex, social motive, and paralanguage. *Biol. Psychol.* 33, 3–100.

Fridlund, A. J. (1994). *Human Facial Expression: An Evolutionary View*. San Diego, CA: Academic Press.

Goubert, L., Craig, K. D., Vervoort, T., Morley, S., Sullivan, M. J. L., Williams, A. C., et al. (2005). Facing others in pain: the effects of empathy. *Pain* 118, 285–288.

Gross, J. J. (1998). Antecedent- and response-focused emotion regulation: divergent consequences for experience, expression and physiology. *J. Pers. Soc. Psychol.* 74, 224–237.

Gross, J. J., and John, O. P. (2003). Individual differences in two emotion regulation processes: implications for affect, relationships, and well-being. *J. Pers. Soc. Psychol.* 85, 348–362.

Gross, J. J., and Muñoz, R. F. (1995). Emotion regulation and mental health. *Clin. Psychol. Sci. Pract.* 2, 151–164.

Gross, J. J., Richards, J. M., and John, O. P. (2006). "Emotion regulation in everyday life," in *Emotion Regulation in Families: Pathways to Dysfunction and Health*, eds D. K. Snyder, J. A. Simpson, and J. N. Hughes (Washington, DC: American Psychological Association), 13–35.

Hendriks, M. C. P., and Vingerhoets, A. J. J. M. (2002). Crying: is it beneficial for one's well-being? *Int. Congr. Ser.* 1241, 361–365.

Hendriks, M. C. P., Croon, M. A., and Vingerhoets, A. J. J. M. (2008). Social reactions to adult crying: the help-soliciting function of tears. *J. Soc. Psychol.* 148, 22–41.

Katz, J. (1999). *How Emotions Work*. Chicago, IL: University of Chicago Press.

Kraemer, D. L., and Hastrup, J. L. (1988). Crying in adults: self-control and autonomic correlates. *J. Soc. Clin. Psychol.* 6, 53–68.

Levine, L. J., and Edelstein, R. S. (2009). Emotion and memory narrowing: a review and goal-relevance approach. *Cogn. Emot.* 23, 833–875.

Lombardo, W. K., Cretser, G. A., and Roesch, S. C. (2001). For crying out loud: the differences persist into the '90s. *Sex Roles* 45, 529–547.

Matsumoto, D., Yoo, S. H., Fontaine, J., Anguas-Wong, A. N., Arriola, M., Ataca, B., et al. (2008). Mapping expressive differences around the world: the relationship between emotional display rules and individualism versus collectivism. *J. Cross Cult. Psychol.* 39, 55–74.

Miceli, M., and Castelfranchi, C. (2003). Crying: discussing its basic reasons and uses. *New Ideas Psychol.* 21, 247–273.

Nelson, J. K. (2008). "Crying in psychotherapy: Its meaning, assessment and management based on attachment theory," in *Emotion Regulation: Conceptual and Clinical Issues*, eds A. J. J. M. Vingerhoets, J. Demollet, and I. Nyklicek (New York, NY: Springer), 202–214.

Parkinson, B. (1996). Emotions are social. *Br. J. Psychol.* 87, 663–683.

Parkinson, B. (2005). Do facial movements express emotions or communicate motives? *Per. Soc. Psychol. Rev.* 9, 278–311.

Parkinson, B., Briner, R. B., Reynolds, S., and Totterdell, P. (1995). The frames for mood: relations between momentary and generalized ratings of affect. *Pers. Soc. Psychol. Bull.* 21, 331–339.

Parkinson, B., and Simons, G. (2012). Worry spreads: interpersonal transfer of problem-related anxiety. *Cogn. Emot.* 26, 462–479.

Richards, J. M., and Gross, J. J. (2000). Emotion regulation and memory: the cognitive cost of keeping one's cool. *J. Pers. Soc. Psychol.* 79, 410–424.

Simons, G., and Bruder, M. (2012). "Are you sure that big boys don't cry?" in *Should I Strap a Battery to my Head (and Other Questions about Emotion)?* eds P. Totterdell and K. Niven (Charleston: Createspace Independent Publishing), 42–47.

Soto, J. A., Perez, C. R., Kim, Y., Lee, E. A., and Minnick, M. R. (2011). Is expressive suppression always associated with poorer psychological functioning? A cross-cultural comparison between European Americans and Hong Kong Chinese. *Emotion* 11, 1450–1455.

Tamir, M. (2009). What do people want to feel and why? Pleasure and utility in emotion regulation. *Curr. Dir. Psychol. Sci.* 18, 101–105.

Timmers, M., Fischer, A. H., and Manstead, A. S. R. (1998). Gender differences in motives for regulating emotions. *Pers. Soc. Psychol. Bull.* 24, 979–985.

Van Hemert, D. A., Van de Vijver, F. J. R., and Vingerhoets, A. J. J. M. (2011). Country and crying: prevalence and gender differences. *Cross Cult. Res.* 45, 399–431.

Vingerhoets, A., and Scheirs, J. (2000). "Sex differences in crying: empirical findings and possible explanations," in *Gender and Emotion: Social Psychological Perspectives*, ed. A. H. Fischer (Cambridge: Cambridge University Press), 143–165.

Vingerhoets, A. J. J. M., Boelhouwer, A. J. W., van Tilburg, M. A. L., and van Heck, G. L. (2001). "The situational and emotional context of adult crying," in *Adult Crying: A Biopsychosocial Approach*, eds A. J. J. M. Vingerhoets and R. R. Cornelius (Hove: Brunner-Routledge), 71–90.

Vingerhoets, A. J. J. M., and Bylsma, L. (2007). Crying as a multifaceted health psychology conceptualisation: crying as coping, risk factor, and symptom. *Eur. Health Psychol.* 9, 68–73.

Vingerhoets, A. J. J. M., Cornelius, R. R., van Heck, G. L., and Becht, M. C. (2000). Adult crying: a model and review of the literature. *Rev. Gen. Psychol.* 4, 354–377.

Wagner, R. E., Hexel, M., Bauer, W. W., and Kropiunigg, U. (1997). Crying in hospitals: a survey of doctors', nurses' and medical students' experience and attitudes. *Med. J. Aust.* 166, 13–16.

Zeman, J., and Shipman, K., (1996). Children's expression of negative affect: reasons and methods. *Dev. Psychol.* 32, 842–849.

Conflict of Interest Statement: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Received: 31 July 2012; accepted: 18 December 2012; published online: 14 January 2013.

Citation: Simons G, Bruder M, van der Löwe I and Parkinson B (2013) Why try (not) to cry: intra- and inter-personal motives for crying regulation. Front. Psychology ***3****:597. doi: 10.3389/fpsyg.2012.00597*

This article was submitted to Frontiers in Emotion Science, a specialty of Frontiers in Psychology.

frontiers in
PSYCHOLOGY

ORIGINAL RESEARCH ARTICLE
published: 09 May 2013
doi: 10.3389/fpsyg.2013.00188

Expressing and amplifying positive emotions facilitate goal attainment in workplace interactions

***Elena Wong*[1,2]*, *Franziska Tschan*[1,2]*, *Laurence Messerli*[1,2] and *Norbert K. Semmer*[2,3]**

[1] *Institute of Work and Organizational Psychology, Université de Neuchâtel, Neuchâtel, Switzerland*
[2] *National Center of Competence in Research Affective Sciences, Neuchâtel, Switzerland*
[3] *Department of Psychology, University of Bern, Bern, Switzerland*

Edited by:
Vera Shuman, University of Lausanne, Switzerland

Reviewed by:
Andrea Fischbach, German Police University, Germany
Neal M. Ashkanasy, The University of Queensland, Australia

***Correspondence:**
Elena Wong and Franziska Tschan, Institute of Work and Organizational Psychology, Université de Neuchâtel, Bureau E023 Unimail, Rue de Emile Argand 11, Neuchâtel, NE 2000, Switzerland.
e-mail: elena.wong@unine.ch; franziska.tschan@unine.ch

Expressing emotions has social functions; it provides information, affects social interactions, and shapes relationships with others. Expressing positive emotions could be a strategic tool for improving goal attainment during social interactions at work. Such effects have been found in research on social contagion, impression management, and emotion work. However, expressing emotions one does not feel entails the risk of being perceived as inauthentic. This risk may well be worth taking when the emotions felt are negative, as expressing negative emotions usually has negative effects. When experiencing positive emotions, however, expressing them authentically promises benefits, and the advantage of amplifying them is not so obvious. We postulated that expressing, and amplifying, positive emotions would foster goal attainment in social interactions at work, particularly when dealing with superiors. Analyses are based on 494 interactions involving the pursuit of a goal by 113 employes. Multilevel analyses, including polynomial analyses, show that authentic display of positive emotions supported goal attainment throughout. However, amplifying felt positive emotions promoted goal attainment only in interactions with superiors, but not with colleagues. Results are discussed with regard to the importance of hierarchy for detecting, and interpreting, signs of strategic display of positive emotions.

Keywords: positive emotion, emotion regulation, goals, social interactions at work, superior, coworker, organizations

INTRODUCTION

If an employe pursues a specific goal in an encounter with his or her superior, will the expression of emotions make a difference for goal attainment? Specifically, will expressing *positive* emotions help goal attainment in this situation? If the employe feels slightly positive, is amplifying the expression of these feelings useful for reaching the goal? Would such a strategy also work in interactions with colleagues? In this paper, we investigate whether (a) the expression and (b) the amplification of positive emotion influence goal attainment in interactions with colleagues and superiors at work.

As will be reviewed in more detail below, research on emotions suggests that emotions and emotion regulation are related to interpersonal consequences in general (e.g., Gross and John, 2003); and to reaching goals specifically (e.g., Scherer et al., 2001); this applies also in the organizational context (e.g., Barsade and Gibson, 2007). On the one hand, *experiencing* positive emotions has been found to foster favorable outcomes in general (e.g., Lyubomirsky et al., 2005) and in the organizational context (for a review, see Ashkanasy, 2003), and to promote proactive goal pursuit in individuals (Bindl et al., 2012). In addition, there also is work on how experiencing emotions by focal persons affects others; the main mechanism by which these effects occur is emotional contagion, which involves a more or less automatic transmission of affective cues to perceivers who, in turn, process, and mimic, these cues more or less automatically as well (e.g., Barger and Grandey, 2006).

Research on *displaying* affect more deliberately comes from two traditions, which are impression management (e.g., Schlenker and Weigold, 1992) and emotional labor (Grandey, 2000). Both support the assumption that expressing positive affect fosters positive social encounters. Among the latter is research on "leading with emotional labor" (e.g., Humphrey et al., 2008; Ashkanasy and Humphrey, 2011b); however, we know much less about how employes try to influence their superiors through affective display, and how that kind of influence compares to effects on peers. Research on emotional labor typically focuses on suppressing emotions one feels and on expressing emotions one does not feel (emotional dissonance, cf. Grandey et al., 2012), but the exaggeration or up-regulation of emotions is often considered part of emotional labor as well (Grandey, 2000).

Up-regulation of positive emotions is arguably especially important for employes low in power, as they are more dependent on creating a positive impression in high-power individuals, who have more means at their disposal to achieve their goals (for instance, they can use negative emotions; Cote et al., 2013). At the same time, exaggerating positive emotion display may increase the danger of appearing inauthentic, which may undermine the intended effects (Liu and Perrewe, 2006). So the question arises whether it may be more effective to just show the positive emotion that is felt, thus delivering a milder, but authentic positive emotion display. We propose that the danger of appearing inauthentic increases to the extent that one has a closer relationship

with the interaction partner, which implies that up-regulating positive emotions should be more effective toward supervisors than toward colleagues.

The current study therefore focuses on (a) experiencing and (b) amplifying positive emotions as a means to achieve goals in naturally occurring social interactions at work, assuming that both have different effects on colleagues versus superiors. We focus on the use of positive emotions and their amplification because expressing negative emotions is conducive to goal attainment only in special circumstances (Cote et al., 2013), whereas positive emotions are likely to foster goal attainment almost ubiquitously. The question of authenticity when expressing positive emotions one does not feel has been the focus of quite some research (Hochschild, 1983; Ashforth and Humphrey, 1995; Grandey et al., 2005a). In the context of positive emotions one *does* feel, up-regulating them in one's display has special implications for the issue of authenticity, in that amplification would seem less necessary if one already feels positive emotions; it therefore may be less effective to up-regulate them in one's display and thus take the risk of appearing inauthentic.

Our article unfolds as follows: we first discuss how the social functions perspective on emotions can help in explaining the effect of expressing and amplifying positive emotions on goal attainment. We then discuss empirical research concerning the display of positive emotions in relation to goal attainment at work. Finally, we present arguments that such an effect may depend on different interaction partners, specifically, superiors or colleagues.

EXPRESSING POSITIVE EMOTION AND GOAL ATTAINMENT IN INTERACTIONS: MECHANISMS

With regard to the processes underlying the effect of expressing and managing emotions on goal attainment, we draw on research related to the social functions of emotions, particularly to their informative, influential, and affiliative functions.

First, according to the Emotion as Social Information Model, expression of emotions is a source of information for interaction partners (Van Kleef, 2010; see also Izard, 1977; Ekman, 2003; Cote, 2005). Emotional expression provides information about one's goals, motivation, and intentions (Van Kleef, 2010, p. 16). Displayed positive emotions signals tendencies to approach a goal (Lyubomirsky et al., 2005), social readiness (Shiota et al., 2004), and the intention to engage in pleasant social interactions (e.g., Keltner and Kring, 1998); these elements are likely to influence an interaction partner to react favorably (Lopes et al., 2005).

Second, expressing emotions is a form of social influence that evokes responses in the interaction partner(s) with regard to attitudes, emotions, thoughts, and behaviors (Kopelman et al., 2008; Niven et al., 2009; Côté and Hideg, 2011). Positive expression conveys a favorable impression (Harker and Keltner, 2001), for instance in terms of friendliness and competence (Barger and Grandey, 2006), which enhances in others the tendency to conform and comply (Cialdini and Goldstein, 2004). Positive expression such as laughter could work as an incentive to induce desirable behavior in others (Staw et al., 1994; Morris and Keltner, 2000).

Furthermore, as mentioned above, expressed emotions influence the *emotions* of others (Zapf, 2002; Niven et al., 2011) via contagion (Hatfield et al., 1994), social appraisal (Zaalberg et al., 2004; Parkinson and Simons, 2009), and social sharing of emotions (Rimé et al., 1998). According to Fredrickson (1998, 2004), positive emotions felt broaden people's thought-action and behavioral repertoires; these broadened thoughts and behaviors could further promote goal pursuit. Positive mood is also linked to a higher probability of prosocial behaviors (Batson and Powell, 2003; Potworowski and Kopelman, 2008), and it triggers more helping and support (Isen and Simmonds, 1978; George, 1991), more reciprocity (Gouldner, 1960; Walter and Bruch, 2008), more information sharing (Baron et al., 1990, 1992), and also higher tendencies to seek integrative solutions (Forgas, 1998). Barsade (2002) found that the expression of positive emotions by a group member not only might "*ripple out*" among members of the group, it further predicts improved cooperation, decreased conflict, and increased perceived task performance in group setting.

Finally, goal attainment could also be fostered through forming and maintaining good relationships due to the presence of positive emotions in the interactions (Manstead and Fischer, 2000; Shiota et al., 2004). Expressing positive emotions is seen as an affirmation of an agreeable relationship (Fisher and Shapiro, 2006), which enhances social connectedness (Mauss et al., 2011), strengthens group attachment (Lawler, 1992), increases trust (Dunn and Schweitzer, 2005), and improves the emotional climate in groups (Scherer and Tran, 2003). For example, Sy et al. (2005) found that leader's positive mood could induce positive mood in the team members, and create a positive affective tone in the group. All these effects from positive expression could further foster cooperation (Fischer et al., 2004) and encourage desired behavior in others (Ashkanasy and Humphrey, 2011b); thus, they are likely to foster goal attainment in interactions.

EXPRESSING POSITIVE EMOTIONS AND GOAL ATTAINMENT IN INTERACTIONS: EVIDENCE

Evidence indicating that the expression and amplification of positive emotions could be helpful for attaining goals in interactions at work comes from three sources. First, research on *impression management* explains how people convey a specific, most often a desirable, image of themselves upon others in order to influence outcomes at work (Giacalone and Rosenfeld, 1989; Schlenker and Weigold, 1992). Successful goal pursuit in organizations is influenced by how well people present themselves, interact with and work with others, particularly with their superior and colleagues (Baumeister, 1989). Impression management helps building a positive professional image (Roberts, 2005) and has been found to be related to positive outcomes such as overall career success (Judge and Bretz, 1994), higher salary (Kipnis and Schmidt, 1988), and better performance evaluations (Higgins et al., 2003). Impression management research does not specifically focus on emotions, as employes use various impression management strategies to accomplish goals (Kipnis et al., 1980; Rosenfeld et al., 1995). However, managing emotion expression is one of those strategies (Jones and Pittman, 1982; Grandey et al., 2005a; Andrade and Ho, 2009). Specifically, the two strategies of impression management that have been shown to have the most consistent effects are ingratiation and flattery (e.g., Kipnis and Schmidt, 1988); both imply the expression of positive emotions (Higgins et al., 2003; Harris et al., 2007), and are often used in interactions with superiors (Baumeister, 1989). Second, research *on emotion work* or *emotional*

labor (Hochschild, 1979; Zapf and Holz, 2006) has found that the regulation of emotions helps reaching goals during social interactions in organizations, with a particular focus on interactions with clients (Mesmer-Magnus et al., 2012). This line of research shows that displaying positive emotions often leads to favorable outcomes in interactions with clients (e.g., Barger and Grandey, 2006). Expressing positive emotions is associated with more task effectiveness (Rafaeli and Sutton, 1989; Ashforth and Humphrey, 1993), higher customer satisfaction (Pugh, 2001), higher perceived service friendliness, higher chances of customers to return to a store (Tsai, 2001), and better financial outcomes such as higher sales and more tips (Rafaeli and Sutton, 1987). A third tradition indicating that the expression of positive emotions may be helpful in social interactions focuses on emotional contagion (Pugh, 2001; Barsade, 2002; George, 2002; Barger and Grandey, 2006). Research in this area shows that people who experience positive emotions often transmit these emotions to others, which typically has positive effects. However, evidence from this tradition is more indirect, in that its main focus is not on deliberate attempts at transmitting positive emotions.

Together, research on impression management, on emotion work, and on emotional contagion indicate that expressing positive emotions at work may help employes to attain their goals. Furthermore, this research suggests that it is the emotion *expressed*, regardless of the emotion *felt*, that is crucial for the desired effect (Andrade and Ho, 2009), provided that the emotional expression is perceived as authentic and the truly felt emotion does not "leak" through (Grandey et al., 2005a; Liu and Perrewe, 2006; Cote et al., 2013).

With regard to the effect on goal attainment of displaying positive emotions in everyday interactions at work, both impression management research and emotional labor research have some important limitations. The impression management literature describes a very broad array of self-presentation strategies – including appearance, communication content, and behavior (Kipnis et al., 1980); each of them encompasses much more than the display of emotions. The display of positive emotions is implied in some of the tactics described, but often it is not specifically investigated. Concerning emotion work, the majority of studies emphasize how the display and the regulation of emotions influence *intra*personal outcomes, such as individual well-being (Giardini and Frese, 2006), job satisfaction (Pugliesi, 1999; Grandey et al., 2005b), and stress (Zapf et al., 2001; Brotheridge and Grandey, 2002; Grandey, 2003; Totterdell and Holman, 2003; Grandey et al., 2005b). There are results that refer to interactional goals (e.g., getting more tips; Rafaeli and Sutton, 1987; see above), but these typically refer to strangers (clients, customers, etc.). In interactions with people that one interacts with on a daily basis, such as colleagues and superiors, these strategies may not be as effective (e.g., because these interaction partners are more skilled in detecting them, or because authenticity may be a strong norm); however, with few exceptions (Tschan et al., 2005), superiors and colleagues as interaction partners have not been in the focus of emotion work research. Furthermore, when dealing with emotion displays that are not in accordance with one's feelings (i.e., surface acting), emotional labor research typically focuses on the suppression of negative emotion and their masking by either neutral or positive emotion display. The up-regulation of positive emotions that one does feel has not received much attention (see Nair, 2008; Cote et al., 2013), nor has the fact that in such a case it may suffice to express the emotion felt, thus showing a weaker expression but avoiding the danger of perceived inauthenticity.

In sum, research on impression management and emotion work provides much general evidence that managing the expression of emotions in interaction is likely to be related to goal attainment, but they are not very specific with regard to expressing emotions (impression management) or they focus on strangers rather than people one interacts with frequently at work, and on the display of positive emotions that are not felt (emotional labor).

EMOTION DISPLAY AND INTERACTION PARTNERS: SUPERIOR VERSUS COLLEAGUES

Strategic emotion expression or the display regulation of emotion strongly depends on the type of interaction partner (Clark et al., 1996). To reach goals, people are likely to selectively focus their emotion regulation behavior toward more important interaction partners, especially those who have power and control over their outcomes in organizations (Kilduff et al., 2010). At the same time, it is also plausible that the *effect* of emotional expression, and particularly the effect of display regulation, on goal attainment depend on the interaction partner. Specifically, we assume that expressing, and amplifying, positive emotions should have a greater impact in interactions with superiors as compared to colleagues. Two aspects of the relationships involved are especially important for our reasoning: familiarity (closeness), and hierarchy (power) (e.g., Zaalberg et al., 2004; Clark and Finkel, 2005; Hall et al., 2007; Glaso and Einarsen, 2008).

First, more frequent, and more informal, interactions between colleagues (as compared to interactions with supervisors) imply higher familiarity (cf. Argyle and Henderson, 1985; Kahn, 2007), which, in turn, implies that one knows the other person comparatively well and may evaluate his or her behavior more in terms of its contribution to the common work goal (e.g., dependability, cooperativeness, supportive behavior, etc.) than in terms of the way the behavior is expressed. In other words, colleagues may be willing to comply with a request even if it is not accompanied by the expression of positive emotions. Such compliance would be in line with the "*rules for coworkers*" investigated by Argyle and Henderson (1985), according to which colleagues are expected to cooperate on common goals independent of the quality of their relationship. The evidence on actual behaviors in the workplace is line with this reasoning. Thus, people perform less emotion work with interaction partners who are closer to themselves as compared to more distant interaction partners (Diefendorff et al., 2010). A recent event-sampling study found that people engage in more effortful impression management with distant than with close others (Gosnell et al., 2011). In closer relationships, other considerations, especially authenticity, seem to gain more weight. Most employes have closer relationships among each other than with their superiors (Argyle and Henderson, 1985). In closer relationships, faking unfelt emotions is generally not well-received; individuals are expected to interact more authentically, openly, and honestly (Clark et al., 1996). People do, indeed, express their emotions more authentically to their coworkers than to their superior

(Diefendorff et al., 2010). Colleagues are more likely than strangers to detect an inauthentic positive emotion display, causing this tactic to "backfire," and potentially ruining one's credibility and one's reputation (Clark et al., 1996). (Such backfiring effects are not confined to colleagues; they have been reported for more distant interaction partners, such as clients (Grandey et al., 2005a). However, as employes usually are in closer contact with their colleagues than with their superiors, the chance of "being caught" is likely to be higher in interactions with colleagues). Therefore, expressing and amplifying positive emotions may be less effective in a relationship that is high in familiarity. In contrast, a superior with whom one has a more distant relationship is less likely to detect (at least subtle) signs of emotion regulation; he or she might rely more strongly on the emotional expression projected by a subordinate when judging the subordinate's emotion (Ashkanasy and Humphrey, 2011b, p. 37); as discussed previously, showing positive emotions toward a superior would be advantageous from this perspective.

Second, being hierarchically lower than the interaction partner, and therefore having less power, implies that one depends on the goodwill of the interaction partner to a much greater extent than when one deals with colleagues of equal standing. Among colleagues, work goals are often imposed on everyone by the organization, and thus, cooperation toward goals in interactions is less discretionary. This lack of discretion is also implied by the fact that colleagues often depend more strongly on each other, which makes reciprocity especially salient and entails greater risks for a tit-for-tat response of a colleague whose interests have been ignored. In contrast, supervisors have more discretion with regard to going along with requests by subordinates or for supporting their specific goals. This power position allows them to be influenced more strongly by momentary signs of cooperativeness and compliance by the subordinate, and to react more strongly to their own mood when making a decision. It also is possible that they are easily flattered, attributing positive emotion display to their convincing and "winning" way of interacting and leading (cf. Pfeffer et al., 1998), thus becoming victims of the "romance of leadership" themselves (Gray and Densten, 2007). Since one of the important aspects of expressing positive emotions is that it may induce a positive mood in others (Hatfield et al., 1994; Zaalberg et al., 2004; Parkinson and Simons, 2009; Niven et al., 2011), these aspects are likely to play a greater role for superiors as compared to colleagues.

Research on actual behavior toward supervisors is in line with our reasoning. For instance, Mann (1999) showed that low status individuals engaged in more display regulation than high status individuals, and research by Méhu (2011) showed that people use more strategic smiles when interacting with people of higher status. In a similar vein, flight attendants expressed more positive emotions toward first and business class passengers than to economy class passengers (Hochschild, 1983). In organizations, employes engaged in less emotion work when dealing with partners of equal or lower status (colleagues) as compared to clients (Tschan et al., 2005) or superiors (Diefendorff et al., 2010). Also, impression management tactics frequently involve *upward* influence tactics (Kipnis and Schmidt, 1988), and employes express positive emotions to foster positive outcomes at work (Wayne and Liden, 1995). Research on impression management shows that people adapt their tactics to the perceived power of the audience (Gardner and Martinko, 1988) and its expectations (Rudman, 1998), and that they use specific impression-management tactics in interactions with superiors (Baumeister, 1989). It seems likely that subordinates are especially vigilant toward their superiors and monitor closely how the superiors react to their behaviors, thus putting special effort into adjusting their behaviors, including their emotion display, to the signals of receptivity sent by the superiors (Kilduff et al., 2010). Furthermore, Staw et al. (1994) found an effect of positive emotions on social support from both colleagues and supervisors; however, this effect was stronger for support by superiors as compared to colleagues. Thus, showing positive emotions seems to be more important, and more effective, when dealing with superiors, as opposed to colleagues, and actual behavior is in accordance with this assumption. Note that we are talking about the likelihood of reacting in a specific way in specific situations; thus, when we say that superiors may let themselves be guided by their mood more than subordinates, we do not imply that they do this consistently. For instance, it seems likely that employes adjust their emotion display to situational characteristics that signal favorability for pursuing their goals (Kilduff et al., 2010).

CURRENT STUDY

The aim of the present research is to investigate if the expression of positive emotions and the enhancement of positive emotions (i.e., amplifying the display of positive emotions felt) facilitate achieving goals during naturally occurring social interactions at work. We examine this issue (a) in general, and (b) with regard to different interaction partners, specifically colleagues and superiors.

We state our hypotheses as follows:

Hypothesis 1. A stronger expression of positive emotions during interactions at work will be related to a higher level of goal attainment.

Given that a positive emotion expression could be due to the actual positive emotion felt, its expression may be based on two processes. First, the intensity of the emotion display may correspond to the intensity of the emotion felt; second, it may be based on display regulation involving its amplification in comparison to the intensity it is felt (cf. Gross, 1998). We emphasized above that it is the expression of positive emotions that is responsible for positive effects in social interactions, not the underlying emotion itself, at least as long as the emotion display is perceived as authentic by the interaction partner, which may often be the case. Amplifying a positive emotion, that is, displaying it with a higher intensity than it is felt, may, therefore, represent a promising strategy for achieving goals. These considerations lead to the following hypothesis:

Hypothesis 2. Employes' *amplification of positive emotions* during a workplace interaction is related to a higher level of goal attainment during the interaction.

Based on the arguments presented above, we also posit that the type of interaction partner (superior versus colleague) moderates the relationship between expressing, as well as amplifying,

positive emotions and the degree of goal attainment in everyday interactions at work. More specifically, we suppose that expressing as well as amplifying positive emotions has a stronger relationship to goal attainment during interactions with superiors than during interactions with colleagues.

Hypothesis 3. The interaction partner moderates the relationship between the expression of positive emotions and goal attainment in the sense that this relationship is stronger for interactions with superiors than for interactions with colleagues.

A similar assumption is formulated for amplifying positive emotions.

Hypothesis 4. The interaction partner moderates the relationship between amplifying positive emotions and goal attainment in the sense that this relationship is stronger for interactions with superiors than for interactions with colleagues.

MATERIALS AND METHODS

PARTICIPANTS

We recruited 113 Swiss employes from different organizations, using a snow ball recruiting system. Of the participants, 61.75% were women, mean age was 34.3 years (SD = 13.8), age ranged from 18 to 66. Level of education ranged from basic training to the completion of a professional or tertiary degree; participants worked in a wide range of occupations across different sectors of employment. Participation was voluntary and not compensated.

STUDY DESIGN AND PROCEDURE

We conducted the study using a variant of the Rochester Interaction Record methodology (Reis and Wheeler, 1991) to sample everyday interactions at work. Participants were first asked to complete a general questionnaire containing demographic questions, a personality scale, and job-related questions. They were then asked to record each interaction they had over a 7-day period, and to answer questions about each interaction. Before the self-observation period, participants met with a research assistant who handed them the general questionnaire and seven daily booklets for recording the interactions. They were instructed on how to use the interaction records. We asked them to answer the questions as soon as possible after every social interaction that lasted 10 min or longer, and on shorter interactions they considered important. They were informed that this study was about investigating emotions in daily life during social interactions at work and in private life. The research assistant explained what we meant by an interaction (an encounter with one or more other people during which they mutually adjusted their behavior); and what was not considered an interaction (e.g., waiting for a bus with other people). Together with the research assistants, participants filled out sample interaction records to familiarize themselves with the methodology. Participants filled in the general questionnaire the same day and started the 7-day interaction record period the next day. They reported interactions for each day in separate daily booklets and mailed the booklets back to the researchers. The study was conducted in French; all non-French-language instruments were translated into French and controlled by back-translation.

MEASURES

General questionnaire (measures on the person-level)

We recorded participants' demographics such as sex, age, level of education, occupation, and the nature of their jobs. We measured neuroticism and extraversion by administrating the Big Five Personality Test (Costa and McCrae, 1995), in a short version developed by Schallberger and Venetz (1999). Cronbach's alpha for neuroticism and extraversion was 0.77 and 0.74, respectively.

Daily interaction records (measures on the interaction-level)

For each interaction, participants indicated whether it took place at work or outside of work. Only interactions at work were considered for this study. For each interaction, participants answered several questions, including whether they pursued a goal during the interaction. Only interactions for which goal pursuit was reported were included in the study.

Interaction partners. Participants provided information about the type of interaction partners for each interaction (colleague, superior, client, other). As the focus of this study is on interactions with superiors and colleagues, we excluded interactions involving only clients or other interaction partners. We created a dummy variable representing the presence of the superior in the interaction (0 = only colleagues are present; 1 = superior is present).

Emotions experienced and emotions shown during the interactions. For each interaction, participants were asked to report the emotion(s) felt and the emotion(s) shown during the interactions, using a variant of the Geneva Emotion Wheel (Scherer, 2005). The Geneva Emotion Wheel is a graphical tool that allows participants to record discrete positive emotions (e.g., interest, joy, pride etc.) and discrete negative emotions (e.g., anger, disappointment, shame etc.) as well as the *intensity* of each emotion on a scale from 1 to 4 on circles with increasing size, with an option to indicate "none" in the middle of the wheel. If an emotion was not ticked, it was coded as 0 (not felt or not shown, respectively). The Geneva Emotion Wheel is an accessible, easy to use tool that has been successfully used under time pressure and for repeated assessments (Tran, 2004; Hunziker et al., 2011; Scherer et al., in press). Two sets of the Geneva Emotion Wheel were used for each interaction, referring (1) to emotions experienced and (2) to emotions shown. *Emotions experienced* were measured on the first emotion wheel by asking "*In this interaction, which emotion(s) did you feel? Indicate all emotions felt as well as their intensity on the emotion wheel.*" *Emotions shown* were measured on the second emotion wheel by asking "*In this interaction, which emotion(s) did you show? Indicate all emotions you showed as well as their intensity on the emotion wheel.*" We computed scores for positive emotions by calculating the mean intensity of the emotions interest, happiness, joy, pleasure, tenderness, enthusiasm, relief, and compassion for emotions felt as well as for emotions shown. We computed scores for negative emotions shown and felt as the mean intensity of anger, contempt, disgust, disappointment, anxiety, sadness, embarrassment, shame, and guilt in an analogous way.

Degree of goal attainment during the interaction. To measure the degree of goal attainment in the interaction, participant

answered the question "*Have you attained your objective(s) in this interaction?*" on a five point Likert scale from 1 (not at all) to 5 (absolutely).

ANALYSES

As interactions are nested within individuals, we analyzed the data by way of multilevel regression analysis (Nezlek, 2003; Hox, 2010) using SPSS (Heck et al., 2010). Interactions are represented on level 1 (interaction-level), and individual participants are represented on level 2 (person-level).

For Hypotheses 1 and 3, which refer to the expression of positive emotions, we used multilevel regression analysis. For testing Hypotheses 2 and 4, which refer to the enhancement of positive emotion (i.e., the discrepancy between positive emotion felt and positive emotion shown), we ran polynomial procedures as suggested by Shanock et al. (2010). Following Hu and Liden (2012) and Vidyarthi et al. (2010), who ran polynomial analyses within a multilevel structure, we included the higher level terms of positive emotion felt and positive emotion shown; however, if the test of the curvature of the estimated response surface, which consists of the higher level terms (i.e., $\text{Felt}^2 - \text{Felt} \times \text{Shown} + \text{Shown}^2$), was not significant, we proceeded with the linear terms only and computed the discrepancies of positive emotion by subtracting the regression coefficient of positive shown from the regression coefficient for positive felt (see Vidyarthi et al., 2010; Hu and Liden, 2012). Finally, we tested the slope of incongruence by surface response tests (Shanock et al., 2010).

For all of our analyses, we included control variables that have been found to covariate with emotional constructs in social contexts. We controlled for age, as it has been shown that a shift in emotion regulation strategies is associated with developmental changes in adulthood (John and Gross, 2004). We controlled for gender, as there are gender differences in participation in social interactions (Wheeler and Nezlek, 1977) and in emotional suppression (Gross and John, 2003). We controlled for extraversion and neuroticism as these personality traits have been found to influence individual's susceptibility for experiencing emotions (Watson et al., 1988; Brotheridge and Grandey, 2002; Diefendorff and Richard, 2003; Diefendorff et al., 2011). Neuroticism and extraversion are related to higher emotional expressivity (Gross and John, 1994), and extraversion is related to display regulation (Diefendorff et al., 2005; Judge et al., 2009). At the interaction-level, we controlled for positive and negative emotion experienced or emotion shown whenever appropriate.

In terms of centering, for all person-level variables where zero was not a meaningful number, we used grand mean centering (GMC). For all continuous interaction-level variables, we chose a centering method that corresponded with our method of analysis. In multilevel analysis (Hypotheses 1 and 3) we used group mean centering (CWC), as suggested for this type of research (Enders and Tofighi, 2007; Hox, 2010; Ohly et al., 2010). For polynomial regression (Hypotheses 2 and 4), we used GMC (Edwards and Parry, 1993).

RESULTS

DESCRIPTIVE STATISTICS

Participants reported a total of 1535 interactions at work, corresponding to a mean of 13.58 interactions per participant. Of those interactions, 930 were with superiors and/or with colleagues. Participants reported pursuing a goal in 72.9% of the interactions with the superior present, and in 47.3% of the interactions with colleagues present. In total, 494 interactions were included in the analyses, which all involved interactions with superiors and/or colleagues as well as goal pursuit. Mean goal attainment per interaction was 3.93 (SD = 1.19).

Table 1 shows the means, standard deviations, and intercorrelations of all person-level variables; **Table 2** shows the means, standard deviations, and intercorrelations of the interaction-level variables.

POSITIVE EMOTIONS EXPRESSED AND GOAL ATTAINMENT

The initial analysis of an unconditional null model without any predictors confirmed that it was appropriate to use multilevel analysis. The intercept varied significantly across individuals (Wald $Z = 2.958$, $p < 0.001$), and the intraclass correlation (ICC) of 0.17 suggested that a large amount of the variability in the degree of goal attainment resided within individuals (Heck et al., 2010).

Hypothesis 1 states that positive emotions expressed during the interaction (whether from genuine emotions felt or from amplification) are related to goal attainment; Hypothesis 3 states that this relationship is moderated by interaction partner in that the relationship between positive emotions expressed and goal attainment is stronger in interactions with superiors than in interactions with colleagues.

Results are displayed in **Table 3**. To test Hypotheses 1 and 3, we first estimated a two-level unconditional null model. Model 1 in **Table 3** shows the results for Hypothesis 1. Besides our predictor variable positive emotions expressed we included the control variables age, gender, extraversion, and neuroticism on the person-level, and negative emotions expressed on the interaction-level. Expression of positive emotions during the interaction was significantly related to the degree of goal attainment ($B = 0.80$, SE = 0.13, $p < 0.01$), supporting Hypothesis 1. Note that the expression of negative emotions also showed a (negative) relationship to goal attainment ($B = -0.54$, SE = 0.23; $p < 0.05$). Of the control variables, only neuroticism was marginally related to goal attainment.

Hypothesis 3 postulated a moderating effect of the interaction partner. It was tested by adding the interaction partner variable (superior present versus only colleague(s) present), and subsequently the interaction term of positive expression times

Table 1 | Means, standard deviations, and correlations between level 2 variables.

	Range	*M*	SD	1	2	3
Gender	Female = 0, Male = 1	0.38	0.49	1		
Age	18–66	35.26	14.28	−0.11	1	
Extraversion	1–6	4.19	0.83	−0.02	−0.21*	1
Neuroticism	1–6	2.80	0.80	−0.22*	0.12	−0.23*

N = 112 employes.

*$^{\dagger}p < 0.10$, *$p < 0.05$, **$p < 0.01$ (two-tailed).*

Table 2 | Means, standard deviations, and correlations between level 1 variables.

	Range	*M*	SD	1	2	3	4	5	6
Positive emotion felt	0–4	0.78	0.65	1					
Positive emotion expressed	0–4	0.75	0.58	0.84**	1				
Negative emotion felt	0–4	0.24	0.37	−0.13**	−0.13**	1			
Negative emotion expressed	0–4	0.11	0.29	−0.17**	−0.19**	0.72**	1		
Amplification of positive emotion	0–4	0.13	0.24	−0.04	0.40**	0.08	−0.11*	1	
Superior present (yes = 1; no = 0)	0, 1	0.34	0.47	−0.11*	−0.08†	0.04	0.05	−0.04	1
Degree of goal attainment	1–5	3.9	1.2	0.32**	0.29**	−0.41**	−0.30**	0.04	−0.02

n = 494 interactions at work with goal pursuit with superiors and/or with colleagues.

*$^{\dagger}p < 0.10$, *$p < 0.05$, **$p < 0.01$ (two-tailed).*

interaction partner to the previous model. The interaction term was significant ($B = 0.72$; SE = 0.28, $p < 0.01$).

To illustrate the direction of the effect, we present the result in **Figure 1** as an interaction plot (Dawson and Richter, 2006), containing separate regression lines for interactions with colleagues and for interactions with superiors. **Figure 1** indicates that expressing positive emotions was more strongly related to goal attainment in interactions with superiors, as compared to interactions with colleagues. A single slope test (Preacher et al., 2006) showed that the slope for interactions with superiors was significantly different from zero ($t = 2.57$, $p = 0.01$), whereas the slope for interactions with colleagues was not ($t = 1.23$, $p = 0.23$). These results support Hypothesis 3.

AMPLIFYING THE EXPRESSION OF POSITIVE EMOTIONS AND GOAL ATTAINMENT

In Hypothesis 2 we state that the amplification of positive emotions felt (i.e., showing positive emotions more strongly than they are felt) is related to higher goal attainment in work-related interactions; Hypothesis 4 states that this relationship is more pronounced in interactions with superiors than in interactions with colleagues.

Results are presented in **Table 4**. Again, age, gender, extraversion, and neuroticism were included as control variables on the person-level. In these analyses, we entered both positive felt and positive shown emotions, which allows for assessing the effect of congruence between positive felt and shown (i.e., authentic positive emotion expression), and the effect of incongruence between positive felt and shown (i.e., the enhancement of positive, and the suppression of positive emotion). In the analyses of emotion display (**Table 3**), expressing negative emotions was significantly associated with lower goal attainment. For the analysis of amplification effects (**Table 4**), we also controlled for negative emotions, both felt and shown. Indeed, negative emotions felt were significantly associated with low goal attainment, both overall and in the analyses involving superiors or colleagues, respectively. Following Hu and Liden (2012), the higher level terms for positive emotion (i.e., $\text{Felt}^2 - \text{Felt} \times \text{Shown} + \text{Shown}^2$) were not included in the final model, as they were insignificant in all analyses, indicating the absence of non-linear relationships (see the section on analyses).

Hypothesis 2 postulated an effect of amplifying positive emotions regardless of the interaction partner. The response surface slope test for the line of congruence ($x = y$) was highly significant ($B = 0.51$, SE = 0.09, $p = 0.001$), suggesting that there is a positive linear relationship between authentic positive expression and degree of goal attainment. However, the response surface slope test for the line of incongruence ($x = -y$) was not significant, suggesting that neither enhancement nor suppression of positive emotion influenced degree of goal attainment. Amplification of positive emotions therefore does not seem to enhance goal attainment in general; Hypothesis 2 is thus not supported. These results are displayed in **Figure 2**.

Hypothesis 4 postulated that the effect of amplifying positive emotions would be stronger for superiors as compared to colleagues as interaction partners. To assess differences between interaction partners, we ran separate analyses for interactions with superior present, and for interactions with colleague(s) present. Results support Hypothesis 4 (**Table 4**, Model 4). For encounters with a superior (displayed in **Figure 3**), the response surface slope test for the line of congruence ($x = y$) was highly significant. ($B = 0.81$, SE = 0.16, $p = 0.001$) suggesting that there is a positive linear relationship between authentic positive expression and degree of goal attainment. Most importantly, the response surface slope test for the line of incongruence ($x = -y$) was significant. ($B = -1.05$, SE = 0.53, $p = 0.047$ two-tailed). The negative sign of the coefficients implies the effect on goal attainment is driven by showing more positive emotions than felt; thus it is the enhancement of positive shown, not the suppression of positive emotion that is important for achieving goals. For encounters with colleagues (displayed in **Figure 4**), the response surface slope test for the line of congruence ($x = y$) was highly significant. ($B = 0.39$, SE = 0.10, $p = 0.001$) suggesting that there is a positive linear relationship between authentic positive expression and degree of goal attainment. The response surface slope test for the line of incongruence ($x = -y$) was not significant, suggesting that neither enhancement nor suppression of positive emotions influence degree of goal attainment. These results support Hypothesis 4.

ALTERNATIVE ANALYSIS

With regard to Hypotheses 2 and 4, we considered several ways of conducting these analyses besides multilevel polynomial analysis. One involves an interaction between emotion felt and emotion shown, and the other involves the creation of an emotion enhancement score (i.e., a difference score). All these analyses led essentially

Table 3 | Predicting goal attainment in workplace interactions by expressing positive emotions (Hypothesis 1 and Hypothesis 3).

Variables	Unconditional Estimate (SE)	Model 1 (Hypothesis 1) Estimate (SE)	Model 2 (Hypothesis 3) Estimate (SE)
Intercept	3.91 (0.07)**	3.97 (0.10)**	3.99 (0.10)**
LEVEL 2 (GRAND MEAN CENTERED)			
Gender (female = 0, male = 1)		−0.12 (0.15)	−0.13 (0.15)
Age		0.00 (0.01)	0.00 (0.01)
Extraversion		0.01 (0.09)	0.03 (0.09)
Neuroticism		−0.18 (0.09)†	−0.18 (0.09)†
LEVEL 1 (GROUP MEAN CENTERED)			
Positive emotions expressed		**0.80 (0.13)****	**0.59 (0.15)****
Negative emotions expressed		−0.54 (0.23)*	−0.50 (0.23)*
Superior present (yes = 1; no = 0)			−0.02 (0.11)
Interaction term:			
Positive shown × superior present			**0.72 (0.28)****

N = 113 employes, n = 494 interactions at work involving goal pursuit with superiors and/or with colleagues.

*†p < 0.10, *p < 0.05, **p < 0.01. Tests are all two-tailed.*

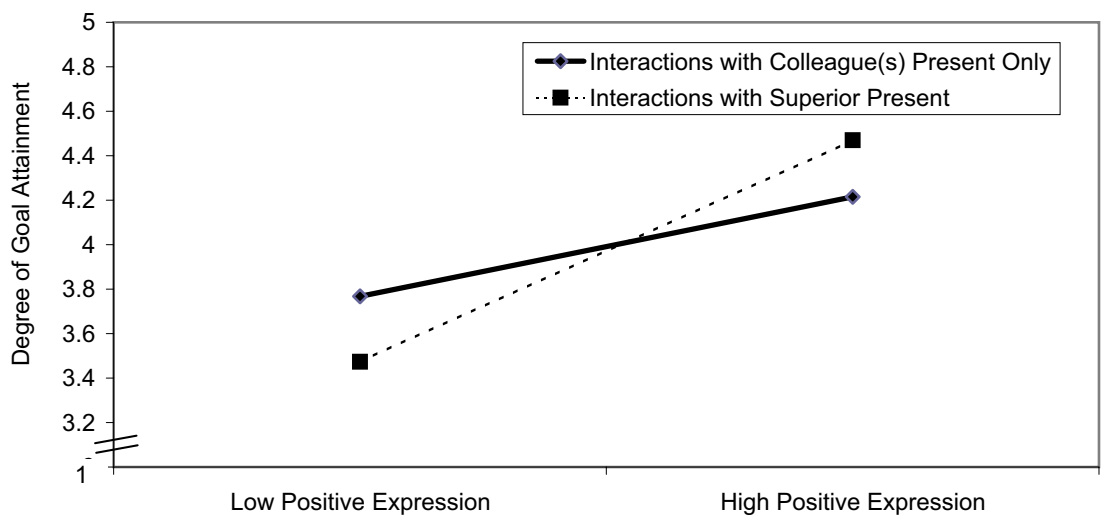


FIGURE 1 | Predicting goal attainment by *expressing* positive emotions during interactions at work with a superior present versus not present.

to the same results; the interaction plot (Dawson and Richter, 2006) for enhancing positive expression is similar to **Figure 1**; the slope test (Preacher et al., 2006) showed that more amplification of positive emotions was related to higher levels of goal attainment only in interactions with superiors ($t = 2.48$, $p = 0.01$), but not in interactions with colleagues ($t = 0.28$, $p = 0.78$).

DISCUSSION

We investigated the effects of expressing and amplifying the expression of positive emotions in interactions with colleagues and/or superiors at work on goal attainment. In more than half (53.1%) of the interactions participants reported having pursued a goal; this underscores the importance of goals in interactions at work. Although the degree of goal attainment was relatively high (AM = 3.9 on a scale from one to five), we did find relationships between emotions expressed and goal attainment and between display regulation and goal attainment. We were interested in whether expressing and amplifying *positive* emotions is related to the degree of goal attainment in social interactions at work. The results, based on 494 interactions at work provided by 113 employes, suggest that (1) the *expression* of positive emotions is related to higher goal attainment, but (2) this main effect is qualified by an interaction indicating that this effect only holds for interactions with superiors, not for interactions with

colleagues. The results furthermore (3) suggest that *amplifying positive emotions* in interactions is significantly related to goal attainment in interactions with superiors, but not in interactions with colleagues.

We discuss (1) the expression of positive emotions and the role of authenticity in general, and (2) the differential findings for interactions with coworkers and superiors.

(1) Our result of a significant main effect of expressing positive emotions is in accordance with previous research that tested similar effects in a more indirect way or by experimental research. For example, negotiation research has shown that people in a positive mood are more likely to adopt optimistic, cooperative strategies, and seek integrative solutions (e.g., Carnevale and Isen, 1986; Forgas, 1998), and less likely to engage in aggressive tactics (e.g., Baron, 1984), thus contributing to better joint outcomes (Potworowski and Kopelman, 2008). Our findings are also in accordance with the literature on social functions of emotions (Clark et al., 1996; Van Kleef, 2010), which suggests that expressing positive emotions may be perceived by the interaction partner as signaling cooperation, which could be functional for goal attainment.

Note that effects of expressing positive emotions cannot be attributed to an absence of negative emotions, as expressing negative emotions were controlled for in our analyses. Not unexpectedly (although not hypothesized, as it was not the focus of this paper), we found a negative effect of expressing negative emotions on goal achievement. Again, this is in accordance with previous studies. For example, Friedman et al. (2004) showed that in real electronic mediations, expressing anger reduced settlement quality. Our finding that expressing negative emotions is negatively related to reaching goals thus replicates these earlier findings. Note that expressing anger has been found to predict better outcomes for the person expressing anger in some specific circumstances, such as short term negotiations among strangers (Van Kleef et al., 2004).

However, our study extends previous research by showing that expressing positive emotions is not conducive for goal attainment unconditionally. Specifically, the effect for expressing positive emotions was moderated by the type of interaction partner: expressing positive emotions increased goal attainment only during interactions with superiors as when compared to during interactions with colleagues; we will comment on that result below.

The polynomial regression analysis offers additional insights. The results of this analysis suggests that expressing positive emotions *authentically* is beneficial regardless of the interaction partner, as the slope for the line of congruence is significant in all three analyses.

It is not surprising that expressing positive emotions authentically has positive effects regardless of the interaction partner. Authentic expression of positive emotions has all the advantages associated with expressing positive emotions that have been postulated, and found, in research on emotional contagion (e.g., Barsade, 2002) and on emotional labor (regarding deep acting and genuine emotional displays; Ashkanasy and Humphrey, 2011a), but it does not contain the risk of "leaking" associated with faking (Grandey et al., 2005a; Liu and Perrewe, 2006).

That the effect of authentic display of positive emotions is not likely to be disputed actually provides the basis for our focus on the way people express positive emotions they actually feel. Most notably, since an authentic expression of these emotions promises positive effects without risks, can one expect any additional effect of amplifying these positive emotions? Amplifying positive emotions might not only yield little additional value, as

Table 4 | Predicting goal attainment in workplace interactions from positive felt and shown (Hypothesis 2 and Hypothesis 4).

Variables	All partners (Hypothesis 2) Estimate(SE)	Superior (Hypothesis 4) Estimate(SE)	Coworker (Hypothesis 4) Estimate(SE)
Intercept	4.15 (0.08)**	4.32 (0.13)**	4.14 (0.09)**
LEVEL 2 (GRAND MEAN CENTERED)			
Gender (female = 0, male = 1)	−0.11 (0.12)	−0.48 (0.18)*	−0.07 (0.13)
Age	0.00 (0.00)	−0.02 (0.01)*	0.00 (0.00)
Extraversion	0.02 (0.07)	−0.11 (11)	0.04 (0.08)
Neuroticism	−0.06 (0.08)	−0.11 (0.12)	−0.05 (0.08)
LEVEL 1 (GRAND MEAN CENTERED)			
Positive felt	0.37 (0.14)*	−0.12 (0.26)	0.44 (0.15)**
Positive shown	0.17 (0.15)	0.93 (0.29)**	−0.05 (0.17)
Congruence between positive felt and shown	**0.51 (0.09)****	**0.81 (0.16)****	**0.39 (0.10)****
Discrepancy between positive felt and shown	**0.16 (0.28)**	**−1.05 (0.53)***	**0.50 (0.31)**
Control variables			
Negative felt	−1.31 (0.18)**	−1.24 (0.26)**	−1.38 (0.22)**
Negative shown	0.43 (0.25)†	0.35 (0.34)	0.66 (0.35)†

N = 113 employes, n = 494 interactions at work involving goal pursuit with superiors and/or with colleagues.

*†p < 0.10, *p < 0.05, **p < 0.01. Tests are all two-tailed.*

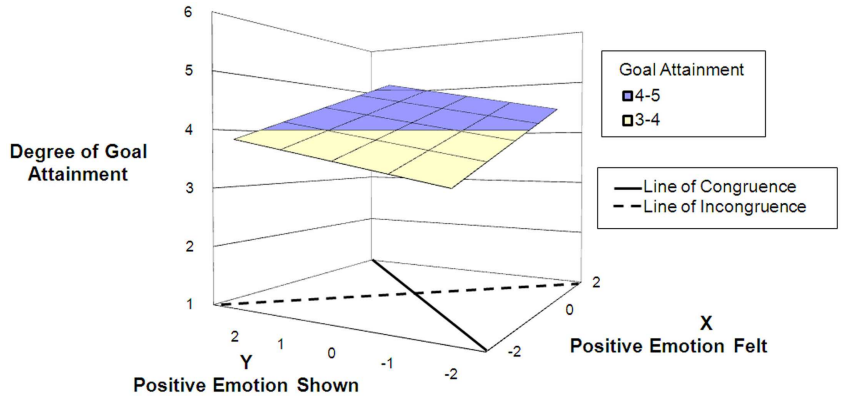


FIGURE 2 | Predicting goal attainment by positive emotions felt and shown during interactions at work.

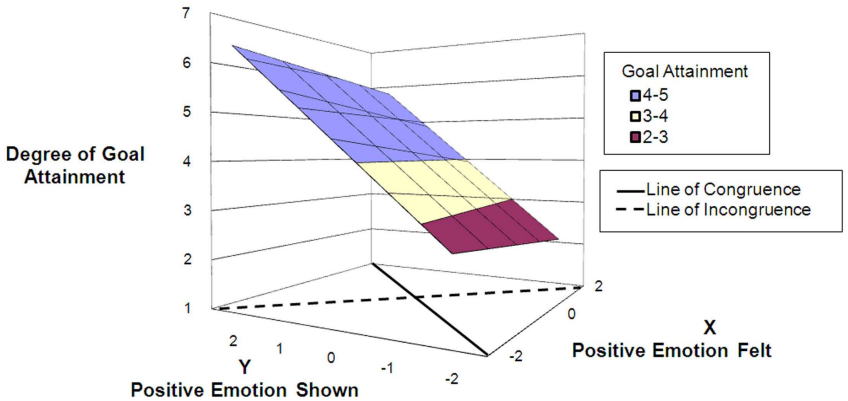


FIGURE 3 | Predicting goal attainment by positive emotions felt and shown during interactions with *superiors*.

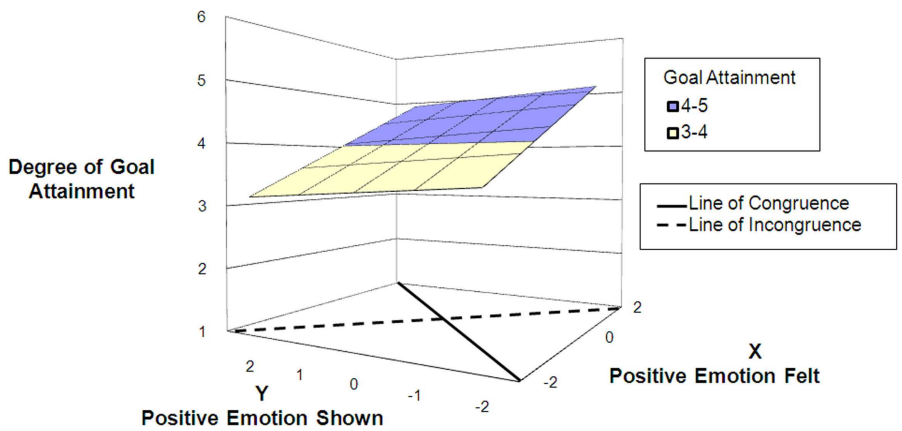


FIGURE 4 | Predicting goal attainment by positive emotions felt and shown during interactions with *coworkers*.

the underlying emotion felt already is positive; it might actually backfire if it is detected as non-authentic. Thus, there is an important contrast to the issue of negative emotion display. Expressing negative emotions may have such damaging effects that the risk of being detected may seem worth taking in many situations. For positive emotions, the benefits of amplifying them are not so obvious. Showing that amplifying positive emotions may support goal attainment therefore adds to the literature.

We postulated a main effect of amplifying positive emotions on goal attainment in everyday social interactions at work. To formulate our hypotheses we drew, among others, on the impression management literature (Giacalone and Rosenfeld, 1989). Impression management tactics that include expressing and amplifying positive emotions have been found to have the most consistent effects on long-term organizational outcomes (Higgins et al., 2003; Harris et al., 2007). While we did not find an effect for the amplified expression of positive emotions for colleagues as interaction partners, we did find it for supervisors; it is that effect that we turn to now.

(2) We hypothesized that the influence of expressing or amplifying positive emotions on goal attainment is more pronounced in interactions with superiors than in interactions with colleagues, based on considerations concerning power (Mast and Hall, 2004), relationship closeness (Clark and Finkel, 2005), and rules of cooperation at work (Henderson and Argyle, 1986). Multilevel moderated regression analyses supported these contentions, and slope tests revealed that an effect of expressing positive emotions was only found in interactions with superiors, but not in interactions involving colleagues only, as hypothesized. Furthermore, in the polynomial regression analysis, amplifying positive emotions increased goal attainment only in interactions with superiors, but not in interactions with colleagues. These findings are in accordance with research showing that people adapt their tactics to the perceived power of the audience (Gardner and Martinko, 1988) and specifically to situations that involve interacting with superiors (Baumeister, 1989). We argued that this tendency to engage in more emotion regulation vis-a-vis superiors is not only more frequent but also especially effective (cf. the study by Staw et al. (1994), who did not, however, distinguish between emotions felt and shown, and did not refer to daily interactions).

Bound by work rules and norms (Argyle and Henderson, 1985), colleagues typically are dependent on the focal person to a much greater degree than supervisors, which implies that they have less discretion concerning whether or not they will comply with the focal person's goals; they therefore should be less strongly influenced by the expression of positive emotions than supervisors. Also, for colleagues, the focal person's behavior is embedded in a much wider and richer context, such as their more intimate knowledge about the dependability, cooperativeness, and contributions of the focal person in general; such a rich context-knowledge should render specific behavioral instances less important for colleagues, as compared to superiors, who often do not have such a rich contextual background knowledge. Furthermore, the chances that faking emotions may backfire should be greater when interacting with colleagues, as they are more likely to detect an inauthentic positive emotion expressed.

In contrast to colleagues, superiors often know the employe less well and therefore may be less likely to detect subtle signs of inauthenticity. Unless there is a specific reason to be very attentive (e.g., when they depend on the cooperation of a specific employe in a given situation; cf. Kilduff et al., 2010), they may not search for pertinent information deeply enough, being satisfied with external signs of positivity. Such a lack of vigilance may be supported by the fact that deliberate smiles are more common in people who are low in status (Méhu, 2011); superiors therefore may simply be used to that kind of behavior and assume it to be normal. One might even speculate that some supervisors may notice the inauthenticity but not be bothered by it; rather, they may interpret such behavior as appropriate for subordinates to display toward their superiors, as they indicate the awareness, and acceptance, of the power differential by the less powerful partner (cf. Méhu and Dunbar, 2008).

All in all, in terms of achieving one's goals, it seems to pay off to express positive emotions when interacting with superiors, and to even amplify positive emotions that are not strongly felt. There is a certain irony in these findings: Employes tend to *show more* positive emotions when superiors are present, as indicated by the positive correlation between the presence of a superior and the expression of positive emotions in **Table 2**. However, they *experience fewer* positive emotions when interacting with superiors as compared to colleagues, as indicated by the negative correlation between the presence of a superior and the experience of positive emotions (see **Table 2**, and cf. the finding by Tschan et al. (2010) that people experience less pleasure when superiors are present). Emotional labor toward superiors, which so far has been overshadowed by the dominant focus on clients (for an exception, see Tschan et al., 2005), deserves much more attention, as does the question of by which mechanisms employes manage to induce their superiors to comply with their objectives by showing positive emotions.

LIMITATIONS AND STRENGTH

This study has several limitations. First, all data are based on self-report, which bears the risk of common method bias. There are still limited alternatives to self-report when assessing emotions (De Gelder, 2010), particularly in everyday situations. As self-report bias has been found to be influenced by positive and negative trait affectivity (Podsakoff et al., 2003), we controlled for trait extraversion and trait neuroticism in this research, thus alleviating the common method problem. Note also that we asked questions about feeling and showing emotions and goal attainment in interactions repeatedly; our results could therefore be attributed to common method bias only to the extent that this bias is differentially associated with specific interactions. Also, emotions (felt and shown) and goal attainment are assessed by different types of scales, which also might alleviate the common method problem (Ashkanasy et al., 2006). Finally, common method bias makes it, if anything, more difficult to detect statistical interactions. Note also that a number of authors recently have concluded that the common method problem may have been overstated (e.g., Spector, 2006). Common methods bias may have influenced our results, but it is unlikely that this bias would render the results spurious.

Second, the most important limitation of the study is that we cannot reliably establish cause-effect relations. Information about the interactions, the interaction partners, emotions expressed and the amplification of positive emotions were all measured immediately after the interaction. It is plausible that part of the emotional aspects reported is a result of the degree of goal attainment rather than a predictor of goal attainment. This concern would not be alleviated much by a temporal separation of the measures, as in real life interactions it may become clear already during the interaction whether a goal can be reached or not, and emotional

experiences may thus be influenced by this. This concern is particularly important for the interpretation of our results regarding emotions expressed (Hypotheses 1 and 3), because they correlate highly with the emotions felt. However, we feel that the argument applies less for amplification of positive emotions; they were measured as the discrepancy between positive emotions expressed and positive emotions felt, and, in addition, positive emotions felt were controlled for in our polynomial regression analyses. Whereas failure or successful goal attainment are affective events and influence emotions *felt* (Weiss and Cropanzano, 1996), it is theoretically less plausible that a higher degree of goal attainment should cause more *exaggerating* of positive emotions. However, the issue cannot be resolved in this study.

Third, with 113 participants and about 500 analyzed interactions the sample size is relatively small; furthermore, it is geographically constrained to the French speaking region of Switzerland. Some studies found cross-cultural differences in emotion regulation and its effects (e.g., Grandey et al., 2005b; Fischbach et al., 2006), and this has to be considered. In addition, France and the French part of Switzerland are known to show particularly high scores in power distance, a measure that indicates a particularly low relationship closeness between employes and superiors (Hofstede, 1993), thus, results for other cultures might well differ.

Fourth, when using event-sampling methodology, there are always constraints in the number of questions that can be asked without losing compliance (Nezlek, 1990). We therefore could only ask people if they had a goal but could not ask more specifically about the nature of these goals. The brief descriptions participants gave concerning the interaction sometimes contain hints about possible goals, indicating a wide variety of topics, as one would expect in a work setting (e.g., "I asked my boss if I could leave early"; "Help a client solve a problem"; "No computer in my office"; "Pay raise"). However, these comments were not always informative, and where goals were described we do not know specifics about them (e.g., how large a pay rise the participant expected), nor do we know to which extent the goals were focused on solving a problem (e.g., achieve a solution concerning division of labor) or on one's personal standing (e.g., not being made responsible for a problem).

Lastly, given the constraint in the length of the study, we did not control for emotional intelligence, and therefore could not investigate how emotional intelligence might influence the link between amplifying and goal attainment. We did control for extraversion and neuroticism, which are strong correlates of trait emotional intelligence (Van der Zee et al., 2002; Petrides et al., 2010). Nevertheless, future studies should include the emotional intelligence measures, especially the dimensions of perceiving and managing emotions (cf. Salovey and Grewal, 2005).

This study also has strengths. First, we investigated effects of emotion expression and display regulation in everyday interactions, and thus can show differences and similarities to experimental research. Second, we particularly focused on the expression and amplification of positive emotions in interactions; most research related to display regulation at work has been done in the context of emotion work with an emphasis on regulating the expression of felt *negative* emotions; this also applies to research that focuses on social interactions (Friedman et al., 2004; Van Kleef and Cote, 2007). Showing that there may be circumstances in which amplifying positive emotions benefits goal attainment therefore constitutes a unique contribution, since simply showing the positive emotion authentically already would likely be associated with considerable benefits but less risk.

Although a vast literature on impression management indicated that a general tendency to amplify positive emotions can lead to general positive outcomes at work, our study contributes to showing where exactly this tactic is used and with what effect; in this sense, it contributes to the impression management literature. Furthermore, our findings also demonstrate how important it is to consider *who* is in the interaction, underscoring the role and the status of interaction partners at work.

IMPLICATIONS FOR FURTHER RESEARCH

There are several implications of our results for further research. One issue relates to the type of goals people pursue. As indicated by the short descriptions people gave about the interactions, they do pursue all kinds of task-related goals in interactions. Which type of goals is most frequently pursued by means of expressing positive emotions, however, requires further research that specifies the goals involved. One interesting distinction in this context relates to goals that are related to one's work (e.g., getting a new computer) versus goals that are related to the person him- or her-self, e.g., appearing competent, dependable, etc., but also avoiding negative outcomes such as being blamed for mistake (cf. Cropanzano et al., 1993). Such goals are implied by the research on impression management, but they should be assessed in greater detail in daily interactions. Note that this type of goal may well be pursued in parallel with task- and job-related goals. Also, it is important to investigate the relative importance of the goals involved. From our research one might conclude that it is relatively easy for employes to "manipulate" their superiors. However, it is conceivable that the goals attained by our participants were not very far-reaching, but rather small-scale, everyday goals without substantial implications for the long-term strategy of the superiors. How far the influence of expressing positive emotions goes in terms of more "strategic" goals is an issue that should be investigated.

FINAL REMARKS

Together, our findings contribute to the existing literature on display regulation of emotions in interactions at work by showing that expressing positive emotions may not only benefit the organization to the detriment of the employe (Hochschild, 1983); rather, display regulation may also help to achieve individual goals, and thus create success experiences, which then benefit the individual (Gross et al., 2011). Whereas authentic display of positive emotions seems to be beneficial for goal attainment throughout, amplifying positive emotions evidently works specifically when interacting with superiors.

ACKNOWLEDGMENTS

This research was supported by a grant from the Swiss National Science Foundation (58452 SNF) through the National Center of Competence in Research Affective Sciences (128911 SNF, project 6) hosted by the University of Geneva. This research was also supported by the University of Neuchâtel. We thank Veronique Tran for her input and Celine Hendrickse for her help in data collection. We also thank Barbara Stalder for her advice regarding statistical analyses.

REFERENCES

Andrade, E. B., and Ho, T. H. (2009). Gaming emotions in social interactions. *J. Consum. Res.* 36, 539–552.

Argyle, M., and Henderson, M. (1985). *The Anatomy of Relationships: And the Rules and Skills Needed to Manage Them Successfully*. London: David & Charles.

Ashforth, B. E., and Humphrey, R. H. (1993). Emotional labor in service roles: the influence of identity. *Acad. Manag. Rev.* 18, 88–115.

Ashforth, B. E., and Humphrey, R. H. (1995). Labeling processes in the organization: constructing the individual. *Res. Organ. Behav.* 17, 413.

Ashkanasy, N. M. (2003). "Emotions in organizations: a multilevel perspective," in *Research in Multi-Level Issues*, Vol. 2, eds F. Dansereau and F. J. Yammarino (Oxford: Elsevier/JAI Press), 9–54.

Ashkanasy, N. M., and Humphrey, R. H. (2011a). Current emotion research in organizational behavior. *Emot. Rev.* 3, 214–224.

Ashkanasy, N. M., and Humphrey, R. H. (2011b). "A multi-level view of leadership and emotions: leading with emotional labor," in *Sage Handbook of Leadership*, eds A. Bryman, D. Collinson, K. Grint, B. Jackson, and M. Uhl-Bien (London: Sage Publications), 363–377.

Ashkanasy, N. M., Windsor, C., and Trevino, L. K. (2006). Bad apples in bad barrels revisited: cognitive moral development, just world beliefs, rewards, and ethical decision making. *Bus. Ethics Q.* 16, 449–473.

Barger, P. B., and Grandey, A. A. (2006). Service with a smile and encounter satisfaction: emotional contagion and appraisal mechanisms. *Acad. Manag. J.* 49, 1229–1238.

Baron, R. A. (1984). Reducing organizational conflict: an incompatible response approach. *J. Appl. Psychol.* 69, 272.

Baron, R. A., Fortin, S. P., Frei, R. L., Hauver, L. A., and Shack, M. L. (1990). Reducing organizational conflict: the role of socially-induced positive affect. *Int. J. Conflict Manag.* 1, 133–152.

Baron, R. A., Rea, M. S., and Daniels, S. G. (1992). Effects of indoor lighting (illuminance and spectral distribution) on the performance of cognitive tasks and interpersonal behaviors: the potential mediating role of positive affect. *Motiv. Emot.* 16, 1–33.

Barsade, S. G. (2002). The Ripple effect: emotional contagion and its influence on group behavior. *Adm. Sci. Q.* 47, 644–675.

Barsade, S. G., and Gibson, D. E. (2007). Why does affect matter in organizations? *Acad. Manag. Perspect.* 21, 36–59.

Batson, C. D., and Powell, A. A. (2003). Altruism and prosocial behavior. *Handbook of Psychology* 3, 463–484.

Baumeister, R. F. (1989). "Motives and costs of self-presentation in organizations." in *Impression Management in the Organization*, eds R. A. Giacalone and P. Rosenfeld, (Hillsdale, New Jersey: Lawrence Erlbaum Associates), 57–71.

Bindl, U. K., Parker, S. K., Totterdell, P., and Hagger-Johnson, G. (2012). Fuel of the self-starter: how mood relates to proactive goal regulation. *J. Appl. Psychol.* 97, 134.

Brotheridge, C. M., and Grandey, A. A. (2002). Emotional labor and burnout: comparing two perspectives on 'people work'. *J. Vocat. Behav.* 60, 17–39.

Carnevale, P. J. D., and Isen, A. M. (1986). The influence of positive affect and visual access on the discovery of integrative solutions in bilateral negotiation. *Organ. Behav. Hum. Decis. Process.* 37, 1–13.

Cialdini, R. B., and Goldstein, N. J. (2004). Social influence: compliance and conformity. *Annu. Rev. Psychol.* 55, 591–621.

Clark, M. S., and Finkel, E. J. (2005). Willingness to express emotion: the impact of relationship type, communal orientation, and their interaction. *Pers. Relatsh.* 12, 169–180.

Clark, M. S., Pataki, S. P., and Carver, V. H. (1996). "Some thoughts and findings on self-presentation of emotions in relationships," in *Knowledge Structures in Close Relationships: A Social Psychological Approach*, eds G. J. O. Fletcher and J. Fitness (Mahwah, NJ: Erlbaum), 247–274.

Costa, P. T., and McCrae, R. R. (1995). Domains and facets: hierarchical personality assessment using the Revised NEO Personality Inventory. *J. Pers. Assess.* 64, 21–50.

Cote, S. (2005). A social interaction model of the effects of emotion regulation on work strain. *Acad. Manag. Rev.* 30, 509–530.

Côté, S., and Hideg, I. (2011). The ability to influence others via emotion displays. *Organ. Psychol. Rev.* 1, 53–71.

Cote, S., Kleef, G. A. V., and Sy, T. (2013). "The social effects of emotion regulation in organizations," in *Emotional Labor in the 21st Century: Diverse Perspectives on Emotion Regulation at Work*, eds A. A. Grandey, J. M. Diefendorff, and D. E. Rupp (New York: Routledge), 79–100.

Cropanzano, R., James, K., and Citera, M. (1993). A goal hierarchy model of personality, motivation, and leadership. *Res. Organ. Behav.* 15, 267–267.

Dawson, J. F., and Richter, A. W. (2006). Probing three-way interactions in moderated multiple regression: development and application of a slope difference test. *J. Appl. Psychol.* 91, 917–926.

De Gelder, B. (2010). Frontiers in emotion science. The grand challenge. *Front. Psychol.* 1:187. doi:10.3389/fpsyg.2010.00187

Diefendorff, J., Morehart, J., and Gabriel, A. (2010). The influence of power and solidarity on emotional display rules at work. *Motiv. Emot.* 34, 120–132.

Diefendorff, J. M., Croyle, M. H., and Gosserand, R. H. (2005). The dimensionality and antecedents of emotional labor strategies. *J. Vocat. Behav.* 66, 339–357.

Diefendorff, J. M., Erickson, R. J., Grandey, A. A., and Dahling, J. J. (2011). Emotional display rules as work unit norms: a multilevel analysis of emotional labor among nurses. *J. Occup. Health Psychol.* 16, 170–186.

Diefendorff, J. M., and Richard, E. M. (2003). Antecedents and consequences of emotional display rule perceptions. *J. Appl. Psychol.* 88, 284–294.

Dunn, J. R., and Schweitzer, M. E. (2005). Feeling and believing: the influence of emotion on trust. *J. Pers. Soc. Psychol.* 88, 736–748.

Edwards, J. R., and Parry, M. E. (1993). On the use of polynomial regression equations as an alternative to difference scores in organizational research. *Acad. Manag. J.* 36, 1577–1613.

Ekman, P. (2003). *Emotions Revealed: Recognizing Faces and Feelings to Improve Communication and Emotional Life*. New York: Henry Holt and Co.

Enders, C. K., and Tofighi, D. (2007). Centering predictor variables in cross-sectional multilevel models: a new look at an old issue. *Psychol. Meth.* 12, 121–138.

Fischbach, A., Meyer-Gomes, K., Zapf, D., and Rank, J. (2006). Emotion work across cultures: a comparison between the United States and Germany. *Res. Emot. Organ.* 2, 193–217.

Fischer, A. H., Rotteveel, M., Evers, C., and Manstead, A. S. R. (2004). Emotional assimilation: how we are influenced by other's emotions. *Curr. Psychol. Cogn.* 22, 223–246.

Fisher, R., and Shapiro, D. (2006). *Beyond Reason: Using Emotions as You Negotiate*. New York: Penguin Group.

Forgas, J. P. (1998). On feeling good and getting your way: mood effects on negotiator cognition and bargaining strategies. *J. Pers. Soc. Psychol.* 74, 565.

Fredrickson, B. L. (1998). What good are positive emotions? *Rev. Gen. Psychol.* 2, 300–319.

Fredrickson, B. L. (2004). The broaden-and-build theory of positive emotions. *Philos. Trans. R. Soc. Lond. B Biol. Sci.* 359, 1367–1377.

Friedman, R., Anderson, C., Brett, J., Olekalns, M., Goates, N., and Lisco, C. C. (2004). The positive and negative effects of anger on dispute resolution: evidence from electronically mediated disputes. *J. Appl. Psychol.* 89, 369.

Gardner, W. L., and Martinko, M. J. (1988). Impression management: an observational study linking audience characteristics with verbal self-presentations. *Acad. Manag. J.* 14, 321–338.

George, J. M. (1991). State or trait: effects of positive mood on prosocial behaviors at work. *J. Appl. Psychol.* 76, 299.

George, J. M. (2002). "Affect regulation in groups and teams," in *Emotions in the Workplace: Understanding the Structure and Role of Emotions in Organizational Behavior*, eds R. G. Lord, R. J. Klimoski and R. Kanfer (San Francisco, CA: Jossey-Bass), 182–217.

Giacalone, R. A., and Rosenfeld, P. (1989). *Impression Management in Organizations*. Hillsdale, NJ: Erlbaum.

Giardini, A., and Frese, M. (2006). Reducing the negative effects of emotion work in service occupations: emotional competence as a psychological resource. *J. Occup. Health Psychol.* 11, 63–75.

Glaso, L., and Einarsen, S. (2008). Emotion regulation in leader-follower relationships. *Eur. J. Work Organ. Psychol.* 17, 482–500.

Gosnell, C. L., Britt, T. W., and McKibben, E. S. (2011). Self-presentation in everyday life: effort, closeness, and satisfaction. *Self Identity* 10, 18–31.

Gouldner, A. W. (1960). The norm of reciprocity: a preliminary statement. *Am. Sociol. Rev.* 25, 161–178.

Grandey, A. A. (2000). Emotional regulation in the workplace: a new way to conceptualize emotional labor. *J. Occup. Health Psychol.* 5, 95.

Grandey, A. A. (2003). When the show must go on: surface acting and deep acting as determinants of emotional exhaustion and peer-rated service delivery. *Acad. Manag. J.* 46, 86–96.

Grandey, A., Dieffendorf, J., and Rupp, D. E. (2012). "Emotional labor in the 21st century: diverse perspectives on emotion regulation at work." in *Organizational and Management Series*. New York: Psychology Press/Routledge.

Grandey, A. A., Fisk, G. M., Mattila, A. S., Jansen, K. J., and Sideman, L. A. (2005a). Is "service with a smile" enough? – authenticity of positive displays during service encounters. *Organ. Behav. Hum. Decis. Process* 96, 38–55.

Grandey, A. A., Fisk, G. M., and Steiner, D. D. (2005b). Must "service with a smile" be stressful? The moderating role of personal control for U.S. and French employees. *J. Appl. Psychol.* 90, 893–904.

Gray, J. H., and Densten, I. L. (2007). How leaders woo followers in the romance of leadership. *Appl. Psychol.* 56, 558–581.

Gross, J. J. (1998). Antecedent- and response-focused emotion regulation: divergent consequences for experience, expression, and physiology. *J. Pers. Soc. Psychol.* 74, 224–237.

Gross, J. J., and John, O. P. (1994). Facets of emotional expressivity: three self-report factors and their correlates. *Pers. Indiv. Differ.* 19, 555–568.

Gross, J. J., and John, O. P. (2003). Individual differences in two emotion regulation processes: implications for affect, relationships, and well-being. *J. Pers. Soc. Psychol.* 85, 348–362.

Gross, S., Semmer, N. K., Meier, L. L., Kälin, W., Jacobshagen, N., and Tschan, F. (2011). The effect of positive events at work on after-work fatigue: they matter most in face of adversity. *J. Appl. Psychol.* 96, 654.

Hall, J. A., Murphy, N. A., and Mast, M. S. (2007). Nonverbal self-accuracy in interpersonal interaction. *Pers. Soc. Psychol. Bull.* 33, 1675–1685.

Harker, L., and Keltner, D. (2001). Expressions of positive emotion in women's college yearbook pictures and their relationship to personality and life outcomes across adulthood. *J. Pers. Soc. Psychol.* 80, 112–124.

Harris, K. J., Kacmar, K. M., Zivnuska, S., and Shaw, J. D. (2007). The impact of political skill on impression management effectiveness. *J. Appl. Psychol.* 92, 278.

Hatfield, E., Cacioppo, J. T., and Rapson, R. L. (1994). *Emotional Contagion*. Cambridge: Cambridge University Press.

Heck, R. H., Thomas, S. L., and Tabata, L. N. (2010). *Multilevel and Longitudinal Modeling with IBM SPSS*. New York: Routledge.

Henderson, M., and Argyle, M. (1986). The informal rules of working relationships. *J. Occup. Behav.* 7, 259–275.

Higgins, C. A., Judge, T. A., and Ferris, G. R. (2003). Influence tactics and work outcomes: a meta-analysis. *J. Organ. Behav.* 24, 89–106.

Hochschild, A. R. (1979). Emotion work, feeling rules, and social-structure. *Am. J. Sociol.* 85, 551–575.

Hochschild, A. R. (1983). *The Managed Heart: Commercialization of Human Feeling*. Berkeley: University of California Press.

Hofstede, G. (1993). Cultural constraints in management theories. *Acad. Manag. Exec.* 7, 81–94.

Hox, J. J. (2010). *Multilevel Analysis. Techniques and Applications*. New York: Routledge.

Hu, J., and Liden, R. C. (2012). Relative leader-member exchange within team contexts: how and when social comparison impacts individual effectiveness. *Pers. Psychol.* 66, 127–172.

Humphrey, R. H., Pollack, J. M., and Hawver, T. (2008). Leading with emotional labor. *J. Manag. Psychol.* 23, 151–168.

Hunziker, S., Laschinger, L., Portmann-Schwarz, S., Semmer, N., Tschan, F., and Marsch, S. (2011). Perceived stress and team performance during a simulated resuscitation. *Intensive Care Med.* 37, 1473–1479.

Isen, A. M., and Simmonds, S. F. (1978). The effect of feeling good on a helping task that is incompatible with good mood. *Soc. Psychol.* 41, 346–349.

Izard, C. E. (1977). *Human Emotions*. New York: Springer.

John, O. P., and Gross, J. J. (2004). Healthy and unhealthy emotion regulation: personality processes, individual differences, and life span development. *J. Pers.* 72, 1301–1334.

Jones, E. E., and Pittman, T. S. (1982). "Toward a general theory of strategic self-presentation," in *Psychological Perspectives on the Self*, Vol. 1, 231–262.

Judge, T. A., and Bretz, R. D. (1994). Political influence behavior and career success. *J. Manag.* 20, 43–65.

Judge, T. A., Woolf, E. F., and Hurst, C. (2009). Is emotional labor more difficult for some than for others? A multilevel, experience-sampling study. *Pers. Psychol.* 62, 57–88.

Kahn, W. A. (2007). "Meaningful connections: positive relationships and attachments at work," in *Exploring Positive Relationships at Work: Building a Theoretical and Research Foundation*, eds J. E. Dutton and B. Ragins (Mahwah, NJ: Lawrence Erlbaum Associates Publishers), 189–207.

Keltner, D., and Kring, A. M. (1998). Emotion, social function, and psychopathology. *Rev. Gen. Psychol.* 2, 320.

Kilduff, M., Chiaburu, D., and Menges, J. (2010). Strategic use of emotional intelligence in organizational settings: exploring the dark side. *Res. Organ. Behav.* 30, 129–152.

Kipnis, D., Schmidt, S., and Wilkinson, I. (1980). Intraorganizational influence tactics: explorations in getting one's way. *J. Appl. Psychol.* 65, 440–452.

Kipnis, D., and Schmidt, S. M. (1988). Upward-influence styles: relationship with performance evaluations, salary, and stress. *Adm. Sci. Q.* 33, 528–542.

Kopelman, S., Gewurz, I. G., and Sacharin, V. (2008). "The power of presence: strategic response to displayed emotions in negotiations," in *Research Companion to Emotion in Organizations*, eds N. M. Ashkanasy and C. L. Cooper (Cheltenham: Edward Elgar Publishing), 405–420.

Lawler, E. J. (1992). Affective attachments to nested groups: a choice-process theory. *Am. Sociol. Rev.* 57, 327–339.

Liu, Y., and Perrewe, P. L. (2006). Are they for real? The interpersonal and intrapersonal outcomes of perceived authenticity. *Int. J. Work Organ. Emot.* 1, 204–214.

Lopes, P. N., Salovey, P., Côté, S., and Beers, M. (2005). Emotion regulation abilities and the quality of social interaction. *Emotion* 5, 113–118.

Lyubomirsky, S., King, L. A., and Diener, E. (2005). The benefits of frequent positive affect: does happiness lead to success? *Psychol. Bull.* 131, 803–855.

Mann, S. (1999). Emotion at work: to what extent are we expressing, suppressing, or faking it? *Eur. J. Work Organ. Psychol.* 8, 347–369.

Manstead, A. S. R., and Fischer, A. H. (2000). Emotion regulation in full. *Psychol. Inq.* 11, 188–191.

Mast, M. S., and Hall, J. A. (2004). When is dominance related to smiling? Assigned dominance, dominance preference, trait dominance, and gender as moderators. *Sex Roles* 50, 387–399.

Mauss, I. B., Shallcross, A. J., Troy, A. S., John, O. P., Ferrer, E., Wilhelm, F. H., et al. (2011). Don't hide your happiness! Positive emotion dissociation, social connectedness, and psychological functioning. *J. Pers. Soc. Psychol.* 100, 738.

Méhu, M. (2011). Smiling and laughter in naturally occurring dyadic interactions: relationship to conversation, body contacts, and displacement activities. *Hum. Ethol. Bull.* 26, 10–28.

Méhu, M., and Dunbar, R. I. M. (2008). Relationship between smiling and laughter in humans: testing the power asymmetry hypothesis. *Folia Primatol.* 79, 269–280.

Mesmer-Magnus, J. R., DeChurch, L. A., and Wax, A. (2012). Moving emotional labor beyond surface and deep acting: a discordance–congruence perspective. *Organ. Psychol. Rev.* 2, 6–53.

Morris, M. W., and Keltner, D. (2000). How emotions work: the social functions of emotional expression in negotiations. *Res. Organ. Behav.* 22, 1–50.

Nair, N. (2008). Towards understanding the role of emotions in conflict: a review and future directions. *Int. J. Conflict Manag.* 19, 359–381.

Nezlek, J. B. (1990). Self report diaries in the study of social interaction. *Contemp. Soc. Psychol.* 14, 205–210.

Nezlek, J. B. (2003). Using multilevel random coefficient modeling to analyze social interaction diary data. *J. Soc. Pers. Relat.* 20, 437–469.

Niven, K., Totterdell, P., and Holman, D. (2009). A classification of controlled interpersonal affect regulation strategies. *Emotion* 9, 498.

Niven, K., Totterdell, P., Stride, C. B., and Holman, D. (2011). Emotion regulation of others and self (EROS): the development and validation of a new individual difference measure. *Curr. Psychol.* 30, 53–73.

Ohly, S., Sonnentag, S., Niessen, C., and Zapf, D. (2010). Diary studies in organizational research: an introduction and some practical recommendations. *J. Pers. Psychol.* 9, 79–93.

Parkinson, B., and Simons, G. (2009). Affecting others: social appraisal and emotion contagion in everyday decision making. *Pers. Soc. Psychol. Bull.* 35, 1071.

Petrides, K., Vernon, P., Schermer, J., Ligthart, L., Boomsma, D., and Veselka, L. (2010). Relationships between trait emotional intelligence and the Big Five in the Netherlands. *Pers. Individ. Dif.* 48, 906–910.

Pfeffer, J., Cialdini, R. B., Hanna, B., and Knopoff, K. (1998). Faith in supervision and the self-enhancement bias: two psychological reasons why managers don't empower workers. *Basic Appl. Soc. Psych.* 20, 313–321.

Podsakoff, P. M., MacKenzie, S. B., Lee, J.-Y., and Podsakoff, N. P. (2003). Common method biases in behavioral research: a critical review of the literature and recommended remedies. *J. Appl. Psychol.* 88, 879–903.

Potworowski, G., and Kopelman, S. (2008). Strategic display and response to emotions: developing evidence based negotiation expertise in emotion management (NEEM). *Negotiation Conflict Manag. Res.* 1, 333–352.

Preacher, K. J., Curran, P. J., and Bauer, D. J. (2006). Computational tools for probing interaction effects in multiple linear regression, multilevel modeling, and latent curve analysis. *J. Educ. Behav. Stat.* 31, 437–448.

Pugh, S. D. (2001). Service with a smile: emotional contagion in the service encounter. *Acad. Manag. J.* 44, 1018–1027.

Pugliesi, K. (1999). The consequences of emotional labor: effects on work stress, job satisfaction, and well-being. *Motiv. Emot.* 23, 125–154.

Rafaeli, A., and Sutton, R. I. (1987). Expression of emotion as a part of the work role. *Acad. Manag. Rev.* 12, 23–37.

Rafaeli, A., and Sutton, R. I. (1989). The expression of emotion in organizational life. *Res. Organ. Behav.* 11, 1–42.

Reis, H. T., and Wheeler, L. (1991). Studying social interaction with the Rochester Interaction Record. *Adv. Exp. Soc. Psychol.* 24, 269–318.

Rimé, B., Finkenauer, C., Luminet, O., Zech, E., and Philippot, P. (1998). Social sharing of emotion: new evidence and new questions. *Eur. Rev. Soc. Psychol.* 9, 145–189.

Roberts, L. M. (2005). Changing faces: professional image construction in diverse organizational settings. *Acad. Manag. Rev.* 30, 685–711.

Rosenfeld, P., Giacalone, R. A., and Riordan, C. A. (1995). *Impression Management in Organizations: Theory, Measurement, Practice.* London: Routledge.

Rudman, L. A. (1998). Self-promotion as a risk factor for women: the costs and benefits of counterstereotypical impression management. *J. Pers. Soc. Psychol.* 74, 629–645.

Salovey, P., and Grewal, D. (2005). The science of emotional intelligence. *Curr. Dir. Psychol. Sci.* 14, 281–285.

Schallberger, U., and Venetz, M. (1999). *Kurzversionen des MRS-Inventars von Ostendorf (1990) zur Erfassung der fünf "grossen" Persoenlichkeitsfaktoren [Brief Versions of Ostendorf's MRS Inventory for the Assessment of the Big Five Personality Factors].* Department of Applied Psychology, Zurich: University of Zürich.

Scherer, K. (2005). What are emotions? And how can they be measured? *Soc. Sci. Inform.* 44, 695–729.

Scherer, K. R., Schorr, A. E., and Johnstone, T. E. (2001). *Appraisal Processes in Emotion: Theory, Methods, Research.* New York: Oxford University Press.

Scherer, K. R., Shuman, V., Fontaine, J. R. J., and Soriano, C. (in press). "The GRID meets the wheel: assessing emotional feeling via self-report," in *Components of Emotional Meaning: A Sourcebook*, eds J. R. J. Fontaine, K. R. Scherer, and C. Soriano (Oxford: Oxford University Press).

Scherer, K. R., and Tran, V. (2003). "Effects of emotion on the process of organizational learning," in *Handbook of Organizational Learning and Knowledge*, eds M. Dierkes, J. Child, and I. Nonaka (New York: Oxford University Press), 369–392.

Schlenker, B. R., and Weigold, M. F. (1992). Interpersonal processes involving impression regulation and management. *Annu. Rev. Psychol.* 43, 133–168.

Shanock, L. R., Baran, B. E., Gentry, W. A., Pattison, S. C., and Heggestad, E. D. (2010). Polynomial regression with response surface analysis: a powerful approach for examining moderation and overcoming limitations of difference scores. *J. Bus. Psychol.* 25, 543–554.

Shiota, M. N., Campos, B., Keltner, D., and Hertenstein, M. J. (2004). "Positive Emotion and the Regulation of Interpersonal Relationships," in *The Regulation of Emotion*, eds P. Phillipot and R. Feldman (Mahwah, NJ: Erlbaum), 127–156.

Spector, P. E. (2006). Method variance in organizational research truth or urban legend? *Organ. Res. Meth.* 9, 221–232.

Staw, B. M., Sutton, R. I., and Pelled, L. H. (1994). Employee positive emotion and favorable outcomes at the workplace. *Organ. Sci.* 5, 51–71.

Sy, T., Côté, S., and Saavedra, R. (2005). The contagious leader: impact of the leader's mood on the mood of group members, group affective tone, and group processes. *J. Appl. Psychol.* 90, 295.

Totterdell, P., and Holman, D. (2003). Emotion regulation in customer service roles: testing a model of emotional labor. *J. Occup. Health Psychol.* 8, 55–73.

Tran, V. (2004). *The Influence of Emotions on Decision-Making Processes in Management Teams.* Genève: Faculté de Psychologie et des Sciences de L'Éducation, Université de Genève.

Tsai, W. C. (2001). Determinants and consequences of employee displayed positive emotions. *J. Manag.* 27, 497–512.

Tschan, F., Rochat, S., and Zapf, D. (2005). It's not only clients: studying emotion work with clients and co-workers with an event-sampling approach. *J. Occup. Organ. Psychol.* 78, 195–220.

Tschan, F., Semmer, N. K., Messerli, L., and Janevski, C. (2010). "Discrete emotions in interactions with superiors: some are more role-related, some are more relationship related," in *Gesund Mit und Ohne Arbeit (Healthy With and Without Work)*, eds T. Rigotti, S. Korek, and K. Otto (Lengerich: Pabst Science Publishers), 289–304.

Van der Zee, K., Thijs, M., and Schakel, L. (2002). The relationship of emotional intelligence with academic intelligence and the Big Five. *Eur. J. Pers.* 16, 103–125.

Van Kleef, G. A. (2010). The emerging view of emotion as social information. *Soc. Pers. Psychol. Compass* 4, 331–343.

Van Kleef, G. A., and Cote, S. (2007). Expressing anger in conflict: when it helps and when it hurts. *J. Appl. Psychol.* 92, 1557–1569.

Van Kleef, G. A., De Dreu, C. K. W., and Manstead, A. S. R. (2004). The interpersonal effects of anger and happiness in negotiations. *J. Pers. Soc. Psychol.* 86, 57.

Vidyarthi, P. R., Liden, R. C., Anand, S., Erdogan, B., and Ghosh, S. (2010). Where do I stand? Examining the effects of leader–member exchange social comparison on employee work behaviors. *J. Appl. Psychol.* 95, 849.

Walter, F., and Bruch, H. (2008). The positive group affect spiral: a dynamic model of the emergence of positive affective similarity in work groups. *J. Organ. Behav.* 29, 239–261.

Watson, D., Clark, L. A., and Tellegen, A. (1988). Development and validation of brief measures of positive and negative affect: the PANAS scales. *J. Pers. Soc. Psychol.* 54, 1063–1070.

Wayne, S. J., and Liden, R. C. (1995). Effects of impression management on performance ratings: a longitudinal study. *Acad. Manag. J.* 38, 232–260.

Weiss, H. M., and Cropanzano, R. (1996). Affective events theory: a theoretical discussion of the structure, consequences of affective experiences at work. *Res. Organ. Behav.* 18, 1–74.

Wheeler, L., and Nezlek, J. (1977). Sex differences in social participation. *J. Pers. Soc. Psychol.* 35, 742.

Zaalberg, R., Manstead, A., and Fischer, A. (2004). Relations between emotions, display rules, social motives, and facial behaviour. *Cogn. Emot.* 18, 183–207.

Zapf, D. (2002). Emotion work and psychological well-being: a review of the literature and some conceptual considerations. *Hum. Resour. Manag. Rev.* 12, 237–268.

Zapf, D., and Holz, M. (2006). On the positive and negative effects of emotion work in organizations. *Eur. J. Work Organ. Psychol.* 15, 1–28.

Zapf, D., Seifert, C., Schmutte, B., Mertini, H., and Holz, M. (2001). Emotion work and job stressors and their effects on burnout. *Psychol. Health* 16, 527–545.

Conflict of Interest Statement: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Received: 02 August 2012; accepted: 28 March 2013; published online: 09 May 2013.

*Citation: Wong E, Tschan F, Messerli L and Semmer NK (2013) Expressing and amplifying positive emotions facilitate goal attainment in workplace interactions. Front. Psychol. **4**:188. doi: 10.3389/fpsyg.2013.00188*

This article was submitted to Frontiers in Emotion Science, a specialty of Frontiers in Psychology.

frontiers in
PSYCHOLOGY

ORIGINAL RESEARCH ARTICLE
published: 08 October 2012
doi: 10.3389/fpsyg.2012.00394

You spin me right round: cross-relationship variability in interpersonal emotion regulation

Karen Niven[1]*, Ian Macdonald[2] and David Holman[1]

[1] *Manchester Business School, University of Manchester, Manchester, UK*
[2] *Department of Psychology, University of Sheffield, Sheffield, UK*

Edited by:
Vera Sacharin, University of Geneva, Switzerland

Reviewed by:
Cosimo Urgesi, University of Udine, Italy
Peter McGraw, University of Colorado Boulder, USA

***Correspondence:**
Karen Niven, Manchester Business School, University of Manchester, Booth Street East, Manchester M15 6PB, UK.
e-mail: karen.niven@mbs.ac.uk

Individuals use a range of interpersonal emotion regulation strategies to influence the feelings of others, e.g., friends, family members, romantic partners, work colleagues. But little is known about whether people vary their strategy use across these different relational contexts. We characterize and measure this variability as "spin," i.e., the extent of dispersion in a person's interpersonal emotion regulation strategy use across different relationships, and focus on two key questions. First, is spin adaptive or maladaptive with regard to personal well-being and relationship quality? Second, do personality traits that are considered important for interpersonal functioning (i.e., empathy, attachment style) predict spin? The data used in this study is drawn from a large online survey. A key contribution of this study is to reveal that people who varied the type of strategies they used across relationships (i.e., those with high spin) had lower positive mood, higher emotional exhaustion, and less close relationships. A further key contribution is to show that spin was associated with low empathic concern and perspective taking and high anxious attachment style. High variability in interpersonal emotion regulation strategies across relationships therefore appears to be maladaptive both personally and socially.

Keywords: interpersonal emotion regulation, emotion regulation, interpersonal behavior, spin, relationships

INTRODUCTION

People often try to shape the feelings of others in interpersonal relationships. This is reflected in the many anecdotal tales of people cheering friends up, making family members feel guilty, calming anxious coworkers, or making romantic partners feel jealous. Attempting to influence the feelings of a relationship partner has been termed "interpersonal emotion regulation" and research has documented that people use a broad range of interpersonal emotion regulation strategies (Niven et al., 2009). Furthermore, the choice of which strategies to use can have important consequences for the well-being of both parties involved (those who engage in the attempts and those they are directed toward) as well as the quality of the relationship between them [e.g., Niven et al. (2012a)]. What is less clear, however, are the implications of using the same or different strategies across various relationships. Varying one's strategy use across relationships could signal an attempt to match strategy choice to the relational situation and thus be considered functional. However, it could also be a sign of an underlying instability and be perceived by relationship partners as inconsistent and thus be considered dysfunctional.

The first aim of this paper is to examine whether it is adaptive or maladaptive to have higher variation in the use of interpersonal emotion regulation strategies across different types of relationship (romantic, friendly or familial, work), focusing on the outcomes of personal well-being (i.e., positive mood, emotional exhaustion) and relationship quality (i.e., relational closeness). Based on analytic innovations within the psychology of interpersonal behavior (Moskowitz and Zuroff, 2004), we characterize and measure variability in interpersonal emotion regulation strategy use across different relationships as a form of interpersonal "spin," i.e., the extent of dispersion in a person's interpersonal behavior across different social contexts. Because interpersonal spin may have important consequences for people's well-being and relationships, it is also important to know whether certain individuals are more prone to interpersonal spin than others. The second aim of the paper is therefore to examine whether personality traits considered important for interpersonal functioning (i.e., empathy, attachment style) are antecedents of spin.

Emotion regulation refers to "the process of initiating, maintaining, modulating, or changing the occurrence, intensity, or duration of internal feeling states" (Eisenberg et al., 2000, p. 137). Research on this process has traditionally focused on the ways that people try to manage and control their own emotions (intrapersonal emotion regulation), for example, distinguishing different types of strategies people use to shape their feelings (Gross, 1998; Parkinson and Totterdell, 1999) and investigating their relative effectiveness (Augustine and Hemenover, 2009; Webb et al., 2012).

Increasingly, however, researchers are interested in the social aspects of emotion regulation. Many theoretical models begin with the basic assumption that emotions and emotion regulation are typically experienced and engaged in the presence of others (e.g., Côté, 2005; Hareli and Rafaeli, 2008; Van Kleef, 2009), and it is now well-established that even when we are alone, our attempts to manage our emotions may be in anticipation of social interaction (Erber et al., 1996).

Within this broader context, the process of interpersonal emotion regulation has emerged as an important research concern. Interpersonal emotion regulation concerns deliberate attempts to

influence others' feelings. Although interpersonal emotion regulation can be used by larger social groups (e.g., a support group working together to alleviate the negative emotions of one of its members; Thoits, 1996) or directed toward multiple people (e.g., a sports coach trying to motivate and enthuse members of a team; Friesen et al., 2011), in this paper we focus on interpersonal emotion regulation in which one person (known as the "agent") attempts to shape the feelings of another person (the "target"). Dyadic interpersonal emotion regulation attempts have been reported in a broad range of social relationships, including romantic relationships (Vangelisti et al., 1991), familial relationships (Thompson and Meyer, 2007), friendships (Nils and Rimé, 2012), and work relationships (Rafaeli and Sutton, 1991; Locke, 1996; Francis et al., 1999; Pierce, 1999; Lively, 2000).

A person engaging in interpersonal emotion regulation has many strategies at his or her disposal. A classification developed by Niven et al. (2009) highlighted two main distinctions between strategy types. The first distinction concerns whether the regulatory motive behind the strategy is to improve how the target feels or to worsen the target's feelings. The second distinction concerns whether the strategy is implemented using cognitive or behavioral resources. Cognitive strategies involve the agent trying to influence a target's thoughts about his or her feelings or situation, e.g., an agent reinterpreting a situation to make a target feel better. Behavioral strategies involve the agent using his or her behavior to change the target's feelings, e.g., an agent sulking to make a target feel worse. Thus, their classification proposes four key strategy types: cognitive improving, behavioral improving, cognitive worsening, and behavioral worsening (see **Table 1** for example strategies).

Initial studies exploring the relative effects of these strategy types have primarily concentrated on differences between improving and worsening strategies. Improving strategies have been found to have positive consequences for the short-term affect and longer-term well-being of the agent and target of regulation and the quality of the relationship between the two, while worsening strategies are found to have negative consequences for these outcomes (Niven et al., 2007, 2012a,b). A recent study by Nils and Rimé (2012), however, noted divergent consequences of improving strategies that engaged cognitively (labeled by the authors as "agentic" strategies) and those that focused on more behavioral means of regulation (labeled as "communal"). Broadly, cognitive improving strategies facilitated greater emotional recovery from emotional events, whereas behavioral improving strategies had more positive social consequences, including feelings of proximity between agent and target.

While the emerging body of research concerning interpersonal emotion regulation has much to say about the use and effects of different strategies within social relationships, little is known about whether people vary their use of interpersonal emotion regulation across social contexts and if it is adaptive or maladaptive to do so. In the present study, we explore this question by investigating whether high variation in one's use of interpersonal emotion regulation across relationships (i) facilitates or inhibits personal and social functioning, and (ii) is associated with personality traits that are typically considered functional or dysfunctional for interpersonal relationships. We focus on the use of interpersonal emotion regulation within three distinct types of relationships: romantic, familial or friendly, and work. According to Neyer et al. (2011), relationship types can largely be differentiated based on their degree of emotional closeness (defined as a sense of kinship with others) and reciprocity (defined as norms regarding equity, balance, and fairness). By selecting the three relationships of interest in our research, we capture a high closeness-high reciprocity relationship type (romantic), a high closeness-low reciprocity relationship type (familial or friendly), and a low closeness-high reciprocity relationship type (work), thus providing a good range of relationships to study variability across.

The idea that people might vary their behavior across different situations has been studied for some years now by researchers of interpersonal behavior (see Moskowitz, 2009, for a review). Critiquing the view popularized by personality researchers that interpersonal behavior is necessarily consistent, such researchers have investigated the extent to which people vary their behavior across time and situations. Drawing on the interpersonal circumplex model (Wiggins, 1991), research in this area differentiates interpersonal behaviors according to two key dimensions: communality (is the behavior agreeable or quarrelsome); and agency (is the behavior dominant or submissive). Studies investigating the extent to which these types of behaviors are used in different situations have reported links between variability and stable personality traits, such as extraversion and neuroticism (Moskowitz and Zuroff, 2004) as well as links with important outcomes including well-being and the development of high-quality relationships (e.g., Erickson et al., 2009; Côté et al., 2011).

Although early studies of variability focused on taking measures in multiple situations and calculating the standard deviation or coefficient of variability of mean scores across the various

Table 1 | Interpersonal emotion regulation strategy types.

		Regulatory motive	
		To improve affect	**To worsen affect**
Implementation	**Cognitive**	Engaging with the target's cognitions about his or her feelings or a situation in order to improve his or her affect, *e.g., giving the target advice*	Engaging with the target's cognitions about his or her feelings or a situation in order to worsen his or her affect, *e.g., complaining about the target's behavior*
resource	**Behavioral**	Pleasant behaviors intended to improve the target's affect, *e.g., spending time with the target*	Unpleasant behaviors intended to worsen the target's affect, *e.g., being rude to the target*

situations as an index of variation (e.g., Fleeson, 2001), the now-dominant method used to operationalize variability in interpersonal behavior was proposed by Moskowitz and Zuroff (2004). Like earlier indices, Moskowitz and Zuroff's method involves collecting data about people's engagement with interpersonal behavior across different situations. However, rather than calculating the variability of either grand mean scores of the focal process (e.g., variability in the total amount of interpersonal behavior used) or calculating separate indices of variability for each facet of interest (e.g., variability in agreeable, quarrelsome, dominant, and submissive behaviors), this method allows researchers to take into account variability in the distinct dimensions within a single score. The popularity of this method is such that it is now being applied to studying variability in other processes, including "core affect" (i.e., people's background feeling states), in which researchers are concerned both valence (is the state pleasant or unpleasant) and arousal (is the state highly activated or deactivated; Kuppens et al., 2007). Certainly, the advantage of this method for the current study is clear, as interpersonal emotion regulation, like interpersonal behavior and core affect, is not a unidimensional construct. Rather, research has clearly established two key dimensions along which interpersonal emotion regulation strategies differ (motives and resources; Niven et al., 2009).

Applied to the present study, Moskowitz and Zuroff's (2004) method is used to quantify the amount of variability that a person displays in the overall nature of interpersonal emotion regulation (taking into account both the motives and resources involved) across all relationships of interest. The single variability score produced by this method, referred to as "spin," reflects the extent of dispersion in a person's strategy use across social relationships. A demonstration of high and low spin is illustrated in **Figure 1**. The two dimensions that characterize interpersonal emotion regulation strategies are plotted such that each vector in the figure represents the overall nature of strategy use within a given relationship; a person's motive for regulation (calculated by subtracting the extent to which a person uses strategies to worsen emotions within a given relationship from the extent to which a person uses strategies to improve emotions within that relationship) is plotted along the vertical axis, while his or her resource (calculated by subtracting behavioral strategies from cognitive strategies) is plotted along the horizontal axis. It should be noted, however, that a person's spin score is independent of the axes, such that a person would have the same level of spin if motive was represented along the horizontal axis and resource along the vertical axis. Person 1, shown in the left panel, has high spin; in his or her work relationship cognitive improving strategies are favored, in the friendship behavioral improving strategies are used, while in the romantic relationship behavioral worsening strategies are preferred. In contrast, Person 2, shown in the right panel, exhibits low spin; there is consistency within all of his or her relationships, with mostly cognitive improving strategies used.

Theoretically, there are reasons to believe that high variability in the use of interpersonal emotion regulation strategies might be adaptive. In different relationships there are likely to be different demands and social norms, and it would seem important to display a certain degree of flexibility in the way one attempts to regulate a relationship partner's emotions (the functional flexibility argument; Paulhus and Martin, 1988). Certainly, research concerning interpersonal emotion regulation highlights situational differences with respect to the appropriateness and effectiveness of particular strategies. For example, Francis et al.'s (1999) research in hospitals highlights how "dark" humor can be appropriate as a way for medical professionals to improve the feelings of a coworker but not a patient.

However, there are also reasons to believe that high variability might be maladaptive. It has been suggested that high variability is the result of heightened reactivity to the influence of situations, such that the person is unable to maintain consistency and to develop effective strategies for interaction (Erickson et al., 2009). This may cause difficulties with regard to social relationships, as people tend to prefer consistency in their interaction partners because it helps them to build a mental model of who the person is and how to interact with them (Devine et al., 1989). As such, high variability may be unhelpful for the development of close bonds, and may impact negatively on perceptions of relationship closeness, i.e., the extent of overlap between another person's life and one's own (Aron et al., 1992).

In addition, variability might compromise people's well-being. More inconsistent interactions are likely to be more demanding to carry out and will thus require more attention and effort,

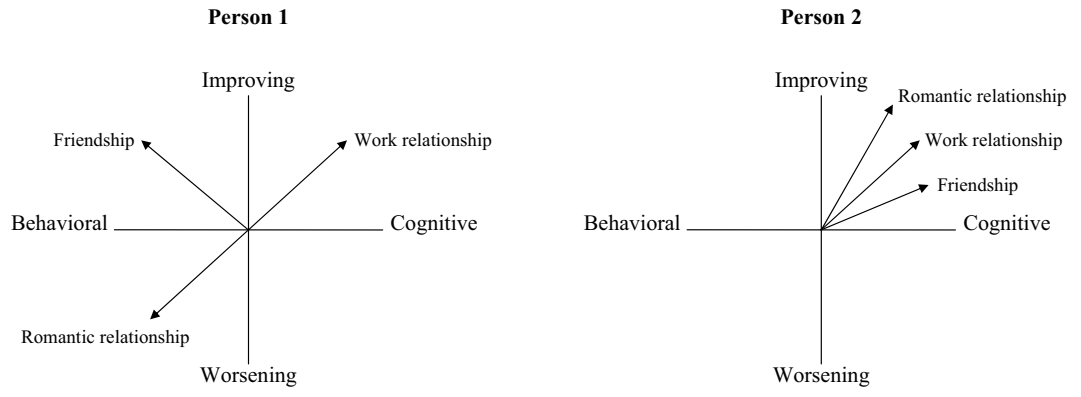


FIGURE 1 | Illustration of a person with high spin (left panel) and low spin (right panel).

particularly if the person needs to repair interactions that have gone wrong (Schegloff et al., 1977). Increased attention and effort are in turn likely to induce heightened physiological activation (Dormann and Zapf, 2004) and overtax personal energy resources (Hobfoll, 1989). Difficult interactions may also make it less likely that a person will attain their goals which, according to goal-based theories of behavior, will negatively impact on the personal resources of self-competence and self-efficacy (Locke and Latham, 1990; Bandura, 1997). Both depletion of energy resources and threats to personal resources are likely to lead to increased feelings of emotional exhaustion – a state of emotional depletion and fatigue – and decreased positive mood (Hobfoll, 1989). In sum, there are strong theoretical reasons to expect high interpersonal spin to have maladaptive outcomes with regard to relationship quality and psychological well-being.

Although both perspectives are equally viable theoretically, the cumulative evidence from studies of spin in interpersonal behavior provides strong support for the perspective that high variability is maladaptive. Higher levels of interpersonal spin have been linked to indicators of poor quality relationships, including low relationship closeness, low dyadic adjustment, and high coworker social avoidance (Côté et al., 2011), and poor well-being, including depression and distress (Erickson et al., 2009). Studies of affect spin similarly report higher variability to be associated with poorer psychological adjustment (Kuppens et al., 2007). We therefore expect spin to be negatively associated with relationship closeness and positive mood and to be positively associated with emotional exhaustion.

Given that interpersonal spin might be maladaptive, it would seem important to understand its antecedents. Previous research has revealed that interpersonal spin is positively associated with personality traits typically considered to be dysfunctional (e.g., neuroticism) and negatively associated with functional traits (e.g., agreeableness, extraversion, self-esteem; Moskowitz and Zuroff, 2004; Côté et al., 2011). In addition, people with borderline personality disorder exhibit significantly higher spin in interpersonal behavior compared to non-clinical control participants (Russell et al., 2007). According to Moskowitz and Zuroff (2004), these findings are indicative of spin reflecting behavioral lability, i.e., variability that is poorly controlled, as opposed to behavioral flexibility, which is variability that stems from effective responses to different situations. In the present study, we build on this research by exploring the links between interpersonal emotion regulation spin and two sets of personality traits, one set that is typically considered functional for interpersonal relationships (empathic concern and perspective taking) and one set that is typically considered dysfunctional (avoidant and anxious attachment styles).

Empathic concern and perspective taking are two facets of empathy, i.e., "the reactions of one individual to the observed experiences of another" (Davis, 1983, p. 113). Empathic concern refers to feelings of sympathy or concern for others and is the main emotional aspect of empathy, while perspective taking refers to the tendency to adopt the point of view of others and is the main cognitive aspect. Empathy is thought to be a highly functional trait for the development of high-quality connections with others, and both empathic concern and perspective taking have been associated with improved social functioning in past research (e.g., Oswald, 1996; Litvack-Miller et al., 1997). Attachment styles are "systematic patterns of relational expectations, emotions, and behaviors that result from internalization of a particular history of attachment experiences" (Mikulincer and Shaver, 2005, p. 150). An avoidant attachment style is characterized by a distrust of relationship partners' goodwill and the need to maintain independence and emotional distance, whereas an anxious attachment style is characterized by worrying that relationship partners will not be available in times of need, a strong need for closeness, and a fear of rejection (Brennan et al., 1998). Both forms of attachment are thought to be highly dysfunctional for the development of relationships as they increase anger episodes and depression, and reduce compassion and caregiving behaviors, all of which may drive potential relationship partners away (Mikulincer, 1998; Mikulincer et al., 2005; Shaver et al., 2005).

Based on the existing evidence that spin tends to be maladaptive for the development of close relationships (Côté et al., 2011), and that it is reflective of behavioral lability (Moskowitz and Zuroff, 2004), it seems likely that those people who display higher variability in interpersonal emotion regulation will have more dysfunctional traits. We therefore expect empathic concern and perspective taking to be negatively associated with interpersonal spin and avoidant and anxious attachment to be positively associated with interpersonal spin.

MATERIALS AND METHODS

DESIGN

A repeated measures study design was used, whereby participants reported their use of interpersonal emotion regulation strategies within up to three specific relationships: a romantic relationship, a work relationship, and a familial relationship or friendship. Those participants who did not have a romantic partner or who did not work did not complete the measures of their interpersonal emotion regulation within those particular relationships. Participants were randomly assigned to complete the interpersonal emotion regulation measures corresponding to each relationship in different orders, and independent-samples analyses of variance (ANOVAs) using the mean interpersonal emotion regulation strategy scores in the three different relationships as dependent variables confirmed no order effects (Fs < 2.28, ps > 0.10). Ethical approval was obtained for the study from the Institute of Work Psychology Research Ethics Committee at the University of Sheffield in the UK (the institution where the first author formerly worked).

SAMPLE

An online survey was advertised to members of the public via several means, including advertising on websites that promote social sciences research studies and specialist websites designed to target harder-to-reach populations in order to ensure the sample was representative (e.g., lesbian gay bisexual transgender websites), as well as emails to staff and students at several UK universities. To be eligible to take part, people had to be over the age of 16. Informed consent was obtained from all respondents in a form at the start of the survey. A total of 1509 people completed the survey. Because calculating spin requires measures across multiple situations, respondents who only completed a single measure

of interpersonal emotion regulation ($N = 248$) were excluded from subsequent analyses, leaving 1261 respondents. A further 50 respondents had to be excluded as their answer pattern for at least one relationship resulted in an overall position at the origin (0,0) and so did not allow calculation of a vector from which spin could be derived (this answer pattern was typically due to respondents giving the same answer to all items in the interpersonal emotion regulation measure).

Our final sample therefore comprised 1211 participants (79% females). The ages of participants ranged from 16 to 71 (M age = 30.96 years, SD = 12.08). Of the total sample, 970 participants worked (64% full-time). The largest occupational grouping was professional occupations ($N = 280$), followed by administrative or secretarial occupations ($N = 149$), and manager or senior official ($N = 74$). Students made up the majority of the non-working sample, but there were also 36 unemployed respondents and 4 retired respondents. 55% of respondents completed the survey in their home, and the remainder in their place of work. In total, 663 participants reported on all three relationship types, while the remaining 548 reported on two of the three types. All of the respondents completed the friend or family measure of interpersonal emotion regulation, while 973 completed the romantic partner measure, and 901 completed the work measure.

Due to the relatively high load placed on participants of responding to the interpersonal emotion regulation measure up to three times relating to different relationships, we split our participants randomly into groups to complete our individual difference measures, so that each participant only had to complete one set of measures. A total of 228 participants (79% females; M age = 30.09 years, SD = 12.69) provided data about their empathy, and 273 (77% females; M age = 31.31 years, SD = 11.65) provided data about their attachment style. The remaining 710 participants completed measures not relevant to the focus of this study, e.g., self-efficacy, emotional expressivity.

MEASURES

Interpersonal emotion regulation spin

The 12-item extrinsic subscale of the Emotion Regulation of Others and Self (EROS; Niven et al., 2011) measure was used to assess respondents' use of interpersonal emotion regulation strategies within each relationship. The subscale comprises four factors relating to the four distinct types of interpersonal emotion regulation strategies proposed in Niven et al.'s (2009) classification, each of which is assessed using three items. The scale has been shown to be reliable and valid in previous research (e.g., Niven et al., 2011). To complete the measures, participants were first instructed to bring a particular person to mind (their romantic partner, a friend or relative, or someone they worked with, depending on the relationship in question), and then to indicate the extent to which they had used the various interpersonal emotion regulation strategies to influence the way that person had felt over the previous 4 weeks. The cognitive improving factor was measuring using items such as "I gave [*person x*] helpful advice to try to improve how they felt" (αs for the different relationships ranged between 0.79 and 0.88). An example behavioral improving item was "I did something nice with [*person x*] to try to make them feel better" (αs for the different relationships ranged between 0.81 and 0.85). Cognitive worsening items included "I explained to [*person x*] how they had hurt myself or others, to try to make them feel worse" (αs for the different relationships ranged between 0.76 and 0.82). Finally, the behavioral worsening factor included items such as "I was unfriendly to [*person x*] to try to make them feel worse" (αs for the different relationships ranged between 0.79 and 0.85).

Respondents' self-reports of their use of interpersonal emotion regulation were validated using a follow-up measure of their strategy use as reported by the other person in each of their relationships. At the end of the survey, respondents were invited to leave the email addresses of those individuals who they had reported their use of interpersonal emotion regulation toward. These people were then contacted with a link to a new survey which comprised a single interpersonal emotion regulation scale; this time people were asked to report on use of strategies by their relationship partner (the original participant) toward themselves over the same 4 week period. Although only a small number of matched pairs were collected ($N = 50$), analyses revealed medium to large sized correlations between original participants' self-reports of their use of interpersonal emotion regulation strategies and their relationship partners' reports (cognitive improving $r = 0.32$, $p < 0.05$; behavioral improving $r = 0.44$, $p < 0.01$; cognitive worsening $r = 0.46$, $p < 0.01$; behavioral worsening $r = 0.64$, $p < 0.01$), providing support for the validity of our data.

The self-report data was used to calculate spin. The first step to calculate spin was to create a motive score and a resource score for each relationship. The motive score was derived by taking the mean score of all six worsening items within a given relationship from the mean score of all six improving items. The resource score was similarly calculated by taking the mean score of all six behavioral items within a given relationship from the mean score of the six cognitive items. In the second step, the resulting scores on the dimensions of resource and motive for each relationship were treated as Cartesian coordinates (x, y) from which polar coordinates (r, Θ) were calculated (see **Figure 2**), so that each relationship could be represented as a vector with Θ in radians. In the final step, a single spin score for each participant was computed. Conceptually, spin is the standard deviation of the values of Θ across the relationships, but because observations were vectors rather than scalars, we used Mardia's (1972) method to calculate the standard deviation (see Moskowitz and Zuroff, 2004, for a detailed description). In brief, the circular variance (CVar) and the circular standard deviation (spin) measure the variability of the individual vectors around the circular mean angle. Mcos is the mean of the cosines from the angles of those vectors and Msin is the mean of the sines. CVar ranges from 0 to 1 and is calculated as $[1-\sqrt{(M\cos^2 + M\sin^2)}]$. Spin ranges from 0 to ∞ and is calculated as $\sqrt{(-2\log_e(1-\text{CVar})}$. Because the resulting spin variable was positively skewed, we used an inverse transformation [calculated as $1-1/(1-\text{spin})$] in our analyses.

Relationship closeness

Participants were asked to rate the closeness of each relationship they reported on, using the Inclusion of Other in the Self measure (Aron et al., 1992). Aron and colleagues' measure presents

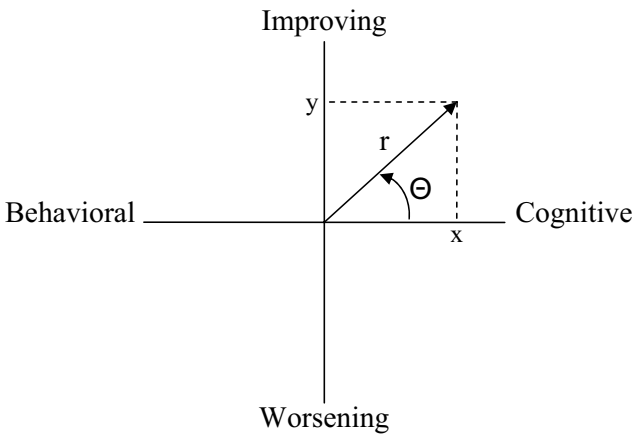


FIGURE 2 | Illustration of Cartesian (*x, y*) and polar (*r,* Θ) coordinates used to calculate spin.

participants with a series of seven pictures each comprising two circles, one representing the "self" and one representing the specified "other" that the participant has chosen to respond about. The first picture has the two circles completely separate and in each successive picture the two circles increasingly overlap. Participants select which picture best describes their relationship and receive a score between 1 (lowest closeness) and 7 (highest closeness). The mean score across all relationships participants reported on was used as an overall index of relationship closeness.

Well-being

Two indicators of participants' well-being were included in the survey. The first was a six-item measure used to assess participants' moods over the past 4 weeks. Each item was a mood state selected from the UWIST checklist (Matthews et al., 1990) to represent each end of three key dimensions of affect: hedonic tone ("Happy" and "Gloomy"); tense arousal ("Anxious" and "Calm"); and energetic arousal ("Energetic" and "Sluggish"). Negative items were reverse coded so that mean scores represented positive mood. Participants indicated the extent to which they had felt each state over the previous 4 weeks on a seven-point scale from "Not at all" to "A great extent" ($\alpha = 0.74$). The second indicator was a measure of emotional exhaustion. This measure comprised the four highest loading items from the emotional exhaustion subscale of the Maslach Burnout Inventory (Maslach and Jackson, 1981). For this scale, participants were asked how often they had experienced indicators of emotional exhaustion (e.g., "I felt emotionally drained") over the past 4 weeks, responding on a five-point scale ranging from "Never" to "All of the time" ($\alpha = 0.89$).

Empathy

The empathic traits of empathic concern and perspective taking were both measured using subscales from Davis's (1983) Interpersonal Reactivity Index. Both subscales include seven items, for example "I often have tender concerned feelings for people less fortunate then me" for empathic concern ($\alpha = 0.74$) and "I believe that there are two sides to every question and try to look at them both" for perspective taking ($\alpha = 0.72$). Participants were required to indicate how well each item described them, on a five-point scale ranging from "does not describe me well" to "describes me very well."

Attachment style

Avoidant and anxious attachment styles were assessed using Brennan et al.'s (1998) Experiences in Close Relationships measure. Measures of attachment style typically ask about people's relationships with either romantic partners or their parents, with the expectation that this represents a stable underlying pattern of attachment style that will be predictive of their behavior in other relationships, for instance those at work (e.g., Hazan and Shaver, 1990). Brennan and colleagues' scale asks participants about how they feel and behave in romantic relationships, referring to people's romantic relationships in general, not just their current romantic relationship (if they have one). There are 36 items in total, 18 of which form the avoidant attachment subscale (e.g., "I prefer not to show a partner how I feel deep down"; $\alpha = 0.92$), and 18 of which form the anxious attachment subscale (e.g., "I worry about being abandoned"; $\alpha = 0.93$). Participants indicate how much they agree or disagree with each statement on a seven-point scale ranging from "strongly disagree" to "strongly agree."

Control variables

We measured several variables to serve as controls in our analyses to help rule out possible alternative explanations. Specifically, we controlled for the age and gender of the participant, which might have been related to the outcomes of interest (e.g., relationship closeness, well-being). In addition, we controlled for variability in the gender of the relationship partner (calculated as the standard deviation of the gender of all relationship partners each participant reported on), because it is possible that people use different types of interpersonal emotion regulation strategies toward males and females, which could conflate our results. For a similar reason, we controlled for the number of relationships that participants had reported about (two or three), as higher variability would be expected when reporting on more relationships. Finally, we controlled for the mean amount of interpersonal emotion regulation used across all relationships (calculated as the average of all 12 strategies across all relationships reported on), to ensure that any observed relationships were uniquely relating to interpersonal emotion regulation variability rather than simply the amount of regulation used.

RESULTS

Mean levels of the use of each type of interpersonal emotion regulation strategy are shown in **Table 2**. Repeated measures ANOVAs on the sample who had completed data about all three relationships, using relationship type (romantic, friend or relative, work) as the repeated measures factor and mean strategy use scores as dependent variables, revealed significant differences in the use of each of the four main strategy types between the relationships we studied (Fs ranged between 128.25 and 704.73, ps < 0.01). Inspection of the mean scores suggests that all strategy types were used most often within romantic relationships and least often within work relationships. Thus, across the sample as a whole, there was

Table 2 | Mean use of interpersonal emotion regulation strategies in different relationships.

	Romantic relationship	Friend or relative	Work relationship	Mean strategy use across relationships
Cognitive improving	3.79	3.49	2.73	3.34
Behavioral improving	3.95	3.43	2.51	3.30
Cognitive worsening	1.76	1.32	1.20	1.43
Behavioral worsening	1.58	1.25	1.21	1.35
Mean use of interpersonal emotion regulation	2.77	2.38	1.92	2.35

N = 663, which is the sample completing interpersonal emotion regulation strategies across all three relationships.

between-relationship variation in the use of interpersonal emotion regulation.

The focus of the current study, however, was on between-relationship variation at the individual-level, operationalized as a person's level of "spin." Means, standard deviations, and correlations between spin and the other variables are displayed in **Table 3**. Correlations involving the main study variables were in line with the view of intra-individual variability as maladaptive. With respect to our control variables, spin was not related to participants' gender ($r = -0.04, p = 0.14$) or age ($r = 0.03, p = 0.23$), but was positively related to both the variability in relationship partners' gender ($r = 0.06$, $p < 0.05$) and the number of relationships reported on ($r = 0.14$, $p < 0.01$).

Spin was also negatively related to mean levels of interpersonal emotion regulation across the relationships ($r = -0.13$, $p < 0.01$), signifying that people with high spin are not simply those who use more of all strategies; rather, it is a reflection of the extent of dispersion across relationships. Further exploratory analyses revealed that spin was negatively related to the use of cognitive improving strategies ($r = -0.42$, $p < 0.01$) and behavioral improving strategies ($r = -0.41$, $p < 0.01$), and positively related to the use of cognitive worsening strategies ($r = 0.38$, $p < 0.01$) and behavioral worsening strategies ($r = 0.48$, $p < 0.01$).

Regression results further demonstrate that the observed relationships between spin and the main study variables held after controlling for participant age and gender, variation in partner gender, number of relationships reported, and mean levels of interpersonal emotion regulation. With regard to relationship quality and psychological well-being, regression analyses, shown in **Table 4**, indicate that spin was negatively related to the closeness of relationships ($\beta = -0.14$, $p < 0.01$) and positive mood ($\beta = -0.11$, $p < 0.01$), and positively related to emotional exhaustion ($\beta = 0.11$, $p < 0.01$).

With respect to the individual difference predictors of spin, we ran our regression analyses separately for each predictor so that the effects of each predictor would not be conflated (empathic concern and perspective taking were correlated, as were anxious and avoidant attachment; see **Table 3**). The results, shown in **Table 5**, indicate that over and above the control variables, the functional traits we studied were both positively related to spin (empathic concern $\beta = -0.17$, $p < 0.05$; perspective taking $\beta = -0.15$, $p < 0.05$), while the dysfunctional trait of anxious attachment negatively predicted spin ($\beta = 0.21$, $p < 0.01$). Only avoidant attachment was not related to spin ($\beta = 0.09$, $p = 0.14$).

SUPPLEMENTARY ANALYSES

Because spin was differentially related to mean use of different types of strategies, we also conducted exploratory analyses to investigate whether variability in different types of interpersonal emotion regulation related to the main study variables. To assess such variability, we calculated four measures of "flux" to assess the standard deviation in the use across different relationships of improving strategies, worsening strategies, cognitive strategies, and behavioral strategies (Moskowitz and Zuroff, 2004). Equivalent "spin" scores cannot be calculated as spin quantifies variability across two dimensions.

The results in **Table 6** indicate that variability in the use of all types of strategies, with the exception of worsening strategies, was negatively related to relationship closeness, while variability in the use of worsening strategies and cognitive strategies was negatively related to positive mood and positively related to emotional exhaustion. Regarding the individual differences, empathic concern, and perspective taking were unrelated to variability in the use of any single type of strategy. In contrast, avoidant attachment was related to variability in the use of improving strategies and anxious attachment was related to variability in the use of worsening strategies and cognitive strategies. These results verify the notion that higher variability may be maladaptive, and further suggest that varying one's use of certain types of strategies may be more maladaptive for some outcomes than others.

DISCUSSION

The regulation of others' feelings is a common feature of most of the important relationships people have, e.g., those with romantic partners, friends or family members, and people at work. Our findings indicate that variability in a person's interpersonal emotion regulation strategy use across these different relationships, as indicated by a person's level of interpersonal "spin," is associated with higher emotional exhaustion and lower positive mood and relationship closeness. Moreover, high anxious attachment style, low empathic concern, and low perspective taking were associated with higher levels of spin. These findings suggest that, in line with previous research on spin, high variability in the use of interpersonal emotion regulation can be considered maladaptive for both personal and social functioning (Moskowitz and Zuroff, 2004).

Our findings are consistent with theoretical arguments that high variability in interpersonal emotion regulation is a sign of heightened reactivity to the influence of situations (Erickson et al., 2009). The result of this heightened reactivity is an inability to maintain consistency in interactions, and interactions becoming

Table 3 | Means, standard deviations, and correlations between main study variables.

	Mean	SD	1	2	3	4	5	6	7	8	9	10	11	12
1. Gender	–	–												
2. Age	30.96	12.08	−0.06*	–										
3. Variability in gender of partner	0.46	0.28	0.08**	0.03	–									
4. Number of relationships reported	–	–	−0.02	0.17**	0.22**	–								
5. Mean interpersonal emotion regulation	2.43	0.46	0.11*	−0.26**	−0.03	−0.18**	–							
6. Relationship closeness	3.93	1.35	0.06*	−0.26**	<0.01	−0.10**	0.40**	–						
7. Positive mood	3.50	1.10	−0.03	0.14**	−0.05	0.03	−0.02	0.04	–					
8. Emotional exhaustion	2.55	1.01	0.04	−0.18**	0.01	−0.01	0.18**	0.05	−0.53**	–				
9. Empathic concern	3.95	0.61	0.21**	0.03	0.02	0.03	0.13*	0.13*	0.07	0.02	–			
10. Perspective taking	3.51	0.65	0.10	0.25**	0.06	0.04	0.07	<0.01	0.10	0.04	0.42**	–		
11. Avoidant attachment	2.78	1.08	−0.02	0.05	−0.09	−0.27**	−0.06	−0.30**	−0.14*	0.22**	–	–	–	
12. Anxious attachment	3.61	1.29	0.20**	−0.30**	0.02	−0.22**	0.17**	0.03	−0.44**	0.35**	–	–	0.16**	–
13. Spin (inverse transformation)	0.16	0.15	−0.04	0.03	0.06*	0.14**	−0.13**	−0.19**	−0.11**	0.09**	−0.17*	−0.13*	0.04	0.14*

*N ranges from 228 (for analyses involving empathy), through 273 (for analyses involving attachment), to 1211 for all other analyses. Gender was coded as 1 = female and 0 = male. *p < 0.05, **p < 0.01.*

more effortful and demanding yet less successful in terms of goal-pursuit. As such, interpersonal emotion regulation variability can be considered poorly controlled (Moskowitz and Zuroff, 2004) and therefore maladaptive for both personal and social functioning.

A potential alternative explanation is that our findings were strongly influenced by the use of strategies to worsen others' emotions. Strategies to worsen others' emotions have previously been linked to negative outcomes (e.g., poor well-being; Niven et al., 2012b) and in the present study mean use of worsening strategies was associated with spin. It could therefore be the case that people who exhibited greater overall variability in their use of strategies were those who engaged more in worsening strategies, which are likely less adaptive. Our supplementary analyses, however, highlighted that while variability in the use of affect-worsening strategies was particularly maladaptive for personal well-being, it was not so maladaptive for social functioning, showing no association with the closeness of relationships. In contrast, higher variability in the use of other strategy types (affect-improving, cognitive, and behavioral) was associated with lower relationship closeness. Thus, the maladaptive nature of variability is unlikely to be driven purely by use of or variability in strategies to worsen others' feelings.

Against expectations, we did not observe a relationship between avoidant attachment style and interpersonal spin. We had anticipated this relationship because avoidant attachment style is typically considered dysfunctional (people with an avoidant attachment style tend to have poorer quality relationships, characterized by anger, hostility, and distress; Mikulincer, 1998; Shaver et al., 2005), and prior research has suggested that interpersonal spin is connected to other traits and disorders that are maladaptive, such as neuroticism and borderline personality disorder (e.g., Moskowitz and Zuroff, 2004; Russell et al., 2007). One possible explanation for our incongruous finding is that because people with avoidant attachment style have a strong need for maintain independence and emotional distance from others, they may be similarly disengaged within all their relationships. However, it is worth noting that we did find a relationship between avoidant attachment style and variability across relationships (flux) in the use of improving strategies.

The present study makes a key contribution to research on interpersonal emotion regulation. To date, most studies of this process have focused on exploring the divergent effects of different strategies used to regulate others' emotions (e.g., Niven et al., 2007, 2012b), with little consideration of the notion that people may vary the strategies they use in different relationships. The present study therefore represents the first attempt to document differences in interpersonal emotion regulation use between relationships, and the first to investigate whether greater variation in strategy use is functional or dysfunctional for people's well-being and relationship development.

A second key contribution of this research is with regard to studies of intra-individual variability. Previous studies have examined variability of interpersonal behavior and core affect, using the framework of spin (e.g., Moskowitz and Zuroff, 2004; Kuppens et al., 2007; Côté et al., 2011). However, the present study is the first to apply the ideas from these fields to the specific area of

Table 4 | Regression of spin onto relationship closeness, positive mood, and emotional exhaustion.

	Relationship closeness		Positive mood		Emotional exhaustion	
	β	*t*	β	*t*	β	*t*
Gender	0.01	0.20	−0.02	−0.74	0.02	0.57
Age	−0.17	−6.32**	0.13	3.83**	−0.14	−4.24**
Variability in gender of partner	0.02	0.91	−0.06	−1.60	<0.01	−0.01
Number of relationships reported	0.01	0.30	0.05	1.34	−0.02	−0.44
Mean interpersonal emotion regulation	0.34	12.72**	−0.01	−0.20	0.16	4.89**
Spin	−0.14	−5.41**	−0.11	−3.21**	0.11	3.31**

*N = 1211. Gender was coded as 1 = female and 0 = male. *p < 0.05, **p < 0.01.*

Table 5 | Regression of individual difference variables onto spin.

	Empathic concern		Perspective taking		Avoidant attachment		Anxious attachment	
	β	*t*	β	*t*	β	*t*	β	*t*
Gender	0.07	0.98	0.04	0.62	−0.05	−0.83	−0.09	−1.44
Age	0.04	0.61	0.08	1.04	−0.04	−0.72	0.02	0.27
Variability in gender of partner	0.04	0.61	0.05	0.70	−0.01	−0.11	−0.02	−0.33
Number of relationships reported	0.03	0.45	0.03	0.36	0.19	2.84**	0.19	3.02**
Mean interpersonal emotion regulation	−0.12	−1.72	−0.11	−1.58	<0.01	0.02	−0.03	−0.42
Empathic concern	−0.17	−2.58*						
Perspective taking			−0.15	−2.22				
Avoidant attachment					0.09	1.48		
Anxious attachment							0.21	3.25**

*N = 228 for analyses involving empathy, N = 273 for analyses involving attachment. Gender was coded as 1 = female and 0 = male. *p < 0.05, **p < 0.01.*

Table 6 | Correlations between variability in the use of different types of strategies and main study variables.

	Flux in improving strategies	Flux in worsening strategies	Flux in cognitive strategies	Flux in behavioral strategies
Flux in improving strategies	–			
Flux in worsening strategies	0.07**	–		
Flux in cognitive strategies	0.62**	0.37**	–	
Flux in behavioral strategies	0.65**	0.37**	0.63**	–
Relationship closeness	−0.14**	−0.01	−0.10**	−0.14**
Positive mood	<0.01	−0.17**	−0.09**	−0.03
Emotional exhaustion	0.03	0.20**	0.08**	0.06
Empathic concern	0.03	0.03	0.03	0.03
Perspective taking	0.04	−0.07	0.01	0.03
Avoidant attachment	0.13*	0.05	−0.05	−0.03
Anxious attachment	0.06	0.28**	0.22**	0.09

*N ranges from 228 (for analyses involving empathy), through 273 (for analyses involving attachment), to 1211 for all other analyses. *p < 0.05, **p < 0.01.*

interpersonal emotion regulation. Similarly, it is the first to consider the association between spin and traits such as empathy and attachment styles, as prior studies have focused on self-esteem and the Big-5 traits. That our findings are in line with those reported in prior intra-individual variability research adds weight to the body of evidence suggesting that high variability might be maladaptive and an indicator of instability and behavioral liability.

Nonetheless, there are some important limitations of the present study. First, our results are all based on self-reported cross-sectional data, which could be subject to biases, including social desirability. However, the validation of our self-reported interpersonal emotion regulation data against relationship partners' reports, along with the fact that the key variable of interest, spin, was an indicator of variability across relationships rather than a mean score, gives us confidence that such biases have not unduly affected our findings. The direction of causality also cannot be stated with certainty, and thus future longitudinal research is needed on this subject. Second, due to a desire not to overload participants in the study, we only studied three types of relationships (romantic, friend or family, work), whereas interpersonal emotion regulation may be used in many other relational contexts (e.g., towards support group members, teammates in sports, or even strangers; Cahill and Eggleston, 1994; Thoits, 1996; Friesen et al., 2011), which might show meaningful variation. Third, unlike some other studies that have used daily reports of interactions to calculate interpersonal spin (e.g., Moskowitz and Zuroff, 2004; Côté et al., 2011), we calculated spin based on responses to a one-off survey, asking about people's use of interpersonal emotion regulation in different relationships. This had the clear advantage of allowing us to equally represent each different type of relationship of interest in our spin score (in diary studies, respondents might, for example, report only interactions with their romantic partner, meaning that other types of relationships are not well-represented). However, an important disadvantage of this approach is that intra-individual variability over time within the same relationship is not captured. Future studies of variability in interpersonal emotion regulation could therefore use a daily diary method and extend the range of relationships participants report on.

ACKNOWLEDGMENTS

The support of the Economic and Social Research Council (ESRC) UK is gratefully acknowledged [RES-060-25-0044: "Emotion regulation of others and self (EROS)"].

REFERENCES

Aron, A., Aron, E. N., and Smollan, D. (1992). Inclusion of other in the self scale and the structure of interpersonal closeness. *J. Pers. Soc. Psychol.* 63, 596–612.

Augustine, A. A., and Hemenover, S. H. (2009). On the relative effectiveness of affect regulation strategies: a meta-analysis. *Cogn. Emot.* 23, 1181–1220.

Bandura, A. (1997). *Self-Efficacy: The Exercise of Control.* New York: Freeman.

Brennan, K. A., Clark, C. L., and Shaver, P. R. (1998). "Self-report measurement of adult attachment: an integrative overview," in *Attachment Theory and Close Relationships*, eds J. A. Simpson and W. S. Rholes (New York: Guilford Press), 46–76.

Cahill, S. E., and Eggleston, R. (1994). Managing emotions in public: the case of wheelchair users. *Soc. Psychol. Q.* 57, 300–312.

Côté, S. (2005). A social interaction model of the effects of emotion regulation on work strain. *Acad. Manage. Rev.* 30, 509–530.

Côté, S., Moskowitz, D. S., and Zuroff, D. C. (2011). Social relationships and intraindividual variability in interpersonal behavior: correlates of interpersonal spin. *J. Pers. Soc. Psychol.* 102, 646–659.

Davis, M. H. (1983). Measuring individual differences in empathy: evidence for a multidimensional approach. *J. Pers. Soc. Psychol.* 44, 113–126.

Devine, P. G., Sedikides, C., and Fuhrman, R. W. (1989). Goals in social information processing: the case of anticipated interaction. *J. Pers. Soc. Psychol.* 56, 680–690.

Dormann, C., and Zapf, D. (2004). Customer-related stressors and burnout. *J. Occup. Health Psychol.* 9, 61–82.

Eisenberg, N., Fabes, R. A., Guthrie, I. K., and Reiser, M. (2000). Dispositional emotionality and regulation: their role in predicting quality of social functioning. *J. Pers. Soc. Psychol.* 78, 136–157.

Erber, R., Wegner, D. M., and Therriault, N. (1996). On being cool and collected: mood regulation in anticipation of social interaction. *J. Pers. Soc. Psychol.* 70, 757–766.

Erickson, T. M., Newman, M. G., and Pincus, A. L. (2009). Predicting unpredictability: do measures of interpersonal rigidity/flexibility and distress predict intraindividual variability in social perceptions and behavior? *J. Pers. Soc. Psychol.* 97, 893–912.

Fleeson, W. (2001). Toward a structure- and process-integrated view of personality: traits as density distribution of states. *J. Pers. Soc. Psychol.* 80, 1011–1027.

Francis, L. E., Monahan, K., and Berger, C. (1999). A laughing matter? The uses of humor in medical interactions. *Motiv. Emot.* 23, 154–177.

Friesen, A., Lane, A. M., Devonport, T., and Sellars, C. (2011). "A qualitative analysis of interpersonal emotion regulation in ice hockey," in *Proceedings from Canadian Society for Psychomotor Learning and Sport Psychology*, Winnipeg, Canada.

Gross, J. J. (1998). Antecedent- and response-focused emotion regulation: divergent consequences for experience, expression, and physiology. *J. Pers. Soc. Psychol.* 74, 224–237.

Hareli, S., and Rafaeli, A. (2008). Emotion cycles: on the social influence of emotion in organisations. *Res. Organ. Behav.* 28, 35–59.

Hazan, C., and Shaver, P. R. (1990). Love and work: an attachment-theoretical perspective. *J. Pers. Soc. Psychol.* 59, 270–280.

Hobfoll, S. E. (1989). Conservation of resources: a new attempt at conceptualizing stress. *Am. Psychol.* 44, 513–524.

Kuppens, P., Van Mechelen, I., Nezlek, J. B., Dossche, D., and Timmermans, T. (2007). Individual differences in core affect variability and their relationship to personality and adjustment. *Emotion* 7, 262–274.

Litvack-Miller, W., McDougall, D., and Romney, D. M. (1997). The structure of empathy during middle childhood and its relationship to prosocial behaviour. *Genet. Soc. Gen. Psychol. Monogr.* 123, 303–324.

Lively, K. J. (2000). Reciprocal emotion management: working together to maintain stratification in private law firms. *Work Occup.* 27, 32–63.

Locke, E. A., and Latham, G. P. (1990). *A Theory of Goal Setting and Task Performance.* Englewood Cliffs, NJ: Prentice-Hall.

Locke, K. (1996). A funny thing happened: the management of consumer emotions in service encounters. *Organ. Sci.* 7, 40–59.

Mardia, K. V. (1972). *Statistics of Directional Data.* New York: Academic Press.

Maslach, C., and Jackson, S. E. (1981). The measurement of experienced burnout. *J. Organ. Behav.* 2, 99–113.

Matthews, G., Jones, D. M., and Chamberlain, A. G. (1990). Refining the measurement of mood: the UWIST mood adjective checklist. *Br. J. Psychol.* 81, 17–42.

Mikulincer, M. (1998). Adult attachment style and individual differences in functional versus dysfunctional experiences of anger. *J. Pers. Soc. Psychol.* 74, 513–524.

Mikulincer, M., and Shaver, P. R. (2005). Attachment theory and emotions in close relationships: exploring the attachment-related dynamics of emotional reactions to relational events. *Pers. Relationship.* 12, 149–168.

Mikulincer, M., Shaver, P. R., Gillath, O., and Nitzberg, R. A. (2005). Attachment, caregiving, and altruism: boosting attachment security increases compassion and helping. *J. Pers. Soc. Psychol.* 89, 817–839.

Moskowitz, D. S. (2009). Coming full circle: conceptualizing the study of interpersonal behavior. *Can. Psychol.* 50, 33–41.

Moskowitz, D. S., and Zuroff, D. C. (2004). Flux, pulse, and spin: dynamic additions to the personality lexicon. *J. Pers. Soc. Psychol.* 86, 880–893.

Neyer, F. J., Wrzus, C., Wagner, J., and Lang, F. R. (2011). Principles of relationship differentiation. *Eur. Psychol.* 16, 267–277.

Nils, F., and Rimé, B. (2012). Beyond the myth of venting: social sharing modes determine the benefits of emotional disclosure. *Eur. J. Soc. Psychol.* 42, 672–681.

Niven, K., Holman, D., and Totterdell, P. (2012a). How to win friendship and trust by influencing people: an investigation of interpersonal affect regulation and the quality of relationships. *Human Relat.* 65, 777–805.

Niven, K., Totterdell, P., Holman, D., and Headley, T. (2012b). Does regulating others' feelings influence people's own affective well-being? *J. Soc. Psychol.* 152, 246–260.

Niven, K., Totterdell, P., and Holman, D. (2007). Changing moods and influencing people: the use and effects of emotional influence behaviours at HMP Grendon. *Prison Serv. J.* 173, 39–45.

Niven, K., Totterdell, P., and Holman, D. (2009). A classification of controlled interpersonal affect regulation strategies. *Emotion* 9, 498–509.

Niven, K., Totterdell, P., Stride, C., and Holman, D. (2011). Emotion regulation of others and self (EROS): the development and validation of a new individual difference measure. *Curr. Psychol.* 30, 53–73.

Oswald, P. A. (1996). The effects of cognitive and affective perspective taking on empathic concern and altruistic helping. *J. Soc. Psychol.* 136, 613–623.

Parkinson, B., and Totterdell, P. (1999). Classifying affect regulation strategies. *Cogn. Emot.* 13, 277–303.

Paulhus, D. L., and Martin, C. L. (1988). Functional flexibility: a new conception of interpersonal flexibility. *J. Pers. Soc. Psychol.* 55, 88–101.

Pierce, J. L. (1999). Emotional labor among paralegals. *Ann. Am. Acad. Pol. Soc. Sci.* 561, 127–142.

Rafaeli, A., and Sutton, R. I. (1991). Emotional contrast strategies as means of social influence: lessons from criminal interrogators and bill collectors. *Acad. Manage. J.* 34, 749–775.

Russell, J., Moskowitz, D., Zuroff, D., Sookman, D., and Paris, J. (2007). Stability and variability of affective experience and interpersonal behaviour in borderline personality disorder. *J. Abnorm. Psychol.* 116, 578–588.

Schegloff, E. A., Jefferson, G., and Sacks, H. (1977). The preference for self-correction in the organization of repair in conversation. *Language* 53, 361–382.

Shaver, P., Schachner, D. A., and Mikulincer, M. (2005). Attachment style and excessive reassurance seeking, relationship processes, and depression. *Pers. Soc. Psychol. Bull.* 31, 343–359.

Thoits, P. A. (1996). Managing the emotions of others. *Symb. Interact.* 19, 85–109.

Thompson, R. A., and Meyer, S. (2007). "Socialization of emotion regulation in the family," in *Handbook of Emotion Regulation*, ed. J. J. Gross (New York: Guilford), 249–268.

Van Kleef, G. A. (2009). How emotions regulate social life: the emotions as social information (EASI) model. *Curr. Dir. Psychol. Sci.* 18, 184–188.

Vangelisti, A. L., Daly, J. A., and Rudnick, J. R. (1991). Making people feel guilty in conversations: techniques and correlates. *Hum. Commun. Res.* 18, 3–39.

Webb, T. L., Miles, E., and Sheeran, P. (2012). Dealing with feeling: a meta-analysis of the effectiveness of strategies derived from the process model of emotion regulation. *Psychol. Bull.* 138, 775–808.

Wiggins, J. S. (1991). "Agency and communion as conceptual coordinates for the understanding and measurement of interpersonal behaviour," in *Thinking Clearly about Psychology*, eds W. M. Grove and D. Cicchetti (Minneapolis: University of Minnesota Press), 89–113.

Conflict of Interest Statement: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Received: 07 June 2012; accepted: 20 September 2012; published online: 08 October 2012.

*Citation: Niven K, Macdonald I and Holman D (2012) You spin me right round: cross-relationship variability in interpersonal emotion regulation. Front. Psychology **3**:394. doi: 10.3389/fpsyg.2012.00394*

This article was submitted to Frontiers in Emotion Science, a specialty of Frontiers in Psychology.

frontiers in
PSYCHOLOGY

ORIGINAL RESEARCH ARTICLE
published: 19 November 2012
doi: 10.3389/fpsyg.2012.00513

Regulating emotion in the context of interpersonal decisions: the role of anticipated pride and regret

Job van der Schalk [1] ****, Martin Bruder*** [2] ***and Antony Manstead*** [1]

[1] School of Psychology, Cardiff University, Cardiff, UK
[2] Department of Psychology, Zukunftskolleg, University of Konstanz, Konstanz, Germany

Edited by:
Vera Shuman, University of Geneva, Switzerland

Reviewed by:
Luis F. Martinez, ISCTE-University Institute of Lisbon, Portugal
Marijke C. Leliveld, University of Groningen, Netherlands

****Correspondence:***
Job van der Schalk, School of Psychology, Cardiff University, Tower Building, Park Place, Cardiff CF10 3AT, UK.
e-mail: vanderschalkj@cardiff.ac.uk

Recent theories about the relation between emotion and behavior hold that social behavior is influenced not only by the experience of emotion, but also by the anticipation of emotion. We argue that anticipating future emotional states is an emotion regulation strategy when it leads to a change in behavior. In the current studies we examined how construal of a fair or an unfair situation in terms of positive or negative anticipated emotions influences the fairness of subsequent behavior. We used the Ultimatum Bargaining Game – an experimental game in which participants divide a resource between themselves and another person – as a social situation that offers the opportunity to engage in fair and unfair behavior. In Study 1 we used an autobiographical recall task to manipulate anticipated emotions. Although the task did not influence anticipated emotions directly, results showed that anticipated pride about fair behavior increased levels of fairness, whereas anticipated pride about unfair behavior decreased levels of fairness. Similarly, anticipated regret about fair behavior decreased levels of fairness, whereas anticipated regret about unfair behavior increased levels of fairness. In Study 2 we replicated this pattern of findings, and found that participants who thought about their anticipated emotions (pride or regret) in relation to unfair behavior behaved more fairly. We discuss these findings in relation to theories of emotion regulation and economic decision-making.

Keywords: anticipated emotions, fairness, ultimatum bargaining game, pride, regret

INTRODUCTION

One way of regulating emotions is to anticipate how one's actions will make one feel and to adjust one's behavior accordingly. In terms of Gross and Thompson's (2007) process model of emotion regulation, this form of regulation belongs to the category of "situation modification," which refers to efforts to change a situation so as to modify its emotional impact. Anticipating how you would feel if you were to behave one way rather than another, and then deciding to act in the way that evokes desired emotions and avoids undesirable emotions is therefore an emotion regulation strategy. Although this way of regulating emotions applies to a wide variety of settings, both intrapersonal and interpersonal, we focus in the present research on interpersonal behavior, where the emotions concerned are ones relating to outcomes for the self vs. outcomes for another person. We focus on pride and regret relating to decisions to act fairly, in the sense of an equal distribution of resources between self and other, or unfairly, in the sense of retaining a larger proportion of the resource for oneself. We show that the extent to which one anticipates feeling proud or regretful about either course of action is related systematically to how one then decides to allocate resources between self and other.

Our theoretical reasoning derives from theory and research on anticipated emotions. In particular, we draw on the dual-process model proposed by Baumeister et al. (2007). These theorists distinguish between "automatic affect" and "conscious emotion." The former is quick and can operate without awareness. The latter is slower, requiring more processing resources, and is by definition something of which the individual is aware. These two types of affective reaction are seen as having different relationships with behavior. As Baumeister et al. (2007, p.169) put it, "[E]motion may be rather too slow to guide behavior directly in a fast-changing situation, because time is required for the cognitive processing of the event to lead to physiological changes such as arousal, which in turn may activate motor responses. In contrast, automatic affect will arise almost instantaneously and therefore be available to steer behavior even at a moment's notice."

If conscious emotion is too slow to have a direct impact on behavior, what is its function? Baumeister et al. (2007) argue that its most important function is to establish the conditions for being able to anticipate future emotional reactions and thereby the capacity to modify one's behavior so as to evoke desired emotions and avoid undesirable ones. This is achieved by stimulating conscious reflection about one's past behavior and by leaving an "affective residue." Acting in a way that is regretted and gives rise to guilt stimulates reflection about the action and tags the action with a negative affective residue. This is a resource that can be drawn on in future settings that involve similar features: "Emotion provides feedback about recent actions and, by implication, about the adequacy of the current if-then rules on which those actions were based. . . . Positive emotions generally validate the existing rules because those emotions signify that what the person did turned out well, and so the existing rules were presumably effective. . . . Negative emotions signal that one's behavior was not successful,

and hence they suggest that the if-then rules need to be revised" (Baumeister et al., 2007, p. 173).

Adults have all experienced past situations in which that have had to choose between acting in their own interests, regardless of others, or in the interests of others. Each course of action has advantages and disadvantages in the form of material and psychological outcomes. Depending on individual dispositions, these past experiences are ones that may have aroused pride (about having stood up for oneself, or about having acted fairly) or regret (about having been unfair, or about having ceded too much to the other). There is a large literature demonstrating that the anticipation of regret is a powerful motivator of strategic social decision-making (e.g., Zeelenberg, 1999). Although there is less research on the effects of anticipated pride in such situations, there is reason to believe that anticipated pride plays an important role in encouraging behavior that conforms to social standards (Tangney et al., 2007). On the basis of Baumeister et al.'s (2007) dual-process model, we argue that these past experiences of pride and regret gave rise to conscious reflection about how one acted (e.g., counterfactual thinking), and (in the case of regret) a revision of the if-then rules that guided the past action. When similar decisions have to be made in the future, people anticipate how they would feel if they were to act in accordance with these if-then rules. Anticipating these emotional consequences is likely to play a role in how people decide (see also Mellers et al., 1999; Loewenstein and Lerner, 2003).

Based on the above reasoning, we predicted that individuals who anticipate pride about acting fairly would be more likely to divide resources between themselves and another in a fair way, whereas those who anticipate regret about acting fairly would be less likely to do so. Similarly, we predicted that individuals who anticipate pride about acting unfairly would be less likely to divide resources between themselves and another in a fair way, whereas those who anticipate regret about acting unfairly would be more likely to do so. We conducted two online studies to investigate these hypotheses. In both studies participants played an economic game, the Ultimatum Bargaining Game (UBG; Güth et al., 1982), which was used as a measure of fairness of resource allocation. It could be argued that other moral emotions might also be relevant in social bargaining situations such as the UBG. These include self-conscious emotions such as shame and guilt, and anger-related responses such as moral outrage. Note, however, that we are interested in the interaction between the salience of social norms concerning fairness and unfairness and the anticipation of emotions associated with actually behaving in a fair or unfair manner. We therefore chose emotions that are applicable to both fair and unfair behavior. Pride and regret are psychologically plausible responses to both fair and unfair behavior, whereas emotions such as shame, guilt, or moral outrage, apply to unfair behavior but not to fair behavior.

There is a body of research on the role of emotion in the UBG, but that work has focused for the most part on the roles of anger, aggression, and reputation management on the part of responders in rejecting offers perceived to be unfair (e.g., Pillutla and Murnighan, 1996; Sanfey et al., 2003; Burnham, 2007). By contrast, our focus is on the role of emotions on the part of proposers, and how these emotions shape the offers they make. Recent work suggests that emotions do play a role in determining the offers made by proposers. For example, Martinez et al. (2011) found that proposers who were led to experience regret made higher offers than proposers in a neutral emotional state, whereas proposers who were led to experience disappointment made lower offers than their emotionally neutral counterparts.

More directly relevant to the current research is work reported by Nelissen et al. (2011, Study 1), in which they observed that proposers' offers were influenced by the fear that they anticipated experiencing if their offers were rejected and the guilt they anticipated experiencing if their offers were thought to be inadequate. This provides initial evidence in support of the argument that proposers take the likely emotional consequences of their decisions into account when making offers. The explanation offered by Nelissen et al. (2011) for their findings was that anticipated fear and guilt reflect underlying concerns (concern for rejection, and concern for other player, respectively). This explanation is compatible with the present argument that anticipated emotion shapes the decision-making process by signaling to proposers how they would feel if they were to act in one way rather than another. This affective forecasting (Wilson and Gilbert, 2005) is presumably based on past experiences of offers being accepted or rejected and the emotions that were directly experienced as a result. The anticipated fear and guilt observed by Nelissen et al. (2011) stemmed from variations of the UBG that gave rise to heightened concern for self (fear) or concern for others (guilt). In the current research we examined a related but different issue. The point made by Nelissen and colleagues is that higher offers in the UBG may be driven by fear (of having one's offer rejected) or guilt (about the opponent's outcomes). Our objective is to show that *within* the context of fairness (which presumably enhances concern for others) or unfairness (which presumably reduces concern for others), the emotion one anticipates experiencing will shape one's offer level. If you anticipate feeling proud about acting unfairly, you will offer less than you would if you anticipated feeling regret about acting unfairly. In contrast, if you anticipate feeling proud about acting fairly, you will offer more than you would if you anticipated feeling regret about acting fairly. To study this we examined the influence of both positive and negative anticipated emotions relating to both fair and unfair offers.

In the first of the present studies we manipulated anticipated emotions by first asking participants to engage in an autobiographical recall task. Anticipated emotions about fair or unfair behavior were measured before participants made an offer in the UBG. In the second study we investigated the effect of reminding participants about specific anticipated emotions (pride or regret) on subsequent fairness behavior. We manipulated anticipated pride and regret by having participants report their anticipated pride, their anticipated regret, or no emotion, before making an offer in the UBG. Both studies were approved by the Ethics Committee of Cardiff University's School of Psychology.

STUDY 1

METHOD

Participants and design

The study had a 2 (Behavior: fair vs. unfair) × 3 (Emotion: pride vs. regret vs. control) between-subjects design, and was administered online. Participants were 210 people (131 female, 77 male, 2 undisclosed; age range: 18–77 years, median: 35 years; nationality: 85.7% British) who were recruited through an online loyalty program. As

compensation for their time, participants received loyalty points that can be used for online shopping.

Materials

To manipulate behavior and anticipated emotion we asked participants to recall an incident from their own lives in which they had acted either in a way that was fair or unfair to others, and felt either proud or regretful as a result. Depending on behavior condition, we specifically asked participants to think back to a time when they behaved fairly (fair condition) or unfairly (unfair condition). Depending on emotion condition, we specifically asked participants to think back to a time when they felt proud (pride condition) or regretful (regret condition), "because you voluntarily gave up something that otherwise could have been yours" (fair condition) or "because you gained something for yourself that otherwise would not have been yours" (unfair condition). In the control condition participants also recalled an event in which they had acted fairly or unfairly, but no mention of emotions was made. As manipulation checks we asked participants to rate the extent to which they behaved fairly and unfairly in the recalled situation and the extent to which they had felt proud and regretful. The response scale for all measures ran from 1 (*not at all*) to 5 (*very much*).

Participants then played the UBG. This experimental game simulates a single-round negotiation; participants play for a resource that has monetary value. The game involves two roles, the "proposer" and the "responder." The proposer divides the resource between the two players and this division is presented as an offer to the responder. The responder can accept or reject the offer. If the responder accepts the offer the resource is divided as proposed; if the responder rejects the offer neither player receives anything. In this study the resource for which participants played was £100, represented by 50 monetary units (MU) of £2 each. We explained to participants that at the end of the study we would randomly select two pairs of participants, and that we would divide the resource between the players in accordance with how they had played the game. Because we were interested in the number of MU that the proposer was willing to share with the responder as a measure of fair behavior, all participants were assigned the role of "proposer."

Participants reported their anticipated emotions directly before playing the UBG. Because we were interested in anticipated emotions about fair and unfair behavior, we asked participants to report how they would feel if they were to divide the MU equally, or how they would feel if they were to keep most of the MU for themselves. Depending on behavior condition, we asked: "If you were to divide the MU equally between yourself and the responder (for example, if you would offer a 25–25 split), to what extent would you feel. . ." (fair condition), or "If you were to divide the MU in such a way that you keep most for yourself (for example, if you would offer a 45–5 split), to what extent would you feel. . ." (unfair condition). We asked participants to report their anticipated emotions on a scale from 1 (*not at all*) to 5 (*extremely*) for 10 different emotion terms: *pleased*, *proud*, *regretful*, *sorry*, *satisfied*, *relieved*, *embarrassed*, *foolish*, *guilty*, and *ashamed*.

Procedure

Participants first received general information about the study, confirmed that they were 18 years of age or older, and consented to participate in the study. Demographic information was collected, and participants completed a measure of Social Value Orientation (because this construct was not involved in our hypotheses, the results relating to this measure will not be reported). They then described the autobiographical event involving fair or unfair behavior and their experienced feelings of pride or regret (except in the control condition). In the next part of the study they learned about the rules of the UBG. Participants were led to believe that they were randomly assigned to their role; however, all participants were allocated to the role of "proposer." Next, participants completed a set of comprehension checks that captured the most important aspects of the UBG ("What is your role in the game?", "How many MU are there to divide?", "How many MU will you receive if the offer is rejected?") and received feedback on their answers to ensure that everyone was fully aware of the rules. Participants then reported their anticipated emotions, and made their offer in the UBG. After an open question about their thoughts and feelings concerning the game, participants indicated the minimum MU they would accept as an offer if they were a responder in the UBG. The £100 resource was paid to the randomly selected pairs of players in accordance with the responses they gave (e.g., if the participant selected as a proposer had offered a 30_{proposer}:$20_{\text{responder}}$ division of MU and the participant selected as a responder had indicated that he/she would accept a minimum offer of 35_{proposer}:$15_{\text{responder}}$ MU, then the £100 would be divided $£60_{\text{proposer}}$:$£40_{\text{responder}}$). Then participants completed manipulation checks and a second measure of Social Value Orientation. Finally, participants were thanked and debriefed.

RESULTS

Participants and data treatment

An independent judge, blind to condition, read the autobiographical reports of participants, and coded whether the stories made reference to fair or unfair behavior. Participants who did not provide an answer, could not think of a situation, or gave an unintelligible answer were excluded from analyses. One hundred fifty-two participants remained in the analyses. Three anticipated emotion items were combined into a single pride scale (*pleased*, *proud*, and *satisfied*; $\alpha = 0.90$), and two items were combined into a single regret scale (*regretful* and *sorry*; $\alpha = 0.93$).

Manipulation checks

We tested the effects of conditions on the manipulation checks with 2 (Behavior: fair, unfair) × 3 (Emotion: pride, regret, control) ANOVAs. The manipulation check for fair behavior revealed the expected main effect of the behavior manipulation, $F(1, 146) = 42.29$, $p < 0.001$, $\eta^2 = 0.23$. In the fair condition, participants reported having behaved more fairly ($M = 4.32$, SD = 1.15) than in the unfair condition ($M = 2.91$, SD = 1.48). No other effects were significant. The reverse pattern was found for unfair behavior. As expected, participants reported behaving more unfairly in the unfair condition ($M = 3.03$, SD = 1.49) than in the fair condition ($M = 1.61$, SD = 1.11), $F(1, 145) = 43.39$, $p < 0.001$, $\eta^2 = 0.23$, and no other effects were found.

The manipulation check for pride revealed the expected main effect of emotion condition, $F(2, 146) = 12.14$, $p < 0.001$, $\eta^2 = 0.14$. Participants felt more proud in the recalled situation

in the pride condition ($M = 3.71$, SD = 1.32) than in the regret ($M = 2.37$, SD = 1.51) or control conditions ($M = 3.12$, SD = 1.51). There also was a significant main effect of the behavior manipulation, $F(1, 146) = 27.35$, $p < 0.001$, $\eta^2 = 0.16$, showing that participants felt more pride in the fair autobiographical stories ($M = 3.57$, SD = 1.36), than in the unfair stories ($M = 2.40$, SD = 1.52). The interaction was not significant. The manipulation check for regret revealed a similar pattern, but in the reverse direction. As expected, participants felt more regret in the recalled situation in the regret condition ($M = 3.27$, SD = 1.58) than in the pride ($M = 2.63$, SD = 1.52) or control conditions ($M = 2.47$, SD = 1.56), $F(2, 146) = 3.36$, $p = 0.038$, $\eta^2 = 0.04$. Again, the main effect of behavior was significant, $F(1, 146) = 13.42$, $p < 0.001$, $\eta^2 = 0.08$. Participants felt more regret in the unfair stories ($M = 3.34$, SD = 1.48) than in the fair stories ($M = 2.39$, SD = 1.54). The interaction was not significant.

Dependent variables

Anticipated emotions. We investigated the effect of behavior and emotion on anticipated pride and regret in two separate 2 × 3 ANOVAs. For anticipated pride the predicted main effect of emotion condition was not significant, $F < 1$, ns. Participants in the pride condition ($M = 3.54$, SD = 1.16) did not anticipate more pride than participants in the regret ($M = 3.33$, SD = 1.35) or control conditions ($M = 3.59$, SD = 1.17). However, there was a significant main effect of behavior, $F(1, 144) = 70.39$, $p < 0.001$, $\eta^2 = 0.33$. Participants anticipated more pride in the fair ($M = 4.08$, SD = 0.94) than in the unfair condition ($M = 2.66$, SD = 1.10). The interaction was not significant. For regret, too, the predicted main effect of emotion condition was not significant, $F < 1$, ns. Participants in the regret condition ($M = 2.41$, SD = 1.49) did not anticipate more regret than participants in the pride ($M = 2.19$, SD = 1.15) or control conditions ($M = 2.10$, SD = 1.22). However, there was again a significant main effect of behavior condition, $F(1, 140) = 145.49$, $p < 0.001$, $\eta^2 = 0.51$. Participants anticipated more regret in the unfair ($M = 3.29$, SD = 1.10) than in the fair condition ($M = 1.43$, SD = 0.74). The interaction was not significant.

Offer level. The number of MU allocated to the responder ranged between 5 and 30, with a median of 25, and a mean of 24.26. We investigated the effect of behavior and emotion on offer level in a 2 × 3 ANOVA. There were no significant effects (all Fs ≤ 1.00).

We then investigated the combined effects of behavior condition, emotion condition, and self-reported anticipated emotion on offer level using multiple regression. We regressed offer level on behavior condition, emotion condition, self-reported anticipated emotion, and their interactions in two separate analyses: one with the measure of anticipated pride and its interaction terms, the other with the measure of anticipated regret and its interaction terms. We entered the main effects for the predictors in step 1 ($R^2 = 0.01$, ns), the two-way interactions between these terms in step 2 ($\Delta R^2 = 0.20$, $p < 0.001$), and the three-way interaction term in step 3 ($\Delta R^2 = 0.004$, ns). For the regression involving anticipated pride there was a significant two-way interaction between behavior and self-reported anticipated emotion, $\beta = 0.33$, SE = 0.06, $p < 0.001$. This interaction is depicted in **Figure 1**. The simple slope of anticipated pride was significantly positive in the fair condition, $\beta = 0.39$, SE = 0.09, $p < 0.001$, while the simple slope of anticipated pride was significantly negative in the unfair condition, $\beta = -0.27$, SE = 0.09, $p = 0.003$. There were no other significant two-way interactions involving anticipated pride, and the three-way interaction between behavior condition, emotion condition, and anticipated pride was not significant.

For the regression that involved anticipated regret we again entered the main effects for the predictors in step 1 ($R^2 = 0.004$, ns), the two-way interactions between these terms in step 2 ($\Delta R^2 = 0.16$, $p < 0.001$), and the three-way interaction term in step 3 ($\Delta R^2 = 0.003$, ns). Here, there was a significant two-way interaction between behavior and self-reported anticipated emotion in the opposite direction, $\beta = -0.38$, SE = 0.09, $p < 0.001$. This interaction is depicted in **Figure 2**. The simple slope of anticipated regret was significantly negative in the fair condition, $\beta = -0.43$, SE = 0.13, $p = 0.001$, while the simple slope of anticipated regret was significantly positive in the unfair condition, $\beta = 0.24$, SE = 0.10, $p = 0.017$. There were no other significant interactions that involved anticipated regret, and the three-way interaction between behavior condition, emotion condition, and anticipated regret was not significant.

DISCUSSION

Despite the fact that the manipulation check data showed that participants recalled autobiographical events in accordance with the experimental instructions, the autobiographical recall task did not directly influence anticipated emotions and the manipulation had no direct effect on offer level. However, and in line with our predictions, the more that participants anticipated feeling proud about acting fairly, the more fairly they distributed the resources, whereas the more that they anticipated feeling proud about acting unfairly, the less fairly they distributed the resources. With regret the same pattern was found, but in reverse.

In better understanding why the autobiographical recall task did not influence anticipated emotions, it may be useful to consider the distinction between "exogenous" and "endogenous" emotion, as drawn by de Hooge et al. (2008), who argue that "Influences of emotions are denoted as endogenous when they concern behaviors in situations that are related to the emotion-causing event" (p. 935). In the present context, it could be argued that the autobiographically recalled event and its accompanying emotion were exogenous to the ultimatum game that participants played. Generalizing from the finding that exogenous shame is less likely than endogenous shame to influence prosocial behavior (de Hooge et al., 2008), it could be reasoned that the exogenous nature of the autobiographical recall procedure used here might have been responsible for the lack of influence on anticipated emotion in the UBG.

Another possible explanation for the fact that the manipulation was not successful in changing levels of anticipated emotion is that we measured anticipated emotions with a range of items and this may have served to "undo" the effect of the emotion manipulation. The results of the anticipated emotion measure suggested that it was easier to arouse pride in the fair than in the unfair condition, and regret in the unfair condition than in the fair condition. By asking participants to reflect on their anticipated emotions (and

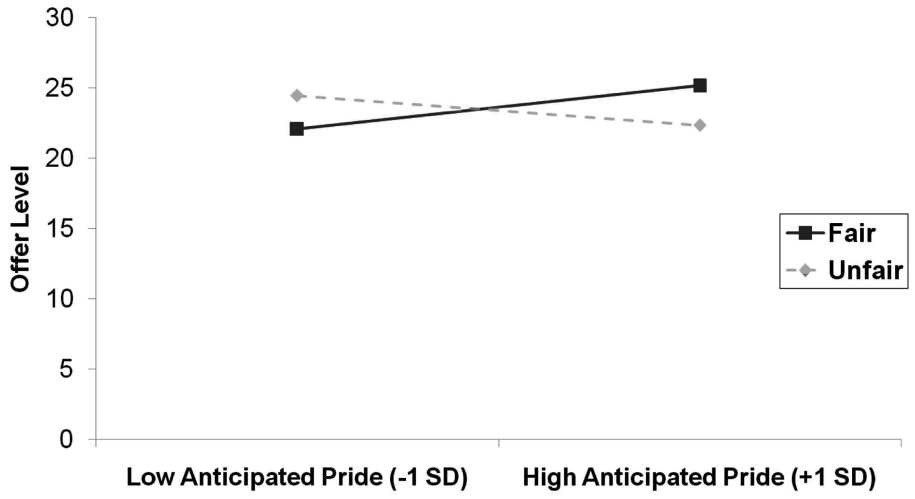


FIGURE 1 | Offer level (number of MU allocated to responder) as a function of anticipated pride and behavior condition in Study 1.

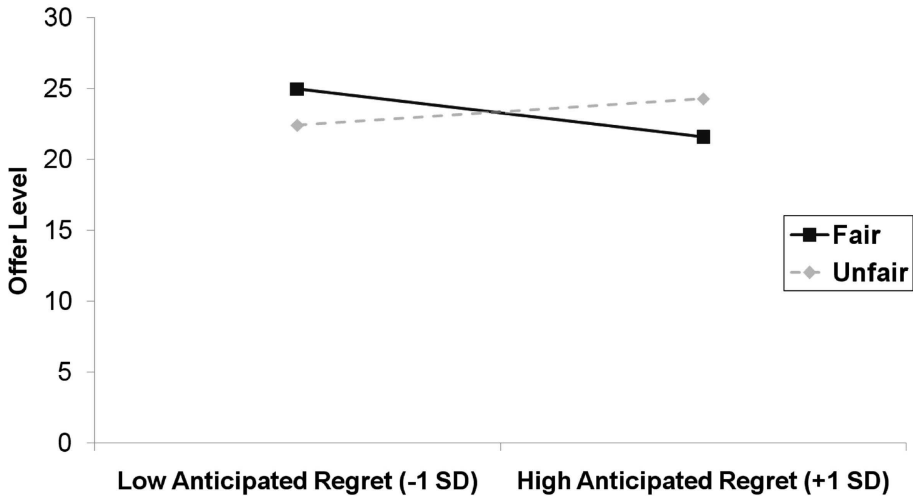


FIGURE 2 | Offer level (number of MU allocated to responder) as a function of anticipated regret and behavior condition in Study 1.

measuring both pride and regret), we may have led participants to revert to the "default" of anticipating pride in the fair condition, and regret in the unfair condition.

In Study 2 we therefore used a different manipulation of anticipated emotion: we measured only anticipated pride, or anticipated regret, or no emotion (as appropriate). In this way we ensured that the manipulation of anticipated emotion was endogenous to the experimental task participants had to complete. At the same time, by restricting the number of anticipated emotion items we ensured that there would be less interference from other emotion terms. We predicted that measuring pride in the fair condition would increase offer level, whereas measuring regret in the fair condition would decrease offer level. The reverse pattern of results was predicted in the unfair condition.

STUDY 2

METHOD

Participants and design

The study had a 2 (Behavior: fair vs. unfair) × 3 (Emotion: pride vs. regret vs. control) between-subjects design. Participants were 132 students of a British university (124 female, 7 male, 1 undisclosed; age range: 18–33 years, median: 19 years). Participants received course credit (as partial course requirement) in exchange for their time. The study was administered online.

Materials

We again used the UBG and the number of MU that proposers were willing to share as a measure of fair behavior. The resource (£1) was represented by 50 MU with a value of 2 pence each. Again, in a seemingly random assignment to the roles of "proposer" and

"responder," all participants were actually assigned the role of proposer. Because we did not collect information about the minimum offer that participants would accept (as we had done in Study 1) all participants received the maximum possible winnings (£1) at the end of the study in addition to their course credit.

Before participants divided the resource, they indicated their anticipated emotions. Depending on behavior condition we asked them to consider the following: "If you were to divide the MU equally between yourself and the responder (for example, if you would offer a 25–25 split), to what extent would you feel. . ." (fair condition), or "If you were to divide the MU in such a way that you keep most for yourself (for example, if you would offer a 45–5 split), to what extent would you feel. . ." (unfair condition). Depending on emotion condition, we asked participants to report either their anticipated pride (*pleased* and *proud*) or their anticipated regret (*regretful* and *sorry*) on a scale from 1 (*not at all*) to 5 (*extremely*). In the control conditions no anticipated emotion measure was administered. Instead, in the fair control condition participants were asked to consider dividing the MU equally, and in the unfair control condition to consider dividing the MU in such a way that they would keep most for themselves.

Procedure

After sign-up, participants received a link to the study website. On entering the website, participants received general information about the study and provided consent for participation. We recorded demographic information, and explained the UBG. We told them that their offer would be communicated to another participant by email, and participants provided their contact details for this purpose. All participants then learned that they were randomly allocated to the role of proposer. We checked for participants' comprehension of the UBG using the same checks as in Study 1. Then participants reported their anticipated emotions, before making their offer in the UBG. Some additional measures were taken (e.g., an open question about their thoughts and feelings about the game, and Social Value Orientation), but because these measures are unrelated to the present hypotheses they will not be discussed further. Finally, participants were debriefed, provided with payment information and thanked.

RESULTS

Participants and data treatment

We excluded participants who shared all of their tokens (three participants) or kept everything for themselves (two participants) because such behavior likely reflects insufficient understanding of the game or lack of motivation to take the game seriously. For the remaining participants, offers ranged between 1 and 30 MU, with a median of 25, and a mean of 22.63. Anticipated emotion items were combined to create an anticipated pride scale ($\alpha = 0.70$), and an anticipated regret scale ($\alpha = 0.88$).

Dependent variables

Anticipated emotions. We investigated the effect of behavior condition and emotion condition on anticipated emotion with a 2 (Behavior: fair, unfair) × 2 (Emotion: pride, regret) ANOVA (because we did not collect anticipated emotion data in the control conditions, these were not included in the ANOVA). There was a significant main effect of behavior, $F(1, 76) = 9.71$, $p = 0.003$, $\eta^2 = 0.11$, and a significant main effect of emotion, $F(1, 76) = 24.60$, $p < 0.001$, $\eta^2 = 0.25$, but these main effects were qualified by a significant behavior by emotion interaction, $F(1, 76) = 56.23$, $p < 0.001$, $\eta^2 = 0.43$. Simple main effects revealed that participants anticipated more pride in the fair ($M = 3.67$, $SD = 0.58$) than in the unfair condition ($M = 2.84$, $SD = 1.20$), $F(1, 76) = 8.77$, $p = 0.004$, whereas participants anticipated more regret in the unfair ($M = 3.32$, $SD = 0.86$) than in the fair condition ($M = 1.31$, $SD = 0.52$), $F(1, 76) = 39.50$, $p < 0.001$.

Offer level. We investigated the effect of behavior and emotion on offer level in a 2 × 3 ANOVA. There was a significant main effect of behavior, $F(1, 121) = 19.36$, $p < 0.001$, $\eta^2 = 0.14$, and a significant main effect of emotion, $F(2, 121) = 8.52$, $p < 0.001$, $\eta^2 = 0.12$. These effects were qualified by a significant two-way interaction, $F(2, 121) = 6.53$, $p = 0.002$, $\eta^2 = 0.10$ (see **Figure 3**). Simple main effects revealed that there was no effect of emotion in the fair condition ($F < 1$, ns; $M_{pride} = 23.70$, $SD_{pride} = 2.25$; $M_{regret} = 24.29$, $SD_{regret} = 1.79$; $M_{control} = 23.64$, $SD_{control} = 3.51$), but that there was a significant effect of emotion in the unfair condition, $F(2, 121) = 11.69$, $p < 0.001$. Follow-up analyses revealed that in the unfair condition participants offered fewer MU in the control condition ($M_{control} = 16.47$, $SD_{control} = 5.96$) than in either the pride ($M_{pride} = 22.09$, $SD_{pride} = 5.86$; $p < 0.001$), or the regret conditions ($M_{regret} = 23.15$, $SD_{regret} = 4.36$; $p < 0.001$).

We again investigated the combined effect of behavior, emotion, and the anticipated emotion measure on offer level using multiple regression. We entered the main effects for the behavior and emotion conditions and anticipated emotions in step 1 ($R^2 = 0.06$, $p = 0.17$), the two-way interactions between these terms in step 2 ($\Delta R^2 = 0.20$, $p < 0.001$), and the three-way interaction term in step 3 ($\Delta R^2 = 0.12$, $p < 0.001$). This revealed a significant three-way interaction, $\beta = 0.67$, $SE = 0.18$, $p < 0.001$.

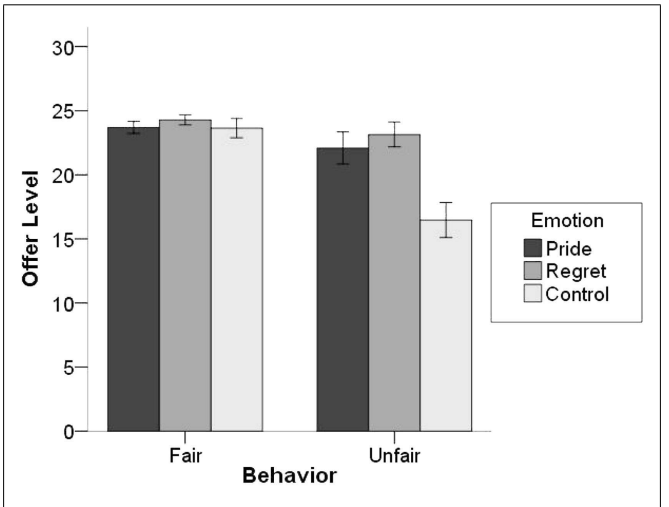


FIGURE 3 | Offer level (number of MU allocated to responder) as a function of behavior and emotion condition in Study 2. Error bars represent ± 1 SE.

To decompose this interaction we regressed offer level on behavior, anticipated emotion, and its interaction separately for each emotion condition. We entered the terms for the main effects in step 1, and their interaction term in step 2. The results replicated the pattern observed in Study 1. In the pride condition (step 1: $R^2 = 0.26$, $p = 0.002$, step 2: $\Delta R^2 = 0.20$, $p < 0.001$) there was a significant two-way interaction between behavior and anticipated emotion, $\beta = 0.70$, SE = 0.18, $p < 0.001$. This interaction is depicted in **Figure 4**. Simple slopes revealed that while there was a trend for a positive association between anticipated pride and offer level in the fair condition, $\beta = 0.54$, SE = 0.32, $p = 0.10$, there was a negative association between anticipated pride and offer level in the unfair condition, $\beta = -0.86$, SE = 0.16, $p < 0.001$. For regret (step 1: $R^2 = 0.15$, $p = 0.076$, step 2: $\Delta R^2 = 0.08$, $p = 0.082$) there was a marginally significant two-way interaction between behavior and anticipated emotion in the reverse direction, $\beta = -0.51$, SE = 0.28, $p = 0.082$. This interaction is depicted in **Figure 5**. Simple slopes revealed that there was no association between anticipated regret and offer level in the fair condition, $\beta = -0.20$, SE = 0.48, ns, whereas there was a significant positive association between anticipated regret and offer level in the unfair condition, $\beta = 0.82$, SE = 0.30, $p = 0.010$.

DISCUSSION

As in Study 1, there was a clear relation between anticipated emotions and the subsequent offer, and the direction of this relation depended on the fair/unfair context: in the fair condition, the more participants anticipated to feel pride, the more MU they tended to allocate to the responder; whereas in the unfair condition, the more participants anticipated to feel pride, the less MU they tended to allocate to the responder. The reverse was found for anticipated regret, although in the fair condition the negative relation between

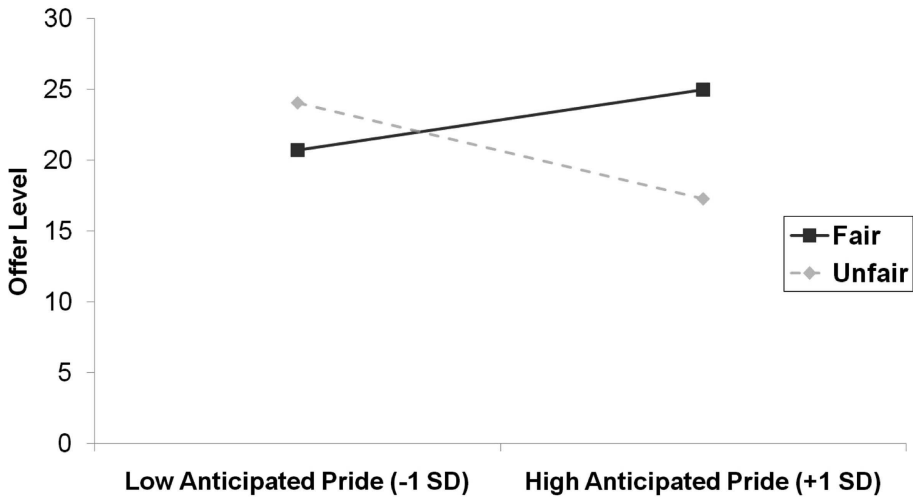


FIGURE 4 | Offer level (number of MU allocated to responder) as a function of anticipated pride and behavior condition in Study 2.

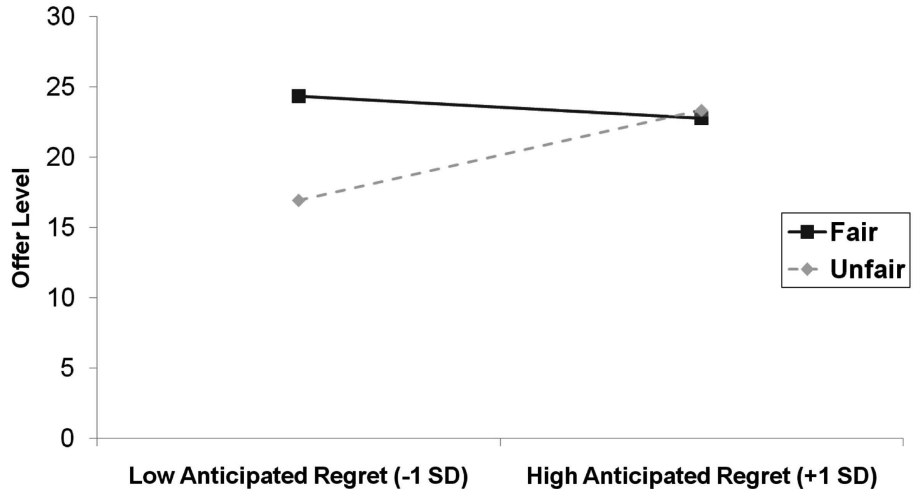


FIGURE 5 | Offer level (number of MU allocated to responder) as a function of anticipated regret and behavior condition in Study 2.

anticipated regret and number of MU allocated to the responder did not reach significance.

Overall, participants anticipated more pride in the fair condition than in the unfair condition, and anticipated more regret in the unfair condition than the fair condition. In particular, there was very little anticipated regret in the fair condition. The latter may help to account for the non-significance of the simple slope of regret in the fair condition.

Asking people about either anticipated pride or anticipated regret increased the offer level in the unfair condition. Although this pattern of results for the direct effects of the behavior condition and the emotion condition on offer level differed from the one we had originally predicted, it can nevertheless be seen as consistent with our general theorizing. At first glance it may seem surprising that both emotion conditions led to higher offers in the unfair condition. However, when we take into account the direct effects of behavior condition on anticipated emotions, we can see that participants reported low levels of anticipated pride and high levels of anticipated regret in the unfair condition. Because low pride and high regret are related to higher offers in the unfair condition, it would appear that both emotion conditions (pride and regret) made participants think about how they would feel after acting unfairly, and that this increased offer levels in both cases. Although this interpretation is *post hoc* and therefore remains tentative, it is consistent with the fact that when participants were asked to consider making an unfair offer but were not asked to report their anticipated emotions, the result was a significantly lower average offer.

GENERAL DISCUSSION

In two studies we found that participants' decisions about how to allocate resources between self and other are associated with the emotions that are anticipated as a result of their decision. The more that participants anticipated feeling proud about acting fairly, the higher were the offers they made to anonymous others; the more that participants anticipated feeling regret about acting fairly, the lower were the offers they made to anonymous others. Likewise, the more that participants anticipated feeling proud about acting unfairly, the lower were the offers they made to anonymous others; and the more that participants anticipated feeling regret about acting unfairly, the higher were the offers they made to anonymous others. These findings are consistent with the argument that decision makers take the emotional consequences of their decisions into account when making decisions (Mellers et al., 1999; Loewenstein and Lerner, 2003), and with the broader argument that anticipated emotions shape behavior (Baumeister et al., 2007).

Interestingly, the fact that participants who anticipated feeling proud about fair behavior or regret about unfair behavior were willing to part with some of their potential material winnings demonstrates that future emotions can be as important to participants as potential monetary rewards. This shows that people not only strive to maximize their gains, but also strive to feel good (or to not feel bad). In this sense positive emotions (or absence of negative emotions) can compensate for material loss or be an additional incentive for material gains. This means that decisions that people make when distributing resources between themselves and another person are better understood when anticipated emotions are taken into account.

It is noteworthy that overall participants more readily anticipated pride in relation to the prospect of behaving fairly and regret in relation to the prospect of behaving unfairly. This reflects the fact that the "default" decision in the UBG is to distribute the resources equally between proposer and responder. The modal proposed division of resources is 50:50 and very unfair offers are rare (Güth et al., 1982; Messick, 1993; Camerer, 2003). Despite some cross-cultural variability, this basic pattern has even been replicated in small-scale societies (Henrich et al., 2005), and has been interpreted as reflecting a social preference for inequity aversion (Fehr and Schmidt, 1999; Bolton and Ockenfels, 2000).

In discussing the results of Study 1 we argued that the fact that we measured a range of anticipated emotions (tapping both pride and regret) may have led participants to think more generally about the emotions that they expected to experience as a function of their resource allocation decisions, thereby undoing the influence of the recalled emotion. In Study 2 we therefore asked only about one anticipated emotion construct (pride or regret, plus a no emotion control condition). We found that in the unfair condition – where participants were asked to contemplate a 45:5 split in favor of them – asking about *either* pride *or* regret led to increased offers relative to the control condition. Thus, rendering future emotions salient led to fairer decisions irrespective of the specific emotion on which participants focused. This suggests that interventions aimed at making people think about how they will feel if they behave one way or the other may increase the probability of decisions that conform to the socially normative behavior in the respective situation. We argue that this is because – once they are led to think about it – most people will feel better about engaging in, rather than acting contrary to, the behavior that they consider to be socially normative. It would appear that the social preference for inequity aversion is sufficiently strong and widespread in society that participants anticipate, on average, less pride and more regret in relation to unfair allocations than in relation to fair allocations, with the result that offer levels were higher in both conditions. Whether alternative manipulations could not only change the saliency of future emotional states, but also induce specific anticipated emotions that exert discrete effects on behavior is an important challenge for future research in this area.

But even if our manipulation simply affected the salience of anticipated emotions, we believe that the practical implications of our findings are potentially substantial. Note that the manipulation we used was short and easy to administer. People were simply asked to consider what they would feel if they were to behave one way or the other. The result of this (irrespective of which emotion they focused on) was that they behaved in a fairer manner than they did when only considering the outcome of their choices. Whether similar interventions reminding people of the possible emotional consequences of their actions and inactions could have socially beneficial effects when printed on tax return forms, library books, office pens, or communal kitchen sinks is worth future research attention.

The present research illustrates one important yet relatively neglected way in which people can regulate their emotions in interpersonal settings: in order to regulate their feelings people

modify the situation (Gross and Thompson, 2007). People anticipate how their actions will affect the self and others, and how they themselves are likely to feel as a result. This then influences the decisions that people make. The particular forecast of how they are likely to feel may be informed by past experiences in similar situations. Importantly, however, the absolute accuracy of this forecast of their feelings is unimportant, as long as it is relatively accurate in the sense that it indexes whether a given outcome is more likely to give rise to feelings of (for example) regret than of pride.

In conclusion, when making resource allocation decisions people take into account how they would feel if they were to do this in ways that vary with respect to fairness, and then make allocations that are informed by these anticipated emotions. In this way, people regulate their own emotions in social situations, giving themselves the opportunity to experience positive emotions such as pride and avoiding the experience of negative emotions such as regret. Interestingly, these anticipated emotions are enough of an incentive for people to sacrifice potential monetary gains. The pride people anticipate about acting fairly leads people to act fairly.

ACKNOWLEDGMENTS

The research reported in this paper was supported by a grant from the Economic and Social Research Council (UK) and formed part of a European Collaborative Research Project sponsored by the European Science Foundation. The authors wish to thank Anniek Hengeveld for her assistance with coding the autobiographical stories.

REFERENCES

Baumeister, R. F., Vohs, K. D., DeWall, C. N., and Zhang, L. (2007). How emotion shapes behavior: feedback, anticipation, and reflection, rather than direct causation. *Pers. Soc. Psychol. Rev.* 11, 167–203.

Bolton, G. E., and Ockenfels, A. (2000). ERC: a theory of equity, reciprocity, and competition. *Am. Econ. Rev.* 90, 166–193.

Burnham, T. C. (2007). High-testosterone men reject low ultimatum game offers. *Proc. R. Soc. Lond. B Biol. Sci.* 274, 2327–2330.

Camerer, C. (2003). *Behavioral Game Theory: Experiments in Strategic Interaction.* Princeton, NJ: Princeton University Press.

de Hooge, I. E., Breugelmans, S. M., and Zeelenberg, M. (2008). Not so ugly after all: when shame acts as a commitment device. *J. Pers. Soc. Psychol.* 95, 933–943.

Fehr, E., and Schmidt, K. M. (1999). A theory of fairness, competition, and cooperation. *Qual. J. Econ.* 114, 817–868.

Gross, J. J., and Thompson, R. A. (2007). "Emotion regulation: conceptual foundations," in *Handbook of Emotion Regulation*, ed. J. J. Gross (New York, NY: Guilford), 3–24.

Güth, W., Schmittberger, R., and Schwarze, B. (1982). An experimental analysis of ultimatum bargaining. *J. Econ. Behav. Organ.* 3, 367–388.

Henrich, J., Boyd, R., Bowles, S., Camerer, C., Fehr, E., Gintis, H., et al. (2005). "Economic man" in cross-cultural perspective: behavioral experiments in 15 small-scale societies. *Behav. Brain Sci.* 28, 795–855.

Loewenstein, G., and Lerner, J. S. (2003). "The role of affect in decision making," in *Handbook of Affective Sciences.* eds R. J. Davison, K. R. Scherer, and H. H. Goldsmith (New York, NY: Oxford University Press), 619–642.

Martinez, L. M. F., Zeelenberg, M., and Rijsman, J. B. (2011). Behavioural consequences of regret and disappointment in social bargaining games. *Cogn. Emot.* 25, 351–359.

Mellers, B. A., Schwartz, A., and Ritov, I. (1999). Emotion-based choice. *J. Exp. Psychol. Gen.* 128, 332–345.

Messick, D. M. (1993). "Equality as a decision heuristic," in *Psychological Perspectives on Justice: Theory and Applications*, eds B. A. Mellers and J. Baron (New York, NY: Cambridge University Press), 11–31.

Nelissen, R. M. A., Leliveld, M. C., van Dijk, E., and Zeelenberg, M. (2011). Fear and guilt in proposers: using emotions to explain offers in ultimatum bargaining. *Eur. J. Soc. Psychol.* 41, 78–85.

Pillutla, M. M., and Murnighan, J. K. (1996). Unfairness, anger, and spite: emotional rejections of ultimatum offers. *Organ. Behav. Hum. Decis. Process* 68, 208–224.

Sanfey, A. G., Rilling, J. K., Aronson, J. A., Nystrom, L. E., and Cohen, J. D. (2003). The neural basis of economic decision-making in the ultimatum game. *Science* 300, 1755–1758.

Tangney, J. P., Stuewig, J., Mashek, D. J. (2007). "What's moral about the self-conscious emotions?" in *The Self-Conscious Emotions: Theory and Research*, eds J. L. Tracy, R. W. Robins, and J. P. Tangney (New York, NY: Guilford Press), 21–37.

Wilson, T. D., and Gilbert, D. T. (2005). Affective forecasting: knowing what to want. *Curr. Dir. Psychol. Sci.* 14, 131–134.

Zeelenberg, M. (1999). Anticipated regret, expected feedback and behavioral decision making. *J. Behav. Decis. Mak.* 12, 93–106.

Conflict of Interest Statement: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Received: 19 June 2012; accepted: 31 October 2012; published online: 19 November 2012.
Citation: van der Schalk J, Bruder M and Manstead A (2012) Regulating emotion in the context of interpersonal decisions: the role of anticipated pride and regret. Front. Psychology ***3****:513. doi: 10.3389/fpsyg.2012.00513*
This article was submitted to Frontiers in Emotion Science, a specialty of Frontiers in Psychology.

frontiers in
PSYCHOLOGY

ORIGINAL RESEARCH ARTICLE
published: 22 October 2012
doi: 10.3389/fpsyg.2012.00431

An experimental decision-making paradigm to distinguish guilt and regret and their self-regulating function via loss averse choice behavior

Ullrich Wagner*, Lisa Handke, Denise Dörfel and Henrik Walter

Division of Mind and Brain Research, Department of Psychiatry and Psychotherapy, Charité – Universitätsmedizin Berlin, Berlin, Germany

Edited by:
Vera Shuman, University of Geneva, Switzerland

Reviewed by:
Tjeert Olthof, VU University, Netherlands
Seger Martijn Breugelmans, Tilburg University, Netherlands
Antoinette Nicolle, University of Hull, UK

****Correspondence:***
Ullrich Wagner, Division of Mind and Brain Research, Department of Psychiatry and Psychotherapy, Charité – Universitätsmedizin Berlin, Charitéplatz 1, CCM, D-10117 Berlin, Germany.
e-mail: ullrich.wagner@charite.de

Both guilt and regret typically result from counterfactual evaluations of personal choices that caused a negative outcome and are thought to regulate human decisions by people's motivation to avoid these emotions. Despite these similarities, studies asking people to describe typical situations of guilt and regret identified the social dimension as a fundamental distinguishing factor, showing that guilt but not regret specifically occurs for choices in interpersonal (social) contexts. However, an experimental paradigm to investigate this distinction systematically by inducing emotions of guilt and regret online is still missing. Here, extending existing procedures, we introduce such a paradigm, in which participants choose in each trial between two lotteries, with the outcome of the chosen lottery (gain or loss) being either assigned to themselves (intrapersonal trials) or to another person (interpersonal trials). After results of both the chosen and the unchosen lottery were shown, subjects rated how they felt about the outcome, including ratings of guilt and regret. Trait Guilt (TG) was determined for all participants in order to take their general inclination to experience guilt into account. Results confirmed that guilt but not regret specifically occurred in an interpersonal context. Percentages of loss averse choices (choosing the lottery with the lower possible monetary loss) were determined as indicators of regulation via guilt and regret avoidance. High TG scorers generally made more loss averse choices than low TG scorers, while trial-by-trial analyses showed that low TG scorers used their feelings of guilt more specifically to avoid the same emotional experience in subsequent choices. Our results confirm the social dimension as the critical factor distinguishing guilt from regret and identify TG as an important moderator determining the way in which guilt vs. regret can regulate their own occurrence by influencing choice strategies.

Keywords: guilt, regret, social decision-making, game theory, loss aversion, emotion regulation

INTRODUCTION

Guilt and regret are two closely related emotions. In everyday life, they tend to co-occur, which may be the reason why many people would find it difficult to distinguish between them conceptually. In their analysis of regret, Gilovic and Medvec (1995) expressed this relatedness by proposing that feelings of regret are "likely to be tinged with guilt." In fact, guilt and regret share essential features. One commonality is that both emotions typically occur in situations when one feels responsible for a negative outcome or harm, which could have been avoided if one had chosen a different action. Thus, both guilt and regret are based on counterfactual choice evaluation, i.e., a comparison of an actual outcome of a choice with what could have happened in case of an alternative choice. Not surprisingly, both emotions accordingly also share essential phenomenological characteristics. For example, in a study by Russell and Mehrabian (1977) participants were asked to rate various emotions on a semantic differential (including pleasure–displeasure, arousal–non-arousal, and dominance–submissiveness). No difference between guilt and regret was found for any of the emotion features. Both guilt and regret, in contrast to most other emotions, are also closely related to agency and personally experienced responsibility. For example, Frijda et al. (1989), comparing appraisal components of 32 emotions, found that guilt and regret differed from all other emotions (including shame) by a particularly strongly associated experience of self-agency. Notably, guilt and regret also share an important functional feature: experiencing them is thought to regulate subsequent behavior by a motivation to avoid the occurrence of these feelings after future choices (Zeelenberg et al., 1996; Coricelli et al., 2005; Ellingsen et al., 2010; Chang et al., 2011). Of course, people are generally motivated to avoid negative emotional states, but because guilt and regret are so closely linked to personal choice behavior and therefore also to personal responsibility and control (which is much less the case for other typical negative emotions like anger or fear), people can actively and deliberately adopt appropriate choice strategies to regulate (i.e., reduce) the probability of experiencing them in the future. From this perspective, both guilt and regret can be regarded as "self-regulating emotions."

Nevertheless, despite all these similarities, two studies performing a closer analysis of the psychological determinants of guilt and

regret revealed one critical dimension that clearly distinguishes between guilt and regret, namely the social dimension (Berndsen et al., 2004; Zeelenberg and Breugelmans, 2008). In this context, social dimension refers to the target of the negative outcome or harm that one caused, i.e., whether the negative outcome affected oneself (intrapersonal or non-social condition) or another person (interpersonal or social condition). Both of the studies showed that when this factor is taken into account, guilt can be clearly distinguished from regret in being strongly associated with interpersonal but not intrapersonal harm, while no such specificity is found for regret. In one of the experiments, Zeelenberg and Breugelmans, 2008, Study 1) presented their subjects with two versions of a hypothetical scenario, asking them how they would feel in the respective situation. Specifically, participants were asked to imagine that they had left their clothes and shoes in the bathroom after taking a shower, and that later they themselves (intrapersonal condition) or their mother (interpersonal condition) would stumble over them, leading to a broken foot and unbearable pain. There was a highly significant interaction between the person suffering from harm (self vs. mother) and the emotion (guilt vs. regret). In particular, subjects rated substantially higher guilt but not regret for the interpersonal as compared to the intrapersonal condition. Similar patterns were found for emotion ratings of actual events that subjects recalled from their own past. Some data in the studies by Berndsen et al. (2004) pointed to an opposite pattern for regret than for guilt, i.e., stronger ratings after intrapersonal than after interpersonal harm, but this could not be confirmed by Zeelenberg and Breugelmans' (2008) data. Together, these results are in line with Baumeister et al.'s (1994) analysis of guilt as an inherently interpersonal emotion, which occurs in social relationships and helps to maintain them, although the specific difference between guilt and regret was not directly addressed in this analysis.

Based on the distinction between intra- and interindividual harm, the primary aim of the present study was to develop an experimental paradigm that allowed us to differentially induce guilt and regret online in a systematic manner as a result of subjects' actual choices during the experiment. Generally, it is quite a challenge to induce these emotions in standardized laboratory settings, especially for guilt, because this requires subjects to act in a way that makes them feel responsible for a damage to another person, which they would naturally avoid (particularly with the knowledge that one's behavior is continuously registered by an experimenter). To circumvent these problems, several procedures have been developed to induce feelings of guilt without directly linking them to choices made online within an experimental paradigm. Such procedures encompass the imagination of hypothetical scenarios (Takahashi et al., 2004; Moll et al., 2007; Kedia et al., 2008), giving false feedback (Amodio et al., 2007), reading newspaper articles (Stillman and Baumeister, 2010), or autobiographical memory paradigms, in which subjects write down specific emotional events from their own past (De Hooge et al., 2007; Gangemi et al., 2007; Nelissen et al., 2007) or are directly asked to specifically relive the emotions from such personal past events (Shin et al., 2000; Wagner et al., 2011). Especially the latter method is well suited to induce relatively intense feelings of guilt in the laboratory, because the strongest guilt-inducing stimuli are selected individually and refer to events that actually happened rather than merely being hypothetical situations (Wagner et al., 2011). In the present study, however, we were specifically interested in the occurrence of guilt and regret in the context of actual choices within the experimental setting. In this way, we would induce these emotions in a manner more fitting to simulate their natural occurrence, which is typically linked to individual choices. Furthermore we would also be able to analyze the consequences of experiencing guilt and regret on the regulation of subsequent choice behavior in repeated conditions.

For this purpose, we used a decision-making paradigm in which subjects repeatedly make choices with real monetary effects. Such paradigms were originally developed within the framework of game theory (von Neumann and Morgenstern, 1944) and are meanwhile frequently used in the fields of social neuroscience, neuroeconomics, and decision-making research to model the dynamics of choice behavior as well as to analyze the underlying neural mechanisms (Fehr and Camerer, 2007; Sanfey, 2007). In recent economic research, emotional factors like guilt and regret are sometimes incorporated into such models as parameters in mathematical formulas of utility functions developed to optimize the prediction of choice behavior in certain game-theoretical paradigms (Coricelli et al., 2005; Krajbich et al., 2009; Chang et al., 2011). However, even though these studies demonstrate that the role of guilt and regret in economic choice behavior has basically been acknowledged, participants in this type of research are typically not directly asked for their specific emotions after they have made a choice and got feedback about the outcome. Here, complementing these neuroeconomic approaches, we obtained participants' ratings regarding their feelings of guilt and regret, which allowed us to directly test the assumed interpersonal specificity of subjective guilt experiences in actual decisions. Although guilt and regret have already been addressed separately in a variety of studies of choice behavior, there is currently no decision-making paradigm that directly compares them as possible factors in their effects on choice behavior.

To develop such a paradigm, we relied on a well-established procedure from Coricelli and coworkers (Camille et al., 2004; Coricelli et al., 2005) that has been used to investigate (intrapersonal) regret, extending it by an interpersonal (social) condition to induce guilt. Within each trial of this paradigm, subjects choose which of two lotteries is to be played. For each of the two lotteries, the amount of money that can be won or lost is indicated on the screen, as well as the respective probabilities of winning or losing. After the decision, the selected lottery is played and the outcome (won or lost amount of money) is added/subtracted from the overall earnings of the subject. Apart from the outcome of the actually played lottery, the outcome of the non-selected lottery is also shown. This procedure, as applied in the original version of the paradigm developed by Coricelli et al. (2005), is well suited to induce regret, which is expected to occur when the outcome of the non-selected lottery would have been better than that of the selected lottery due to counterfactual evaluation. However, all outcomes are only attributed to the participant himself/herself in this original paradigm, so this would constitute only intrapersonal regret, as the possible negative outcome does not affect anybody else. We therefore introduced an interpersonal (social) condition, in which the decision was not made for oneself but for

another person. In order to maximize the probability and extent of feelings of guilt in this interpersonal condition, we designated as the other person a young child, Anastasia, in need of expensive medical treatment for which a local organization was collecting donations (see Materials and Methods, for details). In each trial, the outcome was either assigned to the subject ("self" condition) or to Anastasia ("other" condition), so that gains and losses were independently determined for the two conditions. The assignment was always announced at the beginning of each trial, before the subject made his or her choice. In control conditions (no responsibility), the computer made a random choice, and the subject just watched what happened on the screen. In the end of each trial, subjects were asked to rate how they felt about the outcome with respect to different emotions, including ratings of guilt and regret.

In short, our paradigm basically used the well-known Coricelli procedure, but extended it in two ways in order to allow a distinction between guilt and regret according to previous psychological research (Berndsen et al., 2004; Zeelenberg and Breugelmans, 2008). First, an interpersonal (social) condition was introduced in addition to the intrapersonal (non-social) condition. Second, specific emotion ratings were obtained after each trial, allowing us to directly test the psychological patterns of guilt vs. regret experiences from the studies of hypothetical scenarios and descriptions of personally recalled events within a behavioral decision-making paradigm. According to the results from Berndsen et al. (2004) and Zeelenberg and Breugelmans (2008), we hypothesized that guilt, but not regret, would be substantially more pronounced in the interpersonal than in the intrapersonal condition after negative outcomes[1]. In order to take individual *a priori* differences in the inclination to experience guilt into account, we also assessed Trait Guilt (TG) in each subject (Kugler and Jones, 1992; Jones et al., 2000). We expected stronger guilt feelings in individuals with high TG scores than in individuals with low TG scores after own choices with negative outcomes.

A second aim in this study was to analyze regulating effects of guilt and regret on subsequent choice behavior. As mentioned, both guilt and regret are thought to affect subsequent behavior by a motivation to avoid their occurrence in future choices (Zeelenberg et al., 1996; Coricelli et al., 2005; Ellingsen et al., 2010; Chang et al., 2011) and thus have the capacity to (down-)regulate themselves on the long run. In the present paradigm, there were only very limited options to act, and we held the expected values of the two lotteries within a trial constant, so there were also not many possible criteria on which subjects could decide in a way that would avoid guilt or regret in subsequent choices. Still, participants could decide on the basis of loss aversion (Kahneman and Tversky, 1984), i.e., choosing the lottery with the lower possible amount of lost money in the case of a loss, which would be a simple and effective strategy to reduce the expected extent of guilt/regret if the chosen lottery does not win[2]. We expected that particularly participants high in TG would be inclined to use such a strategy because – due to their overall increased tendency to experience guilt – they may be more motivated to avoid it. This expectation is based on previous findings that subjects with higher TG activate brain areas that are specific to the experience of guilt (in the orbitofrontal cortex) to a stronger degree than subjects with lower TG scores (Wagner et al., 2011). Although mostly pertinent to interpersonal choices, such a strategy would be expected to be adopted in all choices by individuals high in TG, because they tend to interpret their guilt feelings, more than individuals low in TG, as a general hint at possible threats also to the self (Gangemi et al., 2007). Nevertheless, apart from (and independent of) this expected general effect of TG on loss averse choice tendencies, TG could additionally moderate dynamic, condition-specific effects of the expected (interpersonal) guilt vs. (intrapersonal) regret experiences in trial-by-trial analyses. Here, however, subjects low in TG may be more sensitive. Hence, when directly experiencing negative outcomes of own choices, subjects low in TG, as compared with those high in TG, may be more inclined to use specifically (interpersonal) guilt as a relevant information to be considered in the next choice (in order to avoid repetition of this specific experience). This assumption is based on previous findings that subjects with low prosocial value orientation are most sensitive to guilt-induced enhancement of cooperative behavior (Ketelaar and Au, 2003; De Hooge et al., 2007; Nelissen et al., 2007). Accordingly, applying this directly to the personal inclination to experience guilt, more loss aversion would be expected in subjects scoring low in TG specifically after a negatively evaluated outcome in the interpersonal choice condition (assumed to elicit guilt) than in the intrapersonal choice condition (not assumed to elicit guilt). Furthermore, such an effect should be specifically exerted on the subsequent interpersonal condition, where in contrast to the intrapersonal condition guilt feelings would be imminent in the case of a "bad" choice.

MATERIALS AND METHODS

SUBJECTS

We recruited 23 subjects (10 female) for the experiment, who were paid for participation. All but one were right-handed and had no history of neurological or psychological disorder. Participants' ages ranged between 19 and 31 years (mean = 23.61 years) and each gave informed written consent. The study was approved by the local ethics committee at the Charité Berlin. One male participant was excluded because he expressed a generally very negative opinion on charity donations, counteracting the basic idea of our study.

[1]We did not formulate an opposite hypothesis for regret, i.e stronger regret experiences in the intrapersonal than in the interpersonal context. Based on the previous findings from Berndsen et al. (2004) and Zeelenberg and Breugelmans (2008), it seems to depend on specific circumstances of a situation whether regret per se would differ between intra- and interpersonal conditions. Accordingly, our focus is more on guilt than on regret here, and on the *difference* between guilt and regret. Therefore, whatever the effect on regret per se would be, we would in any case expect an interaction in that the propensity to be experienced more strongly in interpersonal as compared to intrapersonal contexts would be clearly more pronounced for guilt than for regret.

[2]An alternative possible strategy would be to compare both gambles in terms of risk as defined by the difference between the possible gain and the possible loss within each gamble. However, we expected that within the constraints of our paradigm, which includes repeated testing with limited decision time, subjects would rather rely on the less cognitively demanding strategy of loss avoidance, in which only two numbers have to be compared.

TASK AND EXPERIMENTAL PROCEDURE

Before participants were given the instructions to the actual task, they were presented with information about a 4-year old Ukrainian girl called Anastasia, the beneficiary of the earnings in the "other" condition. This information included a short text describing the current situation of the child (with a focus on the nature of her illness and her urgent need of medical treatment) and the organization that collects money for this treatment ("Berlin hilft e.V."). Subjects were informed that they would subsequently participate in a computer game where money could be won or lost not only for themselves, but also for Anastasia, depending on their choices in the game. It was made clear that there would be a real donation to the charitable organization collecting for Anastasia at the end of the experiment, and as proof, they would ultimately sign the money transfer form not only for themselves but also for Anastasia. As a further proof that Anastasia and the charitable organization "Berlin hilft e.V." really exists, subjects were shown the internet site of the organization, including photographs of Anastasia. Subsequently, they indicated on rating scales in a short questionnaire their opinion on the usefulness of the organization's aim to collect donations for Anastasia's medical treatment, and their momentary impulse to actually donate to Anastasia. These control questions confirmed a generally positive attitude (means ± SEM on rating scales from 0 to 10: 8.41 ± 0.40 for usefulness, 6.41 ± 0.57 for current impulse to donate).

Subjects then read the instruction for the experimental task. As mentioned, the task was based on the well-established paradigm by Coricelli and colleagues (Camille et al., 2004; Coricelli et al., 2005), but we used a visually simplified version as described by Nicolle et al. (2011). Participants were instructed to choose between two "wheel of fortune" lottery gambles on each trial, each featuring a win and a loss outcome with differing probabilities (25, 50, or 75%). The probabilities of their possible financial gain or loss were represented by the relative size of colored sectors of a circle (green for win probabilities and red for loss probabilities). Possible gains and losses in a given trial were indicated by positive numbers on the green part of the respective circle (for the possible gains) and negative numbers on the red part of the respective circle (for the possible losses). These numbers represented Euro cents that could be won or lost in the respective lottery, which could be up to 500 cents per trial. In half of the trials this amount of money was assigned to the subject ("self" condition = intrapersonal), in the other half of the trials it was assigned to a donation to Anastasia ("other" condition = interpersonal). Additionally, as a control condition for choice responsibility (a critical prerequisite for feelings of both guilt and regret), in both the "self" and the "other" condition, subjects could not choose the lottery themselves, but the computer made a random choice, which subjects could only watch passively on the screen ("follow" condition). No or only very low feelings of guilt and regret were expected to occur in these trials due to a lack of felt responsibility. Thus, the design comprised the two within subjects factors "self vs. other" and "choose vs. follow," with differences between "self" and "other" in the "choose" condition being of primary interest. It should be noted, however, that despite the passivity of the subject in the "follow" trials, these trials were as relevant as the "choose" trials in terms of monetary gain or loss, because their outcomes were still assigned either to the subject or to Anastasia according to the "self"/"other" condition, just as in the "choose" trials.

Altogether, the experiment comprised 128 trials, i.e., 32 per experimental condition, presented in random order. The assignment of specific lottery pairs to experimental conditions was balanced across subjects. An initial capital of 5 Euro was assigned separately to both the subject and to Anastasia, and subjects were told that depending on their decisions, their own as well as Anastasia's initial capital could increase (to up to more than 50 Euro in the best case) or be lost completely in the course of the experimental game. The task was displayed by Eprime2 software on the screen of a desktop computer located on a table in front of the participant. Before the actual task began, subjects performed a short practice run in order to get familiarized with the basic procedure.

Figure 1 shows an exemplary trial of the task from the start up to the display of the gamble outcome. At the beginning of each trial, subjects were presented with a slide informing them about which of the four possible conditions would follow, i.e., showing information about (i) who they were playing for ("self" or "other"

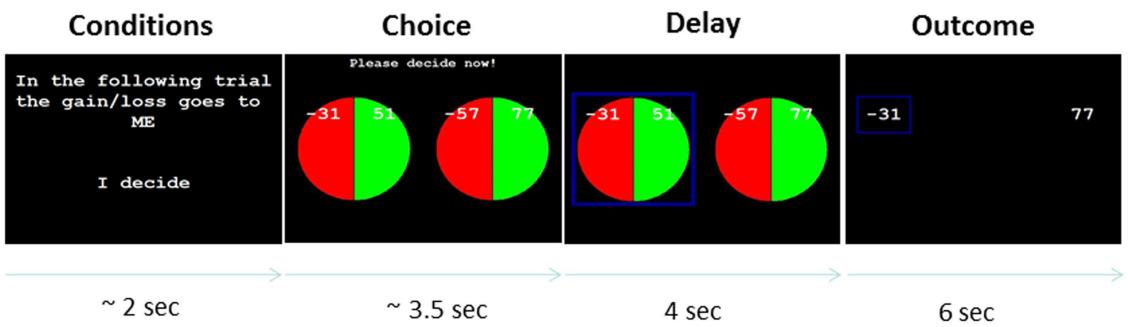


FIGURE 1 | Exemplary trial. One of two lotteries was to be chosen in each trial. The outcome of the chosen lottery had actual monetary consequences (gain or loss) for either the participant or Anastasia. In the beginning of each trail, the experimental condition of the trial was announced. There were four possibilities, depending on whether the gain/loss of the chosen lottery would be assigned to the participant or to Anastasia ("self" vs. "other" condition), and whether the participant or the computer would decide which lottery would be played ("choose" vs. "follow" condition). See text, for detailed description of the procedure.

condition) and (ii) whether it would be them or the computer deciding between the two gambles ("choose" or "follow" condition). After subjects indicated by a button press that they had understood this information, the trial itself started by showing the two lotteries, one of which was to be selected.

In "choose" trials, the preferred gamble was selected by the subject by means of pressing either "c" (gamble on the left-hand side) or "v" (gamble on the right-hand side) on the computer's keyboard. Participants were allowed up to 8 s to make their choice (which was abundant time; mean choice time was 3.49 s). A longer hesitation resulted in a message on the screen reminding them to act faster in the future (which occurred very rarely, on average 1.2 times per subject) before going straight on to the next trial. To ensure that choice times in the "follow" conditions (computer choices) did not differ from the "choose" conditions, the average of the previous three "choose" trials was used as the choice times in the "follow" conditions. Once selected (by either the subject or the computer), the chosen gamble was highlighted on the screen by a blue square, which remained there for 3–5 s (4 s on average). After this delay phase, the outcomes of both gambles (the selected one and the non-selected one) were shown, with the outcome of the selected gamble again being highlighted by a blue square.

After the outcome phase participants were asked to indicate how they felt about the outcome by several subjective ratings. Ratings were provided in a two-stage procedure. First, subjects gave an overall rating on how they felt on a 6-point scale ranging from "very negative" to "very positive." The scale was presented as six horizontally arranged boxes on the screen, with the two verbal labels as anchors shown on the left ("very negative") and on the right ("very positive"). Participants were able to move a cursor (initially positioned in the middle) between the six boxes and finally confirmed their choice by pressing the key "m." Then, in the second step, if the final position of the cursor had been in one of the three boxes symbolizing predominantly negative feelings about the outcome (the focus of interest here), the subject was asked to rate the extent of several specific negative emotions felt, namely guilt, regret[3], anger/irritation, and disappointment. This was done by means of moving the cursor on a straight line, with no such feeling on the outmost left (verbally anchored as "not at all") and a very intense feeling being on the outmost right (verbally anchored as "very strong"). All these questions started with the cursor on the outer left (i.e., using no feeling of the respective emotion as the default) rather than in the middle of the scale, to avoid a possible bias of central tendency. The final cursor position had to be confirmed by pressing "m" before the next question appeared. Eleven cursor positions were possible, which were recoded into numbers from 0 to 10. Analogously, if the participant had initially indicated to feel predominantly positively about the outcome (by choosing one of the three rightmost boxes in the first question), he/she was subsequently asked to rate the extent of several specific positive emotions felt, namely joy/happiness, relief, contentment, and pride. In all trials (whether negative or positive), subjects were further asked in the second rating step to indicate to which extent they felt responsible for the outcome (as a control question for the "choose" vs. "follow" manipulation). The five ratings contained in the second rating step were presented in randomized order. Because the negative emotions guilt and regret were in the focus of interest here, analyses of the subjective ratings were limited to the negatively evaluated outcomes.

The two gambles in each presented gamble pair were of equal or nearly equal expected value (maximal difference of 3 cents). In order not to draw attention to this fact, we used uneven values for gains and losses in most of the gambles (avoiding numbers that could be divided by 10), so that an exact calculation of expected values was difficult even after some task practice. (This procedure is the reason why expected values were not always exactly the same between the two gambles, but could deviate by a few cents.) Furthermore, following the procedure of Nicolle et al. (2011), to additionally obscure the fact that expected values in each gamble pair were essentially identical, as well as to enhance feelings of skill in the game, two of the trials in each condition were "catch trials." This term refers to trials including one gamble with a clearly higher expected value than the other. These "catch trials" were not included in statistical analyses. One catch trial as well as two of the remaining trials in each condition further served as "attention control trials." In these "attention control trials," the outcome phase was not followed by subjective emotion ratings but by three questions to determine how well the participant had paid attention to the experimental conditions of the current trial. Specifically, subjects were asked (i) who decided in the current trial (self or computer), (ii) who received the gain/loss in the current trial (self or Anastasia), and (iii) which of the two gambles had the better outcome (the selected one or the non-selected one). Because subjects knew that such control trials would occur repeatedly throughout the experiment, they were forced to keep their attention level high during the entire time. (In fact, analyses on these control trials confirmed this, with only 1.1 mistakes made per person on average.) Since these trials could not be analyzed due to the absence of emotion ratings, there were finally 112 valid trials (28 per experimental condition) for statistical analyses in each subject. Although gambles in these 112 valid trials were mostly played exactly in the way as indicated on the screen (random and independent outcomes) we manipulated the outcome of three trials per condition to make sure that at least some negatively evaluated outcomes expected to be primarily associated with guilt or regret (which was our focus of interest) actually occurred. Specifically, we made sure that the chosen gamble in these trials lost and the non-chosen gamble won. (In turn, to compensate for this bias toward losing, we made sure that the selected gamble always won in the "catch trials" mentioned above).

After the gamble task, which took about 45 min, subjects filled out the TG scale of the Guilt Inventory (Jones et al., 2000), consisting of 20 items rated on 5-point response scales (exemplary items are: "Guilt and remorse have been a part of my life for as long as I can recall," "I often feel 'not right' because of something I have done," and (with reverse scoring) "Guilt is not a particular problem for me"). Before final debriefing, subjects received their monetary

[3]There are two possible German translations for "regret", i.e. "bedauern" and "bereuen". In our experiment, we used the latter one, which more than the former one implies personal responsibility. We used the verb form "bereuen" because the corresponding noun "Reue" has a religious connotation (similar to repentance) and would normally not be used with respect to simple decisions made in everyday life.

payoff, consisting of a show-up fee of 24 Euro (some of the subjects were psychology students that chose to be reimbursed instead by course credits) and an additional amount based on the outcome of the experimental task. A task-dependent earning was also calculated for Anastasia. As the total expected value across all gamble outcomes was below zero, only few participants actually won anything for themselves or for Anastasia. For ethical reasons, those who lost were informed that they had kept their initial starting capital of five Euros. The same applies to Anastasia. Hence, all participants ended up with additional earnings of at least five Euros for themselves as well as for Anastasia. Participants were informed about their own and Anastasia's earnings and signed both money transfer forms, and the respective amounts of money were then transferred to the subject and to the charitable organization "Berlin hilft e.V.," respectively.

RESULTS

COMPARISONS OF EMOTIONAL EXPERIENCES BETWEEN "SELF" (INTRAPERSONAL) AND "OTHER" (INTERPERSONAL) CONDITIONS

Because the focus of interest was on the negative emotions guilt and regret, the primary analysis comparing the "self" (intrapersonal) vs. "other" (interpersonal) conditions was performed on the negatively evaluated trials (i.e., trials with overall outcome evaluations below the midpoint of the overall negative-to-positive outcome evaluation scale[4]). First, a 2 × 2 ANOVA was performed only on "choose" trials with "guilt vs. regret" and "self vs. other" as within subjects factors, as an analysis directly corresponding to previous psychological studies on intra- vs. interpersonal situation descriptions (Berndsen et al., 2004; Zeelenberg and Breugelmans, 2008). **Figure 2** shows the results. Both main effects were significant ["guilt vs. regret," $F(1,21) = 25.0$, $p < 0.001$; "self vs. other," $F(1,21) = 24.7$, $p < 0.001$]. Most critically, these main effects were qualified by a significant interaction between the two factors [$F(1,21) = 22.8$, $p < 0.001$]. Subsequent pairwise t-test comparisons between "self" and "other" separately for guilt and regret revealed that, as expected, guilt was more strongly experienced in the interpersonal "other" condition than in the intrapersonal "self" condition [$t(21) = 5.62$, $p < 0.001$], while this was not the case for regret [$t(21) = 1.64$, $p = 0.12$], although the trend in the means was in the same direction as for guilt. Pairwise comparisons within conditions further showed that ratings of regret were stronger than ratings of guilt in the "self" condition [$t(21) = 6.61$, $p < 0.001$], but not in the "other" condition [$t(21) = 1.43$, p = 0.17]. The same analysis performed on "follow" control trials (in which guilt and regret ratings were generally very low, as expected; see **Table 1**) did not reveal any significant effects, confirming specificity of the pattern to conditions of subjectively experienced responsibility. Also, when the factor "choose vs. follow" was directly included as an additional factor in the ANOVA, all respective interactions with this factor were likewise highly significant ($p < 0.005$).

When TG was introduced as an additional between-subjects factor in this ANOVA (two groups of $n = 11$ each, formed by median split), this factor did not moderate the critical guilt/regret × self/other interaction [$F(1,20) = 0.66$, $p = 0.43$, for three-way interaction with TG]. However, TG interacted with the factor "guilt vs. regret" alone, indicating generally enhanced ratings of guilt, but not regret, in high as compared to low TG scorers [$F(1,20) = 4.22$, $p = 0.05$]. Separate analyses performed in high and low TG subjects confirmed a significant guilt/regret × self/other interaction in both groups [strongly enhanced ratings of guilt, but not regret, in the interpersonal as compared to the intrapersonal condition; high TG: $F(1,10) = 10.02$, $p = 0.01$, guilt-other 5.18 ± 0.77 vs. guilt-self 2.78 ± 0.78; regret-other 4.93 ± 0.70 vs. regret-self 4.98 ± 0.64; low TG: $F(1,10) = 16.43$, $p = 0.002$, guilt-other 3.90 ± 0.72 vs. guilt-self 1.23 ± 0.56; regret-other 5.21 ± 0.71 vs. regret-self 4.28 ± 0.59].

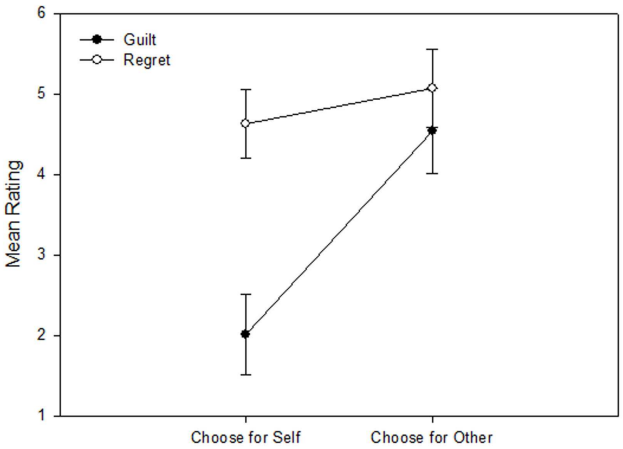


FIGURE 2 | Ratings of guilt and regret (means ± SEM) after negatively valenced outcomes when subjects had chosen a lottery for themselves ("self" condition = intrapersonal/non-social) or for Anastasia ("other" condition = interpersonal/social). Guilt but not regret predominantly occurs in the interpersonal context.

Table 1 | Subjective ratings.

	Choose		Follow	
	Self	**Other**	**Self**	**Other**
Guilt	2.01 (0.50)	4.54 (0.53)	0.42 (0.26)	0.65 (0.29)
Regret	4.63 (0.43)	5.07 (0.49)	1.88 (0.56)	1.69 (0.56)
Anger/irritation	5.74 (0.37)	6.32 (0.41)	5.05 (0.37)	5.61 (0.45)
Disappointment	5.83 (0.37)	6.67 (0.40)	5.47 (0.45)	5.68 (0.42)
Responsibility	5.07 (0.53)	5.54 (0.56)	0.19 (0.11)	0.19 (0.10)

Values indicate means and SEMs (in brackets) for negatively evaluated outcomes on rating scales ranging from 0 to 10.

[4]On average, each experimental condition was represented by 14.2 trials, without differences in the amount of trials between conditions ($p > 0.20$). The broad majority of these trials (88%) was associated with both an absolute financial loss (i.e., the chosen lottery lost) and a relative financial loss (i.e., the non-chosen lottery won, or it lost less than the chosen lottery). On average, the absolute monetary loss was 2.17 ± 0.05 Euro and the relative monetary loss was 2.15 ± 0.15 Euro in these trials, without any significant differences between experimental conditions ($p > 0.25$ for all main effects and interactions). Thus, differences in experienced emotions between conditions cannot be explained simply by differences in objective outcomes.

For explorative purposes, we also looked for sex differences, using gender instead of TG as a between-subjects factor. In fact, there was a significant three-way interaction with gender, indicating that the critical guilt/regret × self/other interaction was stronger in women than in men [$F(1,20) = 7.44$, $p < 0.05$]. However, because the overall pattern was the same in men as in women and was still significant when calculated separately in men alone [$F(1,11) = 7.43$, $p = 0.02$], we do not consider sexes separately in the interpretation of results.

For the sake of completeness, **Table 1** shows means and SEMs also for the other negative emotions anger/irritation and disappointment, as well as responsibility ratings, in all experimental conditions (data not separately shown for the low vs. high TG scorers because of the lack of effects of this factor; all ps > 0.12). These data show that guilt and regret, unlike disappointment, and anger/irritation, were generally closely linked to the "choose" condition, where participants felt – in contrast to the "follow" condition – personally responsible for the outcome.

Because the difference between "other" and "self" was of primary interest here as an indicator of specificity to a social context, we directly calculated in a complementing analysis this difference as a separate dependent variable and compared guilt not only with regret, but also – as an additional control for specificity – for the other negative emotions disappointment and anger/irritation (as well as the control variable of perceived responsibility), and performed the same comparisons not only in the critical "choose" conditions, but also in the no-responsibility control condition of "follow" trials (**Figure 3**). The figure shows that although all emotions were overall somewhat higher in the "other" than in the "self" condition when subjects had actively chosen the gamble to be played, only guilt showed a distinct specificity in this regard. This was confirmed in a 5 (emotion) × 2 (choose/follow) within subjects ANOVA by an emotion × choose/follow interaction [$F(4,84) = 11.38$, $p < 0.001$] qualifying a choose/follow main effect [$F(1,21) = 21.23$, $p < 0.001$]. In fact, guilt in the "choose" condition differed strongly from all other emotion ratings in this respect (all pairwise comparisons $p < 0.001$). Regarding "follow" control trials (gray columns in **Figure 3**), there was no consistent pattern, and for none of the emotions did the other-self difference differ significantly from zero.

Despite the differential extent of guilt and regret experiences depending on interpersonal vs. intrapersonal choices, correlation analyses still showed a close relation between responsibility, guilt, and regret even within the "choose" conditions, where responsibility ratings were generally on a high level. In the critical "Other-Choose" condition, the only condition where ratings indicated the experience of both guilt and regret to a substantial degree, both guilt and regret were highly correlated with subjectively perceived responsibility and also correlated with each other (correlation guilt-responsibility, $r = 0.68$; correlation regret-responsibility, $r = 0.70$; correlation guilt-regret, $r = 0.74$; all $p < 0.001$). Even in the "Self-Choose" condition, despite the generally low level of guilt, responsibility correlated with both regret and guilt (correlation regret-responsibility, $r = 0.77$, $p < 0.001$; correlation guilt-responsibility, $r = 0.44$, $p < 0.05$), and guilt and regret ratings also showed a strong direct correlation ($r = 0.64$, $p < 0.001$). (The correlations between guilt and regret even survived when disappointment and anger/irritation were partialed out ($p < 0.05$), but lost significance when responsibility was additionally partialed out.) When TG was correlated with guilt and regret ratings in the Other-Choose condition, the correlation with guilt but not with regret was significant (guilt, $r = 0.47$, $p < 0.05$; regret $r = 0.17$, $p = 0.46$). In the Self-Choose condition, TG likewise correlated with guilt ($r = 0.49$, $p < 0.05$) but also with regret ($r = 0.42$, $p = 0.05$).

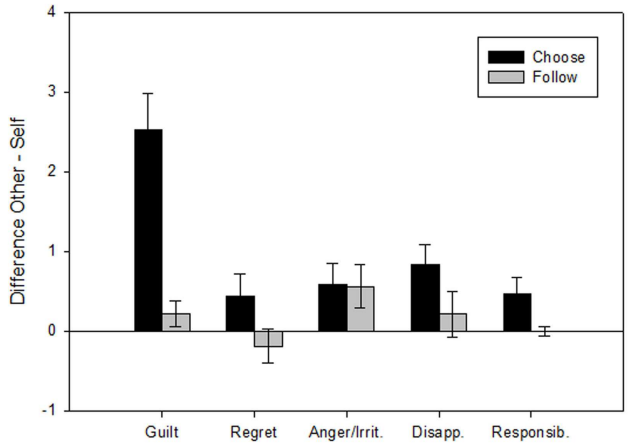


FIGURE 3 | Rating differences (means ± SEM) between "Other" and "Self" conditions (as an indicator of specificity to a social context) for guilt, regret, anger/irritation, disappointment, and responsibility after negatively evaluated trial outcomes. In the active "choose" conditions (black bars), guilt showed distinct social specificity, differing from all other emotions (all $p < 0.001$). In passive "follow" conditions (gray bars), no social specificity was observed for any of the ratings.

TRAIT GUILT AND LOSS AVERSION

To test the hypothesis that higher TG is associated with stronger loss aversion, we first compared low and high TG scorers with respect to the overall number of trials in the "choose" condition in which they preferred the option with lower possible loss over the option with higher possible loss, using a t-test for independent samples. This analysis revealed a significant difference, with a higher percentage of loss averse choices for high as compared to low TG subjects ($23.2 \pm 2.8\%$ vs. $15.3 \pm 2.1\%$, $t(20) = 2.25$, $p < 0.05$).

To test the additional possibility of a more dynamic and more specific influence of TG on choice behavior, we first computed four different variables for each subject: (1) the percentage of negatively evaluated other-choose trials followed by a loss averse choice in the next other-choose trial ("Other–Other" condition), (2) the percentage of negatively evaluated other-choose trials followed by a loss averse choice in the next self-choose trial ("Other-Self" condition), (3) the percentage of negatively evaluated self-choose trials followed by a loss averse choice in the next self-choose trial ("Self–Self" condition), and (4) the percentage of negatively evaluated self-choose trials followed by a loss averse choice in the next other-choose trial ("Self-Other" condition). The first two of these variables represent the conditions of choices after experiencing (interpersonal) guilt, while the latter two variables represent the

conditions of choices after experiencing (intrapersonal) regret. Any specific effects of these emotions would be reflected in selectively enhanced values in congruent choice conditions corresponding to these emotions, i.e., the "Other–Other" condition for specific effects of guilt and the "Self–Self" condition for specific effects of intrapersonal regret. Furthermore, no such effects should occur when a previous choice was not negatively but positively evaluated due to the absence of guilt or regret feelings. For control purposes, we therefore calculated the same four variables also for the choices after positively evaluated outcomes. Thus, the percentage of loss averse choices in these different conditions was subjected to an ANOVA, with the three within subjects factors "self vs. other" in current trials, "self vs. other" in the next "choose" trial, and "negative" vs. "positive" emotional evaluation of the current outcome, and the additional between-subjects factor low vs. high TG.

This ANOVA showed that, apart from a main effect of high vs. low TG [$F(1,20) = 5.05$, $p < 0.05$, confirming the above mentioned overall t-test comparison between the two groups], emotion-specific effects indeed occurred depending on TG. Specifically, a main effect of "self vs. other" in the next choice was qualified not only by an interaction with valence ("negative" vs. "positive") but also with "self vs. other" in the current choice in combination with TG [all $F(1,20) > 4.5$, $p < 0.05$]. To break down these differential effects depending on TG, we analyzed the emotion-specific patterns separately in the groups of high vs. low TG subjects. Within the high TG group, only the main effect of "self vs. other" in the next choice was statistically significant, indicating overall higher loss aversion in "Self" than in "Other" conditions [$F(1,10) = 6.65$, $p < 0.05$]. In contrast, within the low TG group a more complex, emotion-specific pattern was observed, in which a main effect of valence was qualified by an interaction with "self vs. other" in the next choice, and by an interaction with "self vs. other" in the next choice in combination with "self vs. other" in the current choice [all $F(1,10) > 8.3$, $p < 0.05$]. Inspection of the mean values in the different conditions (**Table 2**) shows that this interaction reflects an effect specifically related to the condition of guilt experience (negative Other condition) in this group of subjects. In fact, subjects in this group, just as those in the high TG group, likewise showed an overall tendency toward higher loss aversion in decisions for oneself in all conditions, while only after experiencing guilt this pattern was reversed (i.e., higher loss aversion in decisions for Anastasia). Directly correlating TG with loss averse choice behavior confirmed the ANOVA results. TG was positively correlated [$r = 0.37$] with loss aversion overall (reflecting the main effect), but negatively correlated specifically with the difference between loss averse interpersonal choices after guilt experience (i.e., negative Other–Other condition) and respective control conditions on which the complex interactive effect is based (difference to negative Other–Self, $r = -0.65$; difference to positive Other–Other, $r = -0.41$; each $p < 0.05$).

A control analysis using risk-avoiding choice behavior as the dependent variable (choosing the lottery with the lower difference between the possible gain and the possible loss) did not reveal any statistical significance (all ANOVA effects $p > 0.12$), showing specificity of the observed effects to the simpler choice strategy of loss aversion, in which possible gains are not considered.

Table 2 | Percentages of loss averse choices.

	Current choice	Self		Other	
	Next choice	Self	Other	Self	Other
High trait guilt	Negative evaluation	23.3 (3.8)	18.3 (5.5)	32.1[a] (4.7)	21.2[a] (4.5)
	Positive evaluation	24.3 (4.3)	17.4 (3.6)	31.8[b] (6.5)	17.5[b] (1.3)
Low trait guilt	Negative evaluation	18.3 (2.1)	15.6[c] (3.7)	12.8[d] (3.0)	23.2[c,d,e] (3.8)
	Positive evaluation	14.3 (2.3)	11.1 (3.5)	16.3 (4.3)	10.8[e] (2.7)

Values indicate means and SEMs (in brackets) for percentages of subjects' loss averse next choices when they evaluate the outcome of their choice in the current trial as emotionally negative vs. emotionally positive, depicted separately for the four possible combinations of choice conditions ("Self" followed by "Self"/"Self" followed by "Other"/"Other" followed by "Self"/"Other" followed by "Other") and for participants scoring high vs. low on Trait Guilt (n = 11 per group). Current "Self" choice with negative emotional evaluation is associated with (intrapersonal) regret, current "Other" choice with negative emotional evaluation is associated with (interpersonal) guilt. High Trait Guilt scorers are generally more loss averse, but unlike low scorers do not change their choice behavior in response to specific emotional experiences in the current choice trial. Values with identical superscript differ significantly from each other in pairwise comparisons between experimental conditions at $p < 0.05$.

Although women and men did not differ significantly in TG in our sample [women 54.16 ± 3.37, men 50.56 ± 3.61, $t(20) = 0.72$, $p = 0.48$], we also performed a control analysis on loss averse choices using gender instead of TG as between-subjects factor. None of the effects including gender reached significance (all $p > 0.31$), excluding the possibility that the differential effects observed for low vs. high TG subjects would simply reflect gender differences.

DISCUSSION

Extending a well-established experimental procedure of intrapersonal regret (Camille et al., 2004; Coricelli et al., 2005) by adding an interpersonal (social) dimension, we present here an experimental procedure which allows a differential induction of feelings of guilt and regret. Specifically, in accordance with previous psychological findings based on descriptions of scenarios or personal past events, guilt was induced to a stronger degree when subjects felt responsible for interpersonal harm than when they felt responsible for intrapersonal harm. This was not the case for regret, nor for disappointment, or anger/irritation, although the means in all these emotions tended into the same direction as for guilt. Not only the clear pattern of results that confirmed the primary hypothesis on the differences between guilt and regret is remarkable, but also the absolute intensity of these feelings elicited in this very simple choice paradigm (means of about five on a scale ranging from 0 to 10 in the conditions of interest). As to regret, we had not formulated a specific hypothesis, because previous results were inconsistent with regard to the intrapersonal vs. interpersonal nature of regret (Berndsen et al., 2004; Zeelenberg and

Breugelmans, 2008). In the present study, we found no substantial difference between regret ratings between intrapersonal and interpersonal choice conditions, consistent with the findings from Zeelenberg and Breugelmans (2008).

Despite the clearly different pattern of means for guilt and regret between conditions, our results obtained from correlation analyses also confirm the specific commonalities of these two emotions. In contrast to other negative emotions, guilt and regret were closely associated with subjectively experienced responsibility. Even within "choose" conditions (associated with high responsibility) both guilt and regret correlated substantially with subjective responsibility, and they were also highly correlated with each other. Particularly in interpersonal choice conditions, where both guilt and regret ratings had similarly high absolute values, this raises the interesting question of what conceptually distinguishes guilt from interpersonal regret. Obviously, while there can be regret without substantial guilt (as shown in the intrapersonal condition), it may be impossible to experience guilt without regret in interpersonal conditions, and the high correlation between the two emotions suggests that they do not only co-occur in these contexts, but indeed strongly overlap conceptually. In other words, guilt and interpersonal regret may describe essentially the same core emotion. Alternatively, there may still be differences in the sense that, contrary to interpersonal regret, guilt is not only linked to a social context but also to moral evaluations in a certain situation. A closely related question would be whether regret experienced in an intrapersonal context is qualitatively the same as regret experienced in an interpersonal context. If not, it would be useful to use different names for them, or to always add the respective adjective describing the particular context. The present study was not designed to answer these questions, which should be investigated more directly in future studies. In the following, we will refer to regret only as intrapersonal regret, not only because this is the traditional use of the term in regret research (Mellers et al., 1999; Camille et al., 2004; Coricelli et al., 2005), but also due to its obvious close link to guilt in the interpersonal domain.

It is noteworthy that subjects indicated strongly enhanced feelings of responsibility (and as a consequence also of regret and guilt) after own lottery choices, compared to those made by the computer, even though the final outcome was still a matter of chance. (Subjects did not have to choose the outcome directly, but only the lottery to be played.) This underlines the role of subjective responsibility, as opposed to objective responsibility, as critical factor underlying feelings of guilt and regret. Although objective and subjective responsibility would normally coincide, the latter appears to be the primary determinant if they do not. For example, people typically feel more regret when a negative outcome is a result of their action rather than of their inaction (Kahneman and Tversky, 1982), which can be explained by reduced sense of responsibility for inaction. Conversely, subjectively perceived responsibility may be experienced in certain cases of "survivor guilt" in people who are the only survivor of a traffic accident, even though they were not involved in any way in the circumstances leading to the accident. Thus, although our simplified paradigm does not simulate a prototype of an everyday situation of guilt and regret, it still captures subjective responsibility as a central factor.

A specific advantage of the present paradigm, consisting of a series of personal choices, is that it not only allows the differential induction of guilt and regret, but also examining how avoiding these emotions can affect choice behavior. Because such effects are likely to be influenced by personality differences pertinent to these emotions (De Hooge et al., 2007; Gangemi et al., 2007; Nelissen et al., 2007), we focused here on guilt, for which, in contrast to regret, established procedures to assess stable individual differences exist (see Robins et al., 2007, for an overview). In the present paradigm, subjects had few opportunities to employ complex choice strategies in order to avoid guilt or regret, and there was no objectively better choice option because in each trial both lotteries had comparable expected values. Given these constraints of the task, we assumed that subjects motivated to avoid guilt or regret would apply the simple strategy of loss aversion by choosing the lottery in which less money was lost in the case of a loss. We found two interesting results in this regard. First, subjects high in TG were generally more loss averse than those low in TG. Second, however, only subjects *low* in Trait displayed enhanced loss aversion in the next emotion-congruent trial (next interpersonal choice) after an antecedent experience of guilt. Although seemingly contradictory at first glance, this pattern makes sense. Subjects high in TG are probably most strongly motivated to avoid guilt. As confirmed by our data, these subjects did indeed exhibit overall higher guilt ratings after choices with negative outcomes. Because this was likewise the case for interpersonal as well as for intrapersonal choices, it makes sense that these subjects generalize their motivation to avoid guilt to all decisions. From this perspective, loss aversion *per se* in risky choices may represent a stable trait-like factor, which is linked to high TG. In contrast, low TG scorers, who do not feel guilt as frequently, may be able to use their guilt and regret feelings more readily as helpful information that they can use to adapt future behavior specifically under similar circumstances.

Thus, our results confirm previous studies also pointing to personality-dependent effects of guilt-associated behavior. In a study from Ketelaar and Au, 2003, Study 1, effects of experimentally induced guilt led to increased cooperation in a repeated prisoner's dilemma game only in subjects who initially played uncooperatively (a behavior likely to be associated with low TG), while participants who played highly cooperatively from the beginning, showed no effect of guilt induction. Such effects may be explained by a ceiling effect, but this explanation would not be convincing because subjects were clearly below ceiling at least in some of the conditions, and even more so in the present study, where the overall percentage of loss averse choices was on average below 25% even in high TG subjects[5]. The findings by Ketelaar and Au (2003) were further supported by subsequent studies demonstrating that only proself-oriented, but not prosocial subjects were particularly sensitive to effects of guilt induction procedures on subsequent cooperation in a one-shot social dilemma game (De Hooge et al., 2007; Nelissen et al., 2007).

[5]The generally low level of loss-averse choices may be explained by the fact that subjects knew that overall not more than the initial capital could be lost. Hence there was no overall risk to really lose money in the experiment, which may bias subjects toward optimistic choices.

Consistent with these previous results, and in line with the original interpretation from Ketelaar and Au (2003), we would therefore take our findings as a support for a functional view of the "affect-as-information" model (Schwarz and Clore, 1983), where using the own affective state (in this case: feelings of guilt) as an information for future behavior is most effective in individuals who are not too strongly accustomed to experiencing these emotions. If experiencing certain emotions becomes a habit or trait (as in the case of guilt in high TG scorers), these emotions may become less informative, and a more general pattern of choice behavior (a general loss aversion here) may emerge. This more general effect, found to be related to high TG in our study, is in line with a previous study by Gangemi et al. (2007) who showed that individuals high in TG more than those low in TG use their guilt feelings as information about possible threats when anticipating types of negative events in which oneself feels responsible and which would potentially lead to damage not only to others, but also to oneself.

Our analysis focused on loss aversion, because we assumed that subjects' differential motivation to avoid guilt or regret would most likely be reflected in this behavioral strategy as the easiest possible strategy that subjects could apply within the constraints of our experimental paradigm. Consistent with this assumption, we did not observe differences between experimental conditions when we performed the same analysis on risk-focused rather than simply loss-focused behavior, i.e., a strategy that compares the two lotteries not only with regard to possible losses but with regard to the difference between gains and losses within each lottery. Such risk-focused behavior is more cognitively demanding in our task because it requires taking four rather than only two numbers into account as a basis for the decision. However, these results do not imply that loss averse choice behavior would generally be the preferred strategy that people apply. Depending on specific circumstances of a task (e.g., number of trials, time limits for decisions) risk-focused strategies can likewise be used. We would expect this particularly if such a strategy is less cognitively demanding than in our task. This is in fact the case in the more prototypical studies related to risk aversion vs. risk seeking, where subjects choose between a gamble and a safe option, so that the risk differences between the two alternatives are obvious. Actually, behavioral effects of anticipated regret and guilt have previously been shown in such tasks (e.g., Zeelenberg et al., 1996; Mancini and Gangemi, 2003). The influence of task-dependent cognitive load is certainly a relevant aspect that would deserve closer examination in future studies.

In sum, the results on the effects of emotional experiences on choice strategies in our paradigm overall demonstrate basically two ways in which guilt and regret could exert self-regulating effects via an influence on loss averse choice behavior. One is a general one linked to high TG, i.e., an individual tendency to experience guilt (but most likely also to some degree to the tendency to experience regret, because the TG scale does not unambiguously differentiate between the two emotions), which leads to generally enhanced loss aversion in decisions. This way, these individuals can generally minimize the occurrence of both guilt and regret. The second way is a situation-specific effect where interpersonal guilt and intrapersonal regret experiences lead to behavioral changes only in subsequent congruent experimental conditions, i.e., when interpersonal guilt and intrapersonal regret can be avoided, respectively. However, this second effect is not independent of the first one, because it is only found in individuals with low TG in relation to guilt avoidance. It can therefore be regarded as an alternative strategy for those subjects who do not adopt the general strategy, as the high TG scorers do.

Both strategies can be interpreted within the framework of "indirect causation theory" (Baumeister et al., 2007), which proposes that consciously experiencing emotions enables people to learn from their experiences. Specific evidence for this view with regard to guilt comes from self-reports of people who typically indicate that they have learned something from personal events in which they had experienced guilt feelings (Baumeister et al., 2007; Stillman and Baumeister, 2010). Our data suggest that one behavioral indicator of this learning process is expressed in loss aversion (consistent with an attempt to avoid feelings of guilt and regret), but what exactly has been learned in this regard appears to differ between individuals high vs. low in TG as a result of different learning histories associated with guilt experiences. Whereas the former group, being prone to guilt in all choice situations (as confirmed by our subjective rating data), apparently learned a general lesson to avoid guilt (but also all other associated negative emotions, including regret) in decision situations, the latter group seems to have learned more specifically to behave in a way that avoids the repetition of a specific guilt experience having occurred shortly before (cf. "feeling-is-for-doing" approach by Zeelenberg et al., 2008). Put differently, the first group may have adapted their behavior more generally on the basis of their overall enhanced guilt experiences, regardless of their occurrence in a specific situational context, while the other group rather learned to use these emotions to change behavior acutely within a situational context.

Regarding differences between guilt and regret, at least the second strategy appears to be clearly emotion-specific, being confined to conditions of interpersonal choice, and hence experiences of guilt. However, two possible caveats are to be considered here. First, our data show a generally higher loss aversion in "self" choices than in "other" choices. This might indicate that subjects' motivation to avoid intrapersonal regret was overall higher than the motivation to avoid guilt, and could therefore less easily be further enhanced by additional motivational effects of personality factors. Second, and more importantly, we focused our analysis here on TG as a moderating personality factor. It is likely that analogous results could be found for regret avoiding decisions in relation to personality factors specifically related to regret proneness. It would be useful to include such a personality factor in future studies in order to strengthen the interpretation of emotion specificity of behavioral effects of guilt vs. regret. Most desirable for this purpose would be the development of an instrument that specifically aims at distinguishing guilt- and regret-related trait factors. To our knowledge, such an instrument is still missing, while much work has been devoted to create differential measures for guilt and shame proneness (Tangney, 1990; Kugler and Jones, 1992; Robins et al., 2007; Rüsch et al., 2007; Tangney et al., 2007).

In conclusion, we developed a new experimental decision-making paradigm that allows a differential induction of guilt and regret online (despite the close relatedness of these two emotions),

as well as an analysis of their effects on regulation of subsequent choice behavior. The results show that TG is a critical factor that moderates the role of guilt vs. regret avoidance as critical regulators of choice behavior by way of loss averse strategies. Although definite conclusions regarding the differential self-regulating functions of guilt vs. regret would be premature at this stage, the data suggest that feelings of guilt are mostly informative in acute, short-term decisions for those people who do not experience them often. However, if experienced more regularly and intensely, guilt may exert behavioral and emotion regulating effects that go beyond the short-term anticipation of its occurrence, resulting in a more generalized strategy to avoid guilt with its associated negative emotions (including regret). If confirmed, it would be interesting to investigate how such processes can contribute to certain clinical conditions, such as obsessive compulsive disorder, borderline personality disorder, and major depression, which are associated with enhanced guilt propensity (Mancini and Gangemi, 2004; Rüsch et al., 2007; Kim et al., 2011). It is conceivable that in certain extreme cases, where guilt is increasingly experienced even without any reasonable justification, such generalized effects of guilt on choice behavior and decision-making may become more and more maladaptive and could in this way eventually lead to "pathological guilt" as observed in such disorders (Shapiro and Stewart, 2011). Because our results point to a critical role of stable individual differences, it would be useful to develop differential trait questionnaires techniques that can better distinguish between the inclinations to experience guilt vs. regret than it is possible at present. Such an improved distinction would be relevant not only theoretically, but may ultimately also be useful to understand how exactly guilt- vs. regret-related regulation mechanisms contribute to the etiology of psychiatric disorders in which these emotions play a critical role.

ACKNOWLEDGMENTS

This study was funded by grants from the Deutsche Forschungsgemeinschaft (DFG, Wa1539/2-1) and the European Science Foundation (ESF, 08-ECRP-028 "The Social Dimension of Emotion Regulation: Brain, Mind and Behavior"). We thank Antoinette Nicolle for providing advice for the experimental procedure, and Sylvia Berndt, Judith Daniels, Susanne Erk, Michael Gaebler, Jimmy Jensen, Jan-Peter Lamke, Vera Ludwig, Sebastian Mohnke, Sabine Müller, Lena Paschke, Phöbe Schmierer, Björn Schott, Rosa Steimke, Christine Stelzel, Corinde Wiers, and Andrew Wold for valuable assistance and inspiring discussions.

REFERENCES

Amodio, D. M., Devine, P. G., and Harmon-Jones, E. (2007). A dynamic model of guilt: implications for motivation and self-regulation in the context of prejudice. *Psychol. Sci.* 18, 524–530.

Baumeister, R. F., Stillwell, A. M., and Heatherton, T. F. (1994). Guilt: an interpersonal approach. *Psychol. Bull.* 115, 243–267.

Baumeister, R. F., Vohs, K. D., deWall, C. N., and Zhang, L. (2007). How emotions shape behavior: feedback, anticipation and reflection rather than direct causation. *Pers. Soc. Psychol. Rev.* 11, 167–203.

Berndsen, M., van der Pligt, J., Doosje, B., and Manstead, A. S. R. (2004). Guilt and regret: the determining role of interpersonal and intrapersonal harm. *Cogn. Emot.* 18, 55–70.

Camille, N., Coricelli, G., Sallet, J., Pradat-Diehl, P., Duhamel, J. R., and Sirigu, A. (2004). The involvement of the orbitofrontal cortex in the experience of regret. *Science* 304, 1167–1170.

Chang, L. J., Dufwenberg, M., and Sanfey, A. G. (2011). Triangulating the neural, psychological, and economic bases of guilt aversion. *Neuron* 70, 560–572.

Coricelli, G., Critchley, H. D., Joffily, M., O'Doherty, J. P., Sirigu, A., and Dolan, R. J. (2005). Regret and its avoidance: a neuroimaging study of choice behavior. *Nat. Neurosci.* 8, 1255–1262.

De Hooge, I. E., Zeelenberg, M., and Breugelmans, S. M. (2007). Moral sentiments and cooperation: differential influences of shame and guilt. *Cogn. Emot.* 21, 1025–1042.

Ellingsen, T., Johannesson, M., Tjotta, S., and Torsvik, G. (2010). Testing guilt aversion. *Games Econ. Behav.* 47, 268–298.

Fehr, E., and Camerer, C. F. (2007). Social neuroeconomics: the neural circuitry of social preferences. *Trends Cogn. Sci. (Regul. Ed.)* 11, 419–427.

Frijda, N. H., Kuipers, P., and ter Schure, E. (1989). Relations among emotion, appraisal, and emotional action readiness. *J. Pers. Soc. Psychol.* 57, 212–228.

Gangemi, A., Mancini, F., and van den Hout, M. (2007). Feeling guilty as a source of information about threat and performance. *Behav. Res. Ther.* 45, 2387–2396.

Gilovic, T., and Medvec, V. H. (1995). The experience of regret: what, when, and why. *Psychol. Rev.* 102, 379–395.

Jones, W. H., Schratter, A. K., and Kugler, K. (2000). The guilt inventory. *Psychol. Rep.* 87, 1039–1042.

Kahneman, D., and Tversky, A. (1982). The psychology of preferences. *Sci. Am.* 246, 160–173.

Kahneman, D., and Tversky, A. (1984). Choices, values and frames. *Am. Psychol.* 39, 341–350.

Kedia, G., Berthoz, S., Wessa, M., Hilton, D., and Martinot, J. L. (2008). An agent harms a victim: a functional magnetic resonance imaging study on specific moral emotions. *J. Cogn. Neurosci.* 20, 1788–1798.

Ketelaar, T., and Au, W. T. (2003). The effects of feelings of guilt on the behaviour of uncooperative individuals in repeated social bargaining games: an affect-as-information interpretation of the role of emotion in social interaction. *Cogn. Emot.* 17, 429–453.

Kim, S., Thibodeau, R., and Jorgensen, R. S. (2011). Shame, guilt, and depressive symptoms: a meta-analytic review. *Psychol. Bull.* 137, 68–96.

Krajbich, I., Adolphs, R., Tranel, D., Denburg, N. L., and Camerer, C. F. (2009). Economic games quantify diminished sense of guilt in patients with damage to the prefrontal cortex. *J. Neurosci.* 29, 2188–2192.

Kugler, K., and Jones, W. H. (1992). On conceptualizing and assessing guilt. *J. Pers. Soc. Psychol.* 62, 318–327.

Mancini, F., and Gangemi, A. (2003). Responsibility, guilt, and decision under risk. *Psychol. Rep.* 93, 1077–1079.

Mancini, F., and Gangemi, A. (2004). Fear of guilt from behaving irresponsibly in obsessive-compulsive disorder. *J. Behav. Ther. Exp. Psychiatry* 35, 109–120.

Mellers, B. A., Schwartz, A., and Ritov, I. (1999). Emotion-based choice. *J. Exp. Psychol. Gen.* 128, 332–345.

Moll, J., de Oliveira-Souza, R., Garrido, G. J., Bramati, I. E., Caparelli-Daquer, E. M., Paiva, M. L., et al. (2007). The self as a moral agent: linking the neural bases of social agency and moral sensitivity. *Soc. Neurosci.* 2, 336–352.

Nelissen, R. M. A., Dijker, A. J., and de Vries, N. K. (2007). How to turn a hawk into a dove and vice versa: interactions between emotions and goals in a give-some dilemma game. *J. Exp. Soc. Psychol.* 43, 280–286.

Nicolle, A., Bach, D., Frith, C., and Dolan, R. J. (2011). Amygdala involvement of self-blame regret. *Soc. Neurosci.* 6, 178–189.

Robins, R. W., Noftle, E. E., and Tracy, J. L. (2007). "Assessing self-conscious emotions: a review of self-report and nonverbal measures," in *The Self-Conscious Emotions: Theory and Research*, eds J. L. Tracy, R. W. Robins, and J. M. Tangney (New York: Guilford), 443–469.

Rüsch, N., Corrigan, P. W., Bohus, M., Jacob, G. A., Brueck, R., and Lieb, K. (2007). Measuring shame and guilt by self-report questionnaires: a validation study. *Psychiatry Res.* 150, 313–325.

Russell, J. A., and Mehrabian, A. (1977). Evidence for a three-factor theory of emotions. *J. Res. Pers.* 11, 273–294.

Sanfey, A. G. (2007). Social decision-making: insights from game theory and neuroscience. *Science* 318, 598–602.

Schwarz, N., and Clore, G. L. (1983). Mood, misattribution, and judgments of well-being: informative and directive functions of affective states. *J. Pers. Soc. Psychol.* 45, 513–523.

Shapiro, L. J., and Stewart, E. S. (2011). Pathological guilt: a persistent yet overlooked treatment factor in obsessive-compulsive disorder. *Ann. Clin. Psychiatry* 23, 63–70.

Shin, L. M., Dougherty, D. D., Orr, S. P., Pitman, R. K., Lasko, M., Macklin, M. L., et al. (2000). Activation of anterior paralimbic structures during guilt-related script-driven imagery. *Biol. Psychiatry* 48, 43–50.

Stillman, T. F., and Baumeister, R. (2010). Guilt, free, and wise: determinsism and psychopathy diminish learning from negative emotions. *J. Exp. Soc. Psychol.* 46, 951–960.

Takahashi, H., Yahata, N., Koeda, M., Matsuda, T., Asai, K., and Okubo, Y. (2004). Brain activation associated with evaluative processes of guilt and embarrassment: an fMRI study. *Neuroimage* 23, 967–974.

Tangney, J. P. (1990). Assessing differences in proneness to shame and guilt: development of the self-conscious affect and attribution inventory. *J. Pers. Soc. Psychol.* 59, 102–111.

Tangney, J. P., Stuewig, J., and Mashek, D. J. (2007). Moral emotions and moral behavior. *Annu. Rev. Psychol.* 58, 345–372.

von Neumann, J., and Morgenstern, O. (1944). *Theory of Games and Economic Behavior*. Princeton: Princeton University Press.

Wagner, U., N'Diaye, K., Ethofer, T., and Vuilleumier, P. (2011). Guilt-specific processing in the prefrontal cortex. *Cereb. Cortex* 21, 2461–2470.

Zeelenberg, M., Beattie, J., van der Pligt, J., and De Vries, N. K. (1996). Consequences of regret aversion: effects of expected feedback on risky decision making. *Organ. Behav. Hum. Decis. Process* 65, 148–158.

Zeelenberg, M., and Breugelmans, S. M. (2008). The role of interpersonal harm in distinguishing regret from guilt. *Emotion* 8, 589–596.

Zeelenberg, M., Nelissen, R. M. A., Breugelmans, S. M., and Pieters, R. (2008). On emotion specificity in decision making: why feeling is for doing. *Judgm. Decis. Mak.* 3, 18–27.

Conflict of Interest Statement: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Received: 30 June 2012; accepted: 01 October 2012; published online: 22 October 2012.

*Citation: Wagner U, Handke L, Dörfel D and Walter H (2012) An experimental decision-making paradigm to distinguish guilt and regret and their self-regulating function via loss averse choice behavior. Front. Psychology **3**:431. doi: 10.3389/fpsyg.2012.00431*

This article was submitted to Frontiers in Emotion Science, a specialty of Frontiers in Psychology.

frontiers in PSYCHOLOGY

ORIGINAL RESEARCH ARTICLE
published: 10 May 2013
doi: 10.3389/fpsyg.2013.00260

Talking about emotion: prosody and skin conductance indicate emotion regulation

Moritz Matejka[1,2,3†], Philipp Kazzer[1,2,4*†], Maria Seehausen[1,2,4], Malek Bajbouj[1,2,4], Gisela Klann-Delius[1,5], Winfried Menninghaus[1,6], Arthur M. Jacobs[1,2,3], Hauke R. Heekeren[1,2,3] and Kristin Prehn[1,2]

[1] Cluster of Excellence "Languages of Emotion," Freie Universität, Berlin, Germany
[2] Dahlem Institute for Neuroimaging of Emotion, Freie Universität, Berlin, Germany
[3] Department of Education and Psychology, Freie Universität, Berlin, Germany
[4] Department of Psychiatry, Campus Benjamin Franklin, Charité, Berlin, Germany
[5] Department of Linguistics, Institut für Deutsche und Niederländische Philologie, Freie Universität Berlin, Berlin, Germany
[6] Max Planck Institute for Empirical Aesthetics, Frankfurt am Main, Germany

Edited by:
Vera Shuman, University of Lausanne, Switzerland

Reviewed by:
Matthew Lieberman, University of California, USA
Petri Laukka, Stockholm University, Sweden
Thomas Dresler, University of Tuebingen, Germany

***Correspondence:**
Philipp Kazzer, Cluster of Excellence "Languages of Emotion," Freie Universität Berlin, Habelschwerdter Allee 45, 14195 Berlin, Germany.
e-mail: philipp.kazzer@fu-berlin.de

†Moritz Matejka and Philipp Kazzer have contributed equally to this work.

Talking about emotion and putting feelings into words has been hypothesized to regulate emotion in psychotherapy as well as in everyday conversation. However, the exact dynamics of how different strategies of verbalization regulate emotion and how these strategies are reflected in characteristics of the voice has received little scientific attention. In the present study, we showed emotional pictures to 30 participants and asked them to verbally admit or deny an emotional experience or a neutral fact concerning the picture in a simulated conversation. We used a 2 × 2 factorial design manipulating the focus (on emotion or facts) as well as the congruency (admitting or denying) of the verbal expression. Analyses of skin conductance response (SCR) and voice during the verbalization conditions revealed a main effect of the factor focus. SCR and pitch of the voice were lower during emotion compared to fact verbalization, indicating lower autonomic arousal. In contradiction to these physiological parameters, participants reported that fact verbalization was more effective in down-regulating their emotion than emotion verbalization. These subjective ratings, however, were in line with voice parameters associated with emotional valence. That is, voice intensity showed that fact verbalization reduced negative valence more than emotion verbalization. In sum, the results of our study provide evidence that emotion verbalization as compared to fact verbalization is an effective emotion regulation strategy. Moreover, based on the results of our study we propose that different verbalization strategies influence valence and arousal aspects of emotion selectively.

Keywords: emotion regulation, verbalization, IAPS, skin conductance, voice

INTRODUCTION

Emotion regulation, that is the up- or down-regulation of positive or negative emotion, has primarily been investigated by focusing on *cognitive control mechanisms* (Lazarus and Folkman, 1984; Gross, 1998a, 2007). The model by Gross, for instance, distinguishes different control strategies by the time of occurrence: antecedent-focused strategies precede emotional responses, whereas response-focused strategies are employed to modulate an already initiated emotional response. Antecedent-focused strategies comprise situation selection, situation modification, attention deployment, and cognitive change. A form of cognitive change that has received particular attention in the research literature is the so-called "reappraisal." Response-focused strategies include, among others, the suppression of emotional expressions. There is evidence that both reappraisal and suppression of emotional display result in changes of self-reported emotional experience and modify psycho-physiological responses (Jackson et al., 2000; Demaree et al., 2006). Recent studies show that these changes are accompanied by increased activity in the dorsal anterior cingulate cortex and prefrontal cortex, as well as a decrease or increase (in accordance with the objective of the reappraisal technique) of activity in brain regions involved in emotion processing, such as the amygdala and insula (for reviews on the neural correlates, see Ochsner, 2005; Kalisch, 2009; Etkin et al., 2011; Kanske et al., 2011). Another line of research has demonstrated that linguistic processing of the affective aspects of a stimulus can disrupt negative affect (Hariri et al., 2000; Lieberman et al., 2007, Lieberman, 2011). Affect labeling compared to the labeling of facts while experiencing an emotional event reduces amygdala activity. At the same time, activity in the right ventrolateral prefrontal cortex has been shown to increase through affect labeling. This region is involved in inhibiting emotional experience and is associated with the symbolic processing of emotional information. Lieberman et al. (2007) suggested that through affect labeling, language and other symbolic processes could tap into more basic mechanisms of limbic control (e.g., extinction learning). Affect labeling is thought to enhance exposure-related extinction learning effects and to cause unintentional down-regulation of emotion. Interestingly, Lieberman et al. (2011) also showed that in spite of the above mentioned

neural evidence to the contrary, subjects did not expect or believe that affect labeling is useful for the down-regulation of negative affect.

Emotion verbalization, that is, verbally confirming that one is feeling something, is usually embedded in a social context. Experiencing emotion promotes social interaction by spurring people's need to *verbally express and communicate their feelings* to each other. According to Rimé (2009), sharing emotion and receiving social responses, such as empathy and sympathy, serve important hedonic and functional goals, such as stimulating the cognitive processing of a given situation, strengthening interpersonal relationships, and social integration, as well as producing collective meaning and social knowledge. Nils and Rimé (2012) also showed that during emotion sharing, emotional experience varied in accordance with a listener's response mode. Subsequent to watching an emotion-eliciting movie, subjects sharing their emotion with a listener offering a socio-affective response as opposed to a neutral listener reported higher emotional arousal and more negative valence. Hence, in apparent contradiction with Lieberman et al. (2007), Nils and Rimé found that socio-affective sharing did not alleviate the emotional response, which was only effectively down-regulated by a cognitive sharing mode that included a reframing of the upsetting stimulus. However, after the experiment, participants rated socio-affective sharing as helpful, even though their valence and arousal ratings during the experiment indicated the opposite. Considering these two important studies, it appears that the effects of emotion verbalization are possibly quite complex and not fully understood yet. Assuming that both studies produced valid results, the question arises how these seemingly contradictory results can be integrated. Potential starting points may arise from variations in methodology and parameters, time points of measurements, as well as the employment of different emotion regulation strategies (i.e., affect labeling versus socio-affective sharing). Different verbalization strategies may well have entirely different emotional consequences. Nonetheless, speaking about emotion can evidently modulate emotional experience, reflected in both emotional valence and arousal. In addition, these results indicate that emotion and emotion regulation research benefit from employing social and inter- as well as intra-individual perspectives.

Emotion verbalization is a response-focused emotion regulation strategy. This strategy combines certain aspects of some of the emotion regulation strategies referred to in the first paragraph. It alters the focus of attention and involves cognitive and linguistic processes that help to reappraise the situation. At the same time, it effects emotion expression or suppression. In analogy to the "facial feedback hypothesis," stating that facial movements can influence emotional experiences (for a classical review, see Fehr and Stern, 1970), it can be assumed that different strategies of verbalization also have an impact on emotional experience. Although verbalizing may be related to various emotion regulation strategies, it does not seem to be equivalent to any one particular strategy, such as reappraisal, suppression, affect labeling, or attention deployment. There are close parallels to affect labeling as described by Lieberman et al. (2007), insofar that both strategies require recognizing one's own emotional state and verbally attesting to it. However, affect labeling requires identifying the exact emotion (e.g., anger or sadness), whereas verbalizing only demands a general awareness that one is experiencing an emotion. On the other hand, when including denial of the emotional experience as an additional component, verbalizing also involves an aspect of attesting to one's own emotional state truthfully or misleadingly. Purposefully denying one's emotion in a conversation may bring about different emotional consequences than generally talking about one's own emotion. Specifically investigating the role of negation on emotion processing, Herbert et al. (2011) found that negating unpleasant nouns (such as "no fear" compared to "my fear") decreased emotional arousal ratings and inhibited the startle reflex of the eye. The startle reflex has been associated with emotion processing, insofar as it is generally attenuated by the processing of pleasant stimuli and enhanced by unpleasant stimuli (Lang et al., 1990). Thus, the results by Herbert et al. (2011) indicate that negating an unpleasant noun diminishes the emotional response to that noun. This also fosters the assumption that denying one's emotion might reduce arousal and modulate emotion, as there are parallels between negating emotional nouns and denying an emotional experience.

To complement and expand on the various study results summarized above, our study aimed at investigating how different verbalization strategies influence emotion, reflected in subjective experience, voice parameters, and skin conductance. To our knowledge, there are no studies scrutinizing the effects of verbal emotion regulation strategies combining the physiological measures of voice and skin conductance response (SCR) during emotion processing. Introducing these physiological parameters in addition to self-report might help to clarify apparent contradictions in previous study results. Specifically, we were interested in exploring the different effects of speaking about emotion versus facts as well as of admitting or denying currently experienced emotion.

To investigate these questions, we showed participants emotion inducing pictures and asked them to verbally admit or deny an emotional experience or a neutral fact concerning the picture. We used a 2×2 factorial design manipulating the focus (on emotion or facts) as well as the congruency (admitting or denying) of the verbal expression. We simulated a social emotion-sharing situation through presenting participants with recorded questions pertaining to their emotion, which they answered according to experimental instructions under the different conditions. During the different verbalization conditions, we measured SCR as one indicator of emotional arousal. SCR has been used in a number of studies focusing on emotion regulation. Studies on reappraisal, for instance, report that emotional down-regulation is accompanied by a decrease in SCR (e.g., Egloff et al., 2006; Driscoll et al., 2009; Urry et al., 2009). Previous studies have also shown that the concurrent presentation of affective words during exposure to aversive pictures can diminish SCR (Tabibnia et al., 2008).

Since changes in emotional state are generally accompanied by changes in the laryngeal tension and subglottal pressure in the vocal production system (Schirmer and Kotz, 2006), we also analyzed three parameters of the voice (pitch, voice quality, and average volume) during the different verbalization strategies. Human beings are able to produce highly differentiated sounds (by altering volume, pitch, and spectral energy of different frequency bands,

etc.) to communicate more information than the bare words which are being said (Banse and Scherer, 1996). Correspondingly, it is possible for humans to distinguish between different emotions of an interlocutor just by the sound of the voice (Luo and Fu, 2007). These facts evidently demonstrate a link between voice parameters and emotion, which is further backed up by the finding that it is possible to measure the emotional state of a person with regard to valence and arousal by analyzing his or her voice (Scherer, 2003). In an emotionally aroused state, the pitch of the voice is higher (Laukka et al., 2005; Goudbeek and Scherer, 2010). Furthermore, voice volume increases in connection with negative emotional valence (Schröder et al., 2001; Laukka et al., 2005). Scherer (1986) reported that spectral distribution of energy varies significantly with manipulations of intrinsic pleasantness. In line with Scherer (1986), Johnstone et al. (2005) found that listening to unpleasant sounds led to less energy in low frequencies in the voice. These findings suggest that a verbal strategy effectively regulating arousal and/or valence is accompanied by changes in pitch as well as other changes in voice quality and volume.

Based on the literature mentioned above (Hariri et al., 2000; Lieberman et al., 2007), we assumed that talking about emotion in contrast to talking about facts (factor focus) would reduce autonomic arousal, indicated by a physiological response (lower pitch and lower SCR). In addition, we expected congruency (admitting or denying) to exert an effect on autonomic arousal, depending on whether facts or emotion were admitted or denied (interaction between focus factor and congruency factor). Specifically, denying facts was expected to result in a heightened autonomic response (higher pitch and higher SCR) compared to admitting facts, based on study results showing a larger SCR when participants concealed information (Gamer et al., 2007, 2008). In contrast, denying emotion was expected to result in weaker autonomic arousal (lower pitch and lower SCR) than admitting emotion. The latter hypothesis was based on the above mentioned findings by Herbert et al. (2011), and on the assumption that, at least in the present experimental setting, the effect of focus on emotion versus facts would outweigh the effect of congruency, since "lying," that is, denying facts, was encouraged by the experimental procedure. Thus, the down-regulating effect of verbalizing emotion should be stronger than the up-regulating effect of denial. Other parameters of the voice, such as intensity and voice quality, were to be examined on an exploratory basis. We further assumed that subjects would not consider talking about emotion as being a useful strategy for the down-regulation of emotion based on the findings by Lieberman et al. (2011). A summary of our hypotheses can be seen in **Table 1**.

Table 1 | Expected results (effects of emotional picture and emotion regulation strategies) on pitch and SCR.

EFFECTS OF EMOTIONAL PICTURE	
Picture	**Assumed effect of factor picture**
Emotional pictures versus neutral pictures	Higher arousal (pitch/SCR) Lower arousal (pitch/SCR)
EFFECTS OF EMOTION REGULATION STRATEGIES	
Focus	**Assumed effect of factor focus**
Focus on emotion versus focus on facts	Lower arousal (pitch/SCR) Higher arousal (pitch/SCR)
Congruency	**Assumed effect of factor congruency**
Admitting emotion versus denying emotion	Higher arousal (pitch/SCR) Lower arousal (pitch/SCR)
Admitting facts versus denying facts	Lower arousal (pitch/SCR) Higher arousal (pitch/SCR)

MATERIALS AND METHODS

PARTICIPANTS

Thirty subjects participated in the study (age range: 21–35 years, $M = 26.2$, SD = 2.98). Half of them were female. Due to technical problems during data recording, post-ratings for one participant, voice data for one participant, and skin conductance data for four subjects were lost. In addition, three participants had to be excluded from SCR data analysis because they lacked a distinct SCR. In sum, $N = 29$ subjects were available for self-report data analyses and voice data analyses and $N = 23$ subjects for skin conductance data analyses.

The study was approved by a local ethics committee and conducted in accordance with the Declaration of Helsinki. Subjects were paid for their participation and gave written informed consent prior to investigation.

PROCEDURE

Participants were shown into a quiet room and seated comfortably in front of a computer screen with a distance of 0.6 m. Prior to the experiment, participants completed a practice session with similar stimulus material, but only including neutral pictures, to become familiar with the task. The main experiment, which then followed, took about 60 min and consisted of two sessions with a break in between. In total, the experiment contained 108 trials (18 trials per condition), which were presented in a randomized order. During the experiment, we measured the influence of the different verbalizing strategies on parameters of the voice (pitch, intensity, voice quality) and SCR as dependent variables.

To measure the effectiveness of the verbalization strategies with regard to emotion regulation, immediately after the experiment participants were asked to rate on a 9-point scale how much their emotional arousal increased or decreased in each condition (admitting or denying emotion or facts). We cannot rule out that asking subjects for an overall efficiency rating of each strategy after the experiment, and not on a trial-by-trial basis, might limit the informative value of the self-report data. On the other hand, it is assumed that a rating on a trial-by-trial basis might trigger other evaluation processes, such as secondary self-reflection and recollection of feelings during the actual regulation, and might therefore induce confounding effects on arousal (Erk et al., 2010).

TASK

To investigate the impact of different verbalization strategies on emotion processing and regulation, we presented participants with pictures inducing negative emotion and instructed them to respond in the following ways: in the *congruent emotion verbalization condition* (1 – Emo con, emotion admitting), participants

were asked to verbally confirm experiencing an emotional reaction elicited by the negative emotional picture ("Correct, I do feel something looking at this picture!" see **Table 2** for examples). In the *incongruent emotion verbalization condition* (2 – Emo incon, emotion denying), participants had to verbally deny any emotional response to a picture known to elicit negative emotion ("No, I do not feel anything looking at this picture!"). In the *congruent fact verbalization conditions* (3 – Facts con, 5 – Neut pic con), participants were asked whether or not they see somebody in the picture. They were instructed to answer truthfully and according to what was depicted: "Correct, I do see someone in this picture!" or: "Correct, I do not see anyone in this picture!" In the *incongruent fact verbalization conditions* (4 – Facts incon, 6 – Neut pic incon), participants were instructed to answer incorrectly (i.e., to claim the opposite): "No, I do see someone in this picture!" (even though the image did not show anyone) or: "No, I do not see anyone in this picture!" (even though the image did show a person). Conditions were presented in short blocks of three trials each. Each block was preceded by an instruction cue for 2 s, which stated "emotion admitting," "emotion denying," "fact admitting," or "fact denying," respectively. For an overview about tasks and conditions, see **Table 2**.

To make the task more interactive and structurally closer to a conversation, we presented one of the following questions during the picture display: "You do feel something looking at this picture, don't you?" or "You do see someone in this picture, don't you?" These questions were presented both visually (written below the picture) and acoustically (via headphone). A male and a female speaker each read half of the questions. Pictures and sentences were presented using Presentation® running on a Microsoft Windows operating system (Neurobehavioral Systems Inc., Albany, CA, USA). Acoustic presentation was done via a headset, which also recorded verbal responses given by the participants.

Each trial started with a picture appearing on the screen (*emotion induction phase*). After 1 s of picture presentation, the question was presented for 3.5 s (in written form below the picture and verbally via headphone). Then, the predefined answer sentence appeared below the picture in red ink and the participant was given 4.5 s to speak the answer out loud (*verbalization phase*). Each trial ended with a fixation cross for 8–10 s ($M = 9$ s) to allow the SCR to recover (Dawson et al., 2000; *jittered relaxation phase*). Participants were instructed to reply instantly and aloud and as convincingly as possible, and not to look at the answer sentence below the picture too often. Participants were told that the purpose of the study was to investigate emotion processing, and they were aware that their verbal responses were recorded for later analysis. See **Figure 1** for a schematic illustration of an experimental trial.

STIMULI

Pictures were taken from the International Affective Picture System (IAPS; Lang et al., 2005) based on their mean normative ratings for valence and arousal given in the technical manual. We

Table 2 | Overview about design and stimulus material.

				Congruent	Incongruent
Unpleasant/ high arousing pictures	**Emotion regulation**	**Verbalization focus on emotion**	Question:	**1 (Emo con)** You do feel something looking at this picture, don't you?	**2 (Emo incon)** You do feel something looking at this picture, don't you?
			Answer:	Correct, I do feel something looking at this picture!	No, I do not feel anything looking at this picture!
	Emotion induction	**Verbalization focus on facts**	Question:	**3 (Facts con)** You do see someone/ not see anyone in this picture, don't you/ do you?	**4 (Facts incon)** You do see someone/ not see anyone in this picture, don't you/ do you?
			Answer:	Correct, I do see someone/ not see anyone in this picture!	No, I do not see anyone/ see someone in this picture!
Neutral/ low arousing pictures		**Verbalization focus on facts**	Question:	**5 (Neut pic con)** You do see someone/ not see anyone in this picture, don't you/ do you?	**6 (Neut pic incon)** You do see someone/ not see anyone in this picture, don't you/ do you?
			Answer:	Correct, I do see someone/ not see anyone in this picture!	No, I do not see anyone/ see someone in this picture!

To investigate effects of emotion regulation within our experimental paradigm, we employed a 2 × 2 factorial design. The conditions used in the emotion induction model are indicated by a blue frame, conditions used in emotion regulation are indicated by a red frame. Conditions 1–4 (with unpleasant pictures) were used to investigate the effect of emotion regulation through different strategies of verbalization. Conditions 5–6 were used as control conditions to test whether the presentation of emotional pictures resulted in emotion induction (during the picture presentation phase) in contrast to neutral pictures (blue). Please note that we used German word material in our study.

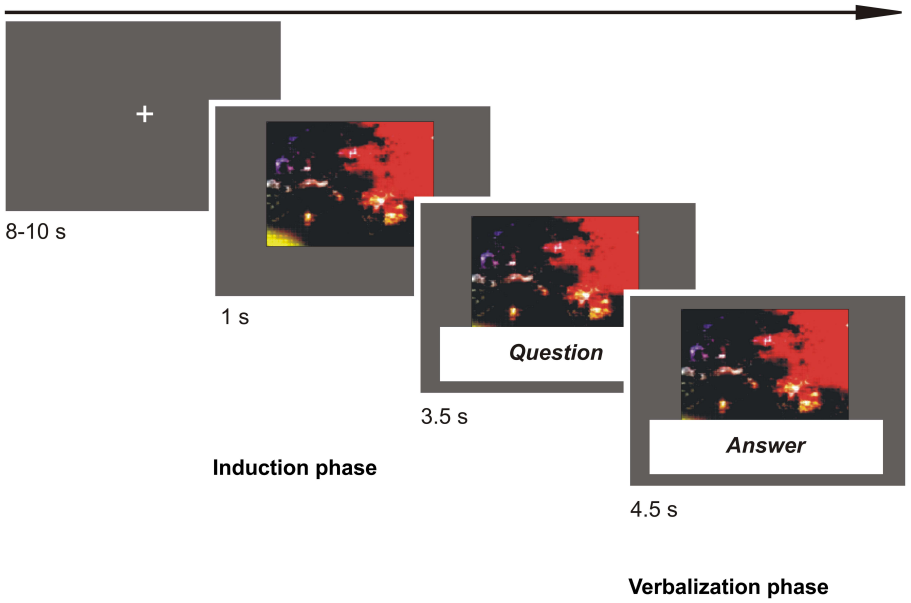


FIGURE 1 | The figure shows a schematic illustration of an experimental trial. First, a picture (emotional or neutral) appeared on the screen for 1 s (*induction phase*). Then, the question asking to verbalize in four different ways following our different conditions was presented for 3.5 s (in written form below the picture and verbally via headphone). Then, the answer sentence in red ink appeared below the picture and the participant was given 4.5 s to speak the answer out loud (*verbalization phase*). At the end of a trial, we presented a fixation cross for variable duration (8–10 s) to allow the skin conductance response to recover.

selected 72 unpleasant and emotionally arousing pictures (valence: $M = 2.74$, SD = 0.96; arousal: $M = 6.05$, SD = 0.69) and 36 neutral pictures (valence: $M = 5.29$, SD = 0.59; arousal: $M = 3.05$, SD = 0.56), with a total range of 5.52 for valence and a total range of 5.54 for arousal on a scale from 1 (very unpleasant and no arousal) to 9 (very pleasant and high arousal). Mean valence and arousal ratings of emotional and neutral pictures differed significantly [valence: $t(106) = -14.49$, $p < 0.001$; arousal: $t(106) = 22.74$, $p < 0.001$]. Negative pictures displayed threatening or disgusting scenes, i.e., wild animals, snakes, spiders, corpses, wounded or emotionally distressed people, natural disasters, and accidents. Neutral pictures showed household objects, harmless animals, people at work, social gatherings, buildings, landscape, or portraits.

Pictures were divided into six sets (i.e., into one set for each condition: four emotional and two neutral sets). Each set comprised 18 pictures and was randomly assigned to one of the conditions for each participant. Half of the pictures in each set depicted people or had a social content, half of them did not. Valence did not differ within the two neutral and the four negative sets [negative: $F(3, 68) = 0.31$, $p = 0.82$; neutral: $F(1, 34) = 0.57$, $p = 0.46$]. This also applied to arousal [negative: $F(3, 68) = 0.13$, $p = 0.94$; neutral: $F(1, 34) = 0.16$, $p = 0.69$], and picture luminance [negative: $F(3, 68) = 0.12$, $p = 0.95$; neutral: $F(1, 34) = 0.06$, $p = 0.81$]. Luminance was derived mathematically from the composite color signal of each picture.

All sentences utilized in the experiment (questions and answers) were syntactically identical and had the same number of syllables (see **Table 2**).

Skin conductance recording and analysis

We recorded SCR continuously during the experiment with a sampling frequency of 40 Hz using a commercial skin conductance sampling device (Biofeedback 2000$^{\text{X-pert}}$, Schuhfried GmbH, Austria). Skin conductance data were processed using Matlab 7.1 (The MathWorks, Inc., MA, USA). For each trial, we calculated the area under curve separately for the emotion induction and the regulation phases (see **Figure 1**). Time frame of analysis was 4.5 s, starting from the onset of the picture or answer phase. Each phase was baseline corrected using a period of 200 ms before either the picture or answer onset.

Audio recording and analysis

To achieve the best possible results concerning the audio data, we isolated the computer used for stimulus presentation by wrapping the table under which it stood in silence cloth. Furthermore, we used a highly directional headset microphone (AKG C520L Headset, Harman International Industries, Inc., CT, USA), which ensured the voice recordings remained clean as possible by canceling out most of the background noise. The microphone was connected to a handheld recorder (Zoom H2, Zoom Co., Tokyo, Japan) with its output connected to the stimulus presentation computer. For each trial, recording of the voice started 4.5 s after the picture appeared on the screen.

To prepare the recorded voice material for analysis, we first cut out all parts of the spoken sentences that were not identical within the six experimental conditions, leading to short audio clips only containing the end of the sentence (i.e., only the words: "this picture"). Then, we used seewave (Sueur et al., 2008), a

package for R Statistics, to compute the following three measurements: pitch (fundamental frequency), intensity, and voice quality. The voice quality was assessed analyzing the frequency spectrum. The spectral analysis returned 256 single frequencies, which were then collapsed, resulting in 11 frequency bands (cf. Banse and Scherer, 1996): 80–125 Hz (s125), 125–200 Hz (s200), 200–300 Hz (s300), 300–500 Hz (s500), 500–600 Hz (s600), 600–800 Hz (s800), 800–1000 Hz (s1000), 1000–1600 Hz (s1600), 1600–5000 Hz (s5000), 5000–8000 Hz (s8000), and 8000–23000Hz (s23000).

STATISTICAL ANALYSES

All analyses of physiological and rating data were conducted using the R 3.1 statistical package (R Development Core Team, 2012). The ratings were standardized on a within-subject basis; that is, each subject's responses were converted to standard scores ($M = 0, \mathrm{SD} = 1$). This procedure eliminates between-subjects variability, so that subsequent analyses reflect only within-subject variation.

All vocal parameters were normally distributed. SCR data, in contrast, showed a positively skewed distribution and were log transformed. General linear mixed effects models (ANOVA, with subject as a random effect) were calculated on mean level of SCR and the voice parameters: pitch, intensity, and voice quality (intensity of the 11 frequency bands; Pinheiro and Bates, 2002).

For each parameter we used two different random intercept models to analyze our physiological data. Both models consisted of two levels: the upper level representing the subject, and the lower level representing single trial data. The first model tested the effect of emotion induction. It contained the factor picture type (emotional or neutral picture), and included only data from the fact verbalization conditions (see **Table 2**): 3 (Fact con), 4 (Fact incon), 5 (Neut pic con), and 6 (Neut pic incon). To measure the effect of emotion induction, we compared SCR and voice data of conditions 3 + 4 (Fact con + Fact incon) versus 5 + 6 (Neut pic con + Neut pic incon), isolating the factor picture type. For this model, SCR data was taken from the moment of picture presentation (*emotion induction phase*), before participants started speaking. Evidently, voice data could only be taken from the *verbalization phase*. The second model was used to test for an effect of the different strategies on emotion, and contained the factors focus (facts or emotion) and congruency (admitting or denying). This second model included only conditions during which participants were presented with emotional pictures: 1 (Emo con), 2 (Emo incon), 3 (Fact con), and 4 (Fact incon).

RESULTS

SELF-REPORT DATA

After the experiment, participants reported that talking about facts was, in their opinion, more effective at regulating their emotion than talking about their emotional experience [main effect factor focus: $F(1, 83) = 5.19$, $p < 0.05$]. There was a marginal effect of congruency [$F(1, 83) = 3.40$, $p = 0.06$], indicating that participants perceived congruent verbalization conditions as more effective in down-regulating their emotion than incongruent verbalization conditions (see **Figure 2**). We found no interaction between focus and congruency [$F(1, 81) = 0.25$, $p = 0.61$].

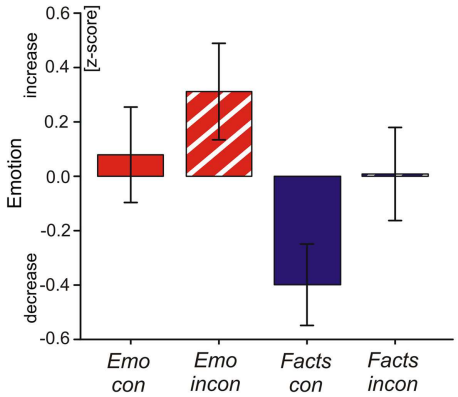


FIGURE 2 | The figure shows standardized subjective ratings (*z*-scores) of emotion regulation efficacy by verbalization strategies: emotion admitting (Emo con), emotion denial (Emo inc), fact admitting (Facts con), fact denial (Facts inc). After the experiment, participants were asked how much each condition subjectively increased or decreased emotional arousal elicited by the pictures on a scale from −4 to +4.

EFFECTS OF EMOTIONAL PICTURES ON SKIN CONDUCTANCE AND VOICE

We first compared SCR (log transformed parameter area under the curve in $\mu S \times s$) of neutral and negative pictures in the emotion induction phase (0–4.5 s) under the fact verbalization condition. The random intercept model with the factor picture type revealed higher SCR for negative pictures [$F(1, 1632) = 18.282$, $p < 0.001$; Emo pic: $M = 0.71$, $\mathrm{SE} = 0.005$; Neut pic: $M = 0.68$, $\mathrm{SE} = 0.004$] (see **Tables 3** and **4**).

In the vocal measures, a significant difference between neutral and emotional pictures appeared in the lower frequency bands [s500: $F(1, 2058) = 6.074$, $p < 0.05$; s600: $F(1, 2058) = 6.634$, $p < 0.01$; s800: $F(1, 2058) = 4.402$, $p < 0.05$]. We found more energy in the lower bands of the frequency spectrum during presentation of negative pictures. We found no differences in intensity [$F(1, 2058) = 1.82$, $p = 0.178$] and pitch with regard to picture type [$F(1, 2058) = 0.17$, $p = 0.679$] (see **Tables 3** and **4**).

EFFECT OF VERBALIZATION ON SKIN CONDUCTANCE AND VOICE

The random intercept model for SCR in the emotion regulation phase (4.5–9.5 s) included the factors focus and congruency and revealed a main effect of focus in SCR data [$F(1, 1630) = 4.84$, $p < 0.05$], but neither an effect of congruency [$F(1, 1630) = 0.095$, $p = 0.75$] nor an interaction between focus and congruency [$F(1, 1630) = 0.397$, $p = 0.528$]. That is, participants showed lower SCR when verbalizing their emotional experience compared to verbalizing facts (see **Table 3**).

To test the different effects of verbalization strategies on voice data, we used random intercept models comparing the four conditions that contained emotional pictures (emotion regulation). The models showed main effects of focus in pitch, intensity, and voice quality. During emotion verbalization, pitch was lower [$F(1, 2060) = 10.987$, $p < 0.001$] and voice intensity was higher [$F(1, 2060) = 57.889$, $p < 0.001$] compared to fact verbalization. Additionally, there were effects for the following voice quality

Table 3 | Results from the random-intercept models of the voice analysis for emotion induction (effect of picture) and regulation (effect of strategy).

M (SE)	Induction		Regulation			
	Neut pic	**Emo pic**	**Emo con**	**Emo incon**	**Fact con**	**Fact incon**
SCR	*0.68 (0.004)*	*0.71 (0.005)*	*0.71 (0.01)*	*0.709 (0.007)*	*0.718 (0.007)*	*0.722 (0.007)*
Pitch	*230.407 (1.263)*	*230.271 (0.33)*	*229.439 (0.489)*	*228.81 (0.69)*	*230.379 (1.261)*	*230.156 (0.488)*
s125	52.538 (0.798)	52.401 (0.104)	52.733 (0.143)	53.192 (0.202)	52.412 (0.834)	52.393 (0.142)
s200	58.297 (0.504)	58.349 (0.085)	59.313 (0.124)	59.707 (0.175)	58.528 (0.545)	58.177 (0.124)
s300	57.042 (0.344)	57.219 (0.109)	58.912 (0.161)	59.173 (0.228)	57.518 (0.375)	56.929 (0.161)
s500	51.33 (0.446)	51.613 (0.115)	53.354 (0.166)	53.339 (0.234)	51.882 (0.478)	51.351 (0.166)
s600	46.915 (0.536)	47.209 (0.114)	48.661 (0.168)	48.671 (0.238)	47.409 (0.569)	47.013 (0.168)
s800	37.03 (0.474)	37.258 (0.109)	38.083 (0.161)	38.388 (0.227)	37.415 (0.502)	37.104 (0.161)
s1000	29.928 (0.376)	30.074 (0.123)	30.524 (0.183)	30.965 (0.258)	30.178 (0.397)	29.972 (0.183)
s1600	24.234 (0.393)	24.366 (0.12)	24.597 (0.182)	24.985 (0.257)	24.391 (0.427)	24.342 (0.182)
s5000	20.895 (0.475)	21.005 (0.099)	20.962 (0.149)	21.018 (0.211)	21.065 (0.494)	20.946 (0.149)
s8000	12.683 (0.542)	12.691 (0.1)	12.217 (0.154)	12.677 (0.217)	12.717 (0.55)	12.665 (0.153)
s23000	2.644 (0.992)	2.587 (0.096)	2.245 (0.142)	3.066 (0.201)	2.603 (1.005)	2.571 (0.142)
Intensity	*47.678 (0.135)*	*47.741 (0.047)*	*48.063 (0.066)*	*48.38 (0.093)*	*47,814 (0.151)*	*47,669 (0.066)*

This table shows mean and standard error (reported in parentheses). A model for each vocal parameter: 80–125 Hz (s125), 125–200 Hz (s200), 200–300 Hz (s300), 300–500 Hz (s500), 500–600 Hz (s600), 600–800 Hz (s800), 800–1000 Hz (s1000), 1000–1600 Hz (s1600), 1600–5000 Hz (s5000), 5000–8000 Hz (s8000), 8000–23000Hz (s23000). SCR [μS] during induction (0–4.5 s), SCR [μS] during regulation (4.5–9.5 s), pitch, and intensity as main parameters are in highlighted in italics.

Table 4 | Results from the random-intercept models of the voice analysis (*F*-values).

	Induction	Regulation		
	Factor picture	**Factor focus**	**Factor congruency**	**Factors focus × congruency**
SCR	$F(1, 1632) = 18.282$, $p < 0.001$	$F(1, 1630) = 4.84$, $p < 0.05$	$F(1, 1630) = 0.095$, $p = 0.75$	$F(1, 1630) = 0.397$, $p = 0.528$
Pitch	$F(1, 2058) = 0.172$, $p = 0.679$	$F(1, 2060) = 10.987$, $p < 0.001$	$F(1, 2060) = 1.52$, $p = 0.218$	$F(1, 2060) = 0.347$, $p = 0.556$
s125	$F(1, 2058) = 1.731$, $p = 0.188$	$F(1, 2060) = 30.996$, $p < 0.001$	$F(1, 2060) = 4.774$, $p < 0.05$	$F(1, 2060) = 5.62$, $p < 0.05$
s200	$F(1, 2058) = 0.373$, $p = 0.542$	$F(1, 2060) = 174.56$, $p < 0.001$	$F(1, 2060) = 0.059$, $p = 0.808$	$F(1, 2060) = 18.018$, $p < 0.001$
s300	$F(1, 2058) = 2.623$, $p = 0.105$	$F(1, 2060) = 255.631$, $p < 0.001$	$F(1, 2060) = 2.075$, $p = 0.15$	$F(1, 2060) = 13.948$, $p < 0.001$
s500	$F(1, 2058) = 6.074$, $p < 0.05$	$F(1, 2060) = 218.147$, $p < 0.001$	$F(1, 2060) = 5.43$, $p < 0.05$	$F(1, 2060) = 4.831$, $p < 0.05$
s600	$F(1, 2058) = 6.634$, $p < 0.01$	$F(1, 2060) = 149.927$, $p < 0.001$	$F(1, 2060) = 2.624$, $p = 0.105$	$F(1, 2060) = 2.919$, $p = 0.088$
s800	$F(1, 2058) = 4.402$, $p < 0.05$	$F(1, 2060) = 74.067$, $p < 0.001$	$F(1, 2060) = 0.001$, $p = 0.98$	$F(1, 2060) = 7.373$, $p < 0.01$
s1000	$F(1, 2058) = 1.399$, $p = 0.237$	$F(1, 2060) = 26.942$, $p < 0.001$	$F(1, 2060) = 0.824$, $p = 0.364$	$F(1, 2060) = 6.268$, $p < 0.05$
s1600	$F(1, 2058) = 1.215$, $p = 0.271$	$F(1, 2060) = 10.974$, $p < 0.001$	$F(1, 2060) = 1.75$, $p = 0.186$	$F(1, 2060) = 2.887$, $p = 0.089$
s5000	$F(1, 2058) = 1.222$, $p = 0.269$	$F(1, 2060) = 0.02$, $p = 0.887$	$F(1, 2060) = 0.089$, $p = 0.765$	$F(1, 2060) = 0.696$, $p = 0.404$
s8000	$F(1, 2058) = 0.006$, $p = 0.938$	$F(1, 2060) = 5.019$, $p < 0.05$	$F(1, 2060) = 3.543$, $p = 0.06$	$F(1, 2060) = 5.594$, $p < 0.05$
s23000	$F(1, 2058) = 0.359$, $p = 0.549$	$F(1, 2060) = 0.489$, $p = 0.484$	$F(1, 2060) = 15.412$, $p < 0.001$	$F(1, 2060) = 18.006$, $p < 0.001$
Intensity	$F(1, 2058) = 1.816$, $p = 0.178$	$F(1, 2060) = 57.889$, $p < 0.001$	$F(1, 2060) = 0.68$, $p = 0.41$	$F(1, 2060) = 5.171$, $p < 0.05$

Effects of picture and strategy.

parameters: s125, s200, s300, s500, s600, s800, s1000, s1600, s8000. That is, energy in these frequency bands was higher during emotion verbalization (Emo con + Emo incon) compared to fact verbalization (Fact con + Fact incon). Furthermore, the analysis of voice data revealed an effect of congruency in voice quality. The distribution of the frequency spectrum displayed less energy in the very low and very high frequencies (s125, s23000) during congruent verbalizations (Emo con + Fact con), compared to incongruent verbalizations (Emo incon + Fact incon), while energy in the frequency band s500 was increased. There was also an interaction between focus and congruency in intensity in a range of frequency bands (s125, s200, s300, s500, s800, s1000, s8000, s23000; see **Tables 3** and **4**). The effects were significant for factor focus in the congruent and in the incongruent condition. Tukey's *post hoc* comparison showed that there was significantly more energy in the s200, s300, and s500 frequencies when participants admitted facts versus denying them, while there was less energy in the very low frequency bands s125 and s200 and the very high frequency

bands s8000 and s23000 when participants admitted emotion versus denying them. There was no interaction between focus and congruency in pitch.

DISCUSSION

In the present study, we investigated how different strategies of verbalization influence emotion processing and regulation in an experimental setting similar to a conversation. We were able to identify effects of the different strategies on SCR, characteristics of the voice, and on self-report data regarding the subjective effectiveness of the different verbalization strategies.

EMOTION INDUCTION: EFFECTS OF EMOTIONAL PICTURES

The presentation of negative as compared to neutral pictures led to an increase in SCR preceding the verbalization phase. As a large number of studies have shown that emotional arousal elicited by affective pictures can be measured in the electrodermal response (Fowles, 1980; Lang et al., 1993), it can be concluded that emotion induction through visual stimulus material was successful in our study.

We also found an effect of negative emotional pictures on voice parameters. As described earlier, the distribution of energy in the frequency spectrum reflects voice quality or timbre (Banse and Scherer, 1996). Participants' voices displayed a difference in the lower frequency bands (s500, s600, s800) while verbalizing facts, depending on whether they were shown negative or neutral pictures (see **Table 3**). However, in contrast to other studies (Scherer, 1986; Johnstone et al., 2005) in which less energy in low frequency bands has been associated with unpleasantness of the stimuli, we found more energy in the lower frequencies in response to negative pictures (s500, s600, s800). We cannot rule out that this dissenting finding might be due to language differences (German versus French), controlled speech use versus free speech use, or the analysis of only the last few words of a sentence versus the whole sentence.

EMOTION REGULATION: EFFECTS OF VERBALIZATION

Arousal level of participants as indicated by SCR data was modulated by the type of verbalization (see **Table 3**). SCR was lower when the focus of verbalization was on emotion (i.e., when participants admitted or denied an emotional response to the picture) compared to facts. The same effect of emotion verbalization was also visible in voice parameters. Analysis of voice data showed that pitch was attenuated during emotion verbalization, indicating lower arousal compared to the conditions in which subjects focused on facts (Ladd et al., 1985). The lower skin conductance and lower pitch (see **Table 3**) during the verbalization of emotion correspond to the results by Tabibnia et al. (2008), suggesting regulatory effects of emotion verbalization similar to the affect labeling mechanism described by Lieberman et al. (2007).

These results are also in line with the findings by Mendolia and Kleck (1993) who compared talking about emotion with talking about the sequence of events of a movie presented previously. The authors showed that subjects who talked about their emotion after watching the movie showed lower autonomic arousal when they viewed the movie a second time 48 h later. In the same study, a reverse effect was found when the second presentation of the movie occurred shortly after the intervention (talking about emotion or facts), indicating that the effect of verbalization is not constant over time. In the present study, we investigated changes in physiological responses at the very moment of the verbalization and found that autonomic arousal was lower for emotion verbalization than for fact verbalization. Hence, the combination of the present results and the findings by Mendolia and Kleck (1993) indicates a U-shaped time course of the regulatory effect of emotion verbalization, insofar that this effect seems to be initiated immediately upon verbalization onset, reverses shortly afterward for a yet unclear period of time, and finally recuperates. This is an interesting thought, as this time course may reflect cognitive or emotional processing induced by the verbalization of emotion. It may be worthwhile to further explore the exact temporal dynamics of this effect of emotion verbalization in future studies.

The effects of emotion verbalization on the physiological indicators of arousal also correspond to the findings by Lieberman et al. (2007), who reported diminished amygdala activity during affect labeling. While utilizing slightly different verbal strategies, our study taken together with the studies by Lieberman et al. (2007) and Mendolia and Kleck (1993) provide cumulative evidence that verbalization of the emotional experience can exert a regulating effect on emotion. Greenberg (2004) argued that putting emotion into words allows an experience to be assimilated into people's conscious conceptual understanding of the self and the world, and therefore might be a necessary tool of emotion focused therapy. On the other hand, the results provided by Nils and Rimé (2012) suggest that emotion verbalization is not always helpful for resolving negative emotion. Again, differences in time point of measurement and parameters may be responsible for these different findings. Alternatively, it is possible that talking about emotion is beneficial compared to not talking about emotion (and speaking about something else instead). Talking about emotion with an interlocutor giving socio-affective support, however, is less effective for emotional recovery than with an interlocutor encouraging cognitive reframing.

An interesting point is that, in conflict with the physiological evidence, participants reported increased emotional arousal in the emotion verbalization conditions as compared to the fact verbalization conditions (see **Table 3**). Thus, even though SCR data clearly showed that participants' autonomic arousal was reduced by emotion verbalization, they seemed to neither notice nor believe that verbalizing their emotion could have this effect. Lieberman et al. (2011) observed the same contradictory results investigating the effects of affect labeling: although affect labeling led to lower distress during the experiment, participants did not believe that affect labeling is an effective emotion regulation strategy. Similarly, Nils and Rimé (2012) also observed that self-report ratings during the experiment stood in direct contradiction with self-report ratings at the end of the experimental procedures with regard to effectiveness of an emotion regulation strategy. These repeated findings invite doubtful speculation on the accuracy of self-reports pertaining to emotional arousal. It is conceivable that participants based their judgment on preconceptions regarding what kind of strategies are generally considered helpful or

not helpful when dealing with emotion, rather than introspection. Alternatively, another explanation might arise from different effects of verbalization strategies on emotional valence and arousal. Specifically, we found lower voice intensity during fact verbalization compared to emotion verbalization (see **Table 3**). Since Scherer (2003) connected an increase of voice intensity to negative valence, we interpret this finding as evidence that fact verbalization led to less negative valence as compared to emotion verbalization. Voice quality measures indicated the same effect. We found less energy in the lower frequencies of the voice for the fact verbalization conditions. Emotion verbalization thus seems to have diminished arousal more than fact verbalization, whereas fact verbalization seems to have reduced negative valence. Subjects might have perceived the changes in valence during fact verbalization as being more important for emotional down-regulation than the changes in arousal during emotion verbalization. Thus, they may have rated fact verbalization as more effective for this reason.

Our results show that emotional responses can be influenced by verbalization, and that emotion is reflected in prosody. Studies comparing the beneficial effects of writing and talking about emotion (Donnelly and Murray, 1991; Harrist et al., 2007) found that participants' mood was more negative after expressive writing than after talking. The authors concluded that above the effect of expressing one's emotion in general, vocal expression has an impact on emotion processing. Izard (1990) states that expressive behavior might amplify as well as down-regulate emotional responses. According to Leventhal's model (Ahles et al., 1983; Leventhal, 1984; Leventhal and Scherer, 1987), verbal expressions stimulate or suppress imagery and expressive motor responses that can alter the emotion associated with the event in question. Leventhal added a feedback loop from automatic facial expressive activity to his perceptual motor model of emotion, which postulates that motor activity modulates emotional experience. A study by Davis et al. (2010) provided evidence for a facial feedback loop by showing that reduced facial expressions after the injection of BOTOX® diminished subjective emotional experience. Adapting Leventhal's perceptual motor model of emotion, we assume that differences in prosody not only indicate emotional states, but are also perceived by the individual speaking and interact via an auditory feedback loop with emotional experience. We therefore think that prosody of the verbal expression might be an additional factor influencing emotion processing. Prosodic components of speech might contribute to the process of emotion regulation in addition to semantic cognitive components. The idea of an auditory feedback loop is also used in verbal self-monitoring models (e.g., Fu et al., 2006), according to which verbalization transiently activates the speaker's auditory cortex very early, around 100 ms, after voice onset (Curio et al., 2000). The verbal denial of emotion might also have initiated response tendencies similar to those induced by the suppression of emotional expression. Expression suppression is an emotion regulation strategy described by Gross (1998a,b, 2007). Verbal expressions presumably include not only facial but also lingual motor responses. This might lead to a mixed physiological state including increased sympathetic activation due to the additional task of suppressing behavioral response tendencies (Gross, 2007).

We also found a main effect for the factor congruency in the distribution of energy in the frequency spectrum (see **Tables 3** and **4**; s125, S500, s23000). We found more energy in the very low (s125) and very high (s23000) frequency bands during the denial conditions, while there was less energy in the s500 frequency bands. Since we had no specific hypotheses regarding the distribution of energy in the frequency spectrum for congruency, these findings have to be considered exploratory. We did hypothesize an interaction between focus and congruency in pitch and SCR, since lying about facts has been associated with an increase in physiological arousal (Gamer et al., 2007, 2008) while denying emotions has been associated with a decrease (Herbert et al., 2011). We did not find an interaction in pitch and SCR but in voice intensity and voice quality in both high and low frequency bands (s125, s200, s300, s500, k800, k1000, k8000, k23000). In line with Hirschberg et al. (2005), these results suggest that voice parameters might be useful for detecting deception. At the same time, our data indicates that denying an emotional experience exerts different physiological consequences than denying facts. Possibly, when it comes to talking about emotion, this effect of denying might be reversed by a potentially stronger effect of emotion verbalization. However, that idea needs to be further explored by future studies.

LIMITATIONS

Since every language has specific characteristics, we cannot rule out that our findings might be influenced by characteristics of the German language, or culture specific language use. Considering that the voice changes over lifespan, our results only refer to young speakers (aged from 20 to 30 years), and cannot be generalized to other age periods.

We cannot rule out that constraining the efficacy rating of each strategy to one point in time after the experiment, as opposed to a trial-by-trial rating, might have limited the informative value of the self-report data. On the other hand, it has been argued that ratings on a trial-by-trial basis can trigger other evaluation processes, such as secondary self-reflection and recollection of feelings during the actual regulation, and might therefore cause confounding effects on arousal (Erk et al., 2010). Nevertheless, for future research we recommend a trial-by-trial rating, bearing in mind the possible implications.

We think that further research is needed to assess how verbalizing affects the different dimensions of emotion, and to replicate our findings, since parts of the study were exploratory. We also recommend assessing both valence and arousal, since different verbalization strategies seem to have different effects on both dimensions.

In the present study, we investigated the regulatory effect of different verbal strategies on skin conductance and voice parameters by using only negative or neutral pictures. Therefore, our results cannot be generalized to emotional stimuli with positive valence.

We found effects in voice parameters indicating a modified emotional state. Given the paradigm of our study, we were unable to test whether the differences in voice parameters are noticeable to a listener and thus impact social interactions (cf. Johnstone et al., 2005). This question could be addressed in further studies

by letting a second group of subjects rate the recorded responses of the first subject group regarding the emotional state of the speaker (valence and arousal).

CONCLUSION

Our experiment focused on the sender's side of communication and investigated through which channels emotion is transmitted, and how emotion is modulated during the act of speaking. We thereby contribute to a more comprehensive understanding of how emotion is communicated, even if the person in question tries to deny his or her emotional state. According to Rimé's (2009) approach, people feel the need to convey their emotion. One explanation emerging from our results for this need to communicate emotion could be that people verbalize their emotion on purpose in an attempt to regulate it. We found evidence suggesting that the different strategies of verbalization employed in the experiment are capable of regulating someone's emotional state, and that a verbal feedback loop affects emotional experience in a similar way to the facial feedback loop described in Leventhal's perceptual motor model of emotion (Leventhal, 1984). We would like to draw attention to the selective influence of different verbalization strategies on valence and arousal and to the potential this distinction might have for future research in this field. Specifically, we found that verbalizing one's emotion affected arousal, while focusing on facts of an emotional event modulated valence.

ACKNOWLEDGMENTS

This study was financially supported by the Cluster of Excellence "Languages of Emotion" at Freie Universität Berlin, which is funded by the DFG (German Research Foundation), and by the Open-Access publication fund of the DFG and the Freie Universität Berlin. We thank Dr. Daina Langner and Dr. Jörg Langner for scientific discussion, advice, and technical support.

REFERENCES

Ahles, T. A., Blanchard, E. B., and Leventhal, H. (1983). Cognitive control of pain: attention to the sensory aspects of the cold pressor stimulus. *Cognit. Ther. Res.* 7, 159–177.

Banse, R., and Scherer, K. R. (1996). Acoustic profiles in vocal emotion expression. *J. Pers. Soc. Psychol.* 70, 614–636.

Curio, G., Neuloh, G., Numminen, J., Jousmäki, V., and Hari, R. (2000). Speaking modifies voice-evoked activity in the human auditory cortex. *Hum. Brain Mapp.* 9, 183–191.

Davis, J., Senghas, A., and Brandt, F. (2010). The effects of BOTOX injections on emotional experience. *Emotion* 10, 433–440.

Dawson, M. E., Schell, A. M., and Filion, D. L. (2000). "The electrodermal system," in *Handbook of Psychophysiology*, 2nd Edn, eds J. T. Cacioppo, L. G. Tassinary, and G. G. Bernston (Boston: Cambridge University Press), 200–223.

Demaree, H., Robinson, J., and Pu, J. (2006). Strategies actually employed during response-focused emotion regulation research: affective and physiological consequences. *Cogn. Emot.* 20, 1248–1260.

Donnelly, D. A., and Murray, E. J. (1991). Cognitive and emotional changes in written essays and therapy interviews. *J. Soc. Clin. Psychol.* 10, 334–350.

Driscoll, D., Tranel, D., and Anderson, S. W. (2009). The effects of voluntary regulation of positive and negative emotion on psychophysiological responsiveness. *Int. J. Psychophysiol.* 72, 61.

Egloff, B., Schmukle, S. C., Burns, L. R., and Schwerdtfeger, A. (2006). Spontaneous emotion regulation during evaluated speaking tasks: associations with negative affect, anxiety expression, memory, and physiological responding. *Emotion* 6, 356–366.

Erk, S., Mikschl, A., Stier, S., Ciaramidaro, A., Gapp, V., Weber, B., et al. (2010). Acute and sustained effects of cognitive emotion regulation in major depression. *J. Neurosci.* 30, 15726–15734.

Etkin, A., Egner, T., and Kalisch, R. (2011). Emotional processing in anterior cingulate and medial prefrontal cortex. *Trends Cogn. Sci.* 15, 85–93.

Fehr, F. S., and Stern, J. A. (1970). Peripheral physiological variables and emotion: the James-Lange theory revisited. *Psychol. Bull.* 74, 411–424.

Fowles, D. C. (1980). The three arousal model: implications of gray's two-factor learning theory for heart rate. *Psychophysiology* 17, 87–104.

Fu, C. H. Y., Vythelingum, G. N., Brammer, M. J., Williams, S. C. R., Amaro, E. Jr., Andrew, C. M., et al. (2006). An fMRI study of verbal self-monitoring: neural correlates of auditory verbal feedback. *Cereb. Cortex* 16, 969–977.

Gamer, M., Bauermann, T., Stoeter, P., and Vossel, G. (2007). Covariations among fMRI, skin conductance, and behavioral data during processing of concealed information. *Hum. Brain Mapp.* 28, 1287–1301.

Gamer, M., Verschuere, B., Crombez, G., and Vossel, G. (2008). Combining physiological measures in the detection of concealed information. *Physiol. Behav.* 95, 333–340.

Goudbeek, M., and Scherer, K. (2010). Beyound arousal: valence and potency/control cues in the vocal expression of emotion. *J. Acoust. Soc. Am.* 128, 1322–1336.

Greenberg, L. S. (2004). Emotion-focused therapy. *Clin. Psychol. Psychother.* 11, 3–16.

Gross, J. J. (1998a). The emerging field of emotion regulation: an integrative review. *Rev. Gen. Psychol.* 2, 271–299.

Gross, J. J. (1998b). Antecedent- and response-focused emotion regulation: divergent consequences for experience, expression, and physiology. *J. Pers. Soc. Psychol.* 47, 224–237.

Gross, J. J. (2007). "Emotion regulation: conceptual foundations," in *Handbook of Emotion Regulation*, ed. J. J. Gross (New York: Guilford Press), 3–24.

Hariri, A. R., Bookheimer, S. Y., and Mazziotta, J. C. (2000). Modulating emotional responses: effects of a neocortical network on the limbic system. *Neuroreport* 11, 43–48.

Harrist, S., Carlozzi, B. L., McGovern, A. R., and Harrist, A. W. (2007). Benefits of expressive writing and expressive talking about life goals. *J. Res. Pers.* 41, 923–930.

Herbert, C., Deutsch, R., Sütterlin, S., Kübler, A., and Pauli, P. (2011). Negation as a means for emotion regulation? Startle reflex modulation during processing of negated emotional words. *Cogn. Affect. Behav. Neurosci.* 11, 199–206.

Hirschberg, J., Benus, S., Brenier, J. M., Enos, F., Friedman, S., Gilman, S., et al. (2005). "Distinguishing deceptive from non-deceptive speech," in *Proceedings of the 9th European Conference on Speech Communication and Technology (Interspeech '05)*, Lisbon, 1833–1836.

Izard, C. E. (1990). Facial expressions and the regulation of emotion. *J. Pers. Soc. Psychol.* 58, 487.

Jackson, D. C., Malmstadt, J. R., Larson, C. L., and Davidson, R. J. (2000). Suppression and Enhancement of Emotional Responses to Unpleasant Pictures. *Psychophysiology* 37, 515–522.

Johnstone, T., van Reekum, C. M., Hird, K., Kirsner, K., and Scherer, K. R. (2005). Affective speech elicited with a computer game. *Emotion* 5, 513.

Kalisch, R. (2009). The functional neuroanatomy of reappraisal: time matters. *Neurosci. Biobehav. Rev.* 33, 1215–1226.

Kanske, P., Heissler, J., Schönfelder, S., Bongers, A., and Wessa, M. (2011). How to regulate emotion? Neural networks for reappraisal and distraction. *Cereb. Cortex* 21, 1379–1388.

Ladd, D. R., Silverman, K. E. A., Tolkmitt, F., Bergmann, G., and Scherer, K. R. (1985). Evidence for the independent function of intonation contour type, voice quality, and F0 range in signaling speaker affect. *J. Acoust. Soc. Am.* 78, 435–444.

Lang, P. J., Bradley, M. M., and Cuthbert, B. N. (1990). Emotion, attention, and the startle reflex. *Psychol. Rev.* 97, 377.

Lang, P. J., Bradley, M. M., and Cuthbert, B. N. (2005). *International Affective Picture System (IAPS): Affective Ratings of Pictures and Instruction Manual.* Technical Report A-6. Gainesville, FL: University of Florida.

Lang, P. J., Greenwald, M. K., Bradley, M. M., and Hamm, A. O. (1993). Looking at pictures: affective, facial, visceral, and behavioral reactions. *Psychophysiology* 30, 261–273.

Laukka, P., Juslin, P., and Bresin, R. (2005). A dimensional approach to vocal expression of emotion. *Cogn. Emot.* 19, 633–653.

Lazarus, R. S., and Folkman, S. (1984). *Stress, Appraisal, and Coping*. New York: Springer Publishing Company.

Leventhal, H. (1984). A perceptual-motor theory of emotion. *Adv. Exp. Soc. Psychol.* 17, 117–182.

Leventhal, H., and Scherer, K. (1987). The relationship of emotion to cognition: a functional approach to a semantic controversy. *Cogn. Emot.* 1, 3–28.

Lieberman, M. (2011). "Why symbolic processing of affect can disrupt negative affect: social cognitive and affective neuroscience investigations," in *Social Neuroscience: Toward Understanding the Underpinnings of the Social Mind*, eds A. Todorov, S. Fiske, and D. Prentice (New York: Oxford University Press), 188–209.

Lieberman, M. D., Eisenberger, N. I., Crockett, M. J., Tom, S. M., Pfeifer, J. H., and Way, B. M. (2007). Putting feelings into words. *Psychol. Sci.* 18, 421–428.

Lieberman, M. D., Inagaki, T. K., Tabibnia, G., and Crockett, M. J. (2011). Subjective responses to emotional stimuli during labeling, reappraisal, and distraction. *Emotion* 11, 468–480.

Luo, X., and Fu, Q. (2007). Vocal emotion recognition by normal-hearing listeners and cochlear implant users. *Trends Amplif.* 11, 301–315.

Mendolia, M., and Kleck, R. E. (1993). Effects of talking about a stressful event on arousal: does what we talk about make a difference? *J. Pers. Soc. Psychol.* 64, 283–292.

Nils, F., and Rimé, B. (2012). Beyond the myth of venting: social sharing modes determine the benefits of emotional disclosure. *Eur. J. Soc. Psychol.* 42, 672–681.

Ochsner, K. (2005). The cognitive control of emotion. *Trends Cogn. Sci. (Regul. Ed.)* 9, 242–249.

Pinheiro, J. C., and Bates, D. M. (2002). *Mixed-Effects Models in S and S-PLUS*. (New York: Springer).

R Development Core Team. (2012). *R: A Language and Environment for Statistical Computing*. Vienna: R Foundation for Statistical Computing.

Rimé, B. (2009). Emotion elicits the social sharing of emotion: theory and empirical review. *Emot. Rev.* 1, 60–85.

Scherer, K. R. (1986). Vocal affect expression: a review and a model for future research. *Psychol. Bull.* 99, 143.

Scherer, K. R. (2003). Vocal communication of emotion: a review of research paradigms. *Speech Commun.* 40, 227–256.

Schirmer, A., and Kotz, S. A. (2006). Beyond the right hemisphere: brain mechanisms mediating vocal emotional processing. *Trends Cogn. Sci. (Regul. Ed.)* 10, 24–30.

Schröder, M., Cowie, R., Douglas-Cowie, E., Westerdijk, M., and Gielen, S. (2001). "Acoustic correlates of emotion dimensions in view of speech synthesis," in *Proceedings of Eurospeech*, Aalborg, Vol. 1, 87–90.

Sueur, J., Aubin, T., and Simonis, C. (2008). Seewave: a free modular tool for sound analysis and synthesis. *Bioacoustics* 18, 213–226.

Tabibnia, G., Lieberman, M. D., and Craske, M. G. (2008). The lasting effect of words on feelings: words may facilitate exposure effects to threatening images. *Emotion* 8, 307–317.

Urry, H. L., van Reekum, C. M., Johnstone, T., and Davidson, R. J. (2009). Individual differences in some (but not all) medial prefrontal regions reflect cognitive demand while regulating unpleasant emotion. *Neuroimage* 47, 852.

Conflict of Interest Statement: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Received: 24 June 2012; accepted: 19 April 2013; published online: 10 May 2013.

Citation: Matejka M, Kazzer P, Seehausen M, Bajbouj M, Klann-Delius G, Menninghaus W, Jacobs AM, Heekeren HR and Prehn K (2013) Talking about emotion: prosody and skin conductance indicate emotion regulation. Front. Psychol. ***4****:260. doi: 10.3389/fpsyg.2013.00260*

This article was submitted to Frontiers in Emotion Science, a specialty of Frontiers in Psychology.

frontiers in
PSYCHOLOGY

ORIGINAL RESEARCH ARTICLE
published: 12 November 2012
doi: 10.3389/fpsyg.2012.00482

Effects of empathic paraphrasing – extrinsic emotion regulation in social conflict

***Maria Seehausen*[1,2,3]*, *Philipp Kazzer*[1,2,3], *Malek Bajbouj*[1,2,3] and *Kristin Prehn*[1,2]**

[1] *Cluster of Excellence "Languages of Emotion," Freie Universität, Berlin, Germany*
[2] *Dahlem Institute for Neuroimaging of Emotion, Freie Universität, Berlin, Germany*
[3] *Department of Psychiatry, Charité University Medicine Berlin, Campus Benjamin Franklin, Berlin, Germany*

Edited by:
Vera Shuman, University of Geneva, Switzerland

Reviewed by:
Philipp Kanske, Max Planck Institute for Human Cognitive and Brain Sciences, Germany
Molly Ireland, University of Pennsylvania, USA

***Correspondence:**
Maria Seehausen, Cluster of Excellence "Languages of Emotion," Freie Universität Berlin, Habelschwerdter Allee 45, 14195 Berlin, Germany.
e-mail: maria.seehausen@fu-berlin.de

In the present study, we investigated the effects of empathic paraphrasing as an extrinsic emotion regulation technique in social conflict. We hypothesized that negative emotions elicited by social conflict can be regulated extrinsically in a conversation by a listener following the narrator's perspective and verbally expressing cognitive empathy. Twenty participants were interviewed on an ongoing or recently self-experienced social conflict. The interviewer utilized 10 standardized open questions inviting participants to describe their perception of the conflict. After each of the 10 descriptions, the interviewer responded by either paraphrasing or taking notes (control condition). Valence ratings pertaining to the current emotional state were assessed during the interview along with psychophysiological and voice recordings. Participants reported feeling less negative after hearing the interviewer paraphrase what they had said. In addition, we found a lower sound intensity of participants' voices when answering to questions following a paraphrase. At the physiological level, skin conductance response, as well as heart rate, were higher during paraphrasing than during taking notes, while blood volume pulse amplitude was lower during paraphrasing, indicating higher autonomic arousal. The results show that demonstrating cognitive empathy through paraphrasing can extrinsically regulate negative emotion on a short-term basis. Paraphrasing led to enhanced autonomic activation in recipients, while at the same time influencing emotional valence in the direction of feeling better. A possible explanation for these results is that being treated in an empathic manner may stimulate a more intense emotion processing helping to transform and resolve the conflict.

Keywords: emotion regulation, empathy, social conflict resolution, paraphrasing, client-centered-therapy

INTRODUCTION

Emotion regulation research to date has mainly focused on an individualistic point of view emphasizing control mechanisms in the individual, such as attention deployment, cognitive reappraisal, or the willful suppression of emotional expressions (Gross and Thompson, 2007; Butler and Gross, 2009; Rime, 2009). Compared to the abundance and sophistication of the research pertaining to classification schemes on such *intrinsic* regulation, systematic analysis of *extrinsic* emotion regulation and especially of controlled interpersonal affect regulation (i.e., the process of deliberately influencing the emotional state of another person, as opposed to non-conscious affect spreading) is still relatively sparse. Rime (2009), however, points out that an emotional experience is virtually indivisible of a social response, which in turn is bound to shape and modify the original emotion, so that emotion has to be regarded as a fundamentally interdependent process.

Niven et al. (2009) propose a classification system for controlled interpersonal affect regulation strategies, derived from Totterdell and Parkinson's (1999) classification of strategies to deliberately improve one's affect. Their final classification distinguishes between strategies used to improve versus strategies used to worsen others' affect, and between strategies that engage the target in a situation or affective state versus relationship-oriented strategies. The technique of empathic paraphrasing, which is investigated in the present study, can be categorized as aiming at affect improvement and engagement within this classification framework. However, it also contains a relationship-oriented component, as empathic paraphrasing communicates interest and commitment in understanding the other's perspective, thereby implying that their feelings are valid and worth listening to.

Empathy has been conceptualized in many different ways, usually involving a cognitive and an emotional component (Preston and de Waal, 2002; Lamm et al., 2007; Decety and Meyer, 2008). Cognitive empathy means the ability to take the perspective of another person and infer their mental state, while emotional empathy refers to the observer's affective response to another person's emotional state (Dziobek et al., 2008).

Paraphrasing or active listening (coined by Carl R. Rogers in Client-Centered-Therapy) is a form of responding empathically to the emotions of another person by repeating in other words what this person said while focusing on the essence of what they feel and what is important to them. In this way, the listener actively demonstrates that he or she can understand the speaker's perspective (cognitive empathy). Rogers described empathy as the ability to sense the client's private world as if it were one's own, but without losing the "as if" quality (Rogers, 1951). Empathy is communicated

through active listening, which in the Client-Centered approach aspires to evoke personal growth and transformation through providing a space of unconditional acceptance for the client. Rogers considered empathy, positive regard, and congruence both necessary and sufficient conditions for therapeutic change (Rogers, 1942, 1951).

This early notion on the importance of empathy for facilitating therapeutic change has gained ample empirical support over the last decades of research. How empathic a therapist is perceived to be has been identified as a critical factor for positive therapy outcome for both psychodynamically oriented and cognitive-behavioral psychotherapies (Bohart et al., 2002; Duan and Kivlighan, 2002; Orlinsky et al., 2004; Marci et al., 2007; Elliott et al., 2011; Norcross and Wampold, 2011). Based on a review of several studies Marci et al. (2007) describe a significant influence of perceived empathy on mood and general clinical improvement, even when controlling for other factors. Along this line, a meta-analysis conducted by Bohart et al. (2002) confirms a modest but consistent importance of empathy during psychotherapy. Zuroff et al. (2010) specifically examined the relationship between patient-reported measures of the three Rogerian conditions (positive regard, empathy, and genuineness) and therapeutic outcome, and found that patients whose therapists provided high average levels of the Rogerian conditions across all patients in their caseloads experienced more rapid reductions in both overall maladjustment and depressive vulnerability (self-critical perfectionism). Farber and Doolin (2011) conducted a meta-analysis on 18 studies also focusing on the effects of positive regard as defined by Rogers on treatment outcome, and found an aggregate effect size of 0.26, confirming a moderate influence of this factor.

The effectiveness of showing empathy on treatment success has also been assured within the field of medical care. Medical researchers have coined the term *clinical empathy*, which Mercer and Reynolds (2002) define as (1) understanding the patient's situation, perspective and feelings (and their attached meanings), (2) communicating that understanding and checking its accuracy, and (3) acting on that understanding with the patient in a helpful (therapeutic) way. Hence, within the clinical setting empathy entails not only cognitive and affective components but also a behavioral component to communicate understanding to the patient, i.e., through active listening (Davis, 2009). Accordingly, the active demonstration of empathy has already been recognized as a crucial component of promoting cooperation in challenging situations within the field of clinical care. Halpern (2007) stresses that physicians who learn to empathize with patients during emotionally charged interactions can thereby increase their therapeutic impact. By the same token, a growing body of evidence demonstrates that empathic communication effectively helps patients through challenging and fearful situations, ranging from painful dental treatments over psychological problems to pandemic crisis (Cape, 2000; Reynolds and Quinn Crouse, 2008; Bernson et al., 2011). Neumann et al. (2009) reviewed prior empirical studies on clinical empathy and conclude that clinical empathy is a fundamental determinant of successful medical care, because "*it enables the clinician to fulfill key medical tasks more accurately, thereby achieving enhanced health outcomes*" (Neumann et al., 2009, p. 344).

In sum, the effectiveness of empathic communication as an extrinsic emotion regulation technique has already gained solid empirical support from psychotherapy and medical research. For the present study, social conflict was chosen as the context to examine the effects of empathic paraphrasing on emotion, for two reasons. Firstly, social conflict is often accompanied by intense emotions such as anger and hurt, and therefore lends itself easily to the investigation of extrinsic emotion regulation, without requiring artificial emotion induction in the laboratory. The setting of real-life social conflict renders it possible to work with "real" emotion, while at the same time concentrating on a non-clinical population. Secondly, empathic paraphrasing is used with vast prevalence within the field of conflict resolution. Paraphrasing is generally applied as one of the most important constitutional elements across all domains of conflict mediation (business mediation, family mediation, community mediation, victim-offender mediation, etc.). Hence, it seems expedient to take a closer look at the emotional effects of a technique so widely used within the context of its most common application.

Social psychology research offers evidence for a connection between dispositional affective empathy as well as dispositional perspective taking and adaptive social conflict behavior (Steins, 2000; Gehlbach, 2004; de Wied et al., 2007). However, there is hardly any research on the effects of *being treated* in an empathic manner (as opposed to feeling empathy oneself) on conflict behavior. Moran and Diamond (2008) report positive effects of therapist empathy on parent's negative attitudes toward their depressed adolescent children. Being treated in an empathic way seems to help parents to also empathize with their children going through a rough time. This is an interesting finding, which contains parallels to social conflict situations and stimulates the question which emotional effects are triggered by being treated empathically, and how these emotional processes aid own empathic reactions toward others.

An interesting train of evidence regarding the socio-cognitive effects of being treated empathically is provided by research on interpersonal mimicry and language matching in social interaction. Numerous studies confirm that non-verbal interpersonal mimicry increases affiliation and positive social judgment as well as pro-social behavior not only toward the mimicker but also toward people not involved in the mimicry situation, indicating that being mimicked not only leads to an increased liking toward the interaction partner, but to an increased pro-social orientation in general (van Baaren et al., 2004; Ashton–James et al., 2007; Fischer-Lokou et al., 2011.; Guéguen et al., 2011; Stel and Harinck, 2011). This is true for the *mimickee* as well as the *mimicker* (Stel et al., 2008). Maddux et al. (2008) also report that strategic mimicry in negotiation abets more favorable negotiation outcomes, facilitating both individual and joint gains. This effect was mediated by higher levels of trust toward the mimicker. Ashton–James et al. (2007) tested several hypotheses on why mimicry promotes pro-social behavior and found that being mimicked during social interaction shifts self-construal toward becoming more interdependent and "other-oriented." Additionally, mimicry strengthens one's perception of interpersonal closeness with other people in general.

Correspondingly, language style matching, i.e., similarity in use of function words, has been found to predict relationship initiation and stability (Ireland et al., 2011). On a similar vein, according to the interactive-alignment account of dialog, the success of any given conversation depends on the extent of the conversation partners arriving at a common understanding of the relevant aspects of what they are talking about, i.e., a common situation model (Pickering and Garrod, 2004). Interlocutors tend to automatically align at different levels of linguistic representation, e.g., through repeating each other's words and grammar (Garrod and Pickering, 2004). This alignment at low-level structure positively affects alignment of interlocutors' situation models – the hallmark of successful communication – as people who describe a situation in the same way tend to think about it in the same way as well (Markman and Makin, 1998; Menenti et al., 2012). These findings strongly support the hypothesis that paraphrasing, which involves a certain degree of language matching and bears parallels to mimicry on a verbal level, administrates emotional and socio-cognitive effects on the person being paraphrased.

Regardless the impressive amount of research reviewed above, the specific dynamics of emotional response to empathic paraphrasing are yet largely unclear. Rime (2009) suggests that socio-affective responses such as comfort and empathy temporarily alleviate a narrator's negative emotions and generate a deep feeling of relief. However, if no cognitive reframing and re-adjustment of goals, motives, models, and schemas occur, the alleviating effects of socio-affective responses can be expected to be only temporary, because the cognitive sources of the emotional unsettledness have not been transformed. Following this reasoning, the emotional effects of empathic paraphrasing should be expected to be short-lived. On the other hand, Rogers argued that receiving empathy and positive regard are necessary conditions for being able to revise overly rigid structures of the self and assimilate dissonant information and experiences (Rogers, 1942, 1951). Hence, empathic paraphrasing may initiate a cognitive-emotional process progressing in several stages, with emotional alleviation and an increased mental openness and disposition for cognitive restructuring possibly being the first one. In this respect, the present research makes a valuable contribution by moving beyond correlational designs to presenting the first experimental study assessing in detail the emotional effects of empathic paraphrasing in the context of social conflict, hopefully providing a useful basis for further analysis in future studies.

To investigate whether and how empathic paraphrasing in the context of a real-life social conflict extrinsically regulates emotion, we invited participants to an interview in which they were asked to talk about an ongoing or recently self-experienced social conflict with a partner, friend, roommate, neighbor, or family member. The interviewer responded to participants' descriptions by either paraphrasing (experimental condition following half of the interview questions) or taking notes (control condition). We assessed valence ratings pertaining to participants' current emotional state as well as skin conductance response (SCR), blood volume pulse (BVP), blood volume pulse amplitude (BVPamp), and heart rate (HR) as indicators of autonomous nervous system (ANS) activity during the interviews. We also recorded the interviews for documentation and analysis.

Psychophysiological and voice parameters have been proven to be reliable indicators for emotional responses (Scherer, 2003; Kushki et al., 2011). HR is regulated by sympathetic (increase) as well as parasympathetic (decrease) pathways of the ANS (Li and Chen, 2006; Kushki et al., 2011), and reflects autonomic arousal (Critchley, 2002) as well as emotional valence (Palomba et al., 1997). BVP is a measure of changes in the volume of blood in vessels and has been associated with affective and cognitive processing (Kushki et al., 2011). BVP amplitude has been found to be lower during episodes of increased sympathetic activity (Shelley, 2007) and has also been shown to decrease when feeling fear or sadness in several studies (Kreibig et al., 2007). SCR depicts changes in the skin's ability to conduct electricity and is considered a sensitive psychophysiological index of changes in autonomic sympathetic arousal that are integrated with emotional and cognitive states. In addition, SCR reflects vicarious emotional responses to another's affective state (pain), and is therefore also connected to empathy (Hein et al., 2011).

Based on the literature reviewed above, we hypothesized that empathic paraphrasing would lead to a reduction of negative emotion in the situation of talking about the conflict. Specifically, we expected valence ratings to be more positive after paraphrasing. Furthermore, we hypothesized that empathic paraphrasing would lead to lower autonomic arousal, reflected in psychophysiological measures and voice analysis.

MATERIALS AND METHODS

PARTICIPANTS

Twenty healthy subjects [10 female; age: mean (M) = 27, standard deviation (SD) = 7.9] participated in this study. All participants were native German speakers, and had recently experienced a potentially ongoing social conflict with a partner, friend, roommate, neighbor, or family member. No conflicts involving physical or psychological violence were included in the study. Due to technical problems, SCR and voice data of four participants as well as BVP data of three participants were lost. Therefore, 20 participants entered the analysis of self-report data, 16 entered voice data analysis and analysis of SCR, and 17 entered analysis of HR and BVP.

The study was carried out in accordance with the Declaration of Helsinki and was approved by the ethical committee of the Charité University Medicine Berlin. All participants gave written informed consent prior to investigation and received payment for participation.

INTERVIEW DESIGN AND PROCEDURE

Participants were told that the study investigates emotion in social conflict, especially how emotions develop while speaking about a social conflict. The interviewer further informed participants that she would try to understand their perspective, and sometimes summarize what she understood so far, while at other times take notes to help her memorize certain things and have them present over the course of the interview.

Interviews consisted of 10 standardized open questions (e.g., "What exactly bothers you about the other person's behavior?"). After the participant answered each question, the interviewer either paraphrased what had been said, or silently took notes

(control condition). Following these paraphrasing interventions or control conditions, respectively, participants were asked to rate their current emotional state. In order to avoid confounding effects resulting from the content of the questions, as well as distortions due to emotional processing over the course of the interview, interventions, and control condition were given alternately during the interview. Half of all participants received an intervention (empathic paraphrasing) after the first question, a control intervention after the second question, and so forth; the other half received a control intervention first. All interviews were conducted by the same female interviewer, who had previously received 190 h of training in conflict resolution and has worked on cases in community mediation, business mediation, and family mediation over several years, applying empathic paraphrasing as one of the core techniques of conflict resolution.

Paraphrasing in the present study was implemented in such a way that after each narration the interviewer briefly summarized the facts of the narration and described her understanding of how the narrator felt, and why, and what she understood was important to the narrator regarding the situation described. To confirm the accuracy of her paraphrasing, the interviewer asked if her understanding was correct at the end of each paraphrase. An example of a paraphrase is given in the Appendix.

All interviews were audiotaped. Interview length was 30.16 min on average (SD = 11.03), depending on how extensively participants answered to the questions. **Figure 1** depicts the interview questions as well as a schematic overview of the interview procedure and measurements.

DATA ACQUISITION AND ANALYSES

Participants were asked to indicate their current emotional state (valence rating) on an eight-point Likert scale ranging from −4 to 4 ("How positive or negative do you feel right now?") 10 times during the interview, following the interventions and control condition, respectively. Ratings were analyzed with two-tailed *t*-tests for repeated measures in IBM SPSS Statistics 20.

Skin conductance response and BVP were recorded continuously with a sampling frequency of 40 Hz using a commercial sampling device (*Biofeedback* 2000$^{X\text{-}pert}$, Schuhfried GmbH, Austria) during the entire interview. Both interviewer's and participant's voices were recorded using Audacity 1.2.6 with a highly directional microphone (Shure, WH20 Dynamic Headset Microphone, IL, USA).

Skin conductance data was analyzed in LedaLab V3.3.1. Time frame of analysis was 25 s after the onset of the intervention or control condition. Within this interval, SCR was decomposed by continuous decomposition analysis (CDA; Benedek and Kaernbach, 2010). For each participant and interval, the maximum phasic activity was computed (with a minimum amplitude of 0.001 μS) and averaged for each participant across all intervals of both conditions).

Blood volume pulse and BVPamp were analyzed for intervals of 23 s after the onset of intervention or control condition using Matlab 7.1 (The Math-Works, Inc., MA, USA). Data were smoothed using a six point Gaussian filter. BVP was further used for extracting HR data through computing the inverse of the distance between successive peaks of the BVP signal in intervals larger

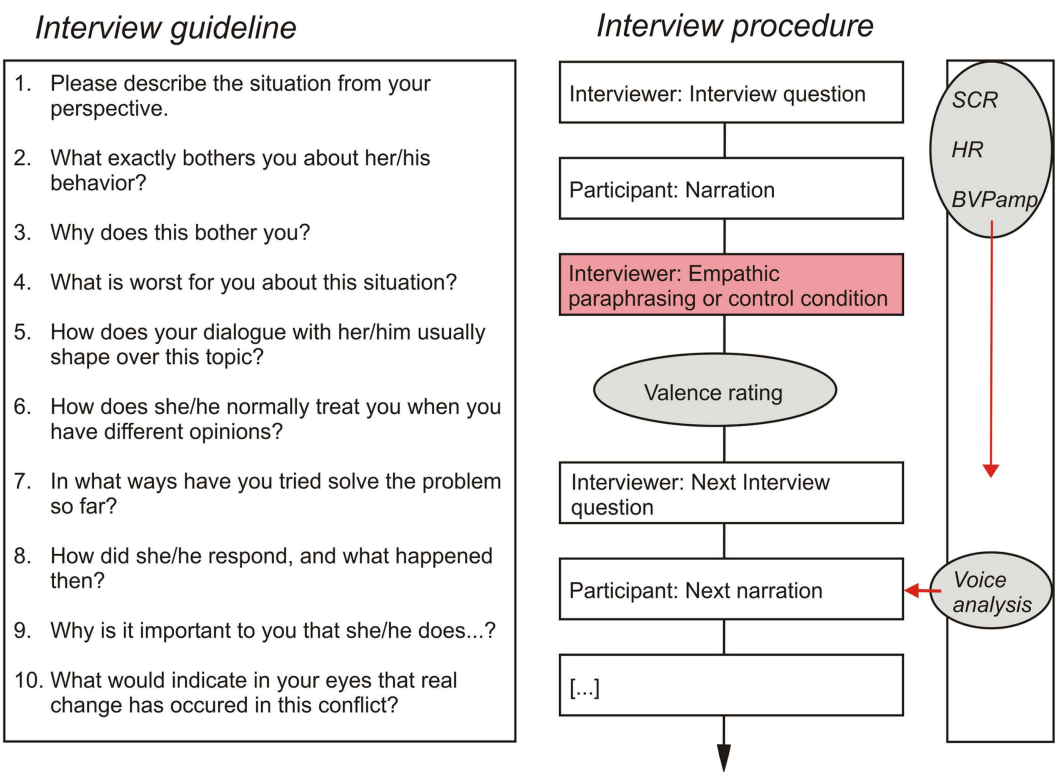


FIGURE 1 | Interview guideline and procedure.

than 0.4 s (Kushki et al., 2011). Mean SCR between both conditions (paraphrasing interventions and control conditions), BVP, BVPamp (in%), and HR (in beats per minute) were also analyzed with two-tailed t-tests for repeated measures in IBM SPSS Statistics 20. In addition, we compared BVP, BVPamp, and HR during the paraphrasing intervention and the interview question directly following the paraphrase, with a standard time frame of 4 s for the question phase.

Analysis of voice recordings was done with seewave in R statistics (Sueur et al., 2008). Using Audacity 1.2.6., intervals of speech for voice analysis were selected manually by listening to the recorded interviews and cutting out participants' responses to each question – following an intervention or control intervention, respectively.

RESULTS

BEHAVIORAL DATA

Valence ratings following paraphrasing revealed less negative feelings than ratings following the control condition [$t(19) = 3.395$, $p = 0.003$]. Effect size is $d = 0.76$ (Cohen's d for repeated measures, calculated with pooled means and standard deviations).

Differences in valence ratings over the conditions are shown in **Figure 2**.

Time series plots over the entire course of the interview show a U-shaped trend in valence ratings over time, which is mainly due to ratings following the control condition (see **Figure 3**). However, a repeated measures ANOVA including sequence of intervention over time as an additional factor demonstrates that the effect of the intervention remains untouched by sequence [main effect of sequence $F(4, 72) = 1.768$; $p = 0.145$; main effect of intervention: $F(1,18) = 11.400$; $p = 0.003$ interaction intervention × sequence $F(4, 72) = 1.489$; $p = 0.215$].

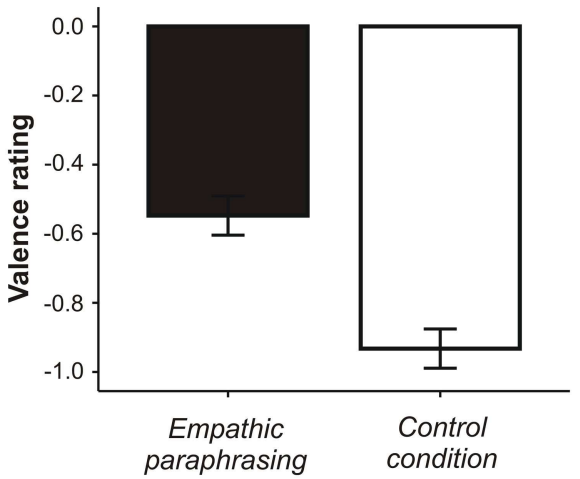


FIGURE 2 | Mean valence ratings (with standard error of the mean) after the empathic paraphrasing and control conditions.

PSYCHOPHYSIOLOGICAL DATA

Two-tailed t-tests for repeated measures show that participants had a higher SCR during paraphrasing than during the control condition [$t(15) = 2.589$; $p = 0.021$]. Effect size is $d = 0.65$ (Cohen's d). Complementary results were found in participants' HR, which was also higher during paraphrasing than during the control condition [$t(16) = 6.491$; $p = 0.000$; effect size $d = 1.57$]. No significant differences between the conditions for BVP were found [$t(16) = 0.22$; $p = 0.812$]. However, there was a strong trend for mean BVPamp [$t(16) = -2.119$; $p = 0.050$; effect size $d = 0.51$], which was lower during paraphrasing than during taking notes. Comparing BVPamp during paraphrasing with the interview question directly following the paraphrase, we also found that BVPamp is lower during paraphrasing than during the following interview question [$t(13) = 2.381$; $p = 0.033$; effect size $d = 0.64$]. For HR and BVP, no such difference between paraphrase and subsequent interview question was found. **Figure 4** illustrates differences in psychophysiological measures and voice intensity over the two conditions.

VOICE ANALYSIS DATA

Mean intensity/volume of participants' voices was lower when they replied to an interview question following a paraphrase [$t(15) = -2{,}466$; $p = 0.026$; effect size $d = 0.62$]. There was no difference in mean fundamental voice frequency (F0) between the conditions [$t(15) = 0.583$; $p = 0.568$]. F0 range and F0 standard deviation did not differ between the conditions, either

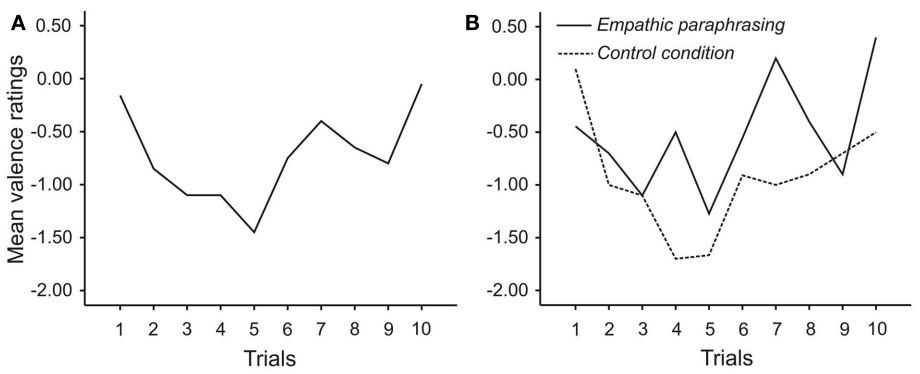


FIGURE 3 | Mean valence ratings over the course of the interview, averaged over both conditions (A) and split up into paraphrasing and control condition (B). At each of the 10 trials, 10 subjects received an intervention and 10 received a control intervention.

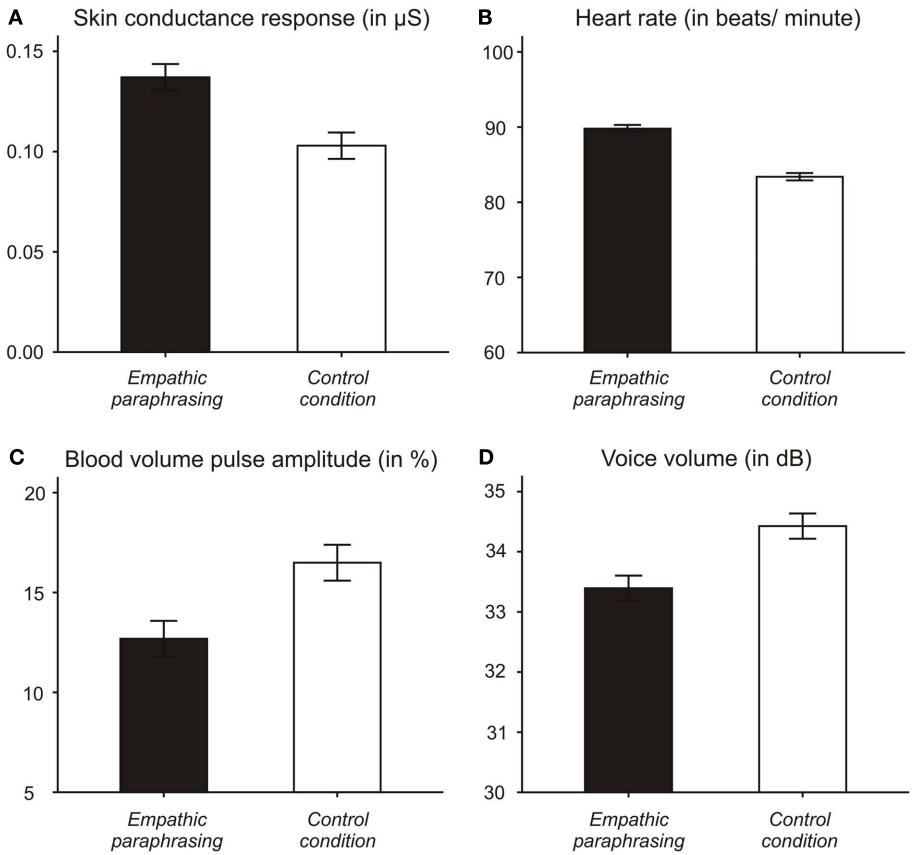


FIGURE 4 | Measures of sympathetic activation (mean values with standard error of the mean). (A) Skin conductance response (SCR; in µS), **(B)** Heart rate (in beats/minute), **(C)** Blood volume pulse amplitude (BVPamp in%), and **(D)** Voice volume (in dB) during empathic paraphrasing and control condition.

(see **Table 1**). However, speech rate and articulation rate showed trends for slower speech following paraphrasing [speech rate $t(15) = -1.86$; $p = 0.082$; articulation rate $t(15) = -2.05$; $p = 0.059$]. Cohen's d yielded effect sizes of $d = 0.47$ for speech rate and $d = 0.51$ for articulation rate.

Table 1 gives an overview of means and standard deviations of all psychophysiological, voice, and self-report parameters over the two conditions.

DISCUSSION

The aim of our study was to investigate the short-term emotional effects of empathic paraphrasing in social conflict. To achieve this, we conducted interviews on real-life social conflicts currently experienced by our participants. During the interview, paraphrasing was alternated with a control condition (taking notes). Emotional valence ratings were obtained after each intervention and control intervention and psychophysiological and voice recordings were executed continuously during the interviews. Our hypothesis was that paraphrasing would lead to more positive emotional valence and lower autonomic arousal. Viewing the results of our study as a whole suggests that empathic paraphrasing has a regulating effect on a narrator's emotions, however, this effect seems to be more complex than originally expected. In sum, we found that participants felt better when the interviewer paraphrased their emotions and perceptions of the conflict. At the same time, and contrary to our expectations, SCR, HR, and BVP amplitude indicate higher autonomic activation during paraphrasing. Voice intensity as well as speech and articulation rate of participants on the other hand was lower when answering to a question following a paraphrase.

EFFECTS OF PARAPHRASING ON VALENCE

The self-report ratings demonstrate that participants felt better after the interviewer had paraphrased what they had said. Also, the relatively high effect size suggests that this effect is strong and practically relevant. The interview itself also induced valence effects over time, insofar that participants experienced a decline in emotional valence in the middle of the interview, which recuperated toward the end of the interview. However, due to the alternation of intervention and control intervention, which was again alternated in sequence over participants, this trend does not affect the intervention effect.

This self-reported valence effect is consistent with participants' lower voice intensity after paraphrasing compared to the control condition. Banse and Scherer (1996) have linked high voice intensity with negative affects or aggressive speaker attitudes, thereby suggesting a conjunction between high voice intensity and negative emotional valence. Conversely, speech and articulation rate

Table 1 | Means (M), standard deviations (SD), *t*-, *p*-, and *d*-values of all parameters in intervention and control condition.

	Empathic paraphrasing		Control condition (taking notes)		*p*	*t*	Cohen's *d*
	M	SD	M	SD			
Valence ratings ($N = 20$)	−0.55	1.10	−0.93	1.02	0.003**	3.40	0.76
VOICE DATA ($N = 16$)							
Volume (in dB)	33.40	3.57	34.43	2.83	0.026*	−2.47	0.62
Fundamental frequency (F0 in Hz)	249.09	8.26	249.33	8.41	0.568	−0.58	
Standard deviation F0	34.38	9.50	34.68	10.63	0.675	−0.43	
Range F0	315.98	30.24	312.75	47.56	0.745	0.33	
Speech rate	3.11	0.76	3.23	0.76	0.082	−1.86	0.47
Articulation rate	4.19	0.73	4.29	0.75	0.059	−2.05	0.51
PSYCHOPHYSIOLOGICAL DATA ($N = 17$)							
Skin conductance response (SCR in μS)	0.14	0.08	0.11	0.06	0.021*	2.59	0.65
Heart rate (HR in beats/minute)	89.79	8.94	83.39	10.89	0.000**	6.49	1.57
Blood volume pulse (BVP in%)	49.64	0.08	49.63	0.11	0.812	0.22	
Blood volume pulse amplitude (BVPamp in%)	12.68	6.93	16.49	12.65	0.050	−2.11	0.51

** and ** indicate significant findings.*

are also slightly lower following an intervention, even though these effects are not statistically significant. Speech rate is defined as the number of spoken units (e.g., words/syllables) per unit of time (minute/second). It is calculated across continuous speech segments, which may include pauses, disruptions, or dysfluency. Articulation rate is an analogical measure based only on fluent utterances, excluding pauses, and dysfluency (Howell et al., 1999). Speech rate has been demonstrated to increase when experiencing anger or fear compared to neutral emotional states (Scherer, 1995; Rochman et al., 2008). Hence, the lower speech and articulation rates following paraphrasing also suggest that participants experienced less negative emotion after paraphrasing.

By the same token, HR was higher during paraphrasing than during the control condition, which according to Palomba et al. (1997) can also be interpreted as a valence effect. HR deceleration has been associated with negative emotional valence during presentation of unpleasant visual stimuli. In social tasks, HR acceleration has been measured in accordance with intensity of emotion, and to a lesser degree, with emotional valence (Palomba et al., 1997). Palomba et al. (1997) found significant differences in HR deceleration between positive, negative, and neutral visual stimuli, with positive stimuli producing the highest and negative stimuli the lowest HR. Hence, self-report data, voice data, and HR analysis all support the conclusion that emotional valence was positively influenced by offering cognitive empathy through paraphrasing. This effect of paraphrasing on valence bolsters Rime's (2009) supposition that being treated empathically while socially sharing negative emotion produces a short-term alleviation of these negative emotions.

Interestingly, the positive impact of mimicry on social judgment mentioned in the introduction (i.e., promoting liking toward the mimicker) suggests the generation of positive emotion as a result of mimicry. This was not the case for paraphrasing in our study: valence ratings in the intervention condition center around the neutral. Nevertheless, it is still possible that paraphrasing led to an increased liking toward the interviewer, while overall affect was neutral. Social judgment was not assessed in the present study, hence, no direct comparison with mimicry is possible. However, it would be interesting to compare the effects of mimicry and paraphrasing on emotion in future studies, as well as to study verbal mimicry or matching more extensively in the context of distressing conversations such as social conflict discussions.

EFFECTS OF PARAPHRASING ON AROUSAL

Skin conductance response, HR and BVP amplitude indicate a period of higher autonomic arousal while the interviewer paraphrased what participants had said, compared to taking notes on what they had said. Again, effects sizes of physiological measures suggest medium and in the case of HR, very strong, effects. This is surprising, as we presumed that the lower intensity of negative emotion induced by paraphrasing would be accompanied by lower arousal. Instead, paraphrasing apparently enhanced autonomic arousal. Quite conversely to psychophysiological data, the lower voice intensity following the intervention on the other hand suggests a calming effect of paraphrasing on autonomic arousal, as several studies on emotion and voice quality have associated high voice intensity with high sympathetic autonomic arousal emotions (Scherer, 2003). This apparent contradiction between voice data and psychophysiological data appears initially confusing, as vocal changes and changes in SCR both originate in mediated variation of HR, blood flow, and muscular tension caused by an arousing event (Duffy, 1932; Laver, 1968; Schirmer and Kotz, 2006).

However, this discrepancy can be explained by the fact that BVP and SCR were recorded *while* participants listened to the interviewer paraphrasing, whereas voice analysis was done on recordings of participants' answers to the interviewer's next question, *following* the paraphrase. Thus, the autonomic arousal induced by paraphrasing may already have subsided and passed into a calmer state at the time participants answered the next question. This possibility is difficult to double-check for SCR as this parameter is reactive to speech and will thus be higher while participants are talking, even though autonomic sympathetic arousal induced

by the intervention might have diminished already. However, we reassessed this hypothesis using BVP, BVPamp, and HR data, comparing the paraphrasing phase with the subsequent question phase and found a confirming result for BVPamp, although not for the other two measures. Participant had a lower BVP amplitude while listening to the paraphrase compared to listening to the interview question asked in direct succession. This indicates a specific effect of paraphrasing on autonomic arousal, which is not induced by speech in general. It should also be noted that voice intensity following paraphrasing is significantly lower than voice intensity following the control condition. Hence, given the assumption made above is correct, participants' autonomic arousal is first heightened by listening to the paraphrasing, and after a short period of time lowered to a level below the control state. This is a very interesting finding, for which two possible explanations should be considered.

Firstly, it is possible that empathic paraphrasing not only leads to a reduction of negative emotion in participants, but even induces positive emotions, such as happiness and relief about being listened to and validated. This would explain the initial higher autonomic arousal, which would in this case be due to a short-term experience of positive emotions, in accordance with Rime (2009) dissipating quickly. However, the behavioral data does not support this notion, as the valence ratings remain in the negative range of the scale even after paraphrasing, only approximating the neutral zero-point. Also, it should be noted that empathic paraphrasing is distinctly different from everyday forms of volunteering empathy or forms of social sharing of emotion as referred to by Rime. Paraphrasing does not offer sympathy or emotional empathy, but instead takes a purely cognitive road by demonstrating that the listener can understand the narrator's perspective. It does not seem likely that this technique should have the same emotional effects as common social sharing responses such as offering sympathy.

Therefore, as an alternative explanation of our results, it is more conceivable that demonstrating cognitive empathy through paraphrasing temporarily leads to a heightened focus on and increased processing of negative emotion, which might eventually have a resolving effect on these emotions. This explanation seems probable considering the nature of paraphrasing, which entails repeating emotional narrations in a pointed way, thereby sharpening and clarifying the emotional experience. In a study on the relationship between therapist pre-session mood, therapist empathy, and session evaluation, Duan and Kivlighan (2002) found that intellectual empathy (demonstrating an understanding of the client's perspective, i.e., empathic paraphrasing) was positively correlated with client-perceived session depth (power and value of the session), but not correlated with perceived session smoothness (comfort and pleasantness of the session). In a way, paraphrasing confronts people with what they are feeling, and thus can stimulate a deeper processing of negative emotion (depth), which temporarily involves higher autonomic arousal and may even be perceived as trying and hard work (smoothness), but eventually abets resolution of the emotional conflict. It however seems unlikely that this process advances automatically without fueling cognitive work such as reappraisal and re-adjustment of goals and schemas. Yet, the clarifying focus on one's own emotion, accompanied by the non-judgmental stance of empathic paraphrasing might strongly push this process forward. This notion is in line with Rogers' original claim to evoke personal growth and transformation in the client through empathic paraphrasing, thereby achieving therapeutic change (Rogers, 1942, 1951).

Also, considering the findings from mimicry and language matching research, which have demonstrated that being treated empathically on basal levels such as facial expression and language style promotes attitude and behavior change, it seems plausible that empathic paraphrasing may foster socio-cognitive processes in a similar direction. As paraphrasing contains a deliberate effort to verbally align with the narrator, it may generate a shared situation model and in this way promote successful communication. It would be interesting to consider if empathic paraphrasing, as it bears a certain resemblance to mimicry on a verbal level, can also stimulate pro-social behavior in the person being paraphrased; for instance a greater willingness to open up for the other party's perspective on the conflict. This would strongly support the idea of paraphrasing stimulating a clearance of negative emotion.

There seems to be wide consensus between psychotherapists of different disciplines that psychotherapy benefits from an optimal level of arousal in the client, similar to the Yerkes–Dodson law, which posits an inverse U-shaped correlation between arousal and performance in complex tasks (Bridges, 2006). Markowitz and Milrod (2011) argue that emotional arousal is central for engaging the client in psychotherapy and making the therapeutic experience meaningful. They claim that the therapist's ability to understand and respond empathically to negative emotional arousal should be considered the most important one of the common factors of psychotherapy. The therapist provides support and at the same time acts as a model, teaching the client to tolerate, verbalize, and integrate their feelings. Thus, negative feelings diminish and lose toxicity. In a similar vein, the traditional concept of the "corrective emotional experience" by Alexander and French (1946) describes the transformation of painful emotional conflicts as re-experiencing the old, unsettled conflict but with a new ending. This notion, which has gained ample empirical support, holds that processing emotional conflicts within a safe and empathic environment is necessary for therapeutic change (Bridges, 2006).

A resembling road is also pursued by acceptance and mindfulness-based interventions. Research on acceptance-based and mindfulness-based therapy has shown that accepting and mindfully observing negative emotions (instead of trying to suppress them) leads to the dissolution of these emotions (Eifert and Heffner, 2003; Arch and Craske, 2006; Hayes-Skelton et al., 2011). Czech et al. (2011) cite several experimental studies which have demonstrated that acceptance of negative emotion decreases distress and increases willingness to engage in challenging tasks. Empathic paraphrasing may have similar effects, as it essentially applies the principles of mindfulness and acceptance from the outside – through a listener who takes on an accepting role, thereby prompting the narrator in the same direction. Offering cognitive empathy through paraphrasing draws attention to emotions, non-judgmentally describes and accepts them, and is thus very similar to acceptance-based and mindfulness-based therapy. The central difference might be the locus of initiation of these processes, which in the case of empathic paraphrasing comes from somebody else. Comparing the effects of mindfulness and empathic

paraphrasing and investigating the potential consequences of this difference on emotion processing and emotion regulation could be an interesting research focus for future studies.

LIMITATIONS OF THE PRESENT STUDY

A potential short-coming of the present study pertains to the nature of the control condition, which consisted of taking notes silently. It could be argued that, as only the experimental condition involved speech, the differences found might be due to a general effect of being spoken to, rather than to an isolated effect of empathic paraphrasing. However, it should be noted that within a social conflict situation, the content of a reply to emotional descriptions can never be perceived as completely neutral, and any control condition involving speech will induce emotional effects of its own, e.g., irritation or even anger caused by inapplicable verbal comments of the interviewer following participants' emotional disclosure. The present control condition was deliberately chosen for providing a neutral baseline against which the effects of empathic paraphrasing can be tested before moving on to other modes of comparison.

An aligned point of concern might be that it cannot be ascertained how the control condition was perceived by participants. For instance, even though they were informed that the note-taking simply served the purpose of bolstering the interviewer's memory during the conversation, some participants may still have worried about the notes containing subjective judgment. This would most likely induce stress and add an emotional bias to the control condition. In this case, however, one would expect an increase in autonomic responses during the control condition, which did not occur. Still, considering these shortcomings of the control condition, the results need to be reproduced with varying kinds of control conditions involving speech before they can be viewed as definite.

It should also be mentioned that this study focused exclusively on short-term emotional reactions to paraphrasing, in order to obtain a constitutional data base illustrating the regulatory effect of this communicational technique. Our results suggest that in addition to influencing immediate emotional valence, paraphrasing sets in motion an initially arousing process of coping with negative emotions associated with the social conflict, which eventually may lead to resolving these emotions. However, as we did not assess longitudinal measures pertaining to the emotions associated with the social conflicts in question, this conclusion has to remain speculative until backed up by further research.

Finally, the relatively small sample size of the study makes it prone to distortions from individual variations and gender differences, e.g., in emotion expression. Again, replication of the results based on larger groups of study participants is called for.

CONCLUSION AND DIRECTIONS FOR FUTURE RESEARCH

The present study provides first experimental evidence that offering cognitive empathy through paraphrasing extrinsically regulates emotion in social conflict. Paraphrasing led to less negative feelings in study participants, while at the same time inducing higher autonomic arousal, which subsided after a short period of time. A possible explanation for these findings is that empathic paraphrasing stimulates an increased and focused processing of negative emotion in social conflict, and thus may contribute to resolving these emotions.

Future studies investigating the emotional effects of demonstrating cognitive empathy may further scrutinize the short- and long-term effects empathic paraphrasing has on arousal, and test the hypothesis that paraphrasing induces a cognitive-emotional process which facilitates the resolution of negative emotion in social conflict. Also, it would be interesting to investigate the dynamics of this process more closely and identify factors necessary for its successful development. Presently, we are working on a neuroimaging paradigm designed to overcome some of the above mentioned shortcomings and further explore the effects of empathic paraphrasing on the disposition to consider other people's perspective in social conflict.

ACKNOWLEDGMENTS

This study was financially supported by the Cluster of Excellence "Languages of Emotion" at Freie Universität Berlin which is funded by the DFG (German Research Foundation), and by the Open-Access publication fund of the DFG and the Freie Universität Berlin.

REFERENCES

Alexander, F., and French, T. (1946). *Psychoanalytic Therapy*. New York: Ronald Press

Arch, J. J., and Craske, M. G. (2006). Mechanisms of mindfulness: emotion regulation following a focused breathing induction. *Behav. Res. Ther.* 44, 1849–1858.

Ashton–James, C., van Baaren, R. B., Chartrand, T. L., Decety, J., and Karremans, J. (2007). Mimicry and me: the impact of mimicry on self-construal. *Social Cogn.* 25, 518–535.

Banse, R., and Scherer, K. R. (1996). Acoustic profiles in vocal emotion expression. *J. Pers. Soc. Psychol.* 70, 614–636.

Benedek, M., and Kaernbach, C. (2010). Decomposition of skin conductance data by means of non-negative deconvolution. *Psychophysiology* 47, 647–658.

Bernson, J. M., Hallberg, L. R.-M., Elfström, M. L., and Hakeberg, M. (2011). "Making dental care possible: a mutual affair": a grounded theory relating to adult patients with dental fear and regular dental treatment. *Eur. J. Oral Sci.* 119, 373–380.

Bohart, A. C., Elliott, R., Greenberg, L. S., and Watson, J. C. (2002). "Empathy," in *Psychotherapy Relationships That Work*, ed. J. Norcross (New York: Oxford University Press), 89–108.

Bridges, M. R. (2006). Activating the corrective emotional experience. *J. Clin. Psychol.* 62, 551–568.

Butler, E. A., and Gross, J. J. (2009). Emotion and emotion regulation: integrating individual and social levels of analysis. *Emot. Rev.* 1, 86–87.

Cape, J. (2000). Patient-rated therapeutic relationship and outcome in general practitioner treatment of psychological problems. *Br. J. Clin. Psychol.* 39(Pt 4), 383–395.

Critchley, H. D. (2002). Electrodermal responses: what happens in the brain. *Neuroscientist* 8, 132–142.

Czech, S. J., Katz, A. M., and Orsillo, S. M. (2011). The effect of values affirmation on psychological stress. *Cogn. Behav. Ther.* 40, 304–312.

Davis, M. A. (2009). A perspective on cultivating clinical empathy. *Complement. Ther. Clin. Pract.* 15, 76–79.

de Wied, M., Branje, S. J. T., and Meeus, W. H. J. (2007). Empathy and conflict resolution in friendship relations among adolescents. *Aggress. Behav.* 33, 48–55.

Decety, J., and Meyer, M. (2008). From emotion resonance to empathic understanding: a social developmental neuroscience account. *Dev. Psychopathol.* 20, 1053–1080.

Duan, C., and Kivlighan, D. M. (2002). Relationships among therapist presession mood, therapist empathy, and session evaluation. *Psychother. Res.* 12, 23–37.

Duffy, E. (1932). The measurement of muscular tension as a technique for the study of emotional tendencies. *Am. J. Psychol.* 44, 146–162.

Dziobek, I., Rogers, K., Fleck, S., Bahnemann, M., Heekeren, H. R., Wolf, O. T., et al. (2008). Dissociation of cognitive and emotional empathy in adults with Asperger syndrome using the multifaceted empathy test (MET). *J. Autism Dev. Disord.* 38, 464–473.

Eifert, G. H., and Heffner, M. (2003). The effects of acceptance versus control contexts on avoidance of panic-related symptoms. *J. Behav. Ther. Exp. Psychiatry* 34, 293–312.

Elliott, R., Bohart, A. C., Watson, J. C., and Greenberg, L. S. (2011). Empathy. *Psychotherapy* 48, 43–49.

Farber, B. A., and Doolin, E. M. (2011). Positive regard. *Psychotherapy* 48, 58–64.

Fischer-Lokou, J., Martin, A., Guéguen, N., and Lamy, L. (2011). Mimicry and propagation of prosocial behavior in a natural setting. *Psychol. Rep.* 108, 599–605.

Garrod, S., and Pickering, M. J. (2004). Why is conversation so easy? *Trends Cogn. Sci. (Regul. Ed.)* 8, 8–11.

Gehlbach, H. (2004). Social Perspective taking: a facilitating aptitude for conflict resolution, historical empathy, and social studies achievement. *Theory Res. Soc. Educ.* 32, 39–55.

Gross, J. J., and Thompson, R. A. (2007). "Emotion regulation: conceptual foundations," in *Handbook of Emotion Regulation*, ed. J. J. Gross (New York: The Guilford Press), 3–24.

Guéguen, N., Martin, A., and Meineri, S. (2011). Mimicry and helping behavior: an evaluation of mimicry on explicit helping request. *J. Soc. Psychol.* 151, 1–4.

Halpern, J. (2007). Empathy and patient-physician conflicts. *J. Gen. Intern. Med.* 22, 696–700.

Hayes-Skelton, S. A., Orsillo, S. M., and Roemer, L. (2011). An acceptance-based behavioral therapy for individuals with generalized anxiety disorder. *Cogn. Behav. Pract.* doi:10.1016/j.cbpra.2011.02.005

Hein, G., Lamm, C., Brodbeck, C., and Singer, T. (2011). Skin conductance response to the pain of others predicts later costly helping. *PLoS ONE* 6, e22759. doi:10.1371/journal.pone.0022759

Howell, P., Au-Yeung, J., and Pilgrim, L. (1999). Utterance rate and linguistic properties as determinants of lexical dysfluencies in children who stutter. *J. Acoust. Soc. Am.* 105, 481–490.

Ireland, M. E., Slatcher, R. B., Eastwick, P. W., Scissors, L. E., Finkel, E. J., and Pennebaker, J. W. (2011). Language style matching predicts relationship initiation and stability. *Psychol. Sci.* 22, 39–44.

Kreibig, S. D., Wilhelm, F. H., Roth, W. T., and Gross, J. J. (2007). Cardiovascular, electrodermal, and respiratory response patterns to fear- and sadness-inducing films. *Psychophysiology* 44, 787–806.

Kushki, A., Fairley, J., Merja, S., King, G., and Chau, T. (2011). Comparison of blood volume pulse and skin conductance responses to mental and affective stimuli at different anatomical sites. *Physiol. Meas.* 32, 1529–1539.

Lamm, C., Batson, C. D., and Decety, J. (2007). The neural substrate of human empathy: effects of perspective-taking and cognitive appraisal. *J. Cogn. Neurosci.* 19, 42–58.

Laver, J. D. (1968). Voice quality and indexical information. *Br. J. Disord. Commun.* 3, 43–54.

Li, L., and Chen, J. (2006). "Emotion recognition using physiological signals," in *Advances in Artificial Reality and Tele-Existence*. Lecture Notes in Computer Science, Vol. 4282, eds Z. Pan, A. Cheok, M. Haller, R. W. H. Lau, H. Saito, and R. Liang (Berlin: Springer), 437–446.

Maddux, W. W., Mullen, E., and Galinsky, A. D. (2008). Chameleons bake bigger pies and take bigger pieces: strategic behavioral mimicry facilitates negotiation outcomes. *J. Exp. Soc. Psychol.* 44, 461–468.

Marci, C. D., Ham, J., Moran, E., and Orr, S. P. (2007). Physiologic correlates of perceived therapist empathy and social-emotional process during psychotherapy. *J. Nerv. Ment. Dis.* 195, 103–111.

Markman, A. B., and Makin, V. S. (1998). Referential communication and category acquisition. *J. Exp. Psychol. Gen.* 127, 331–354.

Markowitz, J. C., and Milrod, B. L. (2011). The importance of responding to negative affect in psychotherapies. *Am. J. Psychiatry* 168, 124–128.

Menenti, L., Pickering, M. J., and Garrod, S. C. (2012). Toward a neural basis of interactive alignment in conversation. *Front. Hum. Neurosci.* 6:185. doi:10.3389/fnhum.2012.00185

Mercer, S. W., and Reynolds, W. J. (2002). Empathy and quality of care. *Br. J. Gen. Pract.* 52(Suppl.), S9–S12.

Moran, G., and Diamond, G. (2008). Generating non-negative attitudes among parents of depressed adolescents: the power of empathy, concern, and positive regard. *Psychother. Res.* 18, 97–107.

Neumann, M., Bensing, J., Mercer, S., Ernstmann, N., Ommen, O., and Pfaff, H. (2009). Analyzing the "nature" and "specific effectiveness" of clinical empathy: a theoretical overview and contribution towards a theory-based research agenda. *Patient Educ. Couns.* 74, 339–346.

Niven, K., Totterdell, P., and Holman, D. (2009). A classification of controlled interpersonal affect regulation strategies. *Emotion* 9, 498–509.

Norcross, J. C., and Wampold, B. E. (2011). Evidence-based therapy relationships: research conclusions and clinical practices. *Psychotherapy* 48, 98–102.

Orlinsky, D. E., Rønnestad, M. H., and Willutzki, U. (2004). "Fifty years of psychotherapy process outcome research: continuity and change," in *Bergin and Garfield's Handbook of Psychotherapy and Behavior Change*, 5th Edn, ed. M. J. Lambert (New York: Wiley), 307–389.

Palomba, D., Angrilli, A., and Mini, A. (1997). Visual evoked potentials, heart rate responses and memory to emotional pictorial stimuli. *Int. J. Psychophysiol.* 27, 55–67.

Pickering, M. J., and Garrod, S. (2004). Toward a mechanistic psychology of dialogue. *Behav. Brain Sci.* 27, 169–90; discussion 190–226.

Preston, S. D., and de Waal, F. B. M. (2002). Empathy: its ultimate and proximate bases. *Behav. Brain Sci.* 25, 1–20; discussion 20–71.

Reynolds, B., and Quinn Crouse, S. (2008). Effective communication during an influenza pandemic: the value of using a crisis and emergency risk communication framework. *Health Promot. Pract.* 9(Suppl. 4), 13S–17S.

Rime, B. (2009). Emotion elicits the social sharing of emotion: theory and empirical review. *Emot Rev* 1, 60–85.

Rochman, D., Diamond, G. M., and Amir, O. (2008). Unresolved anger and sadness: identifying vocal acoustical correlates. *J. Couns. Psychol.* 55, 505–517.

Rogers, C. R. (1942). *Counseling and Psychotherapy*. New York: Houghton Mifflin Co.

Rogers, C. R. (1951). *Client-Centered Therapy: Its Current Practice, Implications, and Theory*. Oxford: Houghton Mifflin.

Scherer, K. R. (1995). Expression of emotion in voice and music. *J. Voice* 9, 235–248.

Scherer, K. R. (2003). Vocal communication of emotion: a review of research paradigms. *Speech Commun.* 40, 227–256.

Schirmer, A., and Kotz, S. A. (2006). Beyond the right hemisphere: brain mechanisms mediating vocal emotional processing. *Trends Cogn. Sci. (Regul. Ed.)* 10, 24–30.

Shelley, K. H. (2007). Photoplethysmography: beyond the calculation of arterial oxygen saturation and heart rate. *Anesth. Analg.* 105(Suppl. 6), S31–S6.

Steins, G. (2000). Motivation in Person perception: role of the other's perspective. *J. Soc. Psychol.* 140, 692–709.

Stel, M., and Harinck, F. (2011). Being mimicked makes you a prosocial voter. *Exp. Psychol.* 58, 79–84.

Stel, M., van Baaren, R. B., and Vonk, R. (2008). Effects of mimicking: acting prosocially by being emotionally moved. *Eur. J. Soc. Psychol.* 38, 965–976.

Sueur, J., Aubin, T., and Simonis, C. (2008). Seewave: a free modular tool for sound analysis and synthesis. *Bioacoustics* 18, 213–226.

Totterdell, P., and Parkinson, B. (1999). Use and effectiveness of self-regulation strategies for improving mood in a group of trainee teachers. *J. Occup. Health Psychol.* 4, 219–232.

van Baaren, R. B., Holland, R. W., Kawakami, K., and van Knippenberg, A. (2004). Mimicry and prosocial behavior. *Psychol. Sci.* 15, 71–74.

Zuroff, D. C., Kelly, A. C., Leybman, M. J., Blatt, S. J., and Wampold, B. E. (2010). Between-therapist and within-therapist differences in the quality of the therapeutic relationship: effects on maladjustment and self-critical perfectionism. *J. Clin. Psychol.* 66, 681–697.

Conflict of Interest Statement: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Received: 24 June 2012; accepted: 19 October 2012; published online: 12 November 2012.

Citation: Seehausen M, Kazzer P, Bajbouj M and Prehn K (2012) Effects of empathic paraphrasing – extrinsic emotion regulation in social conflict. Front. Psychology ***3****:482. doi: 10.3389/fpsyg.2012.00482*

This article was submitted to Frontiers in Emotion Science, a specialty of Frontiers in Psychology.

APPENDIX

EXAMPLE OF A PARAPHRASING SEQUENCE

Interviewer: "What is worst for you about this situation?"

Narrator: "The worst thing is not knowing what happens now, well, this uncertainty. I mean, there is a problem, I have to make sure the rent is being paid, because in the end I am responsible, because I am in the rental agreement. . .and then – not being able to deal with that situation, not being able to act, because I just don't know what is going to happen. The worst. . .now I am not so sure anymore, what was worst about it – well, also interpersonally it was very disappointing, because after all I took care of everything, voluntarily, and. . .I mean, when she is acting this way now, that is also a lack of recognition for what I do, what I accomplish. For my whole courtesy. What aggravates things is that is was clear from the beginning that she does not do so well financially, but urgently needed an apartment, and I let her move in with me to help her. And that is something that is. . .not being trampled under her feet. . .but you notice that there is a lack of recognition. Well, I think this second issue is worse than the first one."

Interviewer: "So it is a combination, is it? For one, this thing, that in some way your existence is on stake here, that you are saying, this uncertainty is hard to bear – that you do not know how the rent is going to come around in the future. And then also the interpersonal issue, that you are saying you are disappointed of her, because you helped her, and in return you get this now, right? Especially the lack of recognition, the interpersonal treatment is what is worst – did I understand that correctly?"

Narrator: "Yes."

frontiers in
PSYCHOLOGY

ORIGINAL RESEARCH ARTICLE
published: 02 November 2012
doi: 10.3389/fpsyg.2012.00475

Emotional mimicry in social context: the case of disgust and pride

Agneta H. Fischer*, Daniela Becker and Lotte Veenstra

Department of Social Psychology, University of Amsterdam, Amsterdam, Netherlands

Edited by:
Vera Shuman, University of Geneva, Switzerland

Reviewed by:
Dennis Hofman, Utrecht University, Netherlands
Shlomo Hareli, University of Haifa, Israel

****Correspondence:***
Agneta H. Fischer, Department of Social Psychology, University of Amsterdam, Weesperplein 4, 1018 XA Amsterdam, Netherlands.
e-mail: a.h.fischer@uva.nl

A recent review on facial mimicry concludes that emotional mimicry is less ubiquitous than has been suggested, and only occurs in interactions that are potentially affiliative (see Hess and Fischer, in revision). We hypothesize that individuals do not mimic facial expressions that can be perceived as offensive, such as disgust, and mimic positive emotion displays, but only when the context is affiliative (i.e., with intimates). Second, we expect that in spontaneous interactions not mimicry, but empathic feelings with the other predict the accurateness of emotion recognition. Data were collected in a pseudo-experimental setting, during an event organized for subscribers of a large Dutch women's magazine. One woman (expresser) was exposed to two emotional stimuli (i.e., a vile smell, a compliment) in order to evoke disgust and pride respectively. Another woman (observer: intimate or stranger) was sitting opposite of her. We collected self-report measures on emotions and empathy, and coded facial expressions of disgust and smiling on the basis of FACS. The results show that participants do not mimic disgust. In contrast, smiles displayed after the vile smell and the compliment were mimicked, but only among intimates. We also found that self-reported empathy and not mimicry is related to the recognition of disgust. These findings are discussed in the light of a Social Contextual view on emotional mimicry.

Keywords: emotional mimicry, facial mimicry, disgust, pride, affiliation, social context

INTRODUCTION

How do we react to someone showing faces of fear, disgust, or happiness? One answer to this question is that we mimic these expressions and show similar faces of fear, disgust, and happiness, respectively. The automatic mimicry of non-verbal emotion expressions (Hatfield et al., 1994; Dimberg et al., 2000) is assumed to have two important social functions, namely fostering social bonds, and helping to understand and empathize with others' emotions. However, a recent review of the literature Hess and Fischer (in revision) has raised questions about the consensus that the prevailing response to an emotional facial reaction is mimicry. They argue that the definition of emotional mimicry is unclear and that the evidence, in particular for the mimicry of negative emotions, is rather limited.

This lack of consistent evidence can be explained from a Social Contextual perspective (e.g., Keltner and Haidt, 1999; Fischer et al., 2003; Parkinson et al., 2005; Fischer and Manstead, 2008; Van Kleef, 2009; Parkinson, 2011; Hess and Fischer, in revision). A Social Contextual view holds that mimicry serves a social function, and is dependent on the social context in which the emotion is expressed. Emotional mimicry is the imitation of an emotional intention rather than the movement of facial muscles and we only mimic if the emotional signal and the relationship are perceived as affiliative, and if we want to affiliate. Indeed, there are many situations in which mimicry of negative emotions and even positive emotions could be non-affiliative, and thus rather dysfunctional from a social point of view, for example when our partner is angry at us, or when our friend shows fear for a small spider, or when our enemy laughs at us.

Whereas social context effects on mimicry have been investigated in previous research (e.g., McHugo et al., 1985, 1991; Lanzetta and Englis, 1989; Hess et al., 1999; Yabar and Hess, 2007; Likowski et al., 2008; Van der Schalk et al., 2011), evidence from experimental contexts where the interaction partner is actually present is scarce. However, we think this type of evidence is important for studying social functions of mimicry, because in actual interactions the social effects of emotional mimicry are expected to have more impact than when one is watching a non-respondent target on a photo or in a video. In the present study we test hypotheses following from a Social Contextual view on emotional mimicry. We evoke two emotions, disgust and pride, and examine whether observers mimic these emotions to the same extent among intimates and strangers, and whether the recognition of disgust and pride is determined by attempts to empathize and/or by mimicking.

EVIDENCE FOR EMOTIONAL MIMICRY

Many studies have addressed facial mimicry (e.g., Dimberg, 1982; Dimberg and Lundqvist, 1990; Lundqvist, 1995; Lundqvist and Dimberg, 1995; Dimberg and Thunberg, 1998; Dimberg et al., 2002), leading to a general consensus that there is abundant evidence that we mimic each other's emotions. However, Hess and Fischer (in revision) concluded that the empirical evidence for the existence of emotional mimicry is limited. First, in the majority of studies only two emotions have been included, namely anger and happiness, and the occurrence of mainly smiling and frowning in reaction to these two displays have been regarded as indicative of facial mimicry. Second, studies that have included more than

two emotions have predominantly shown that we frown more in reaction to angry, fearful, sad, or disgust faces than to neutral faces (e.g., Lundqvist and Dimberg, 1995; Hess and Blairy, 2001; Magnée et al., 2007; Bourgeois and Hess, 2008; Likowski et al., 2008; Weyers et al., 2009).

However, frowning is a rather a-specific facial reaction, and these findings therefore need not necessarily reflect mimicry. A frown basically signals that something is wrong and thus needs our attention (Kaiser and Wehrle, 2001), and may indicate various negative emotions, as well as a negative mood, concentration, concern, or effort. More conclusive evidence for the mimicry of discrete emotions should show facial movements of similar muscles as the one's displayed, such as the Frontalis for surprise (lifting the eyebrows), or the Levator Labii Alaeque Nasi for disgust (nose wrinkling). Studies including these facial muscles have produced inconsistent effects, however. In the case of disgust, for example, mimicry effects measured with activity of the Levator were found in only one of three studies (Lundqvist and Dimberg, 1995). Hess and Fischer (in revision) therefore concluded that empirical data on facial mimicry to date mainly justify the conclusion that we react to emotional faces with facial displays that are similar in valence, but not that we mimic discrete emotions, such as anger, disgust, sadness, or fear. We may explain this lack of evidence when considering the social functions of mimicry.

SOCIAL FUNCTIONS OF EMOTIONAL MIMICRY

The occurrence and functions of emotional mimicry can be explained from a Social Contextual perspective. Following other social functional accounts of contagion and empathy (e.g., Hatfield et al., 1994; Keltner and Haidt, 1999; Parkinson, 2005, 2011; Fischer and Manstead, 2008; Hess and Fischer, in revision), we argue that emotional mimicry serves an affiliation function and thus should only occur when the emotional signal can be perceived as affiliative and when mimicry would promote social bonds and mutual understanding.

This implies first of all that mimicry depends on the relationship between expresser and observer, because the interpretation of an emotional signal also depends on how one relates to the expresser. The importance of this relationship is indeed evident from behavioral mimicry studies (Cheng and Chartrand, 2003; Lakin and Chartrand, 2003; Lakin et al., 2003; Stel and Vonk, 2010), but also from emotional mimicry studies. For example, a more positive attitude toward the target (Likowski et al., 2008), or a more cooperative social context (Lanzetta and Englis, 1989), or the target being an ingroup member have all shown to elicit more mimicry (Hess et al., 1999; Yabar and Hess, 2007; Van der Schalk et al., 2011). These results thus suggest that we mimic the emotions of similar others, friends or intimates more than the emotional displays of dissimilar others, strangers or competitors.

Second, these and other studies also demonstrate that mimicry not only depends on the relational context, but also on the nature of the emotional display, for example whether it signals approach or rather attack, or distancing. In examining the spontaneous mimicry of smiles and frowns in different public settings, for example, Hinsz and Tomhave (1991) found that many people mimic strangers' smiles, but they hardly mimic strangers' frowns.

We therefore hypothesize that negative emotions that signal attack or criticism, such as anger or disgust (Roseman et al., 1994) will generally not be mimicked, because they do not intrinsically signal empathy or understanding. Although previous research has sometimes found congruent displays in reaction to anger or disgust, we expect that in an actual interaction the presence of an interaction partner is more salient, which may reduce or even dissolve mimicry in reaction to an offensive display. This is nicely illustrated in a study by Bourgeois and Hess (2008), who found that participants do not mimic anger, but they do mimic the smiles of a fellow student when narrating an anger experience. In addition, social effects may also be more salient if one actually knows the other person well and may be amplified with the intimacy of the relationship. Indeed, Häfner and IJzerman (2011) showed that individuals high in communal strength mimic their partner's anger less than individual slow in communal strength.

Whereas these studies have focused on anger, the same may apply to disgust, as recent research (Chapman et al., 2009) has shown that disgust expressions can also be evoked in reaction to offensive stimuli in the social domain. Therefore, disgust faces, like anger faces can also be interpreted as directed at the observer, or at least interpreted as unpleasant. A social context in which disgust is expressed can thus often be considered non-affiliative.

The display of positive emotions, in contrast, is generally an affiliative signal, reflecting rapport, understanding, or solidarity (see e.g., Bourgeois and Hess, 2008). However, this is only the case to the extent that the relationship is potentially affiliative (see also Stel et al., 2010). Thus, whereas it is most likely that we mimic the smiles of our friends and intimates, and would even mimic the smiles of strangers in a neutral, potentially affiliative situation (e.g., as a signal of politeness or recognition or shared amusement), we would not mimic a smile that could be interpreted as hostile, or offensive, and thus as non-affiliative. This could occur, for example, when strangers smile when they clearly feel Schadenfreude, or inappropriate amusement in response to a racist joke. In the same vein, the proud smile of a stranger would generally not be mimicked, as this expression may imply that the other thinks of him or herself as better, thereby increasing social distance (Markus and Kitayama, 1991). On the other hand, friends may share their pride, because they share the recognition of each other's achievement (i.e., basking in reflected glory), rendering it more likely that pride smiles would be mimicked (e.g., Fischer and Manstead, 2008). In addition, smiles of friends who share an amusing, or even awkward situation would also be mimicked more than smiles of strangers in similar situations (see also Fridlund, 1991; Hess et al., 1995; Jakobs et al., 1999, 2001). In other words, smiles that are perceived to signal affiliation and shared feelings are generally more likely to be spontaneously mimicked, which is the case when friends or intimates smile to each other.

A second function that has been proposed for emotion mimicry is the facilitation of the recognition of others' emotions (Lipps, 1907). The basic assumption is that observers mimic emotion expressions, which generates facial feedback, which in turn helps the observer to recognize the other's non-verbal display through emotional simulation (e.g., Niedenthal, 2007). The relation between mimicry and emotion recognition has been examined in various types of studies, but provided inconclusive

evidence (see Parkinson, 2011; Hess and Fischer, in revision). In one line of research the function of mimicry has been examined by comparing two conditions in which participants' mimicry is either blocked or not (e.g., Blairy et al., 1999; Niedenthal et al., 2000; Stel and van Knippenberg, 2008; Hawk et al., 2011; Maringer et al., 2011). The blocking of specific facial muscles affected the speed of recognition of emotions, either in a positive or negative way, depending on the task and judgment context. Other studies, however, did not find support for the role of mimicry in emotion recognition. For example, Hess and Blairy (2001) measured participants' facial displays and self-reported emotions when decoding short videos of natural facial expressions. They did not find evidence for the idea that either self-reported emotions or emotion mimicry predicted accuracy in emotion recognition. In line with previous theorizing and research (e.g., Hatfield et al., 1994; Hess and Blairy, 2001; Bogart and Matsumoto, 2010; Parkinson, 2011), and because we think mimicry is less prevalent as often assumed, we think that mimicry is not a necessary condition for correctly interpreting another's emotion.

In addition, various studies have shown that emotion expressions may not only elicit mimicry, but also feelings of empathy (e.g., Sonnby-Borgström, 2002; Sonnby-Borgström et al., 2003; Lamm et al., 2008) or perspective taking (Hawk et al., 2011). Hawk et al. (2011) for example, show that observing an embarrassed emotion display of a person dancing on a silly song, elicits both mimicry and perspective taking, as measured by self-reports. We may therefore suggest that an empathic stance could also help to understand or correctly interpret another's emotion (see also Preston and de Waal, 2003). Especially when mimicry is absent because of potential negative effects, the empathy felt by the observer may be more crucial in correctly identifying others' feelings.

THE PRESENT STUDY

In the present study we test hypotheses following from a Social Contextual view on emotional mimicry. We evoke two emotions, disgust and pride. We chose disgust because it is an emotion that is easily evoked and previous studies on its neural underpinnings have shown that both seeing and experiencing disgust activates similar areas in the brain, which would make mimicry of the disgust expression maximally likely (Wicker et al., 2003). Moreover, disgust has a very clear and specific set of facial movements, namely the Nose Wrinkler (AU9), the Upper Lip Raiser (AU10), and AU43 (closing the eyes). If observers mimic disgust, there should be a significant correlation between these facial movements of the observer and expresser. In addition to these specific disgust expressions, we also examined the frown (AU4) as a more general index of negative mood or a signal of worry, and smiles (AU12), as an index of affiliation, appeasement, or amusement.

We chose pride as a positive emotion, because pride is a discrete emotion that has recently been shown to have unique facial expressions (Tracy and Robins, 2004; Mortillaro et al., 2012). It differs from happiness in that it clearly is not an emotion that would be shared unconditionally with others, because pride is triumph about one's own achievements, and therefore need not elicit pride in others, unless those others are intimates or friends. Pride is therefore an interesting emotion to test the social functions of smile mimicry.

In sum, our *first* prediction is that individuals do not mimic disgust, because disgust is a non-affiliative signal, and the mimicry of disgust is therefore not socially functional. *Second*, we predict that individuals mimic positive expressions (i.e., smiles) both during the disgust event, as well as during the pride event, but only when the relationship between expresser and observer is affiliative (e.g., Chartrand and Bargh, 1999; Lakin et al., 2003; Stel et al., 2010). *Third*, we predict that observers' empathy, and not their facial mimicry, will mediate the relationship between the expresser's disgust and pride, and the recognition of these emotions.

MATERIALS AND METHODS

PARTICIPANTS AND DESIGN

We recruited 278 persons during a Dutch summer festival ("Libelle Zomerweek"). We first deleted six couples that included men, because we expected gender differences in emotional expressiveness, and there were too few men to be able to compare the results for men and women. In the original experiment we also had a condition ($N = 120$) in which the expresser had to hide her emotions. We do not report this condition in the present paper. This leaves 146 women. Because the quality of the videos on the first day was bad (too dark), we had to leave out the data of 34 other women. This leaves us with 112 women ($M_{age} = 45.31$, $SD_{age} = 12.65$; 96.4% Dutch), in 56 couples. Participants within each couple were either intimates (friends or family, $N = 60$) or strangers ($N = 52$). The assignment to either condition was however not completely random. Those participants who were together with a familiar person were coupled and assigned to the intimates condition, while those participants who approached us as single visitors were randomly coupled with another, unfamiliar, person, and assigned to the strangers condition. In some occasions, we also asked two couples of intimates to split up and rearrange as two couples of strangers. Additionally, within each couple participants were assigned to either be the expresser, or the receiver on the basis of the chair they chose. They could not know which chair was selected for the expresser and which for the observer. Participation was entirely voluntary.

PROCEDURE

After having provided informed consent, participants were instructed to enter a cubicle together with their partner (intimate vs. stranger) and the experimenter. In the cubicle, the experimenter asked the two participants to choose one of the two available chairs. Depending on their choice of the chair, they were either the expresser or the observer. Both were introduced to the experiment and were told that in the next 5 min one of them had to complete small and simple tasks, while the other person would just observe. They then received a written instruction to "behave naturally during the whole experiment". Expressers were additionally asked to "freely show their feelings and thoughts to their partner", while receivers were instructed to "simply focus their attention on their partner." The experimenter stressed that they were not allowed to speak during the experiment, but that they should stay in (eye) contact.

To evoke disgust, the experimenter asked the expresser to evaluate the smell of two "brand new" cleaning agents. While one of the non-transparent flasks was filled with conventional fabric softener, the other flask was filled with a strong water solution of asafetida, an Eastern spice with a pungent, unpleasant smell (also known as "devil's dung"). After listening to the product evaluation cover story, expressers opened the first bottle, always containing the conventional fabric softener, and smelled it. Then they closed the first bottle, opened the second flask, containing asafetida, and smelled it. Then the experimenter asked which one of the two they preferred.

After this first event, two other emotions were evoked (surprise, disappointment), which will not be reported in the present paper. The last emotion that was elicited was pride. We had participants look at a booklet containing four photos of crying babies. We told them that one of these babies was a boy and they had to figure out which one was the boy. In order to elicit pride, the experimenter introduced the task by telling them that this was a very difficult task and that many people made mistakes. They then could look at the photos for however long they wanted. When they gave their answer, the experimenter always said that this was the correct answer and praised them for being very clever (independent of which answer they gave). After the last part of the experimental session, both participants left the cubicle and were administered a questionnaire about the experiment.

MEASURES

We had two slightly different questionnaires for the expresser and observer. First of all, the expressers were asked to report the intensity of several *emotions* after the smelling of the second flask, and after receiving the compliment, whereas the observers were asked what they thought their partner felt during these events. Both the expresser and the observer could rate the intensity of nine different emotions, seven negative (irritation, disgust, sadness, surprise, shame, sadness, and stress) and two positive (happiness and pride). They were asked to indicate the intensity with which they had felt, or thought their partner had felt, each of these emotions. For all items an 8-point Likert scale was used, ranging from 0 (*not at all*) to 7 (*very strong*).

To measure the degree of *empathy* between the partners, expressers and observers were asked to indicate the extent to which they felt empathy with the other. For the observers, the items were as follows: "I shared my partner's emotions," "I empathized with my partner," and "I saw that my partner felt the same emotion as I did," "I felt a strong bond with my partner," Cronbach's $\text{alpha}_{\text{observers}} = 0.71$; Cronbach's $\text{alpha}_{\text{expressers}} = 0.80$). In order to check whether intimates and strangers indeed differed in the nature of their relationship, we measured the amount of *familiarity* persons felt for the other ("To what extent do you feel familiar with the other person?"). At the end, we asked for their age, nationality, and education. After having completed all self-report measures, participants were debriefed and dismissed.

FACIAL EXPRESSIONS

In order to code the facial expressions of both the expresser and the receiver during the task, we recorded each participant on video camera throughout the experiment (using two cameras who filmed the participants from a frontal perspective). We selected the video fragments for the disgust expressions, starting with the moment that the expressers started smelling at the second bottle with the disgusting smell until they put it down. On average the fragments were about 5 s long. The video fragments for the pride event were selected immediately after the experimenter gave the compliment to the expresser and before they started talking about the expresser's answer. These fragments took about 2 s on average.

The first author coded the intensity of the following action units on the basis of Ekman's Facial Action Coding System (1978). For disgust: AU9 (Nose Wrinkler), AU10 (Upper Lip Raiser), AU43 (closing the eyes[1]), AU4 (Brow Lowerer, or frown), and AU12 (Lip Corner Puller, or smile). AU9 and AU10 were coded as one expression, which we will refer to as AU9/10, because it was very hard to see the distinction between the two facial movements, partly because many of the women wore glasses (see also Hawk et al., 2012, for a similar decision). For pride, one action unit was scored: AU12 (smile). A score of 0 indicated that the action unit was not present, a score of 3 indicated that the action unit was very strongly visible.

In order to calculate inter reliability of the coding, a certified FACS coder coded 61% of the participants ($N = 68$). Correlations between the two coders were high and significant (all p's < 0.0001, for AU9.90; for AU4.91, for AU43.80, and for AU12.84).

RESULTS

CHECKS

We first examined whether the emotion of disgust and pride were adequately evoked. With regard to disgust, a repeated measures ANOVA with the expressers' self-reported disgust, stress, irritation, and surprise right after smelling the disgusting smell (the other emotions were almost always rated as "*not at all*"), showed a significant effect, $F(3, 53) = 115.738$, $p < 0.0001$, $\eta_p^2 = 0.87$. Disgust was reported as much more intense ($M = 5.00$, $\text{SD} = 2.12$) than was surprise ($M = 0.80$, $\text{SD} = 2.00$), irritation ($M = 0.35$, $\text{SD} = 1.25$), or stress ($M = 0.02$, $\text{SD} = 0.13$). A Paired-Samples t-test comparing disgust and the averaged scores on stress, irritation, and surprise showed that disgust was reported as more intense [$t(55) = 14.31$, $p < 0.0001$].

With respect to pride, a repeated measures ANOVA with the expressers' self-reported pride, happiness, disappointment, and surprise felt after the compliment also showed a significant effect, $F(2, 54) = 57.10$, $p < 0.0001$, $\eta_p^2 = 0.36$. Pride was reported as most intense ($M = 3.78$, $\text{SD} = 2.61$), followed by happiness ($M = 2.39$, $\text{SD} = 2.88$), surprise ($M = 1.11$, $\text{SD} = 2.20$), and disappointment ($M = 0.02$, $\text{SD} = 0.13$). A Paired-Samples t-test comparing pride and the averaged scores on happiness, disappointment, and surprise showed that pride was reported as more intense [$t(55) = 6.50$, $p < 0.0001$]. Even the comparison with only happiness, proved to be significant, [$t(55) = 2.55$, $p = 0.014$]. Thus, although pride was felt as less intense than was disgust, the elicitation of both emotions can be considered successful.

[1] We also coded looking away as AU43, although this is not listed in the FACS manual. However, because looking away in this context had the same effect as closing the eyes, and almost always coincided with AU43, we found it appropriate to include this movement.

We then checked whether these feelings of disgust and pride in the expresser were correlated with expresser's facial movements that are typically associated with these emotions. We found significant positive correlations between expresser's self-reported feelings of disgust and looking away (AU43; $r = 0.32$, $p = 0.018$), but not with nose wrinkling (AU9/10, $r = 0.20$, $p = 0.15$). We also did not find a positive correlation between feelings of disgust and frowning (AU4; $r = 0.22$, $p = 0.11$) The three Action Units were positively correlated with each other: AU9/10 (nose wrinkling) with AU4 (frowning, $r = 0.62$, $p < 0.0001$), and with AU43 (looking away, $r = 0.56$, $p < 0.0001$), and AU 4 with AU43 ($r = 0.56$, $p < 0.0001$). In the case of pride we did not find significant correlations between the self-reported feeling of pride or happiness, and smiling (all p's > 0.40). The absence of significant correlations between pride or happiness and smiling is not completely unexpected, because smiling has a variety of meanings (see also Niedenthal et al., 2010). We will discuss this further in the Discussion section.

Finally, we checked whether participants in the intimate condition felt more familiar with each other than the participants in the stranger condition. This was indeed the case, showing that friends ($M = 6.25$, SD $= 0.96$) felt more familiar than strangers ($M = 1.44$, SD $= 1.10$; $F(1, 104) = 571.19$, $p < 0.0001$, $\eta_p^2 = 0.85$)[2]. In addition, friend observers ($M = 5.44$, SD $= 0.97$) also felt more empathy with the other than stranger observers ($M = 4.78$, SD $= 1.00$), $F(1, 52) = 5.83$ $p = 0.019$, $\eta_p^2 = 0.10$.

EMOTIONAL MIMICRY IN REACTION TO DISGUST

In order to examine disgust mimicry, we computed correlations between the negative facial displays of observers and expressers (see **Table 1**). No significant correlations were found, confirming our prediction that observers did not mimic disgust. We then split the file for intimates and strangers, and used the composite score of AU9, AU43, and AU4, in order to have more observations per cell. No significant correlation was found, either for intimates ($r = -0.04$, $p = 0.85$), or for strangers ($r = 0.16$, $p = 0.43$). As expected, however, correlations of expressers' and observers' smiles during the disgust event were significant in the intimate condition ($r = 0.47$, $p = 0.009$), but not in the stranger condition ($r = -0.05$, $p = 0.82$).

We then examined the amount of disgust expressiveness as a function of expressers versus observers and intimates versus strangers. We conducted a repeated measures ANOVA with nature of relation (intimates, strangers) as between-subjects factor, expresser and observer as within-subject factor, and the scores of AU9, AU43, and AU4 as dependent variables. A main effect of expresser-observer was found, $F(3, 52) = 10.83$, $p < 0.0001$, $\eta_p^2 = 0.38$, showing that expressers displayed a greater intensity of all facial expressions (see **Table 2**), but no main effect, nor interaction with the nature of the relationship was found. In other words, intimates did not express more disgust than strangers, but observers clearly showed less disgust than expressers. We also conducted a repeated measures ANOVA with smiling as dependent measure, and nature of relation as between-subjects factor, and again found no effect of the nature of the relation, and no difference between the intensity of smiling of expressers and observers (see **Table 2** for the statistics).

The absence of disgust mimicry, as defined by non-significant correlations between expressers' and observers' facial disgust displays, may also be explained by a lack of empathy. However, the correlation between two of the three facial displays by the expresser and empathic feelings of the observer were significant: frowning ($r = 31$, $p = 0.024$), and looking away ($r = 0.30$, $p = 0.027$). Thus, the more the expresser looked away or frowned, the stronger the empathy evoked in the observer.

EMOTIONAL MIMICRY IN REACTION TO PRIDE

In order to examine pride mimicry, we computed correlations between the smiles of observers and expressers. Across conditions, no significant correlations were found, but when computing separate correlations for intimates and strangers, we found a significant correlation for smiling for intimates ($r = 0.59$, $p = 0.001$), and not for strangers ($r = 0.07$, $p = 0.73$).

We then conducted a repeated measures ANOVA with nature of relation (intimates, strangers) as between-subjects factor, expresser and observer as within-subject factor, with the intensity of smiles (AU12) as dependent variable. We found a significant univariate effect of expresser-observer, $F(1, 54) = 4.37$, $p = 0.041$, $\eta_p^2 = 0.07$, for smiling, and no effect of the nature of the relation. Expressers

[2] Seven participants forgot to fill in this part of the questionnaire.

Table 1 | Correlations between facial actions of expresser and observer after the disgust stimulus.

Observer	AU9/10 (*nose wrinkling*)	AU 43 (*closing eyes*) + *looking away*	AU4 (*frowning*)	AU12 (*smiling*)
EXPRESSER				
AU9/10	0.04	0.18	0.12	0.23#
AU43 (+ *looking away*)	0.03	−0.02	0.13	0.03
AU4	−0.05	0.02	−0.12	0.05
AU12	−0.02	0.06	0.08	0.19

Note. #p = 0.08.

Table 2 | Means (SD) for facial movements after the disgust stimulus, as displayed by expressers and observers.

	Expresser	Observer	$F(1, 54)$	$p <$	η_p^2
AU43 (closing eyes) + looking away	1.05 (1.18)	0.16 (0.46)	26.63	0.0001	0.33
AU9/10 (nose wrinkling)	1.36 (1.15)	0.59 (0.89)	15.96	0.0001	0.23
AU4 (frowning)	1.46 (1.19)	0.64 (0.84)	15.36	0.0001	0.22
AU12 (smiling)	1.36 (1.07)	1.63 (1.04)	2.33	0.13	0.04

Note. Facial actions are coded on a scale ranging from 0 (not visible) to 3 (strongly visible).

($M = 1.88$, SD = 0.69) smiled more than observers ($M = 1.50$, SD = 1.32).

RECOGNITION OF DISGUST

We first examined whether observers accurately recognized the expresser's facial display as disgust. Twenty-one percent ($N = 12$) of the observers did not recognize the expression as disgust, but as another emotion. Repeated measures ANOVA with perceived intensity of disgust, stress, irritation, and surprise (the other emotions were not observed, and therefore are not included in the analysis) and nature of relation showed a significant effect of emotion, $F(3, 52) = 73.41$, $p < 0.0001$, $\eta_p^2 = 0.81$. Disgust was perceived as more intense ($M = 4.07$, SD = 2.62) than was surprise ($M = 1.11$, SD = 1.92), irritation ($M = 0.42$, SD = 1.22), or stress ($M = 0.05$, SD = 0.29). No effect of nature of the relation, $F(3, 52) = 0.69$, $p = 0.69$, was found.

To test whether the relation between the expression and recognition of disgust was mediated by mimicry, we conducted a series of regression analyses following Baron and Kenny (1986). The first regression showed that disgust expression significantly predicted disgust recognition, $b = 0.30$, SE = 0.11; [$t(54) = 2.77$, $p = 0.008$]. Second, disgust expression did not significantly predict our proposed mediator, $b = 0.03$, SE = 0.07; [$t(54) = 42$, $p = 0.68$], and the mediator also did not predict the recognition of disgust $b = -0.09$, SE = 0.22; [$t(54) = -0.40$, $p = 0.69$], thus no support for mediation by mimicry was found.

We then conducted similar regression analyses with empathy as mediator. First, we found a significant relation between disgust expression and empathy as reported by the observer, $b = 0.12$, SE = 0.04; [$t(54) = 2.60$, $p = 0.21$]; second, empathy significantly predicted the recognition of disgust, $b = 0.98$, SE = 0.33; [$t(54) = 2.99$, $p = 0.004$]. When we added empathy to disgust expression as a predictor of recognition, empathy remained a significant predictor, $b = 0.74$, SE = 0.34; [$t(54) = 2.18$, $p = 0.034$], but the relation between disgust expression and recognition also remained significant ($b = 0.24$, SE = −0.11; [$t(54) = 2.11$, $p = 0.04$]. A Sobel test showed that the indirect path was significant, $S = 1.97$ (SE = 0.057, $p = 0.049$), showing that disgust recognition was partly mediated by empathy.

We further explored whether the relationship may also be reversed, such that the empathy that is evoked by an emotion expression is mediated by emotion recognition. Additional analyses testing this model showed that recognition of disgust significantly predicted empathy by the observer, $b = 0.151$, SE = 0.051; [$t(54) = 2.98$, $p = 0.004$], however, when adding emotion recognition to the equation, disgust expression disappeared as a significant predictor of empathy: $b = 0.08$, SE = 0.046; [$t(54) = 1.66$, $p = 0.10$]. In other words, disgust recognition fully mediated the relation between expression and empathy.

RECOGNITION OF PRIDE AND HAPPINESS

We examined whether observers accurately interpreted the expresser's facial display as pride. Sixty-six percent ($N = 38$) of the observers did not recognize the facial expression as pride; 32% ($N = 19$) did not even recognize it as happiness. Repeated measures ANOVA with the perceived intensity of pride, happiness, and surprise and nature of the relation as between-subjects factor showed a significant effect of the emotion, $F(2, 54) = 13.04$, $p < 0.0001$, $\eta_p^2 = 0.33$. The most intensely perceived emotion was happiness ($M = 2.98$, SD = 2.62), followed by pride ($M = 1.59$, SD = 3.00) and surprise ($M = 0.61$, SD = 2.07). Nature of the relationship was not significant, $F(2, 54) = 0.54$, $p = 0.40$. We then tested whether smiling predicted the recognition of happiness (we did not include pride as dependent measure, because pride was not recognized by 66% of the participants). The regression analysis was not significant for happiness, $b = 0.42$, SE = 0.59; [$t(54) = 0.40$, $p = 0.49$]. We further examined whether empathy was a significant predictor of happiness, and found that it was not, $b = -0.30$, SE = 0.41; [$t(54) = -0.72$, $p = 0.48$], but the interaction between empathy and nature of the relationship was marginally significant, $b = 0.33$, SE = 0.17; [$t(54) = 1.93$, $p = 0.059$], suggesting that in the intimate condition more empathy resulted in the perception of marginally more intense happiness.

DISCUSSION

The present study examined mimicry of disgust and pride, which were chosen because they are discrete emotions, but different from the most frequently studied emotions, namely anger and happiness. We used an interactive setting because the social implications of mimicry can best be studied in an actual social interaction. We successfully evoked disgust by having one participant smell a vile odor from a bottle, and pride by giving the participant a compliment after a seemingly difficult task. In both cases, another participant (either an intimate or a stranger) was watching and the faces of both persons were videotaped with two cameras. We assumed that both disgust and pride can signal negative social intentions, which would lead participants to refrain from mimicry. A disgust face can be easily interpreted as offensive (see Chapman et al., 2009) and the expression of pride can signal social distance (Markus and Kitayama, 1991; Fischer and Manstead, 2008).

We found support for the hypotheses that the facial display of disgust was not mimicked, whereas smiles – evoked after the disgust and the pride stimuli – were mimicked, but only among intimates. This is in line with a Social Contextual view on emotional mimicry (see Hess and Fischer, in revision), which states that facial displays of emotions are only mimicked if they serve an affiliation function. The mimicry of emotion should signal empathy or understanding and thereby foster social bonds and should be inhibited when its social consequences can be potentially negative. An affiliation context is determined by both the nature of the emotional signal and the relationship between expresser and observer. The mimicry of negative "attack" emotions (see Roseman et al., 1994) or socially distancing emotions (Markus and Kitayama, 1991) is therefore not likely in most interactive contexts, because it is less probable that these are seen as signals of support or understanding. Looking at a disgust face is somewhat threatening or at least unpleasant, even if you know that the other person is not disgusted by you.

Still, previous research has found mimicry of negative emotions, which requires an explanation. We believe that this is due to the fact that mimicry has been defined and operationalized in different ways. In the current study we operationalized mimicry as a significant correlation between facial expressions of expresser and observer within a fixed time frame, indicating that facial

movements of expressers and observers occurred simultaneously within this time frame (see also Hess and Bourgeois, 2010). In research using photos or video's, however, the mere occurrence of a congruent facial response (i.e., frowning in response to an angry face) has been operationalized as mimicry. Whereas we found no significant correlations, observers did show facial actions in reaction to the disgust face of the other participant. For example, although observers hardly closed their eyes or looked away (AU43) – which makes sense considering that this would be the immediate reaction to the vile smell that they however never directly experienced – they did sometimes frown or wrinkle their nose. In our view however, correlations between facial movements are a more adequate operationalization of mimicry, although we acknowledge that the observer's less intense facial actions related to disgust can at least be seen as assimilative emotion displays (see also Tiedens and Fragale, 2003).

The fact that observers showed less intense emotion displays can be the result of different processes, and the present data are not conclusive in this respect. First of all, it can simply be the result of the fact that the emotional stimulus for the observer, i.e., the other person's face, was less intense than the emotional stimulus that evoked the disgust in the expresser, namely the vile smell in the bottle. Second, it may also point to an inhibition of the mimicry reaction, which is overriden by the motivation to show concern and empathy. The observers' facial reaction to the expressers' disgust would then still reflect empathy, even though it did not meet our strict criteria of mimicry. This idea is supported by the positive correlations between the expresser's display of disgust and self-reported empathic feelings on the part of the observer, but also by the mimicry of smiling after the disgust stimulus.

The finding that smiling was mimicked only in the intimate condition further supports a Social Contextual view of mimicry and is in line with previous studies (Hess and Bourgeois, 2010; Stel et al., 2010). Our participants' mimicry of smiling clearly served an affiliation function, because they only showed smile mimicry when they were familiar with each other. These smiles therefore may reflect an empathic response in a situation where a negative emotion was evoked. These joint smiles can emphasize shared bonding, but also awkwardness or amusement about what was happening during this event. In a situation where negative emotions are elicited, observers may seek positive facial signals in order to mimic their feelings of empathy. It should be noted, however, that the fact that strangers did not show smile mimicry does not mean that strangers did not smile, as can be observed from the means. It merely indicates that they did not respond to each other's smiles. This absence of smile mimicry in our view indicates the absence of an affiliation motive, which may be due to the fact that the context was non-affiliative (display of disgust), and the relationship was not affiliative. There may be situations where individuals still may have a motive to affiliate with the other person, however, we suggest that this is mostly the case when they share a common goal or when the situation requires affiliation. This was not the case in the present situation.

As predicted, the mimicry of smiles in reaction to the pride stimulus was also only found in the intimate condition. We argued that pride would be more easily shared with intimates than with strangers, which is supported by the fact that intimates, and not strangers, mimic each other's smiles. It should be noted that pride (and happiness) were not reported as very intense. In addition, these feelings were not significantly correlated with the intensity of the smiles. Various studies have shown that pride has a unique expression and can be differentiated from other positive emotions (e.g., Tracy and Robins, 2004; Hawk et al., 2009; Mortillaro et al., 2012), but these studies have mostly used prototypical expressions, and predominantly bodily expressions, whereas we used spontaneous pride expressions. In real life – and in the current experiment – pride is often mixed with happiness, or surprise, and thus the expression of such a blend emotion may have been less easy to recognize. In addition, smiles have many meanings (see also LaFrance et al., 2003; Niedenthal et al., 2010), and therefore correlations with specific mental states may be hard to find. Finally, the reported feelings of pride were not very intense, and thus would not always result in a prototypical expression. In some cases, the participants did not seem proud at all, because they found it obvious to have given the correct answer to the question which of the crying babies was a boy.

This all means that the compliment may have been a more ambiguous stimulus than the repulsive smell, and this may explain why no significant determinants of pride recognition have been found. The ambiguity of the situation may also provide an alternative explanation of why smile mimicry only occurs in the intimate condition. Intimates seek support and may wish to strengthen their relationship more than strangers, especially in ambiguous situations. Uncertainty evokes the need for safety and bonding, and participants would then rely more on people they like (see e.g., Likowski et al., 2008; Stel et al., 2010), or who were supportive or rewarding in the past (see also Sims et al., 2012).

The empathy that was evoked by the expression of disgust also played a prominent role in the recognition of disgust, and to a lesser extent in the recognition of happiness (pride was recognized so badly that we did not further test factors influencing pride recognition). We examined whether mimicry and or empathy would improve the correct recognition of emotions. We found no support for this mimicry function. Instead, the more women expressed disgust, the better observers recognized disgust, and this was partially mediated by the reported empathy observers felt with the other person. In other words, the empathy felt for the other person helped observers to perceive higher levels of disgust. In addition, perceiving disgust in turn also increased empathy with the other. Empathy therefore seems to be a facilitating mental state as well as an implication of emotion recognition.

The finding that mimicry did not help to accurately recognize emotions is not inconsistent with previous studies. In studies where mimicry effects on recognition have been found, these were mostly found when mimicry was manipulated, when speed of recognition was measured, or when subtle emotion stimuli were used (e.g., Stel and Vonk, 2010; Hawk et al., 2012). In the present research, mimicry was spontaneous, and was only found for positive emotion displays and thus it is not surprising that it did not influence disgust recognition. The fact that mimicry also did not influence pride/happiness recognition may be explained by the

fact that the pride expression did not result in pride recognition. Mimicry can only play a role when the emotion is clearly expressed and interpreted.

This study has limitations, which simultaneously emphasize its strengths. The fact that data were collected in a natural setting enhances the ecological validity of the study. We had participants with a variety of backgrounds, who were all very motivated to take part in the experiment. Moreover, an interactive setting as used in the current study, where two individuals see each other and react to each other, is most adequate to study social functions of emotion mimicry. In actual social interactions, social regulation processes are prompted and observers may adjust their facial reactions more or less automatically when they expect negative social consequences (see e.g., Manstead and Fischer, 2001; Evers et al., 2005). Studies of mimicry in more natural social interactions are scarce, and we think that this makes the contribution of this study valuable.

We should also acknowledge, however, that the experimental environment was not always as standardized as we would have liked. There was noise that could have distracted, and participants were not alone when completing the questionnaires. Having acknowledged these limitations, however, we think that the present results show that we do not automatically mimic negative emotions, but rather seek out the positive signals that are only mimicked when the context is affiliative. We believe that this study can potentially open up a new avenue of research on emotional mimicry in which its social implications, and thus boundary conditions, are taken into account.

ACKNOWLEDGMENTS

This research was supported by a grant from the Dutch Science Foundation (NWO) awarded to VPRO and NTR. We thank Kaya Peerdeman for help with data collection, and Corinne Brenner for her assistance with coding the facial data.

REFERENCES

Baron, R. M., and Kenny, D. A. (1986). The moderator–mediator variable distinction in social psychological research: conceptual, strategic, and statistical considerations. *J. Pers. Soc. Psychol.* 51, 1173–1182.

Blairy, S., Herrera, S., and Hess, U. (1999). Mimicry and the judgment of emotional facial expression. *J. Nonverbal Behav.* 23, 5–41.

Bogart, K. R., and Matsumoto, D. (2010). Facial mimicry is not necessary to recognize emotion: facial expression recognition by people with Moebius syndrome. *Soc. Neurosci.* 5, 241–251.

Bourgeois, P., and Hess, U. (2008). The impact of social context on mimicry. *Biol. Psychol.* 77, 343–352.

Chapman, H. A., Kim, D. A., Susskind, J. M., and Anderson, A. K. (2009). In bad taste: evidence for the oral origins of moral disgust. *Science* 323, 1222–1226.

Chartrand, T. L., and Bargh, J. A. (1999). The chameleon effect: the perception-behavior link and social interaction. *J. Pers. Soc. Psychol.* 76, 893–910.

Cheng, C. M., and Chartrand, T. L. (2003). Self-monitoring without awareness: using mimicry as a non-conscious affiliation strategy. *J. Pers. Soc. Psychol.* 85, 1170–1179.

Dimberg, U. (1982). Facial reactions to facial expressions. *Psychophysiology* 19, 643–647.

Dimberg, U., and Lundqvist, L. O. (1990). Gender differences in facial reactions to facial expressions. *Biol. Psychol.* 30, 151–159.

Dimberg, U., and Thunberg, M. (1998). Rapid facial reactions to emotional facial expressions. *Scand. J. Psychol.* 39, 39–45.

Dimberg, U., Thunberg, M., and andGrunedal, S. (2002). Facial reactions to emotional stimuli: automatically controlled emotional responses. *Cogn. Emot.* 16, 449–472.

Dimberg, U., Thunberg, M., and Elmehed, K. (2000). Unconscious facial reactions to emotional facial expressions. *Psychol. sci.* 11, 86–89.

Evers, C. A. M., Fischer, A. H., Rodriguez Mosquera, P. M., and Manstead, A. S. R. (2005). Anger and social appraisal: a spicy sex difference. *Emotion* 3, 258–266.

Fischer, A. H., and Manstead, A. S. R. (2008). "The social function of emotions," in *Handbook of Emotions*, 3rd Edn, eds M. Lewis, J. Haviland-Jones, and L. F. Barrett (New York: Guilford), 456–468.

Fischer, A. H., Manstead, A. S. R., and Zaalberg, R. (2003). Social influences on the emotion process. *Eur. Rev. Soc. Psychol.* 14, 171–201.

Fridlund, A. J. (1991). Sociality of solitary smiling: potentiation by an implicit audience. *J. Pers. Soc. Psychol.* 60, 229–240.

Häfner, M., and IJzerman, H. (2011). The face of love: spontaneous accommodation as social emotion regulation. *Pers. Soc. Psychol. Bull.* 37, 1551–1563.

Hatfield, E., Cacioppo, J. T., and Rapson, R. L. (1994). *Emotional Contagion.* Madison, WI: C. W. Brown.

Hawk, S. T., Fischer, A. H., and Van Kleef, G. A. (2011). Taking your place or matching your face: two routes to empathic embarrassment. *Emotion* 11, 502–513.

Hawk, S. T., Fischer, A. H., and van Kleef, G. A. (2012). Face the noise: embodied responses to nonverbal vocalizations of discrete emotions. *J. Pers. Soc. Psychol.* 102, 796–814.

Hawk, S. T., van Kleef, G., Fischer, A. H., and van der Schalk, J. (2009). Worth a thousand words: absolute and relative decoding of nonlinguistic affect vocalizations. *Emotion* 9, 293–305.

Hess, U., and Blairy, S. (2001). Facial mimicry and emotional contagion to dynamic emotional facial expressions and their influence on decoding accuracy. *Int. J. Psychophysiol.* 40, 129–141.

Hess, U., and Bourgeois, P. (2010). You smile – I smile: emotion expression in social interaction. *Biol. Psychol.* 84, 514–520.

Hess, U., Kappas, A., and Banse, R. (1995). The intensity of facial expressions is determined by underlying affective state and social situation. *J. Pers. Soc. Psychol.* 69, 280–288.

Hess, U., Philippot, P., and Blairy, S. (1999). "Mimicry: facts and fiction," in *The Social Context of Nonverbal Behavior. Studies in Emotion and Social Interaction*, eds P. Philippot and R. S. Feldman (Cambridge: Cambridge University Press), 213–241.

Hinsz, V. B., and Tomhave, J. A. (1991). Smile and (half) the world smiles with you, frown and you frown alone. *Pers. Soc. Psychol. Bull.* 17, 586–592.

Jakobs, E., Manstead, A. S. R., and Fischer, A. H. (1999). Social motives and emotional feelings as determinants of facial displays: the case of smiling. *Pers. Soc. Psychol. Bull.* 25, 424–435.

Jakobs, E., Manstead, A. S. R., and Fischer, A. H. (2001). Social context effects on facial activity in a negative emotional setting. *Emotion* 1, 51–70.

Kaiser, S., and Wehrle, T. (2001). "Facial expressions as indicators of appraisal processes," in *Appraisal Processes in Emotion: Theory, Methods, Research. Series in Affective Science.* eds K. R. Scherer, A. Schorr, and T. Johnstone (New York: Oxford University Press), 285–300.

Keltner, D., and Haidt, J. (1999). Social functions of emotions at four levels of analysis. *Cogn. Emot.* 13, 505–521.

LaFrance, M., Hecht, M. A., and Paluck, E. L. (2003). The contingent smile: a meta-analysis of sex differences in smiling. *Psychol. Bull.* 129, 305–334.

Lakin, J. L., and Chartrand, T. L. (2003). Using nonconscious behavioral mimicry to create affiliation and rapport. *Psychol. Sci.* 14, 334–339.

Lakin, J. L., Jefferis, V. E., Cheng, C. M., and Chartrand, T. L. (2003). The Chameleon effect as social glue: evidence for the evolutionary significance of nonconscious mimicry. *J. Nonverbal Behav.* 27, 145–162.

Lamm, C., Porges, E. C., Cacioppo, J. T., and Decety, J. (2008). Perspective taking is associated with specific facial responses during empathy for pain. *Brain Res.* 1227, 153–161.

Lanzetta, J. T., and Englis, B. G. (1989). Expectations of cooperation and competition and their effects on observers' vicarious emotional responses. *J. Pers. Soc. Psychol.* 56, 543–554.

Likowski, K. U., Mühlberger, A., Seibt, B., Pauli, P., and Weyers, P. (2008). Modulation of facial mimicry by attitudes. *J. Exp. Soc. Psychol.* 44, 1065–1072.

Lipps, T. (1907). "Das Wissen von fremden Ichen," in *Psychologische Untersuchungen (Band 1)*, ed. T. Lipps (Leipzig: Engelmann), 694–722.

Lundqvist, L. O. (1995). Facial EMG reactions to facial expressions: a case of facial emotional contagion? *Scand. J. Psychol.* 36, 130–141.

Lundqvist, L. O., and Dimberg, U. (1995). Facial expressions are contagious. *J. Psychophysiol.* 9, 203–211.

Magnée, M. J. C. M., Stekelenburg, J. J., Kemner, C., and de Gelder, B. (2007). Similar facial electromyographic responses to faces, voices, and body expressions. *Neuroreport* 18, 369–372.

Manstead, A. S. R., and Fischer, A. H. (2001). "Social appraisal," in *Appraisal Processes in Emotion: Theory, Methods, Research*, eds K. R. Scherer, A. Schorr, and T. Johnstone (Oxford, NY: Oxford University Press), 221–232.

Maringer, M., Krumhuber, E. G., Fischer, A. H., and Niedenthal, P. M. (2011). Beyond smile dynamics: mimicry and beliefs in judgments of smiles. *Emotion* 1, 181–187.

Markus, H. R., and Kitayama, S. (1991). Culture and the self: implications for cognition, emotion and motivation. *Psychol. Rev.* 98, 224–253.

McHugo, G. J., Lanzetta, J. T., and Bush, L. K. (1991). The effect of attitudes on emotional reactions to expressive displays of political leaders. *J. Nonverbal Behav.* 15, 19–41.

McHugo, G. J., Lanzetta, J. T., Sullivan, D. G., Masters, R. D., and Englis, B. G. (1985). Emotional reactions to a political leader's expressive displays. *J. Pers. Soc. Psychol.* 49, 1513–1529.

Mortillaro, M., Mehu, M., and Scherer, K. R. (2012). Different positive emotions can be distinguished by their facial expressions. *Soc. Psychol. Pers. Sci.* 2, 262–271.

Niedenthal, P. M. (2007). Embodying emotion. *Science* 316, 1002–1005.

Niedenthal, P. M., Halberstadt, J., Margolin, J., and Innes-Ker, A. H. (2000). Emotional states and the detection of change in facial expression of emotion. *Eur. J. Soc. Psychol.* 30, 211–222.

Niedenthal, P. M., Mermillod, M., Maringer, M., and Hess, U. (2010). The Simulation of smiles (SIMS) model: embodied simulation and the meaning of facial expression. *Behav. Brain Sci.* 33, 417–433.

Parkinson, B. (2005). Do facial movements express emotion or communicate motives? *Pers. Soc. Psychol. Rev.* 9, 278–311.

Parkinson, B. (2011). Interpersonal emotion transfer: contagion and social appraisal. *Soc. Pers. Psychol. Compass* 5, 428–439.

Parkinson, B., Fischer, A. H., and Manstead, A. S. R. (2005). *Emotion in Social Relations: Cultural, Group, and Interpersonal Processes.* New York, NY: Psychology Press.

Preston, S. D., and de Waal, F. B. M. (2003). Empathy: its ultimate and proximate bases. *Behav. Brain Sci.* 25, 1–20.

Roseman, I. J., Wiest, C., and Swartz, T. S. (1994). Phenomenology, behaviors, and goals differentiate discrete emotions. *J. Pers. Soc. Psychol.* 67, 206–221.

Sims, T. B., van Reekum, C., Johnstone, T., and Chakrabarti, B. (2012). How reward modulates mimicry; EMG evidence of greater facial mimicry of more rewarding happy faces. *Psychophysiology* 49, 998–1004.

Sonnby-Borgström, M. (2002). Automatic mimicry reactions as related to differences in emotional empathy. *Scand. J. Psychol.* 43, 443–443.

Sonnby-Borgström, M., Jönsson, P., and Svensson, P. (2003). Emotional empathy as related to mimicry reactions at different levels of information processing. *J. Nonverbal Behav.* 27, 3–23.

Stel, M., Blascovich, J., McCall, C., Mastop, J., van Baaren, R. B., and Vonk, R. (2010). Mimicking dislike others: effects of a-priori liking on the mimicry-liking link. *Eur. J. Soc. Psychol.* 40, 867–880.

Stel, M., and van Knippenberg, A. (2008). The role of facial mimicry in the recognition of affect. *Psychol. Sci.* 19, 984–985.

Stel, M., and Vonk, R. (2010). Mimicry in social interaction: benefits for mimickers, mimickers, and their interaction. *Br. J. Psychol.* 101, 311–323.

Tiedens, L. Z., and Fragale, A. R. (2003). Power moves: complementarity in dominant and submissive nonverbal behavior. *J. Pers. Soc. Psychol.* 84, 558–568.

Tracy, J., and Robins, R. (2004). Show your pride, evidence for a discrete emotion expression. *Psychol. Sci.* 15, 194–197.

Van der Schalk, J., Fischer, A. H., Doosje, B. J., Wigboldus, D., Hawk, S. T., Hess, U., et al. (2011). Congruent and incongruent responses to emotional displays of ingroup and outgroup. *Emotion* 11, 286–298.

Van Kleef, G. A. (2009). How emotions regulate social life. *Curr. Dir. Psychol. Sci.* 18, 184–188.

Weyers, P., Mühlberger, A., Kund, A., Hess, U., and Pauli, P. (2009). Modulation of facial reactions to avatar emotional faces by nonconscious competition priming. *Psychophysiology* 46, 328–335.

Wicker, B., Keysers, C., Plailly, J., Royet, J.-P., Gallese, V., and Rizzolatti, G. (2003). Both of us disgusted in my insula. *Neuron* 40, 655–664.

Yabar, Y. C., and Hess, U. (2007). Display of empathy and perception of outgroup members. *NZ J. Psychol.* 36, 42–50.

Conflict of Interest Statement: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Received: 01 July 2012; accepted: 16 October 2012; published online: 02 November 2012.

*Citation: Fischer AH, Becker D and Veenstra L (2012) Emotional mimicry in social context: the case of disgust and pride. Front. Psychology **3**:475. doi: 10.3389/fpsyg.2012.00475*

This article was submitted to Frontiers in Emotion Science, a specialty of Frontiers in Psychology.

frontiers in
PSYCHOLOGY

ORIGINAL RESEARCH ARTICLE
published: 27 February 2013
doi: 10.3389/fpsyg.2013.00095

Neural substrates of social emotion regulation: a fMRI study on imitation and expressive suppression to dynamic facial signals

Pascal Vrticka[1,2,3]*, Samanta Simioni[3,4], Eleonora Fornari[5], Myriam Schluep[4], Patrik Vuilleumier[2,6] and David Sander[2,3]

[1] *Center for Interdisciplinary Brain Sciences Research, Department of Psychiatry and Behavioral Sciences, School of Medicine, Stanford University, Stanford, CA, USA*
[2] *Swiss Center for Affective Sciences, University of Geneva, Geneva, Switzerland*
[3] *Laboratory for the study of Emotion Elicitation and Expression (E3 Lab), Department of Psychology, University of Geneva, Geneva, Switzerland*
[4] *Service of Neurology, Department of Clinical Neurosciences, Centre Hospitalier Universitaire Vaudois and Lausanne University Hospital, Lausanne, Switzerland*
[5] *Centre d'Imagerie BioMédicale, Radiology Department, Centre Hospitalier Universitaire Vaudois and University of Lausanne, Lausanne, Switzerland*
[6] *Laboratory for Behavioral Neurology and Imaging of Cognition, Department of Neuroscience, University Medical Center, University of Geneva, Geneva, Switzerland*

Edited by:
Ullrich Wagner, Charité – University Medicine Berlin, Germany

Reviewed by:
Susanne Erk, Charite – Universitätsmedizin Berlin, Germany
Niklas Ihssen, Cardiff University, UK

****Correspondence:***
Pascal Vrticka, Center for Interdisciplinary Brain Sciences Research, Department of Psychiatry and Behavioral Sciences, School of Medicine, Stanford University, 401 Quarry Road, MC 5795, Room 1378, Stanford, CA 94305, USA.
e-mail: pvrticka@stanford.edu

Emotion regulation is crucial for successfully engaging in social interactions. Yet, little is known about the neural mechanisms controlling behavioral responses to emotional expressions perceived in the face of other people, which constitute a key element of interpersonal communication. Here, we investigated brain systems involved in social emotion perception and regulation, using functional magnetic resonance imaging (fMRI) in 20 healthy participants. The latter saw dynamic facial expressions of either happiness or sadness, and were asked to either imitate the expression or to suppress any expression on their own face (in addition to a gender judgment control task). fMRI results revealed higher activity in regions associated with emotion (e.g., the insula), motor function (e.g., motor cortex), and theory of mind (e.g., [pre]cuneus) during imitation. Activity in dorsal cingulate cortex was also increased during imitation, possibly reflecting greater action monitoring or conflict with own feeling states. In addition, premotor regions were more strongly activated during both imitation and suppression, suggesting a recruitment of motor control for both the production and inhibition of emotion expressions. Expressive suppression (eSUP) produced increases in dorsolateral and lateral prefrontal cortex typically related to cognitive control. These results suggest that voluntary imitation and eSUP modulate brain responses to emotional signals perceived from faces, by up- and down-regulating activity in distributed subcortical and cortical networks that are particularly involved in emotion, action monitoring, and cognitive control.

Keywords: emotion regulation, expressive suppression, imitation, emotional facial expressions, fMRI

INTRODUCTION

During the last decade, studies using functional magnetic resonance imaging (fMRI) have begun to disclose the neural substrates of distinct emotion regulation strategies in response to various affective stimuli. In this context, the *process model of emotion* proposed by Gross (1998) has provided a major psychological theoretical framework that distinguishes between antecedent- versus response-focused emotion regulation, often operationalized as (cognitive) re-appraisal versus (expressive) suppression. Antecedent-focused emotion regulation was further extended by additional components such as *situation selection and modification* as well as *attention deployment*. These are thought to affect emotion processing even earlier than re-appraisal through avoidance or modification of, or distraction from an emotion-eliciting situation (Gross, 2002).

Several imaging studies have tested for brain activation differences between natural viewing (no explicit emotion regulation) versus re-appraisal (Ochsner et al., 2002, 2004; Ochsner and Gross, 2005; Kim and Hamann, 2007), or between natural viewing versus suppression (Levesque et al., 2003); while other investigations compared different emotion regulation strategies with each other, particularly re-appraisal versus suppression (Goldin et al., 2008; Vrticka et al., 2011). Furthermore, a few recent studies focused on the difference between attention deployment (also referred as to distraction) versus re-appraisal (McRae et al., 2010; Kanske et al., 2011; Payer et al., 2012). Most of these studies on emotion regulation examined modulation of brain responses to complex visual scenes or movie excerpts. Taken together, results converge to indicate that emotion regulation skills rely on a number of prefrontal cortical areas, either implicated in top-down modulation of limbic regions, or more generally involved in attention selection, action or thought inhibition, and working memory. In addition, both re-appraisal and distraction have been found effective in down-regulating neural responses in brain areas critically involved in the processing of emotional stimuli (such as amygdala or insula), which are activated otherwise during natural

viewing conditions. These findings have been used to suggest that antecedent-focused emotion regulation strategies provide a beneficial means of controlling one's emotions, particularly in the case of re-appraisal (Gross, 1998, 2002; McRae et al., 2010). Less consistent results have been reported for response-focused emotion regulation and in particular (expressive) suppression, which is generally regarded as a less efficient strategy for emotion control (Gross, 1998, 2002). It may actually be associated with increased activity in emotion brain regions, such as the insula or amygdala (Goldin et al., 2008), or produce decreases in only some of these areas under specific circumstances (Vrticka et al., 2011).

Social reactions to others may not only involve the ability to express or – in some circumstances – suppress our own emotions, but also imply the sharing of others' feelings. Research on empathy suggests that facial mimicry, possibly associated with "mirror" neural activity in the observer, may constitute an important feature of social processing and social emotional understanding (Premack and Woodruff, 1978; Rizzolatti et al., 1996; Leslie et al., 2004; Lee et al., 2006; Pfeifer et al., 2008). The extensive brain network(s) of such sharing have been particularly investigated in experimental paradigms involving empathy for pain (see Singer and Lamm, 2009; Lamm et al., 2011). This has lead to the description of a "core network" of affective (pain) empathy, comprising anterior insula (aINS), and anterior cingulate cortex. It has been suggested that picture-based paradigms of pain observation may also reveal stronger somatosensory area activity in the observer (Singer and Lamm, 2009; Corradi-Dell'Acqua et al., 2011; Lamm et al., 2011). Furthermore, when more abstract visual stimuli were used to provide information about other's feelings, increased activity has been observed in brain areas that are typically associated with theory of mind, such as the precuneus, ventral medial prefrontal cortex, superior temporal cortex, and temporo-parietal junction (Lamm et al., 2011). Recently, activity within this extended affective empathy network and "mirror neuron system" has also been described during automatic and spontaneous facial mimicry of happy, sad, and angry expressions (Likowski et al., 2012).

Building on such evidence from research on emotion regulation, empathy, and facial mimicry, we designed an fMRI study to specifically examine the social aspects of emotion perception and regulation. This included the introduction of two novel experimental factors.

Firstly, emotions to be regulated were not induced by images or movie-clips of complex scenes [e.g., pictures from the International Affective Picture System (IAPS) or movies of food or disgusting places], as used, to the best of our knowledge, in all fMRI studies on emotion regulation so far (e.g., Ochsner et al., 2002, 2004; Ochsner and Gross, 2005; Kim and Hamann, 2007; Goldin et al., 2008; McRae et al., 2010; Kanske et al., 2011; Vrticka et al., 2011; Payer et al., 2012), but rather by short movie-clips of actors displaying happy or sad facial expressions. Faces represent a category of stimuli with major social significance, and regulating one's emotion in response to others' facial expressions is a crucial ability during social interactions. In a previous fMRI study, we demonstrated distinctive patterns of regulation between social versus non-social emotion conditions (Vrticka et al., 2011), but the social nature of stimuli in the latter study was essentially defined by the presence of humans in complex visual scenes – not faces specifically. Here, by using face movies, we could test for emotion regulation at a level closer to direct real-world interpersonal interaction.

Secondly, the experimental conditions used in our study differed from more recent fMRI studies on emotion regulation (Ochsner et al., 2002, 2004; Ochsner and Gross, 2005; Kim and Hamann, 2007; Goldin et al., 2008; McRae et al., 2010; Kanske et al., 2011; Vrticka et al., 2011; Blechert et al., 2012; Payer et al., 2012), again inspired by the above-mentioned fact that social emotional understanding (at least partly) involves facial mimicry possibly linked with mirror neuron activity (Leslie et al., 2004; Lee et al., 2006; Pfeifer et al., 2008; Likowski et al., 2012). Accordingly, our first regulation condition was conceptualized as requiring an increase in emotional response to faces and involved the voluntary imitation (IMT) of the seen expressions. In contrast, our second regulation condition implied a reduction in emotion response to faces and required expressive suppression (eSUP). We were particularly interested in this emotion regulation strategy (over cognitive re-appraisal) because it provided a more direct comparison with instructed facial mimicry during the IMT condition with regard to the involvement of sensory-motor processes. In addition, a third experimental condition required gender decision (GND) and served as a control task, during which participants were exposed to the same dynamic facial expressions without any explicit demands for eSUP or IMT.

We anticipated stronger responses in brain regions typically associated with emotion processing during IMT relative to the eSUP regulation condition (and possibly GND), because the latter should act to down-regulate the spontaneous neural activity related to emotion processing. We also predicted stronger activation in motor/mirror networks during IMT as compared with eSUP (and possibly GND), due to the fact that this condition should directly affect overt behavioral responses to emotion signals seen in others. By contrast, we anticipated increases in prefrontal cortical activity during eSUP (as compared to IMT) due to stronger demands on cognitive control.

MATERIALS AND METHODS

PARTICIPANTS

The study group consisted of 20 healthy volunteers (12 women, mean age 33.5 ± 4.5 years; mean years of education: 14.9 ± 2.5) with no history of alcohol or drug abuse, major psychiatric disorders (major depression, psychosis, untreated bipolar disorders), head trauma, other neurological disorders, or systemic illness. The local ethics committee approved the study, and all subjects gave written informed consent for their participation in accordance with the Declaration of Helsinki.

STIMULI

We selected stimuli out of the Geneva Multimodal Emotion Portrayals (GEMEP) database consisting of dynamic multimodal emotion expression video recordings performed by actors (Baenziger et al., 2012). A subset of 30 videos including eight actors (four women) expressing either happiness/amusement (15 videos) or sadness/despair (15 videos) was retained. Only the visual features of videos were presented to participants (no audio was played).

The video choice was based on results of an independent validation study evaluating the level of emotional intensity (on a four-point scale) and the accuracy of emotion judgment (rate of correct identification of emotions by independent raters) for each video (Schlegel et al., in preparation), ensuring that our target emotions were easily identifiable by study participants. For selected videos, the mean values of emotion intensity ratings were 3.5 ± 0.2 for happiness/amusement and 2.5 ± 0.4 for sadness/despair ($t = -8.26$, $p < 0.001$, paired t-tests); the mean recognition rate was 0.79 ± 0.09 for happiness/amusement and 0.61 ± 0.19 for sadness/despair ($t = -3.37$, $p < 0.001$, paired t-tests). The mean duration of movies was 2223 ms (minimum: 1290 ms, maximum: 3970 ms, balanced across conditions).

Videos were then distributed into three different lists, each containing 10 videos counterbalanced for valence (five positive and five negative), and comparable for intensity [$F(2,29) < 1$] and recognition rate [$F(2,29) < 1$]. Each list was used once in each of the experimental conditions described hereafter.

EXPERIMENTAL CONDITIONS

Three experimental conditions were proposed to participants in a block design: (A) *Gender decision* (GND), during which participants had to indicate the actor's gender by a button press after each video without any particular instruction given to participants regarding actor's facial expressions; (B) *IMT*, where participants were instructed to mimic actors' facial emotions during the exposure to emotional stimuli; and (C) *eSUP*, during which participants were requested to voluntary suppress any IMT/facial movement while seeing emotional facial expressions.

Each task was performed three times by participants with conditions presented in a counterbalanced order (ABC, BAC, BCA) during three scanning runs, with the only constraint that IMT always preceded eSUP. Total task duration was 14 min (each run lasted approximately 4 min, 40 s).

PROCEDURE

Participants were instructed about the different tasks before entering the scanner. During the scanning session, they first saw an instruction slide for 10 s telling them which task was to be performed next. Subsequently, they were exposed to 10 videos per task, each preceded and followed by a fixation cross, jittered between 4159 and 5924 ms (mean 4860 ms). During GND, participants had to indicate the actor's gender by button press while seeing the fixation cross immediately following emotional videos. During IMT and eSUP, participants either mimicked or suppressed any facial expression during the movie presentation, and then relaxed during the fixation cross periods, with no response required.

IMAGE ACQUISITION

MRI data were acquired on a 3-T whole-body scanner (Siemens TIM TRIO), using a 32-channels head-coil. For each participant, a structural image was obtained with a MPRAGE T1-weighted sequence [TI/TR/TE/FA = 900/2300/2.98 ms/9°, parallel acquisition (GRAPPA) with acceleration factor 3, FOV = 256 mm × 256 mm, Matrix = 256 × 256, 160 slices, thickness = 1 mm]. Functional images [EPI, gradient echo sequence, TR/TE/FA = 2200/30 ms/90°, parallel acquisition (GRAPPA) with acceleration factor 2, FOV = 216 mm × 216 mm, matrix = 72 × 72] covered the whole brain, were composed of 35 contiguous 3.0 mm axial slices parallel to the inferior edge of the occipital and temporal lobes, and were acquired continuously for a total of 393 images per participant (131 images per session – including instructions, etc.).

MRI ANALYSIS

Image processing was performed with SPM8 (www.fil.ion.ucl.ac.uk) using standard procedures for realignment of the time-series, slice-timing correction, normalization to a standard brain template in MNI space, resampling to 2 mm^3, and smoothing with an 8-mm FWHM Gaussian kernel. Statistical analysis was performed using the general linear model implemented in SPM8, with a separate regressor for each event type in an event-related manner. For each task (GND, IMT, eSUP), two event types were modeled for each participant (positive and negative faces), using the three scanning runs at the single-subject level. Movement parameters from realignment corrections were entered as additional covariates of no interest for each scanning run, in order to account for residual movement artifacts after realignment. Statistical parametric maps were then generated from linear contrasts between the different conditions in each participant, for each task separately.

Second-stage random-effect analysis was performed using one-sample t-tests on contrast images computed in each subject for each comparison of interest. This included IMT > GND, IMT > eSUP, as well as eSUP > GND and eSUP > IMT contrasts, with a statistical threshold of $p < 0.001$ uncorrected and $k \geq 20$ (Lieberman and Cunningham, 2009). The contrasts GND > IMT and GND > eSUP were not considered because our aim was to investigate the neural substrates of explicit social emotion regulation by comparing emotion expression (IMT) versus eSUP, the condition (GND) during which incidental emotion regulation possibly took place only serving as a control task. Because no significant effects emerged for the eSUP contrasts during these analyses at $p < 0.001$ and $k \geq 20$, we lowered the threshold to $p < 0.005$ and $k \geq 20$ for the two eSUP > IMT and eSUP > GND comparisons, in accord with the exploratory nature of this study (for rationale to use similar thresholds in social affective paradigms, see Lieberman and Cunningham, 2009). Finally, raw activation (betas) in functionally defined regions of interests (ROIs) was extracted for all significant voxels and for all three experimental conditions, and the presence of possible activation differences as well as valence effects [positive (POS) versus negative (NEG) – happiness versus sadness] was assessed with paired t-tests using a separate statistical software (IBM SPSS Statistics 19).

RESULTS

The computation of the main contrasts of interest and follow-up statistical analyses revealed the following activation patterns. For a summary, please refer to **Table 1**.

During IMT (as compared to eSUP and/or GND), neural activity was found increased in several cortical and subcortical brain areas. This included bilateral aINS and left putamen (PUT; **Figure 1**). In these areas, activity was selectively increased during IMT as compared to both eSUP (as by the fMRI contrast) and GND

Table 1 | List of activations for the contrasts of interest.

Number of voxels	*Z*-value	*x, y, z*	Region	BA
IMITATION > GENDER				
660	4.15	6, −2, 58	SMA	6
102	3.66	−52, −2, 50	Precentral gyrus left	4/6
70	4.12	−18, 10, 2	Putamen left	
IMITATION > EXPRESSIVE SUPPRESSION				
1980	5.42	−50, −18, 18	Parietal lobe/insula/putamen left	2/3/4/6/40/41/43/44/45/47
838	4.9	54, −26, 24	Parietal lobe/insula left	3/4/6/22/40/41/43/44
316	4.66	8, 16, 36	Dorsal cingulate cortex	24/32
750	4.36	22, −66, 18	Cuneus/precuneus right	18/31
72	3.97	50, 2, 52	Precentral gyrus right	6
20	3.42	40, 32, 4	Anterior insula right	
52	3.42	42, −10, 36	Postcentral gyrus right	6/43
EXPRESSIVE SUPPRESSION > GENDER ($p < 0.005$)				
147	3.26	32, −12, 54	Precentral gyrus right	4/6
EXPRESSIVE SUPPRESSION > IMITATION ($p < 0.005$)				
22	4.3	38, 24, 52	Dorsolateral prefrontal cortex right	8
35	3.31	30, 66, 12	LPFC right	10

Coordinates are given in MNI space and associated with Brodmann areas (BA). Z-scores represent the numbers from the unit normal distribution (mean = 0, SD = 1). x, y, z coordinates refer to the voxel with highest statistical significance within a cluster. SMA, supplementary motor area; LPFC, lateral prefrontal cortex.

($ts > 2.65$, $ps < 0.016$). The putamen (but not the insula) showed a significant valence effect (POS > NEG) during IMT ($t = 2.87$, $p = 0.01$).

In addition, fMRI signal was increased during IMT in supplementary motor area (SMA; **Figure 2A** upper panel) when compared to GND, and in bilateral parietal lobe (extending to pre- and post-central gyri; **Figure 2A** lower panel) and dorsal cingulate cortex (DCC; **Figure 3B**) when compared to eSUP. In the SMA, subsequent ROI analyses confirmed that BOLD signal change during IMT was stronger not only relative to GND (as by the fMRI contrast), but also to a weaker degree relative to eSUP ($t = 2.83$, $p = 0.011$), but there was no effect of valence ($ps > 0.20$). In bilateral parietal lobe, the *post hoc* ROI analysis revealed a general consistent valence effect (POS > NEG) during IMT ($ts > 2.29$, $ps < 0.033$), and a similar valence effect during eSUP ($t = 2.25$, $p = 0.037$) in left inferior parietal lobe specifically (**Figure 2A** lower panel). The DCC also exhibited a selective valence effect (POS > NEG) during IMT ($t = 4.11$, $p = 0.001$; **Figure 3B**).

Finally, activity was also higher during IMT as compared to eSUP in the (pre)cuneus (CUN; **Figure 3A**). Follow-up analyses showed that this activation did not significantly differ between IMT and GND ($t = 1.40$, $p = 0.18$), but was significantly increased during both GND and IMT as compared to eSUP ($t > 3.09$, $p < 0.006$ for *post hoc* test). Furthermore, there was a significant valence effect (POS > NEG) in this region during IMT ($t = 5.99$, $p < 0.001$).

Conversely, during eSUP, we observed increased activity in right precentral gyrus (PCG; **Figure 2B**) when compared to GND, as well as in right dorsolateral and lateral prefrontal areas [(D)LPFC; **Figures 4A,B**] when compared to IMT. In the PCG, activity was actually higher not only during eSUP (as of the fMRI contrast) but also during IMT as compared to GND ($t = 2.52$, $p = 0.021$), but there was no effect of valence. In both the DLPFC and LPFC, activity was again not only higher during eSUP (as of the fMRI contrast) but also higher during GND as compared to IMT ($ts > 3.03$, $ps < 0.007$). In addition, there was a selective valence effect (POS > NEG) in LPFC during IMT ($t = 3.43$, $p = 0.003$).

DISCUSSION

This fMRI study investigated the neural substrates of social emotion regulation processes by contrasting activity elicited during voluntary IMT versus eSUP to dynamic facial signals of either happiness or sadness. These two regulation strategies were compared to a control condition requiring face gender judgments (GND), which did not involve any explicit voluntary strategy, but maybe incidental regulation based on distraction (see McRae et al., 2010; Kanske et al., 2011; Payer et al., 2012). We found both distinct and shared brain systems for IMT and eSUP effects. These can schematically be regrouped into four different core components of social cognitive affective systems, including (i) affective processes, (ii) somatosensory, (pre)motor, and motor mirror neuron activity, (iii) social cognition/theory of mind, and (iv) executive function. These four domains are not meant to be exclusive, and actually show some overlap, but they represent a convenient framework to summarize and interpret our findings (see Lee et al., 2006; Lieberman, 2007 for similar accounts).

AFFECTIVE PROCESSES

Two brain areas typically implicated in emotion were modulated by task demands during IMT, namely bilateral aINS and left putamen.

The aINS has been linked with a variety of emotional processes, including emotional conflict and self-reflection (e.g., Lieberman, 2007), as well as feeling states, affective predictions, and empathy (e.g., Lee et al., 2006). Such mechanisms appear recruited when passively observing emotional expressions of others, suggesting

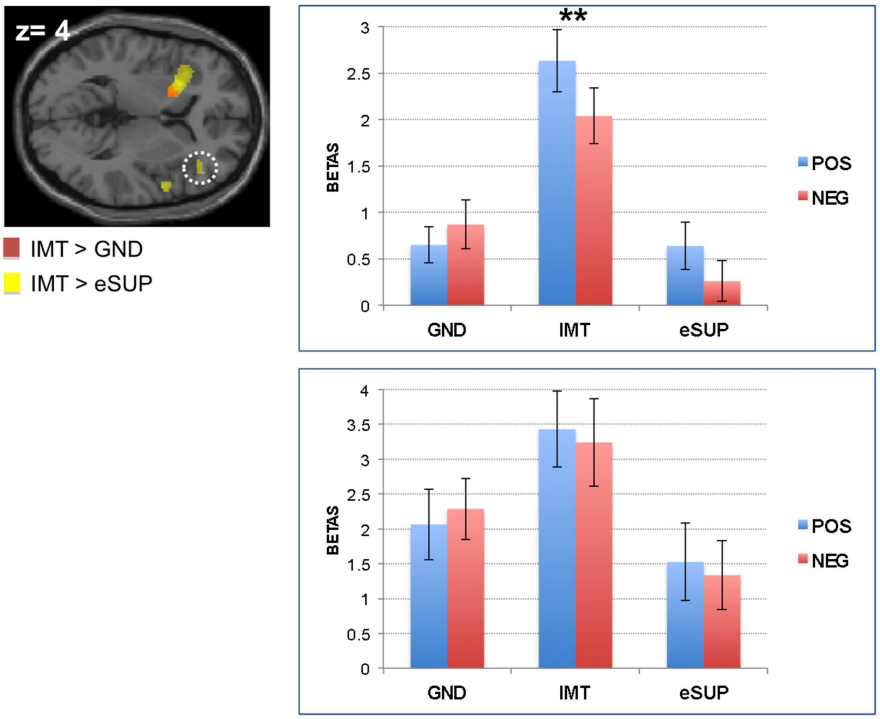


FIGURE 1 | Modulation of brain areas associated with affective processes. *Left*: statistical parametric map of bilateral anterior insula and left putamen activity for the contrasts IMT > GND (red) and IMT > eSUP (yellow) at $p < 0.001$ and $k \geq 20$, superimposed on a template single-subject anatomical brain (T1). *Right Top Panel*: activation values (betas) extracted from the left putamen for all conditions, separated by valence. *Right Lower Panel:* activation values (betas) extracted from the left anterior insula for all conditions. POS, positive/happiness; NEG, negative/sadness. Note that an alternative interpretation of putamen activity is that it was rather directly involved in the motor component of the IMT task (see text). $^{**}p < 0.01$; activation values (GLM regression weights) are displayed with ±1 SEM.

the existence of spontaneous mirroring, mimicry, and/or emotion elicitation effects which may operate with considerable automaticity (Leslie et al., 2004; Lee et al., 2006; Dimberg et al., 2011; Likowski et al., 2012). However, in our study, we found selective increases during IMT as compared to eSUP, but did not observe any activation difference during GND relative to eSUP (as could be expected for automatic mimicry during the GND condition). This suggests that spontaneous IMT, which possibly occurred to a certain degree and modulated other brain areas (see next sections), was either insufficient to elicit activation in aINS when attention was directed to non-emotional information in the GND task, or insufficiently inhibited when overt mimicry was suppressed during eSUP. Most remarkably, aINS activity was significantly lower in our study when participants were instructed to apply an eSUP strategy, so as to reduce bodily – and especially facial – reactions to emotions observed in others, by contrast with greater activation during IMT. These results suggest that eSUP may be effective in diminishing some core affective processes mediated by the insula, particularly in social settings that may otherwise involve IMT of expressions (see below).

Interestingly, a similar pattern of selective activation during IMT (relative to both GND and eSUP) was observed in the (left) putamen. The putamen was more activated when participants were told to explicitly mirror the observed emotional facial expressions (IMT) – rather than when just passively observing the face videos during the GND control task – or when instructed to hold their own face still during the eSUP task. Furthermore, putamen activation during IMT was characterized by a positivity bias. Activity in this area has been suggested to mediate approach motivation and represent reward (O'Doherty, 2003; Delgado et al., 2005; Lee et al., 2006), as well as to correlate with stronger zygomaticus reactions to happy faces during spontaneous facial mimicry (Likowski et al., 2012). Therefore, one interpretation is that such activation increases may contribute to the establishment of a successful social connection with another person, which is facilitated when a (positive) emotional expression by the interaction partner can be reciprocated. Alternatively, the selective increase in putamen activity during IMT might signify an important contribution of the basal ganglia to the motor programming and execution of facial movements (Monchi et al., 2006). This would be consistent with the stronger motor demands during IMT relative to the other two conditions, and accord with similar activation patterns in somatosensory and (pre)motor cortex (see next section).

Taken together, these findings corroborate previous results suggesting that eSUP can be effective in down-regulating emotional brain responses under some circumstances (Vrticka et al., 2011), and thus bolster the notion that this regulation strategy should not be regarded as necessarily detrimental or ineffective (Gross, 1998, 2002; Goldin et al., 2008). However, the link between brain activity during eSUP and the behavioral effects of emotion regulation

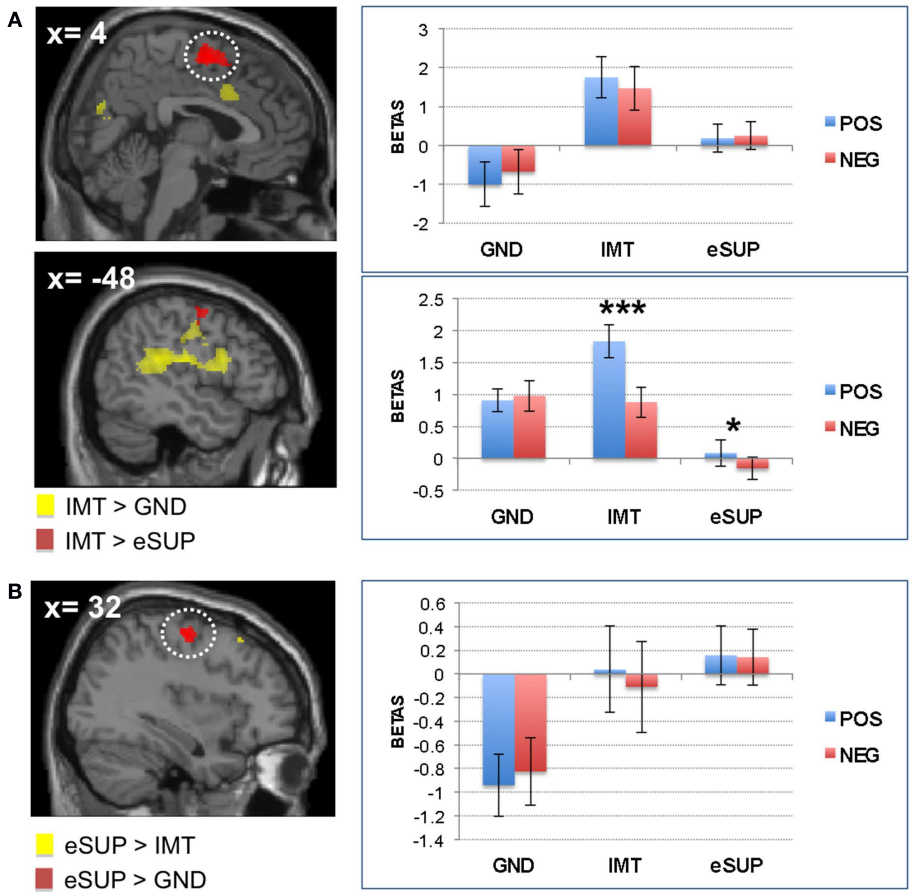


FIGURE 2 | Modulation of brain areas with (pre)motor, somatosensory, and "mirror neuron" functions. (A) *Left*: statistical parametric map of supplementary motor area (SMA; Top Panel) and left inferior parietal lobe (Lower Panel) activity for the contrasts IMT > GND (yellow) and IMT > eSUP (red) at $p < 0.001$ and $k \geq 20$, superimposed on a template single-subject anatomical brain (T1). *Right Top Panel*: activation values (betas) extracted from the SMA for all conditions, separated by valence. *Right Lower Panel*: activation values (betas) extracted from the left parietal lobe (yellow cluster) for all conditions, separated by valence. **(B)** *Left*: statistical parametric map of right pre-central gyrus (PCG) activity for the contrasts eSUP > IMT (yellow) and eSUP > GND (red) at $p < 0.005$ and $k \geq 20$, superimposed on a template single-subject anatomical brain (T1). *Right*: activation values (betas) extracted from the PCG for all conditions, separated by valence. POS, positive/happiness; NEG, negative/sadness. $^{*}p < 0.05$, $^{***}p < 0.001$. Activation values (GLM regression weights) are displayed with ±1 SEM.

still remains incompletely understood (Goldin et al., 2008; Vrticka et al., 2011). More detailed investigations are also needed to clarify the exact nature of any beneficial role of eSUP, especially concerning its long time consequences (McRae et al., 2010).

SOMATOSENSORY, (PRE)MOTOR, AND MOTOR MIRROR NEURON ACTIVITY

Our results also demonstrated significant activity increase during IMT in somatosensory (pre)motor cortex as well as several areas possibly associated with motor "mirror neuron" functions. These sensori-motor effects are consistent with the fact that participants decoded, mirrored, and received somatosensory feedback from the emotional facial expressions they saw and mimicked during the IMT task (Leslie et al., 2004; Lee et al., 2006; Likowski et al., 2012). It is noteworthy that an uniform bias with greater increases for happiness versus sadness was present in both the somatosensory and (pre)motor cortex (BA 3, 4, 6) during IMT, similar to the pattern observed in the left putamen (see above). This positivity bias might reflect the natural tendency to more readily echo positive expressions, such as smiles and laughs, rather than negative expressions (Niedenthal et al., 2010).

BOLD signal change differences between the three experimental conditions were also observed in other premotor regions. On the one hand, the SMA showed significantly stronger activity during IMT as compared to both eSUP and GND. Yet, previous studies reported that SMA may also be involved in motor inhibition (Vrticka et al., 2011; Tabu et al., 2012), and that these effects are enhanced by emotional cues (Sagaspe et al., 2011). Consequently, more research is needed to further determine the role of the SMA in emotion IMT versus regulation, independent of any possible task effects. On the other hand, activity in several sensori-motor regions was significantly different only for the contrast IMT > eSUP, but not IMT > GND, except for an area of the right precentral gyrus (PCG; BA 4/6). Although more direct evidence still needs to be obtained in future studies, this activation pattern is consistent with the possibility that at least some (automatic)

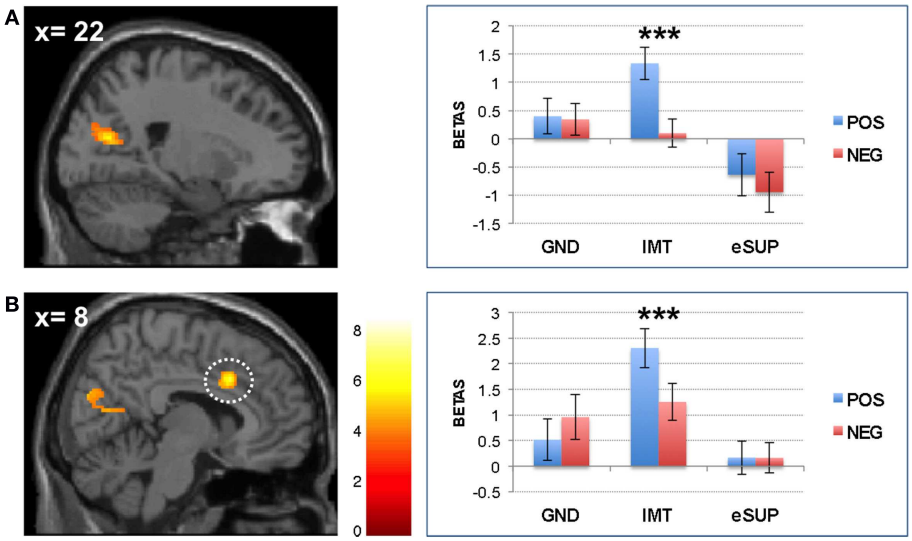


FIGURE 3 | Modulation of brain areas associated with social cognition/theory of mind and self-monitoring. (A) *Left*: statistical parametric map of (pre)cuneus activity for the contrast IMT > eSUP at $p < 0.001$ and $k \geq 20$, superimposed on a template single-subject anatomical brain (T1). *Right*: activation values (betas) extracted from the (pre)cuneus for all conditions, separated by valence. **(B)** *Left*: statistical parametric map of dorsal cingulate cortex (DCC) activity for the contrast IMT > eSUP at $p < 0.001$ and $k \geq 20$, superimposed on a template single-subject anatomical brain (T1). *Activation* values (betas) extracted from the DCC for all conditions, separated by valence. POS, positive/happiness; NEG, negative/sadness. ***$p < 0.001$; activation values (GLM regression weights) are displayed with ±1 SEM.

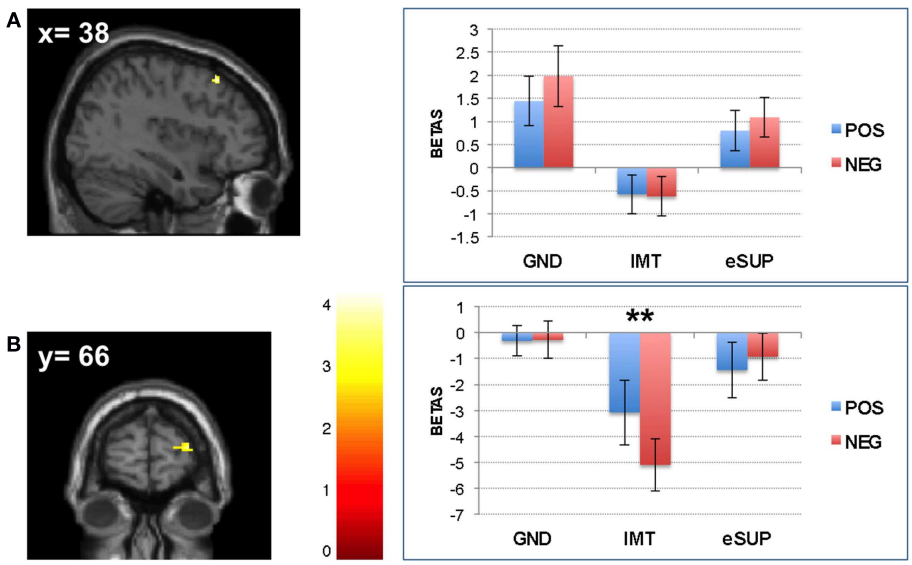


FIGURE 4 | Modulation of prefrontal cortical areas. (A) *Left*: statistical parametric map of right dorsolateral prefrontal cortex (DLPFC) activity for the contrast eSUP > IMT at $p < 0.005$ and $k \geq 20$, superimposed on a template single-subject anatomical brain (T1). *Right*: activation values (betas) extracted from the DLPFC for all conditions, separated by **(B)** *Left*: statistical parametric map of right lateral prefrontal cortex (LPFC) activity for the contrast eSUP > IMT at $p < 0.005$ and $k \geq 20$, superimposed on a template single-subject anatomical brain (T1). *Right*: activation values (betas) extracted from the LPFC for all eSUP conditions. POS, positive/happiness; NEG, negative/sadness. **$p < 0.01$; activation values (GLM regression weights) are displayed with ±1 SEM.

motor mimicry/mirroring did occur during GND (especially in left BA 4/6), but that it was not strong enough to elicit emotional activity (see above). Finally, in one region of the right PCG (BA 4/6), activation solely significantly differed for eSUP > GND, but not for eSUP > IMT. This suggests that key parts within the sensori-motor system may also play an important role in behavioral inhibition, besides motor preparation or execution during IMT.

Taken together, our results for somatosensory, (pre)motor, and motor "mirror neuron" seem to be consistent with the regulation needs of each task condition, suggesting that participants properly imitated emotional facial movements during IMT. In turn, motor activity, particularly in the left precentral gyrus, seems indeed to be prevented during eSUP.

SOCIAL COGNITION/THEORY OF MIND

We also observed activity increase in the (pre)cuneus (CUN) during IMT (as compared to eSUP). This region has been associated with a wide variety of integrative tasks, including visuo-spatial imagery, episodic memory retrieval, first-person perspective taking, and experience of agency, as well as theory of mind (Cavanna and Trimble, 2006). Interestingly, the CUN has also been shown to be recruited during the encoding of two-person cooperative behavior (Leube et al., 2012). Similar to affective processes and sensori-motor activation (see above), self and other representations might be particularly activated in the condition when participants were instructed to actively mimic facial expressions displayed by others (IMT). However, such processing was not significantly different during IMT as compared to GND, suggesting that these aspects of social cognition do not necessarily require voluntary expression (Likowski et al., 2012). Also, the CUN was more active for happiness than for sadness during IMT, an effect we previously associated with the possible explanation of happiness being easier to share with others during social encounters (see *Affective Processes* above). The fact that CUN activation was down-regulated during eSUP (as compared to IMT) suggests that behavioral inhibition (instruction not to mirror the facial expressions displayed by others) could also lead to less implication of theory of mind mechanisms, and not only to blunted affective and sensori-motor processing (see above). Such data accords with previous findings in the posterior cingulate cortex/CUN during another fMRI study, where responses to social (versus non-social) visual scenes, possibly reflecting mentalizing processes, were also negatively affected by emotion regulation, although more strongly by cognitive re-appraisal than eSUP (Vrticka et al., 2011). The current observation that CUN activity was reduced by eSUP during viewing of facial expression is consistent with the notion that this emotion regulation strategy might also partly operate by changing the recruitment of cognitive representations associated with mentalizing. Yet, future research is required as to elucidate the differential processes related to the effects of cognitive re-appraisal versus eSUP on these regions, especially concerning the (possible negative) consequences of eSUP on mentalizing.

EXECUTIVE FUNCTIONS

Finally, significant differences between conditions were observed in two brain are as typically linked with executive functions.

On the one hand, activity was increased during IMT (as compared to eSUP) in dorsal cingulate cortex (DCC), a region often associated with task monitoring, conflict detection, and adjustment in cognitive control (Carter and van Veen, 2007; Shackman et al., 2011). Hence, the DCC might have been activated when participants were engaged in actively mirroring facial expressions in order to imitate them, as this may have required more elaborate monitoring processes to compare observed and subjectively produced emotional displays. Once more, such mechanisms were enhanced during the IMT of happiness versus sadness. Moreover, there was also a significant difference in DCC during IMT as compared to GND, indicating that such executive control related to emotional social processing was less pronounced during simple observation and attention to face gender.

On the other hand, during eSUP (as compared with IMT), we observed increased activity in right dorsolateral and right lateral prefrontal cortex (DLPFC and LPFC, respectively), encompassing BA 8 and 10. The (D)LPFC has previously been associated with voluntary employment of both cognitive (re-appraisal) and behavioral (eSUP) strategies for emotion regulation, and more generally mediates a variety of attentional and inhibitory processes (Ochsner et al., 2002, 2004; Ochsner and Gross, 2005; Kim and Hamann, 2007; Goldin et al., 2008; McRae et al., 2010; Vrticka et al., 2011). The fact that (D)LPFC activity was significantly stronger during eSUP as compared to IMT thus potentially represents the source of inhibitory activity deployed by the eSUP task. Remarkably, activity in (D)LPFC was also increased during GND as compared to IMT. This pattern is consistent with the notion that some form of automatic or incidental emotion regulation processes may occur through cognitive top-down control during spontaneous viewing or non *a priori* emotional conditions such as our GND task here.

We note that the right LPFC showed a positivity bias during the IMT condition, because activity was decreased to a greater extent for sad as compared to happy movies. As already reported previously (e.g., Vrticka et al., 2011), prefrontal cortical activity is not only elevated during down-regulation, but also recruited during up-regulation of emotions. This pattern might therefore suggest that, in addition to regulatory control during eSUP and GND tasks, this region may also contribute to some regulation mechanisms necessary for sustaining IMT.

In sum, our data suggest that face expression control, in reaction to other faces, might recruit two distinct types of cognitive processes. This includes monitoring and adjustment mechanisms implemented by DCC activation, particularly revealed during IMT, as well as behavioral inhibition subserved by the right (D)LPFC, especially during eSUP. Overall, this is consistent with the notion that prefrontal cortical activity during emotion regulation has many functions, comprising monitoring as well as inhibitory (down-regulation) and facilitatory (up-regulation) processes.

LIMITATIONS

One possible limitation of the present investigation is that the GND condition could involve some incidental emotion regulation in order to focus on face gender (see Hariri et al., 2003). However, such incidental processes may be intrinsic to many other "baseline" or "natural" viewing conditions used in emotion regulation studies. Likewise, our IMT condition might imply some degree of emotion up-regulation through mimicry and facial feedback (e.g., Soussignan, 2002). This overlap between strategies could explain why we did not observe significant effects for eSUP at $p < 0.001$ and therefore had to use a slightly more liberal threshold for some contrasts. Such a lower significance threshold due to the recruitment of the same brain regions by different up- and

down-regulation processes is also common in emotion-regulation research (Ochsner et al., 2012).

Another potential limitation concerns the inclusion of both female and male participants in this study, because there are known sex differences in emotion perception and regulation (McRae et al., 2008). Here, due to the small sample size and our main focus on regulation mechanisms, we did not perform any systematic categorical distinction between females and males. In future experiments, however, such sex differences could be addressed more specifically by including a larger number of participants of each group. In any case, our study is the first to systematically compare IMT and eSUP of emotional expression in response to facial displays, and provides novel insights on the neural substrates mediating these effects.

CONCLUSION

This fMRI study investigated the neural substrates of social emotion regulation during the exposure to dynamic happy and sad facial expressions by directly comparing active emotion IMT and eSUP. Distinct activation patterns were revealed in brain circuits typically involved in emotion, somatosensory, and (pre)motor processing, social cognition, as well as executive functions. IMT, as compared to eSUP, produced increased activity within all these networks except for those associated with cognitive control functions. In turn, eSUP relied on right precentral gyrus and prefrontal cortical activity, but only the latter region displayed specific BOLD signal increase as compared with possible incidental emotion regulation during the gender (GND) task. Furthermore, we observed a consistent positivity bias (happiness > sadness) in neural responses during voluntary IMT across several brain areas, in line with greater propensity to echo with positive social signals. Altogether, our findings reveal both common and specific activation patterns in networks that mediate emotion expression, IMT and suppression, and therefore add to our knowledge on brain mechanisms that may mediate appropriate social emotional expressions during social interactions.

ACKNOWLEDGMENTS

This research was supported by (i) the National Center of Competence in Research (NCCR) Affective Sciences financed by the Swiss National Science Foundation (no. 51NF40-104897) and hosted by the University of Geneva; (ii) grants of the Swiss National Science Foundation to DS and PVu, as well as to PVr (Fellowship for advanced researchers nr. 136480); (iii) an award of Geneva Academic Society to PVu (Foremane); (iv) the Centre d'Imagerie BioMédicale (CIBM) that is jointly supported by the University of Lausanne (UNIL), the Swiss Federal Institute of Technology Lausanne (EPFL), the University of Geneva (UniGe), the Centre Hospitalier Universitaire Vaudois (CHUV), the Hôpitaux Universitaires de Genève (HUG), and the Leenaards and the Jeantet Foundations.

REFERENCES

Baenziger, T., Mortillaro, M., and Scherer, K. R. (2012). Introducing the Geneva multimodal expression corpus for experimental research on emotion perception. *Emotion* 12, 1161–1179.

Blechert, J., Sheppes, G., Di Tella, C., Williams, H., and Gross, J. J. (2012). See what you think: reappraisal modulates behavioral and neural responses to social stimuli. *Psychol. Sci.* 23, 346–353.

Carter, C. S., and van Veen, V. (2007). Anterior cingulate cortex and conflict detection: an update of theory and data. *Cogn. Affect. Behav. Neurosci.* 7, 367–379.

Cavanna, A. E., and Trimble, M. R. (2006). The precuneus: a review of its functional anatomy and behavioural correlates. *Brain* 129, 564–583.

Corradi-Dell'Acqua, C., Hofstetter, C., and Vuilleumier, P. (2011). Felt and seen pain evoke the same local patterns of cortical activity in insular and cingulate cortex. *J. Neurosci.* 31, 17996–18006.

Delgado, M. R., Miller, M. M., Inati, S., and Phelps, E. A. (2005). An fMRI study of reward-related probability learning. *Neuroimage* 24, 862–873.

Dimberg, U., Andreasson, P., and Thunberg, M. (2011). Emotional empathy and facial reactions to facial expressions. *J. Psychophysiol.* 25, 26–31.

Goldin, P. R., McRae, K., Ramel, W., and Gross, J. J. (2008). The neural bases of emotion regulation: reappraisal and suppression of negative emotion. *Biol. Psychiatry* 63, 577–586.

Gross, J. J. (1998). Antecedent- and response-focused emotion regulation: divergent consequences for experience, expression, and physiology. *J. Pers. Soc. Psychol.* 74, 224–237.

Gross, J. J. (2002). Emotion regulation: affective, cognitive, and social consequences. *Psychophysiology* 39, 281–291.

Hariri, A. R., Mattay, V. S., Tessitore, A., Fera, F., and Weinberger, D. R. (2003). Neocortical modulation of the amygdala response to fearful stimuli. *Biol. Psychiatry* 53, 494–501.

Kanske, P., Heissler, J., Schoenfelder, S., Bongers, A., and Wessa, M. (2011). How to regulate emotion? Neural networks for reappraisal and distraction. *Cereb. Cortex* 21, 1379–1388.

Kim, S. H., and Hamann, S. (2007). Neural correlates of positive and negative emotion regulation. *J. Cogn. Neurosci.* 19, 776–798.

Lamm, C., Decety, J., and Singer, T. (2011). Meta-analytic evidence for common and distinct neural networks associated with directly experienced pain and empathy for pain. *Neuroimage* 54, 2492–2502.

Lee, T.-W., Josephs, O., Dolan, R. J., and Critchley, H. D. (2006). Imitating expressions: emotion-specific neural substrates in facial mimicry. *Soc. Cogn. Affect. Neurosci.* 1, 122–135.

Leslie, K. R., Johnson-Frey, S. H., and Grafton, S. T. (2004). Functional imaging of face and hand imitation: towards a motor theory of empathy. *Neuroimage* 21, 601–607.

Leube, D., Straube, B., Green, A., Blumel, I., Prinz, S., Schlotterbeck, P., et al. (2012). A possible brain network for representation of cooperative behavior and its implications for the psychopathology of schizophrenia. *Neuropsychobiology* 66, 24–32.

Levesque, J., Eugene, F., Joanette, Y., Paquette, V., Mensour, B., Beaudoin, G., et al. (2003). Neural circuitry underlying voluntary suppression of sadness. *Biol. Psychiatry* 53, 502–510.

Lieberman, M. D. (2007). Social cognitive neuroscience: a review of core processes. *Annu. Rev. Psychol.* 58, 259–289.

Lieberman, M. D., and Cunningham, W. A. (2009). Type I and type II error concerns in fMRI research: re-balancing the scale. *Soc. Cogn. Affect. Neurosci.* 4, 423–428.

Likowski, K. U., Muehlberger, A., Gerdes, A. B. M., Wieser, M. J., Pauli, P., and Weyers, P. (2012). Facial mimicry and the mirror neuron system: simultaneous acquisition of facial electromyography and functional magnetic resonance imaging. *Front. Hum. Neurosci.* 6:214. doi:10.3389/fnhum.2012.00214

McRae, K., Hughes, B., Chopra, S., Gabrieli, J. D. E., Gross, J. J., and Ochsner, K. N. (2010). The neural bases of distraction and reappraisal. *J. Cogn. Neurosci.* 22, 248–262.

McRae, K., Ochsner, K. N., Mauss, I. B., Gabrieli, J. J. D., and Gross, J. J. (2008). Gender differences in emotion regulation: an fMRI study of cognitive reappraisal. *Group Process. Intergr. Relat.* 11, 143–162.

Monchi, O., Petrides, M., Strafella, A. P., Worsley, K. J., and Doyon, J. (2006). Functional role of the basal ganglia in the planning and execution of actions. *Ann. Neurol.* 59, 257–264.

Niedenthal, P. M., Mermillod, M., Maringer, M., and Hess, U. (2010). The simulation of smiles (SIMS) model: embodied simulation and the meaning of facial expression. *Behav. Brain Sci.* 33, U417–U465.

Ochsner, K. N., Bunge, S. A., Gross, J. J., and Gabrieli, J. D. E. (2002). Rethinking feelings: an fMRI study of the cognitive regulation of emotion. *J. Cogn. Neurosci.* 14, 1215–1229.

Ochsner, K. N., and Gross, J. J. (2005). The cognitive control of emotion. *Trends Cogn. Sci. (Regul. Ed.)* 9, 242–249.

Ochsner, K. N., Knierim, K., Ludlow, D. H., Hanelin, J., Ramachandran, T., Glover, G., et al. (2004). Reflecting upon feelings: an fMRI study of neural systems supporting the attribution of emotion to self and other. *J. Cogn. Neurosci.* 16, 1746–1772.

Ochsner, K. N., Silvers, J. A., and Buhle, J. T. (2012). Functional imaging studies of emotion regulation: a synthetic review and evolving model of the cognitive control of emotion. *Ann. NY. Acad. Sci.* 1251, E1–E24.

O'Doherty, J. (2003). Primary reward and the human brain: insights from human neuroimaging. *J. Psychophysiol.* 17, 95–95.

Payer, D. E., Baicy, K., Lieberman, M. D., and London, E. D. (2012). Overlapping neural substrates between intentional and incidental down-regulation of negative emotions. *Emotion* 12, 229–235.

Pfeifer, J. H., Iacoboni, M., Mazziotta, J. C., and Dapretto, M. (2008). Mirroring others' emotions relates to empathy and interpersonal competence in children. *Neuroimage* 39, 2076–2085.

Premack, D., and Woodruff, G. (1978). Does the chimpanzee have a theory of mind. *Behav. Brain Sci.* 1, 515–526.

Rizzolatti, G., Fadiga, L., Gallese, V., and Fogassi, L. (1996). Premotor cortex and the recognition of motor actions. *Cogn. Brain Res.* 3, 131–141.

Sagaspe, P., Schwartz, S., and Vuilleumier, P. (2011). Fear and stop: a role for the amygdala in motor inhibition by emotional signals. *Neuroimage* 55, 1825–1835.

Shackman, A. J., Salomons, T. V., Slagter, H. A., Fox, A. S., Winter, J. J., and Davidson, R. J. (2011). The integration of negative affect, pain and cognitive control in the cingulate cortex. *Nat. Rev. Neurosci.* 12, 154–167.

Singer, T., and Lamm, C. (2009). The social neuroscience of empathy. *Year Cogn. Neurosci.* 1156, 81–96.

Soussignan, R. (2002). Duchenne smile, emotional experience, and autonomic reactivity: a test of the facial feedback hypothesis. *Emotion* 2, 52–74.

Tabu, H., Mima, T., Aso, T., Takahashi, R., and Fukuyama, H. (2012). Common inhibitory prefrontal activation during inhibition of hand and foot responses. *Neuroimage* 59, 3373–3378.

Vrticka, P., Sander, D., and Vuilleumier, P. (2011). Effects of emotion regulation strategy on brain responses to the valence and social content of visual scenes. *Neuropsychologia* 49, 1067–1082.

Conflict of Interest Statement: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Received: 14 August 2012; accepted: 08 February 2013; published online: 27 February 2013.

*Citation: Vrticka P, Simioni S, Fornari E, Schluep M, Vuilleumier P and Sander D (2013) Neural substrates of social emotion regulation: a fMRI study on imitation and expressive suppression to dynamic facial signals. Front. Psychol. **4**:95. doi:10.3389/fpsyg.2013.00095*

This article was submitted to Frontiers in Emotion Science, a specialty of Frontiers in Psychology.

frontiers in
PSYCHOLOGY

ORIGINAL RESEARCH ARTICLE
published: 11 January 2013
doi: 10.3389/fpsyg.2012.00607

Adaptive associations between social cognition and emotion regulation are absent in schizophrenia and bipolar disorder

Jesseca E. Rowland[1], Meelah K. Hamilton[1†], Nicholas Vella[1], Bianca J. Lino[1], Philip B. Mitchell[1,2] and Melissa J. Green[1,2,3]*

[1] School of Psychiatry, University of New South Wales, Sydney, NSW, Australia
[2] Black Dog Institute, Prince of Wales Hospital, Randwick, NSW, Australia
[3] Schizophrenia Research Institute, Darlinghurst, NSW, Australia

Edited by:
Ullrich Wagner, Charité – University Medicine Berlin, Germany

Reviewed by:
Mauro Adenzato, University of Turin, Italy
Frank Schneider, University Hospital Aachen, Germany

***Correspondence:**
Melissa J. Green, University of New South Wales Research Unit for Schizophrenia Epidemiology, O'Brien Centre, St. Vincent's Hospital, Level 4, 394–404 Victoria Street, Darlinghurst, NSW 2010, Australia.
e-mail: melissa.green@unsw.edu.au

[†] *Meelah K. Hamilton is deceased.*

Schizophrenia (SZ) and bipolar disorder (BD) are associated with impairments in facial emotion perception and Theory of Mind (ToM). These social cognitive skills deficits may be related to a reduced capacity to effectively regulate one's own emotions according to the social context. We therefore set out to examine the relationship between social cognitive abilities and the use of cognitive strategies for regulating negative emotion in SZ and BD. Participants were 56 SZ, 33 BD, and 58 healthy controls (HC) who completed the Ekman 60-faces test of facial emotion recognition; a sub-set of these participants also completed The Awareness of Social Inference Test (TASIT) and the Cognitive Emotion Regulation Questionnaire (CERQ). SZ participants demonstrated impairments in emotion perception on both the Ekman and the TASIT Emotion Evaluation tests relative to BD and HC. While both SZ and BD patients showed ToM deficits (i.e., perception of sarcasm and lie) compared to HC, SZ patients demonstrated significantly greater ToM impairment compared to BD. There were also distinct patterns of cognitive strategies used to regulate emotion in both patient groups: those with SZ were more likely to engage in catastrophizing and rumination, while BD subjects were more likely to blame themselves and were less likely to engage in positive reappraisal, relative to HC. In addition, those with SZ were more likely to blame others compared to BD. Associations between social cognition and affect regulation were revealed for HC only: TASIT performance was negatively associated with more frequent use of rumination, catastrophizing, and blaming others, such that more frequent use of maladaptive cognitive emotion regulation strategies was associated with poor social cognitive performance. These associations were not present in either patient group. However, both SZ and BD patients demonstrated poor ToM performance and aberrant use of emotion regulation strategies consistent with previous studies. SZ also showed basic emotion recognition deficits relative to BD and HC. That there were no associations between social cognition and the capacity to self-regulate negative emotion in SZ and BD (in the context of poor social cognition and maladaptive regulatory strategies) suggests that dysfunction in fronto-limbic brain networks may underpin both social cognitive deficits and the use of maladaptive cognitive strategies in these disorders, albeit by potentially different routes.

Keywords: social cognition, emotion, cognitive emotion regulation, schizophrenia, bipolar disorder

INTRODUCTION

Despite their traditional conceptualization as separate diagnostic entities, there is growing recognition of overlapping pathology between schizophrenia (SZ) and bipolar disorder (BD), evident in shared clinical features (Murray et al., 2004), neurocognitive (Reichenberg et al., 2009; Bora et al., 2010), social cognitive deficits (Montag et al., 2010; Sparks et al., 2010), and genetic determinants (Lichtenstein et al., 2009). However, there remain obvious points of departure in the clinical pathology of SZ and BD, most notably in the overt expression of affect. That is, while BD is characterized by disturbance of mood reflected in manic and depressive states (Malhi et al., 2004a,b), overt manifestations of emotionality in SZ are often characterized by inappropriate or blunted affect, that is, lack of context-appropriate emotional expressivity (Gur et al., 2006).

Unique dysfunction in the brain networks required for the voluntary regulation of emotion in BD and SZ (Morris et al., 2012) suggest that the shared tendency to implement *maladaptive* regulatory styles (Rowland et al., in revision) may reflect distinct fronto-limbic brain network abnormalities. Specifically, Morris et al. found that patients with BD demonstrated increased but apparently ineffectual cortical activation during attempts to regulate

negative emotion, while SZ patients generally failed to engage cortical regions during attempts to down-regulate negative emotion. In the context of established brain mechanisms responsible for the regulation of affect (Ochsner et al., 2004), it is possible that common cognitive deficits in SZ and BD (predominantly reflecting prefrontal cortical brain dysfunction) could impede the capacity for effective self-regulation of emotion in these disorders (Green et al., 2007). For instance, a review by Ochsner and Gross (2008) highlights a model of brain networks supporting cognitive emotion regulation where cognitive strategies vary in their reliance on prefrontal and cingulate systems for attention, response-selection, and mental-state attribution. These same deficits in executive function have been shown to influence mentalizing ability and facial affect processing in SZ and BD (Addington and Addington, 1998; Bora et al., 2005; Olley et al., 2005), such that there is potential for social cognitive deficits to also impact emotion regulation capacities in these clinical groups (Ochsner, 2008; Phillips et al., 2008). In this study we aimed to address this question in the context of known aberrations in both social cognition and emotion regulation in these disorders.

Social cognition is a domain of cognitive processing which involves all of the processes necessary for interacting with conspecifics (Adolphs, 2004), and encompasses two important skills: (1) the ability to accurately perceive emotional information from others (e.g., from facial expressions and vocal inflections); and (2) the ability to make higher order social inferences about the intentions and behavior of others, often referred to as Theory of Mind (ToM; Pinkham et al., 2003). Effective social cognitive processes are required to respond appropriately in social interactions (McDonald et al., 2003). Disrupted social cognition is frequently observed in SZ (Brune, 2005), with a considerable body of research demonstrating impairments in the perception of facial affect (Mandal et al., 1998; Edwards et al., 2002; Namiki et al., 2007; Kohler et al., 2010; Sparks et al., 2010) and emotional prosody (Leitman, 2005; Hoekert et al., 2007). There has been some evidence to suggest that SZ patients have more difficulty interpreting negative emotions (such as sadness and disgust) compared to positive emotions (such as happiness; Edwards et al., 2002). A bias to misinterpret "neutral" faces as "sad," "happy," or "disgusted" has also been demonstrated (Kohler et al., 2003). Furthermore, these impairments have been shown to persist during remission of psychotic symptoms (Kern et al., 2009). Similarly, studies of BD reveal that bipolar patients are also impaired on tasks of facial affect perception compared to healthy controls (HC), but do not perform as poorly as SZ patients (Addington and Addington, 1998). Indeed, meta-analyses of emotion perception in both patient groups have revealed a large deficit for SZ (Kohler et al., 2010) compared to a moderate deficit for BD (Kohler et al., 2011).

Interestingly, many studies suggest that mood-congruent biases in emotion perception may be operating in BD. For example, a "negative bias" has been found in BD during a depressed state, where there is a tendency to rate "neutral" faces as "sad" and "happy" faces as "neutral" (Gur et al., 1992; Gray et al., 2006). Comparable research during mania suggests a "positive bias" in which "neutral" facial expressions are interpreted as "happy" (Lennox et al., 2004). Furthermore, the persistence of social cognitive impairments into the euthymic phase of BD has also been reported (Yurgelun-Todd et al., 2000; Lembke and Ketter, 2002; Samame et al., 2012), although these findings are inconsistent (Malhi et al., 2007). In this study, the Ekman 60-faces task from the Facial Expressions of Emotion: Stimuli and Tests (FEEST; Young et al., 2002) was chosen as a well-validated facial affect processing task that requires participants to identify basic emotions from a series of faces presented in a still photographic format.

Static photographs, however, are markedly different to spontaneous dynamic displays of emotion that must be rapidly decoded in everyday social situations where emotions are displayed briefly and quickly. The Awareness of Social Inference Test (TASIT; McDonald et al., 2003) addresses this issue by using videotaped footage of trained actors in dynamic displays of emotion, as well as in conversational interactions with others, requiring the integration of multiple, changing cues (from face, prosody, gesture and context) to identify the emotions, beliefs, and intentions of target characters within the social context. The TASIT thus provides an ecologically valid measure of social cognition that assesses both simple (basic emotion perception) and complex (ToM skills) social cognition, with higher levels of difficulty requiring the integration of contextual cues and the perception of lies and sarcasm. Sarcasm is one example of a non-literal language device used in conversation that relies on ToM, since the true state of affairs is the opposite to that asserted in the literal utterance (Brown and Levinson, 1978; Haverkate, 1990). Recent studies using the TASIT demonstrate impairments of sarcasm perception in SZ (Leitman et al., 2006; Kern et al., 2009; Sparks et al., 2010), while studies of ToM deficits using more traditional picture-story tasks have repeatedly demonstrated ToM impairments in schizophrenic individuals (Brune, 2005; Harrington et al., 2005). Again, these deficits have been shown to persist when patients are in remission (Sprong et al., 2007). Mounting evidence also indicates that BD patients are impaired in their ability to "mentalize": BD patients in an affective state (depressed or manic) have been found to perform worse on ToM tasks than euthymic BD patients who had comparable results to controls (Kerr et al., 2003). However, other studies have reported impaired ToM in euthymic BD as well (Bora et al., 2005; Montag et al., 2010).

The propensity for social cognitive deficits to impact emotion regulation is supported by current knowledge of the cognitive and neural mechanisms for emotion generation and regulation (Green and Malhi, 2006). Specifically, emotion regulation refers to a range of voluntary and involuntary processes used to modulate the occurrence, intensity, and duration of internal feeling states and physiological processes that occur in relationship to external events, in order to respond appropriately in accord with one's goals (Gross, 1998; Eisenberg, 2000). Emotional responses are refined through a complex interaction between primitive limbic structures (engaged in the perception and generation of emotion) and cortical regions (engaged in inhibitory control of affective responses) to provide flexibility in response to changes in both internal and external environments (Green and Malhi, 2006). Common strategies to regulate subjective affect include attempts to cognitively control the type and extent of emotional response via techniques to reframe the meaning of the event (Ochsner and Gross, 2005); cognitive reappraisal is one such technique that involves reappraisal of emotional and social information

to modulate one's own emotional responses (Green and Malhi, 2006).

Cognitive reappraisal requires effective inhibition of the limbic system by prefrontal brain regions, specifically the orbitofrontal cortex (OFC), dorsolateral prefrontal cortex (DLPFC), lateral prefrontal cortex (LPFC), and medial prefrontal cortex (MPFC; Green and Malhi, 2006), such that known abnormalities in neurocognitive and social cognitive deficits in SZ and BD are therefore likely to impact mechanisms for emotion regulation.

For instance, working memory deficits in SZ and BD have also been associated with abnormal brain activity in the OFC and DLPFC (Park et al., 1999), and evidence has shown that social cognitive skills are partially accounted for by non-social neurocognitive capacities (Sergi et al., 2007), particularly those associated with prefrontal cortical function (Crowe et al., 1999). Furthermore, neuroimaging studies of social cognition in patients with mood disorders have revealed enhanced activation in limbic structures and attenuated activity within frontal regions associated with emotion regulation (Cusi et al., 2012). Indeed, we have recently demonstrated distinct aberrations in prefrontal-limbic brain networks in SZ and BD during attempts to down-regulate negative affect using cognitive reappraisal (Morris et al., 2012), In addition, emerging evidence suggests that "exhaustion" of these inhibitory regions can result in over-activation of the amygdala, alongside aberrant connectivity of PFC-amygdala networks (Wagner and Heatherton, 2012). These brain disturbances in networks required for efficient emotion regulation may explain why individuals with a history of psychosis demonstrate less frequent use of cognitive reappraisal relative to non-patient controls (Livingstone et al., 2009). Furthermore, with overt signs of dysregulated emotion in SZ most commonly seen in blunted affect, it is not surprising that attenuated affect in SZ has been associated with difficulties in the amplification (up-regulation) of positive emotional expression (Henry et al., 2007).

Direct comparison of SZ and BD with regard to cognitive processes used to regulate emotion has been recently undertaken in a large sample of outpatients assessed with the Cognitive Regulation of Emotion Questionnaire (CERQ; Rowland et al., in revision). This study revealed a pattern of similarly increased tendencies to employ rumination, self-blame, and catastrophizing evident among SZ and BD, alongside distinct use of other-blame in SZ (Rowland et al., in revision). The CERQ (Garnefski et al., 2001) provides an index of the extent to which particular cognitive strategies are employed to regulate negative emotion in response to threatening or stressful life events. Previous research using this scale has shown increased use of rumination, catastrophizing, and self-blame, coupled with decreased use of adaptive cognitive reframing strategies (for example, positive reappraisal), in association with depression and anxiety symptoms (Garnefski et al., 2001, 2002, 2005; Garnefski and Kraaij, 2006). A similar pattern of responses on the CERQ has also recently emerged for BD patients and their unaffected relatives (Green et al., 2011).

On the basis of likely inter-relationships among social cognitive ability and emotion regulatory capacities, we set out here to examine the relationship between both emotion perception and ToM disturbances and the use of cognitive strategies for regulating negative emotion in SZ and BD. The following hypotheses were tested on the basis of evidence reviewed above. First, we hypothesized that SZ and BD participants would both be impaired on the Ekman 60-faces task and TASIT emotion perception relative to controls, but with SZ patients showing greater impairment than those with BD. Second, it was hypothesized that both SZ and BD participants would be impaired on TASIT social inference tests relative to controls, with SZ participants again demonstrating greater impairments compared to BD participants. Third, we hypothesized that SZ and BD groups would be more likely to use maladaptive cognitive emotion regulation strategies (i.e., increased rumination, catastrophizing, and self-blame) and less likely to use adaptive positive reframing strategies (e.g., positive reappraisal) in comparison to controls. Lastly, we hypothesized that performance on the social cognition tasks would be associated with the use of particular CERQ strategies in the SZ and BD groups; specifically, that poorer performance on the Ekman task and TASIT would be associated with increased use of maladaptive emotion regulation strategies (rumination, self-blame, other-blame, and catastrophizing) and decreased use of adaptive reframing strategies (e.g., positive reappraisal).

MATERIALS AND METHODS

Study procedures were approved by the Human Research Ethics Committees of the University of New South Wales (HREC UNSW Protocol No. 07167) and the South Eastern Sydney Illawarra Area Health Service (SESIAHS Protocol No. 09/081). All participants provided written informed consent prior to participation.

PARTICIPANTS

The sample comprised 56 participants with SZ, 33 with bipolar I disorder, and 58 HC who completed the Ekman task; with a subset of 47 SZ, 27 BD, and 47 HC completing the TASIT. Of these, 32 SZ, 24 BD, and 36 HC completed the CERQ. All subjects fulfilled relevant DSM-IV criteria. Healthy participants had no personal history of a DSM-IV Axis 1 disorder other than anxiety disorders, and no history of psychosis (SZ or BD) in their first-degree biological relatives. Exclusion criteria included inability to communicate sufficiently in English, current neurological disorder and/or having been treated with electro convulsive therapy (ECT) in the previous 6 months.

Participants were recruited from a number of sources, including the Australian Schizophrenia Research Bank (ASRB; Loughland et al., 2011), the Sydney Bipolar Disorder Clinic (Mitchell et al., 2009), and advertisements in the local community and newspaper. The SZ group consisted of 32 males (57.1%) and 24 females (42.9%), aged 19–63 years ($M = 44.57$, SD = 10.37). The BD group comprised 18 males (54.3%) and 15 females (45.7%), aged 22–60 years ($M = 40.67$, SD = 11.27). At the time of assessment, 12 BD participants were determined euthymic (36.4%), 12 hypomanic (36.4%), 1 depressed (3%), and 8 in a mixed state (24.2%). The HC participants were equally divided between males and females and aged 19–61 years ($M = 33.91$, SD = 12.24). There were missing data on less than 10% of items for seven clinical participants; missing data were replaced with the group median for each item.

A number of SZ and BD participants were prescribed antipsychotic, antidepressant, or mood stabilizing medication at the time of testing. Of the SZ patients, 18 were taking an antipsychotic, 18 an antipsychotic and antidepressant, 5 an antipsychotic and mood stabilizer, and 7 an antipsychotic and antidepressant plus a mood stabilizer. Of the BD participants, 2 were taking an antipsychotic, 7 a mood stabilizer, 10 an antipsychotic and a mood stabilizer, 7 an antidepressant and mood stabilizer, and 2 were taking all three. The remaining patients were not currently taking any medication.

MATERIALS

Internal State Scale

Mood state of the BD participants at the time of assessment was indexed by the Internal State Scale (ISS; Bauer et al., 1991) The ISS is a 16-item self-report scale that provides an index of manic and depressive symptomatology for the preceding 24 h. The measure is divided into four subscales: *Activation*, *Perceived Conflict*, *Well-Being*, and a *Depression Index*. Each item is rated on a 100-point visual analog scale anchored at 0 and 100, with each anchor incorporating both the frequency and severity of the symptom. The Activation subscale items correspond to manic symptoms (e.g., "My thoughts are going fast), and the Depression Index to depressive symptoms (e.g., "It seems like nothing will work out for me"), and they have been found to correlate highly with clinician ratings of mania and depression, respectively.

Positive and Negative Syndrome Scale

Current symptoms of SZ and BD patients were assessed using the Positive and Negative Syndrome Scale (PANSS; Kay et al., 1987). The PANSS has three subscales, *positive symptoms*, *negative symptoms*, and *general psychopathology*. Each symptom receives a rating between 1 (*Absent*) and 5 (*Severe*).

Ekman 60-faces task from the Facial Expressions of Emotion: Stimuli and Tests

As a measure of emotion perception, subjects were administered the Ekman 60-faces task from the FEEST (Young et al., 2002). FEEST is a computerized task, where participants are required to identify six basic emotions from the Ekman and Friesen (1976) series (happiness, sadness, anger, fear, surprise, and disgust) presented in a still "photographic" format. In accordance with previous research of emotion recognition, happiness and surprise were considered "positive" expressions, and sadness, anger, fear, and disgust were considered "negative" expressions.

The Awareness of Social Inference Test

All subjects completed Form A of TASIT (McDonald et al., 2003) to index emotion perception and ToM abilities. TASIT comprises three parts, as detailed below, and an administration time of approximately 35 min. Practice items were provided for all parts, and the videotape was paused after each video clip to allow participants time to comprehend and answer the questions.

Part 1: *The Emotion Evaluation Test* comprises 28 short video clips in which an actor portrays one of six basic emotions (happy, sad, fear, disgust, surprise, or anger). The maximum attainable accuracy score is 28.

Part 2: *Social Inference – Minimal* is comprised of 15 video clips depicting sincere and sarcastic (simple sarcasm and paradoxical sarcasm) interaction between two actors, thus examining ToM. The dialog used is ambiguous, requiring attendance to general demeanor, tone of voice, facial expressions, and/or gestures, in order to interpret the situation. In sincere exchanges, the target actors mean what they say. In simple sarcasm exchanges, one of the target actors means the opposite of what is said, and intends for the listener to comprehend the real meaning of what is said. In paradoxical sarcasm exchanges, the dialog between speakers is nonsensical unless it is understood that one speaker is being sarcastic. At the end of each clip, participants answered four questions designed to elicit interpretations of what the speaker was thinking, doing (e.g., criticizing), meaning to say, and feeling. As each of the 15 video clips is given a score out of 4, the maximum score attainable in this part is 60.

Part 3: *Social Inference – Enriched*, which also examines ToM, is comprised of 16 vignettes for which participants are provided extra information about the true state of affairs before or after the dialog of interest. Participants answer four questions designed to examine their ability to detect deception in social encounters (i.e., lies) and sarcasm. The maximum attainable score in this section is 64.

Cognitive Emotion Regulation Questionnaire

The Cognitive Emotion Regulation Questionnaire (CERQ) measures various types of cognitive strategies employed to regulate emotion in response to the experience of threatening or stressful life events (Garnefski et al., 2001). The CERQ is a 36-item questionnaire, consisting of nine conceptually distinct subscales (four items each), each pertaining to a particular type of regulatory strategy. A person's tendency to engage in each strategy is measured on a five-point Likert scale ranging from 1 (almost never) to 5 (almost always). Individual subscale scores are obtained by summing the scores for each strategy (ranging from 4 to 20); the higher the subscale score, the more often the cognitive strategy is used. The four maladaptive subscales of the CERQ include: *self-blame* (thoughts of blaming yourself for what you have experienced), *other-blame* (thoughts of blaming another person for what you have experienced), *rumination* (thinking about feelings and thoughts associated with the negative event), and *catastrophizing* (thoughts that over-emphasize the significance and extent of the experience). The five positive subscales include: *putting into perspective* (thoughts that minimize the seriousness of the event relative to other life events), *positive refocusing* (distracting oneself from thinking about the event by focusing on positive thoughts or issues), *positive reappraisal* (reframing the event in a positive light), *acceptance* (accepting the experience and resigning oneself to what has happened), and *refocus on planning* (thinking about how to handle the negative event and what steps to take). Internal consistencies of CERQ subscales range from 0.68 to 0.83 (Garnefski et al., 2001), and evidence for discriminant and convergent validity has been reported (Garnefski et al., 2004, 2005).

PROCEDURE

Subjects were tested individually in a dedicated testing laboratory. Administration time was approximately 3 h. Participants were reimbursed for their time and travel expenses.

RESULTS

Descriptive statistics for demographic and clinical data collected using the PANSS are presented in **Table 1**. One-way analysis of variance (ANOVA) was conducted to investigate group differences in age and a Chi-squared analysis to examine gender distribution. There were no differences in sex distribution among the three groups. However, there was a significant group difference in age (see **Table 1**); Tukey's HSD tests revealed that both SZ ($p < 0.0001$) and BD ($p < 0.01$) groups were significantly older than the HC group, but the SZ and BD groups did not significantly differ in age ($p = 0.262$). Age was thus employed as a covariate in focal analyses of the clinical and HC groups. Unsurprisingly, a significant difference in PANSS scores was found between the SZ and BD groups, where SZ participants reported significantly higher levels of symptoms than the BD participants on all three subscales; positive symptoms ($F_{1,88} = 27.54$, $p < 0.0001$; $\eta^2 = 0.240$), negative symptoms ($F_{1,88} = 20.57$, $p < 0.0001$; $\eta^2 = 0.191$), and general symptoms ($F_{1,88} = 7.76$, $p = 0.007$; $\eta^2 = 0.082$).

GROUP DIFFERENCES IN PERFORMANCE ON THE EKMAN 60-FACES TASK

To investigate group differences in Ekman performance, we conducted a multivariate analysis of variance (MANOVA) with group (SZ, BD, and HC) as the independent variable and accuracy on the Ekman 60-faces task entered as dependent variables. Group means and SD for facial emotion recognition accuracy are presented in **Table 2**. There was a significant main effect of group for the recognition accuracy of positive, negative, and total emotions (see **Table 2**). Subsequent univariate analyses of covariance (ANCOVAs) were used to examine pairwise group differences between individual patient groups and controls, controlling for age. These analyses revealed that, in comparison to the HC group, SZ participants demonstrated impairments in the recognition of positive ($F_{2,113} = 4.44$, $p = 0.037$; partial $\eta^2 = 0.038$) and negative emotions ($F_{2,113} = 8.45$, $p = 0.004$; partial $\eta^2 = 0.071$), as well as overall emotion recognition ($F_{2,113} = 9.23$, $p = 0.003$; partial $\eta^2 = 0.077$). ANOVAs examining clinical group differences showed poorer performance in the SZ than the BD group in

Table 1 | Demographic information and PANSS scores for each group.

	SZ ($n = 56$)	BD-I ($n = 33$)	HC ($n = 58$)	Statistical values for main effects	Effect size	Direction of significant group differences
Age (years)	44.57 (10.37)	40.67 (11.27)	33.91 (12.24)	$F_{2,146} = 12.81$, $p < 0.0001$	$\eta^2 = 0.151$	SZ > HC***, BD > HC*
Gender (M/F)	32/24	18/15	29/29	$\chi^2 = 0.596$, $p = 0.742$		ns
PANSS positive symptoms	16.32 (7.09)	9.36 (3.58)		$F_{1,88} = 27.54$, $p < 0.0001$	$\eta^2 = 0.240$	SZ > BD***
PANSS negative symptoms	17.34 (7.50)	10.91 (4.09)		$F_{1,88} = 20.57$, $p < 0.0001$	$\eta^2 = 0.191$	SZ > BD***
PANSS general symptoms	31.14 (9.84)	25.88 (5.93)		$F_{1,88} = 7.76$, $p = 0.007$	$\eta^2 = 0.082$	SZ > BD**
PANSS total	64.80 (19.68)	46.64 (10.55)		$F_{1,88} = 20.57$, $p < 0.0001$	$\eta^2 = 0.216$	SZ > BD***

$^{***}p < 0.001$, $^{**}p < 0.01$, and $^{*}p < 0.05$.

PANSS, Positive and Negative Syndrome Scale.

Table 2 | Means and SD for all groups on the social cognition measures.

	SZ	BD	HC	Statistical values for main effects	Effect size	Direction of significant group differences
Ekman subscale and total scores	**($n = 56$)**	**($n = 33$)**	**($n = 58$)**			
Positive emotions	17.89 (2.35)	18.61 (1.48)	18.84 (1.58)	$F_{2,146} = 3.80$, $p = 0.025$	$\eta^2 = 0.050$	SZ < HC*
Negative emotions	26.95 (6.92)	30.88 (3.85)	30.38 (4.44)	$F_{2,146} = 7.80$, $p = 0.001$	$\eta^2 = 0.098$	SZ < BD**; SZ < HC**
Overall total	44.84 (8.63)	49.48 (3.99)	49.22 (4.71)	$F_{2,146} = 8.55$, $p < 0.0001$	$\eta^2 = 0.106$	SZ < BD**; SZ < HC**
TASIT subscale and total scores	**($n = 47$)**	**($n = 27$)**	**($n = 47$)**			
Part 1	22.11 (4.17)	23.52 (2.82)	24.62 (2.72)	$F_{2,120} = 6.524$, $p = 0.002$	$\eta^2 = 0.101$	SZ < HC***
Part 2	45.68 (9.35)	53.37 (4.99)	53.68 (5.97)	$F_{2,120} = 16.75$, $p < 0.0001$	$\eta^2 = 0.221$	SZ < BD***; SZ < HC***
Part 3	48.19 (6.69)	52.33 (6.78)	55.96 (5.54)	$F_{2,120} = 17.93$, $p < 0.0001$	$\eta^2 = 0.233$	SZ < BD*; SZ < HC***; BD < HC*
Overall total	115.98 (16.97)	129.22 (12.28)	134.26 (12.01)	$F_{2,120} = 20.34$, $p < 0.0001$	$\eta^2 = 0.256$	SZ < BD***; SZ < HC***

$^{***}p < 0.001$, $^{**}p < 0.01$, and $^{*}p < 0.05$.

Ekman, Ekman 60-faces task; TASIT, The Awareness of Social Inference Test.

negative ($F_{1,88} = 9.10$, $p = 0.004$; $\eta^2 = 0.094$) and overall emotion recognition ($F_{1,88} = 8.47$, $p = 0.005$; $\eta^2 = 0.089$). There were no significant differences in emotion recognition accuracy between the BD and HC groups.

GROUP DIFFERENCES IN TASIT PERFORMANCE

Group means and SD for TASIT performance are summarized in **Table 2**. To investigate group differences in TASIT performance, we conducted a MANOVA with group as the independent variable (SZ, BD, and HC), and TASIT subscale (Part 1 – Emotion Evaluation Test, Part 2 – Social Inference: Minimal, and Part 3 – Social Inference: Enriched) and overall total scores entered as dependent variables. There was a significant main effect of group for all four scores; Part 1, Part 2, Part 3, and overall total score (see **Table 2**). Subsequent ANCOVAs examining specific group differences between the clinical and control groups, controlling for age, showed that in comparison to the HC group SZ participants demonstrated impairments in every component of the TASIT: Part 1 ($F_{2,93} = 4.52$, $p = 0.036$; partial $\eta^2 = 0.047$); Part 2 ($F_{2,93} = 18.54$, $p < 0.0001$; partial $\eta^2 = 0.169$); and Part 3 ($F_{2,93} = 22.03$, $p < 0.0001$; partial $\eta^2 = 0.195$). The only difference between scores for the BD and HC groups was on Part 3, with BD participants showing deficits on the threshold of significant ($F_{2,73} = 3.97$, $p = 0.05$; partial $\eta^2 = 0.053$). Further ANOVAs undertaken for pairwise comparisons of the clinical groups showed that SZ had more difficulty performing than BD patients on Part 2 ($F_{1,73} = 15.65$, $p < 0.0001$; $\eta^2 = 0.179$), Part 3 ($F_{1,73} = 6.51$, $p = 0.013$; $\eta^2 = 0.083$), and overall ($F_{1,73} = 12.62$, $p = 0.001$; $\eta^2 = 0.149$).

FREQUENCY OF USE OF COGNITIVE EMOTION REGULATION QUESTIONNAIRE STRATEGIES

Group means and SD for CERQ subscales are reported in **Table 3**. To investigate group differences in the frequency of use of CERQ strategies (represented by total scores on each subscale), we conducted a MANOVA with group (SZ, BD, and HC) as the independent variable, and total scores on each of the nine CERQ subscales entered as dependent variables. This revealed a significant main effect of group for rumination, positive reappraisal, blaming others, catastrophizing, and self-blame, but not for acceptance, putting into perspective, positive refocusing, or refocus on planning (see **Table 3**).

In focal analyses of clinical and control groups on the significant CERQ subscales, a series of ANCOVAs were undertaken to examine pairwise group differences in the frequency of use of these strategies, controlling for age. In comparison to the HC group, SZ participants were more likely to engage in *catastrophizing* ($F_{2,67} = 10.78$, $p = 0.002$; partial $\eta^2 = 0.142$) and *rumination* ($F_{2,67} = 3.99$, $p = 0.05$; partial $\eta^2 = 0.058$), while BD participants reported less use of *positive reappraisal* ($F_{2,59} = 9.38$, $p = 0.003$; partial $\eta^2 = 0.141$) and greater use of *self-blame* ($F_{2,59} = 5.15$, $p = 0.027$; partial $\eta^2 = 0.083$). An ANOVA comparing the patient groups showed SZ participants were more likely to employ the regulatory strategy of *blaming others* than BD participants ($F_{2155} = 5.86$, $p = 0.019$; $\eta^2 = 0.098$).

ASSOCIATION OF SOCIAL COGNITIVE PERFORMANCE WITH CERQ

Zero-order correlations between social cognitive performance and CERQ subscales were carried out using Pearson's product-moment correlations. Associations between emotion recognition accuracy on the Ekman task and CERQ subscales are reported in **Table 4**. The only significant correlations were for the HC group, with the Ekman positive emotions subscale score showing positive associations with the CERQ subscales *acceptance* ($r = 0.501$, $p = 0.002$) and *putting into perspective* ($r = 0.429$, $p = 0.009$). There were no significant correlations for either the SZ or BD groups. Subsequently, statistical comparison of correlation coefficients for independent samples was conducted via the Fisher *z transformation of r* procedure (Cohen and Cohen, 1983) to investigate pairwise group differences in the Ekman scores and CERQ subscales that were correlated for controls but not for patients. For all comparisons between the SZ and HC groups there was a significant difference between correlations (positive emotions with: acceptance $Z = -2.45$, $p = 0.014$; putting into perspective $Z = -2.14$, $p = 0.032$). For BD and HC, the correlations were also found to differ significantly between groups (positive emotions with: acceptance $Z = -2.40$, $p = 0.016$; putting into perspective $Z = -2.21$,

Table 3 | Means and SD for all groups on the CERQ.

CERQ subscale	SZ ($n = 32$)	BD ($n = 24$)	HC ($n = 36$)	Statistical values for main effects	Effect size	Direction of significant group differences
Rumination	14.56 (5.95)	13.54 (3.31)	11.69 (3.65)	$F_{2,91} = 3.53$, $p = 0.034$	$\eta^2 = 0.073$	SZ > HC**; BD > HC**
Positive reappraisal	14.13 (4.11)	12.58 (4.09)	15.50 (3.12)	$F_{2,91} = 4.40$, $p = 0.015$	$\eta^2 = 0.091$	BD < HC*
Other-blame	10.59 (4.53)	8.04 (2.85)	8.61 (3.21)	$F_{2,91} = 4.01$, $p = 0.021$	$\eta^2 = 0.083$	SZ > BD**; SZ > HC**
Acceptance	13.66 (3.41)	12.71 (3.21)	12.86 (3.28)	$F_{2,91} = 0.71$, $p = 0.492$		ns
Catastrophizing	11.31 (4.37)	10.33 (4.29)	8.25 (3.24)	$F_{2,91} = 5.36$, $p = 0.006$	$\eta^2 = 0.107$	SZ > HC**; BD > HC**
Putting into perspective	13.06 (3.89)	13.71 (8.67)	15.14 (3.62)	$F_{2,91} = 1.28$, $p = 0.282$		ns
Positive refocusing	11.66 (3.69)	10.00 (4.17)	12.00 (3.38)	$F_{2,91} = 2.25$, $p = 0.111$		ns
Refocus on planning	15.59 (7.64)	13.42 (3.83)	15.44 (2.87)	$F_{2,91} = 1.43$, $p = 0.244$		ns
Self-blame	11.94 (3.41)	12.75 (4.95)	10.33 (3.24)	$F_{2,91} = 3.19$, $p = 0.046$	$\eta^2 = 0.067$	BD > SZ* > HC**

$^{**}p < 0.01$ and $^{*}p < 0.05$.

CERQ, Cognitive Emotion Regulation Questionnaire.

Table 4 | Pearson's two-tailed correlations between Ekman scores and CERQ strategies for SZ, BD, and HC groups.

CERQ subscales	Ekman 60-faces scores								
	Positive emotions			Negative emotions			Total score		
	SZ	BD	HC	SZ	BD	HC	SZ	BD	HC
Rumination	−0.180	0.073	0.124	−0.096	−0.254	0.137	−0.129	−0.214	0.165
Positive Reappraisal	−0.123	−0.084	−0.003	−0.135	−0.027	0.050	−0.148	−0.053	0.045
Other-blame	−0.265	0.227	0.134	−0.163	−0.382	−0.215	−0.209	−0.284	−0.156
Acceptance	−0.073	−0.120	0.501**	−0.159	−0.118	0.077	−0.155	−0.151	0.229
Catastrophizing	−0.245	0.080	0.052	−0.279	−0.113	−0.282	−0.303	−0.080	−0.243
Putting in perspective	−0.086	−0.156	0.429**	−0.192	0.066	0.266	−0.188	0.011	0.380
Positive refocusing	−0.098	−0.202	−0.134	0.010	−0.190	0.014	−0.016	−0.246	−0.029
Refocus on planning	−0.273	−0.083	0.183	−0.102	−0.115	0.035	−0.158	−0.136	0.090
Self-blame	0.055	0.084	0.273	−0.153	−0.108	−0.106	−0.117	−0.074	−0.012

$^{**}p < 0.01$.

CERQ, Cognitive Emotion Regulation Questionnaire.

$p = 0.027$). There was no significant difference between SZ and BD in the correlations for these variables.

Similarly, significant correlations between TASIT scores and CERQ subscales were found for the HC group only, as reported in **Table 5**. Significant negative associations were found in the HC group between TASIT Part 2 scores and the frequent use of *rumination* ($r = -0.452$, $p = 0.008$), *catastrophizing* ($r = -0.476$, $p = 0.005$), and *blaming others* ($r = -0.498$, $p = 0.003$). TASIT Part 3 showed negative correlations with *catastrophizing* ($r = -0.538$, $p = 0.001$) and *blaming others* ($r = -0.451$, $p = 0.008$) as did overall TASIT performance with *catastrophizing* ($r = -0.549$, $p = 0.001$) and *blaming others* ($r = -0.506$, $p = 0.003$). Again, there were no significant correlations for either the SZ or BD groups. Statistical comparison of correlation coefficients for independent samples was subsequently conducted to investigate pairwise group differences in these associations. For TASIT Part 2, the correlations with both rumination ($Z = 3.06$, $p = 0.002$) and catastrophizing ($Z = 4.48$, $p < 0.0001$) differed significantly between the BD and HC groups, as did the correlations of TASIT Part 3 with catastrophizing ($Z = 2.92$, $p = 0.004$). The associations between TASIT scores and blaming others showed no significant group differences in coefficients. None of the comparisons of correlations between SZ and HC or SZ and BD groups were significant.

SOCIAL COGNITIVE PREDICTORS OF FREQUENCY OF USE OF CERQ STRATEGIES

To further examine the pattern of correlations between social cognitive performance and the CERQ, a series of nine stepwise multiple regression analyses were conducted to test which of the social cognition scores best predicted frequency of use of CERQ strategies in the three experimental groups, using the CERQ subscales as dependent variables, controlling for age. Performance scores on each of the Ekman and TASIT subscales were entered as independent variables; significance level for entry was set at 0.01 to reduce type-I error. As the correlations also show the existence of collinearity among social cognition subscales, diagnostics for collinearity of Ekman, and TASIT predictors were therefore considered in subsequent regression analyses by Variance Inflation Factor (VIF) scores, where VIF scores above 10 are considered of serious concern. No VIF score was found to be above 3.

In support of the correlational pattern, these analyses yielded significant regression models for the HC group only, with no variables reaching significance for entry into any model for either the SZ or BD groups. For the HC group, positive emotion recognition accuracy on the Ekman task was found to explain 20.8% of the variance in the frequency of use of *acceptance* ($F_{1,32} = 9.43$, $p = 0.004$; Adjusted $R^2 = 0.208$). Performance on TASIT Part 2 was found to explain 17.9% of the variance in the frequency of use of *rumination* ($F_{1,32} = 7.98$, $p = 0.008$; Adjusted $R^2 = 0.179$) and 22.3% of the variance in the use of *blaming others* ($F_{1,32} = 10.20$, $p = 0.003$; Adjusted $R^2 = 0.223$). TASIT Part 3 scores explained 26.6% of the variance in frequency of use of *catastrophizing* ($F_{1,32} = 7.69$, $p = 0.001$; Adjusted $R^2 = 0.266$).

DISCUSSION

This study set out to examine the relationship between social cognitive abilities and the frequency of use of cognitive strategies for regulating negative emotion in patients with SZ and BD. We firstly examined performance on social cognitive tasks of emotion perception and higher order social cognition (i.e., ToM) between the clinical and control groups. As predicted, SZ participants' demonstrated greater impairments in social cognition (encompassing both basic emotion processing and ToM) relative to BD, who only showed impairment on higher order social cognition on the TASIT (but not basic emotion perception) compared to HC. In addition, there were distinct patterns of CERQ performance in both patient groups, with both SZ and BD groups reporting more frequent use of maladaptive emotion regulation strategies (namely, rumination, catastrophizing, and self-blame), as well as less use of the adaptive strategy of putting into perspective, relative to HC. Examination of the relationship between social cognition and cognitive emotion regulation revealed associations for HC

Table 5 | Pearson's two-tailed correlations between TASIT scores and CERQ strategies for SZ, BD, and HC groups.

CERQ subscales	TASIT subscales											
	Part 1			Part 2			Part 3			Total		
	SZ	BD	HC	SZ	BD	HC	SZ	BD	HC	SZ	BD	HC
Rumination	−0.044	0.231	−0.184	−0.192	0.376	−0.452**	−0.376	0.305	−0.293	−0.272	0.369	−0.396
Positive reappraisal	−0.063	−0.085	0.015	−0.344	0.007	0.087	−0.258	−0.074	−0.015	−0.310	−0.055	0.038
Other-blame	−0.261	−0.065	−0.247	−0.091	−0.086	−0.498**	−0.204	−0.164	−0.451**	−0.177	−0.138	−0.506**
Acceptance	−0.252	0.203	0.042	−0.233	−0.098	−0.007	−0.276	−0.05	−0.040	−0.284	−0.028	−0.013
Catastrophizing	−0.222	0.135	−0.299	−0.092	0.065	−0.476**	−0.268	0.238	−0.538***	−0.198	0.185	−0.549***
Putting in perspective	−0.052	−0.013	0.018	−0.263	0.100	0.130	−0.151	0.018	0.154	−0.217	0.048	0.139
Positive refocusing	0.131	−0.185	0.090	0.054	−0.167	−0.002	0.087	−0.290	−0.124	0.087	−0.265	−0.038
Refocus on planning	−0.286	−0.102	−0.014	−0.044	0.079	0.112	0.064	−0.120	−0.057	−0.040	−0.054	0.024
Self-blame	−0.083	0.336	−0.177	−0.069	0.191	−0.285	−0.091	0.294	−0.224	−0.089	0.309	−0.282

****$p < 0.001$ and **$p < 0.01$.*

TASIT, The Awareness of Social Inference Test; CERQ, Cognitive Emotion Regulation Questionnaire.

participants only, with higher levels of emotion recognition being associated with greater use of the strategy of putting into perspective, and better TASIT performance associated with less frequent use of rumination, catastrophizing, and blaming others. Contrary to predictions, no associations between social cognitive performance and cognitive regulatory strategies were revealed for either the SZ or BD groups. Further investigation of the differences in correlation coefficients for those performance scores and CERQ subscales that were correlated for controls but not for patients showed the relationships between positive emotion recognition and the use of adaptive reframing strategies differed between the clinical and HC groups, while the relationships between ToM abilities and the use of maladaptive strategies (rumination and catastrophizing) differed between the BD and HC groups. Additionally, there was no difference between the clinical groups in the correlations for these variables. Finally, with regard to the predictive utility of social cognitive performance: within the control group, recognition accuracy of positive emotions predicted greater use of acceptance, with the addition of poor TASIT performance predicting increased use of rumination, blaming others, and catastrophizing.

The present findings for social cognitive impairments in SZ and BD converge with previous evidence for emotion perception deficits in SZ (Addington and Addington, 1998; Edwards et al., 2002; Sparks et al., 2010), as well as a number of studies showing ToM deficits in SZ and BD (Addington and Addington, 1998; Kerr et al., 2003; Bora et al., 2005; Brune, 2005; Harrington et al., 2005; Olley et al., 2005; Montag et al., 2010). Our results for SZ are especially consistent with recent studies showing impaired sarcasm perception (Kern et al., 2009; Sparks et al., 2010) and social context processing (Green et al., 2007b, 2008). However, in contrast to previous studies where both SZ and BD patients have shown impaired facial emotion perception in comparison to community controls (Addington and Addington, 1998), there were no such deficits in the BD group. Additionally, the SZ group was found to be impaired on both the Ekman and TASIT tasks when compared to the BD group. It thus appears that the basic emotion perception and ToM abilities of SZ patients are compromised not only in relation to non-patient controls but also in comparison to patients with BD.

With regard to the frequency of use of particular cognitive strategies employed to regulate negative emotion, the tendency for SZ and BD patients to employ maladaptive approaches to regulate affect is consistent with the style demonstrated in other studies (Green et al., 2011; Rowland et al., in revision), and in other disorders such as depression (Garnefski et al., 2002). One distinction is that SZ participants employed other-blame more frequently than both BD and HC groups, while BD participants uniquely demonstrated greater use of self-blame compared to both SZ and HC groups, less positive refocusing compared to the SZ group, and less positive reappraisal than controls. These findings are also consistent with previous evidence (Livingstone et al., 2009; Rowland et al., in revision).

In contrast to our predictions, examination of the relationship between social cognition and emotion regulation revealed associations for HC participants only, with no associations present in either the SZ or BD groups. However, the specific associations found for the HC group were as expected, with the recognition of positive emotions found to be positively associated with the CERQ strategy of acceptance, and (both positive and overall) emotion recognition showing positive associations with the tendency to put things into perspective. Furthermore, within the control group, recognition accuracy of positive emotions actually predicted greater use of the positive reframing strategy of acceptance. This suggests that for people with no history of mental illness, the ability to accurately recognize facial affect expression, and positive affect in particular, is related to more frequent use of adaptive cognitive reframing strategies. In addition, for HC there was also a negative association between TASIT performance and frequent use of rumination, catastrophizing, and blaming others. Of these, performance on Part 2 of the TASIT (*Social Inference – Minimal*) was most predictive of the use of rumination and blaming others, while Part 3 (*Social Inference – Enriched*) performance

best predicted use of catastrophizing, indicating that accurate social cognitive skills are associated with less frequent use of these maladaptive emotion regulation strategies. While these findings confirm expected relationships between social cognitive skills and the capacity to implement adaptive strategies for emotion regulation in non-clinical (healthy) individuals, they also highlight the lack of "normal" associations between social cognition and emotion regulatory styles in SZ and BD. In the context of evidence that a number of these associations differ significantly between the clinical and control groups, it appears that known links between social cognition and the capacity to self-regulate negative emotion are not intact in psychotic individuals.

The present findings may be limited by a number of factors. First, it is possible that the limited range of scores for SZ or BD on some social cognitive measures could have impeded the capacity to reveal significant associations between these measures and cognitive regulatory strategies. This is plausible in the context of the significant associations found for HC. This may also be related to the relatively small sample sizes for each participant group, which may have limited the power to detect within-group associations between social cognition and CERQ strategies, and which precluded analyses of the effects of illness phases (e.g., depressed, euthymic, and manic) of the BD group in particular. Secondly, it should be noted that TASIT performance relies heavily on the interpretation of sarcasm in scenarios involving fluent English speakers, and we do not know whether these findings involving TASIT would translate across cultures. Thirdly, the reliance on self-report to measure self-regulation of affect can be problematic in that individuals may not always be consciously aware or sure of their own use of cognitive emotion regulation strategies in stressful situations; these may be context-dependent or unconsciously triggered and can be impacted by memory biases. Additionally, the CERQ only assesses regulation of negative emotion, and does not take into account strategies utilized in response to positive events. A potentially serious limitation of this study is that we have not examined the effects of medication on our results; given that many SZ and BD patients were receiving pharmacotherapy, future studies would benefit from further investigation of these factors. Fourth, since the participants in this study were outpatients living in the community, it may not be appropriate to generalize the implications of the present findings to individuals who are experiencing acute symptoms or those residing in inpatient settings. Finally, we note that the large number of analyses performed in this study precluded the utility of a formal correction for multiple testing; despite setting a reduced significance level ($p < 0.01$), it is possible that some spurious associations were revealed in this study. Further research with larger samples, testing strict hypotheses (rather than exploratory analyses as presented here), to replicate current findings, will be necessary to determine the reliability of the current results.

In summary, the present findings are consistent with previous evidence for social cognitive impairments and maladaptive patterns of emotion regulation in SZ and BD. We aimed to examine associations between social cognitive performance and emotion regulatory styles in SZ and BD, however the expected associations were revealed for the HC group only. It is possible that competency in the execution of specific emotion regulation strategies may rest on other neuropsychological skills (e.g., executive functioning) not tested here, rather than being mediated via social cognitive skills in BD and SZ. The lack of association between social cognition and cognitive emotion regulation in the patient groups is, however, consistent with a lack of integrity of fronto-limbic brain networks (Morris et al., 2012). The current findings suggest that dysfunction in these brain networks may underpin both social cognitive deficits and regulatory capacities, albeit via different routes. Further investigation of the association between social cognitive skills and emotion regulation capacities in psychotic disorders, ideally integrating neurofunctional and neuroanatomical data, is warranted.

ACKNOWLEDGMENTS

This research was supported by the Australian National Health and Medical Research Council (NHMRC) Project Grant held by Green (#630471), and used data from the Australian Schizophrenia Research Bank, funded by the NHMRC Enabling Grant (#386500 held by V. Carr, U. Schall, R. Scott, A. Jablensky, B. Mowry, P. Michie, S. Catts, F. Henskens, and C. Pantelis; Chief Investigators), and the Pratt Foundation, Ramsay Health Care, the Viertel Charitable Foundation, as well the Schizophrenia Research Institute, using an infrastructure grant from the NSW Ministry of Health. Melissa J. Green was supported by an Australian Research Council Future Fellowship (FT0991511). We acknowledge Carmel Loughland, Kathryn McCabe, and Jason Bridge for management and quality control of data obtained from the Australian Schizophrenia Research Bank. We would like to thank Vaughan Carr for providing some helpful comments on the draft of this manuscript. We would also like to thank the volunteers who participated in this study. Funding source: This research was supported by the National Health and Medical Research Council of Australia (Project Grant 630471 and Program Grant 510135) and the Australian Research Council (Future Fellowship FT0991511, held by Melissa J. Green). The funding bodies had no role in the design of the study, collection and analysis of data, or the decision to publish.

REFERENCES

Addington, J., and Addington, D. (1998). Facial affect recognition and information processing in schizophrenia and bipolar disorder. *Schizophr. Res.* 32, 171–181.

Adolphs, R. (2004). "Processing of emotional and social information by the human amygdala," in *The Cognitive Neurosciences*, 3rd Edn, ed. M. S. Gazzaniga (Cambridge, MA: MIT Press), 1017–1030.

Bauer, M. S., Crits-Christoph, P., Ball, W. A., Dewees, E., McAllister, T., Alahi, P., et al. (1991). Independent assessment of manic and depressive symptoms by self-rating: scale characteristics and implications for the study of mania. *Arch. Gen. Psychiatry* 48, 807–812.

Bora, E., Vahip, S., Gonul, A., Akdeniz, F., Alkan, M., Ogut, M., et al. (2005). Evidence for theory of mind deficits in euthymic patients with bipolar disorder. *Acta Psychiatr. Scand.* 112, 110–116.

Bora, E., Yucel, M., and Pantelis, C. (2010). Cognitive impairment in schizophrenia and affective psychoses: implications for DSM-V criteria and beyond. *Schizophr. Bull.* 36, 36–42.

Brown, P., and Levinson, S. (1978). *Politeness: Some Universals in Language Use.* Cambridge: Cambridge University Press.

Brune, M. (2005). "Theory of mind" in schizophrenia: a review of the literature. *Schizophr. Bull.* 31, 21–42.

Cohen, J., and Cohen, P. (1983). *Applied Multiple Regression/Correlation Analysis for the Behavioural Sciences.* New York: Erlbaum.

Crowe, S. F., Benedict, T., Enrico, J., Mancuso, N., Matthews, C., and Wallace, J. (1999). Cognitive determinants of performance on the digit symbol-coding test, and the symbol search test of the Wais-III, and the symbol digit modalities test: an analysis in a healthy sample. *Aust. Psychol.* 34, 204–210.

Cusi, A. M. B., Nazarov, A., Holshausen, K., Macqueen, G. M. M. D. P., and McKinnon, M. C. P. (2012). Systematic review of the neural basis of social cognition in patients with mood disorders. *J. Psychiatry Neurosci.* 37, 154–169.

Edwards, J., Jackson, H. J., and Pattison, P. E. (2002). Emotion recognition via facial expression and affective prosody in schizophrenia: a methodological review. *Clin. Psychol. Rev.* 22, 789–832.

Eisenberg, N. (2000). Emotion, regulation, and moral development. *Annu. Rev. Psychol.* 51, 665–697.

Ekman, P., and Friesen, W. (1976). *The Pictures of Facial Affect.* Palo Alto, CA: Consulting Psychologist Press.

Garnefski, N., and Kraaij, V. (2006). Relationships between cognitive emotion regulation strategies and depressive symptoms: a comparative study of five specific samples. *Pers. Individ. Dif.* 40, 1659–1669.

Garnefski, N., Kraaij, V., and Spinhoven, P. (2001). Negative life events, cognitive emotion regulation and emotional problems. *Pers. Individ. Dif.* 30, 1311–1327.

Garnefski, N., Kraaij, V., and Van Etten, M. (2005). Specificity of relations between adolescents' cognitive emotion regulation strategies and internalizing and externalizing psychopathology. *J. Adolesc.* 28, 619–631.

Garnefski, N., Legerstee, J., Kraaij, V., Van Den Kommer, T., and Teerds, J. (2002). Cognitive coping strategies and symptoms of depression and anxiety: a comparison between adolescents and adults. *J. Adolesc.* 25, 603–611.

Garnefski, N., Teerds, J., Kraaij, V., Legerstee, J., and Van Den Kommer, T. (2004). Cognitive emotion regulation strategies and depressive symptoms: differences between males and females. *Pers. Individ. Dif.* 36, 267–276.

Gray, J., Venn, H., Montagne, B., Murray, L., Burt, M., Frigerio, E., et al. (2006). Bipolar patients show mood-congruent biases in sensitivity to facial expressions of emotion when exhibiting depressed symptoms, but not when exhibiting manic symptoms. *Cogn. Neuropsychiatry* 11, 505–520.

Green, M. J., Cahill, C. M., and Malhi, G. S. (2007). The cognitive and neurophysiological basis of emotion dysregulation in bipolar disorder. *J. Affect. Disord.* 103, 29–42.

Green, M. J., Lino, B. J., Hwang, E. J., Sparks, A., James, C., and Mitchell, P. B. (2011). Cognitive regulation of emotion in bipolar I disorder and unaffected biological relatives. *Acta Psychiatr. Scand.* 124, 307–316.

Green, M. J., and Malhi, G. S. (2006). Neural mechanisms of the cognitive control of emotion. *Acta Neuropsychiatr.* 18, 144–153.

Green, M. J., Waldron, J. H., and Coltheart, M. (2007b). Emotional context processing is impaired in schizophrenia. *Cogn. Neuropsychiatry* 12, 259–280.

Green, M. J., Waldron, J. H., Simpson, I., and Coltheart, M. (2008). Visual processing of social conxtext during mental state perception in schizophrenia. *J. Psychiatry Neurosci.* 33, 34–42.

Gross, J. J. (1998). The emerging field of emotion regulation: an integrative review. *Rev. Gen. Psychol.* 2, 271–299.

Gur, R. C., Erwin, R. J., Gur, R. E., Zwil, A. S., Heimberg, C., and Kraemer, H. C. (1992). Facial emotion discrimination: II. Behavioral findings in depression. *Psychiatry Res.* 42, 241–251.

Gur, R. E., Kohler, C. G., Ragland, J. D., Siegel, S. J., Lesko, K., and Bilker, W. B. (2006). Flat affect in schizophrenia: relation to emotion processing and neurocognitive measures. *Schizophr. Bull.* 32, 279–287.

Harrington, L., Siegert, R. J., and McClure, J. (2005). Theory of mind in schizophrenia: a critical review. *Cogn. Neuropsychiatry* 10, 249–286.

Haverkate, H. (1990). The speech act analysis of irony. *J. Pragmat.* 14, 77–109.

Henry, J. D., Green, M. J., De Lucia, A., Restuccia, C., McDonald, S., and O'Donnell, M. (2007). Emotion dysregulation in schizophrenia: reduced amplification of emotional expression is associated with emotional blunting. *Schizophr. Res.* 95, 197–204.

Hoekert, M., Kahn, R. S., Pijnenborg, M., and Aleman, A. (2007). Impaired recognition and expression of emotional prosody in schizophrenia: review and meta-analysis. *Schizophr. Res.* 96, 135–145.

Kay, S. R., Fiszbein, A., and Opler, L. A. (1987). The Positive and Negative Syndrome Scale (PANSS) for schizophrenia. *Schizophr. Bull.* 13, 261–276.

Kern, R. S., Green, M. F., Fiske, A. P., Kee, K. S., Lee, J., Sergi, M. J., et al. (2009). Theory of mind deficits for processing counterfactual information in persons with chronic schizophrenia. *Psychol. Med.* 39, 645–654.

Kerr, N., Dunbar, R. I., and Bentall, R. P. (2003). Theory of mind deficits in bipolar affective disorder. *J. Affect. Disord.* 73, 253–259.

Kohler, C. G., Hoffman, L. J., Eastman, L. B., Healey, K., and Moberg, P. J. (2011). Facial emotion perception in depression and bipolar disorder: a quantitative review. *Psychiatry Res* 188, 303–309.

Kohler, C. G., Turner, T. H., Bilker, W. B., Brensinger, C. M., Siegel, S. J., Kanes, S. J., et al. (2003). Facial emotion recognition in schizophrenia: intensity effects and error pattern. *Am. J. Psychiatry* 160, 1768–1774.

Kohler, C. G., Walker, J. B., Martin, E. A., Healey, K. M., and Moberg, P. J. (2010). Facial emotion perception in schizophrenia: a meta-analytic review. *Schizophr. Bull.* 36, 1009–1019.

Leitman, D. I. (2005). Sensory contributions to impaired prosodic processing in schziophrenia. *Biol. Psychiatry* 58, 56–61.

Leitman, D. I., Zjwich, R., Pasternack, R., and Javitt, D. C. (2006). Theory of mind (ToM) and counterfactuality decifits in schizophrenia: misconception or misinterpretation? *Psychol. Med.* 36, 1075–1083.

Lembke, A., and Ketter, T. A. (2002). Impaired recognition of facial emotion in mania. *Am. J. Psychiatry* 159, 302–304.

Lennox, B., Jacob, R., Calder, A., Lupson, V., and Bullmore, E. (2004). Behavioural and neurocognitive responses to sad facial affect are attenuated in patients with mania. *Psychol. Med.* 34, 795–802.

Lichtenstein, P., Yip, B. H., Bjork, C., Pawitan, Y., Cannon, T. D., Sullivan, P. F., et al. (2009). Common genetic determinants of schizophrenia and bipolar disorder in Swedish families: a population-based study. *Lancet* 373, 234–239.

Livingstone, K., Harper, S., and Gillanders, D. (2009). An exploration of emotion regulation in psychosis. *Clin. Psychol. Psychother.* 16, 418–430.

Loughland, C., Draganic, D., McCabe, K., Richards, J., Nasir, A., Allen, J., et al. (2011). Australian Schizophrenia Research Bank: a database of comprehensive clinical, endophenotypic, and genetic data for aetiological studies of schizophrenia. *Aust. N. Z. J. Psychiatry* 44, 1029–1035.

Malhi, G. S., Ivanovski, B., Hadzi-Pavlovic, D., Mitchell, P. B., Vieta, E., and Sachdev, P. (2007). Neuropsychological deficits and functional impairment in bipolar depression, hypomania and euthymia. *Bipolar Disord.* 9, 114–125.

Malhi, G. S., Lagopoulos, J., Sachdev, P., Mitchell, P. B., Ivanovski, B., and Parker, G. B. (2004a). Cognitive generation of affect in hypomania: an fMRI study. *Bipolar Disord.* 6, 271–285.

Malhi, G. S., Lagopoulos, J., Ward, P. B., Kumari, V., Mitchell, P. B., Parker, G. B., et al. (2004b). Cognitive generation of affect in bipolar depression: an fMRI study. *Eur. J. Neurosci.* 19, 741–754.

Mandal, M. K., Pandey, R., and Prasad, A. B. (1998). Facial expressions of emotions and schizophrenia: a review. *Schizophr. Bull.* 24, 399–412.

McDonald, S., Flanagan, S., Rollins, J., and Kinch, J. (2003). TASIT: a new clinical tool for assessing social perception after traumatic brain injury. *J. Head Trauma Rehabil.* 18, 219–238.

Mitchell, P. B., Johnston, A. K., Corry, J., Ball, J. R., and Malhi, G. S. (2009). Characteristics of bipolar disorder in an Australian specialist outpatient clinic: comparison across large datasets. *Aust. N. Z. J. Psychiatry* 43, 1009–1017.

Montag, C., Ehrlich, A., Neuhaus, K., Dziobek, I., Heekeren, H. R., Heinz, A., et al. (2010). Theory of mind impairments in euthymic bipolar patients. *J. Affect. Disord.* 123, 264–269.

Morris, R. W., Sparks, A., Mitchell, P. B., Weickert, C. S., and Green, M. J. (2012). Lack of corticolimbic coupling in bipolar disorder and schizophrenia during emotion regulation. *Transl. Psychiatry* 2, e90.

Murray, R. M., Sham, P., Van Os, J., Zanelli, J., Cannon, M., and McDonald, C. (2004). A developmental model for similarities and dissimilarities between schizophrenia and bipolar disorder. *Schizophr. Res.* 71, 405–416.

Namiki, C., Hirao, K., Yamada, M., Hanakawa, T., Kukuyama, H., Hayashi, T., et al. (2007). Impaired

facial emotion recognition and reduced amygdala volume in schizophrenia. *Psychiatry Res* 156, 23–32.

Ochsner, K. N. (2008). The social-emotional processing stream: five core constructs and their translational potential for schizophrenia and beyond. *Biol. Psychiatry* 64, 48–61.

Ochsner, K. N., and Gross, J. J. (2005). The cognitive control of emotion. *Trends Cogn. Sci.* 9, 242–249.

Ochsner, K. N., and Gross, J. J. (2008). Cognitive emotion regulation. *Curr. Dir. Psychol. Sci.* 17, 153–158.

Ochsner, K. N., Ray, R. D., Cooper, J. C., Robertson, E. R., Chopra, S., Gabrieli, J. D., et al. (2004). For better or for worse: neural systems supporting the cognitive down- and up-regulation of negative emotion. *Neuroimage* 23, 483–499.

Olley, A. L., Malhi, G. S., Bachelor, J., Cahill, C. M., Mitchell, P. B., and Berk, M. (2005). Executive functioning and theory of mind in euthymic bipolar disorder. *Bipolar Disord.* 7, 43–52.

Park, S., Puschel, J., Sauter, B. H., Rentsch, M., and Hell, D. (1999). Spatial working memory deficits and clinical symptoms in schizophrenia: a 4-month follow-up study. *Biol. Psychiatry* 46, 392–400.

Phillips, M. L., Ladouceur, C. D., and Drevets, W. C. (2008). A neural model of voluntary and automatic emotion regulation: implications for understanding the pathophysiology and neurodevelopment of bipolar disorder. *Mol. Psychiatry* 13, 829.

Pinkham, A., Penn, D. L., Lieberman, J., and Perkins, D. (2003). Implications of the neural basis of social cognition for the study of schizophrenia. *Am. J. Psychiatry* 160, 185–194.

Reichenberg, A., Harvey, P. D., Bowie, C. R., Mojtabai, R., Rabinowitz, J., Heaton, R. K., et al. (2009). Neuropsychological function and dysfunction in schizophrenia and psychotic affective disorders. *Schizophr. Bull.* 35, 1022–1029.

Samame, C., Martino, D. J., and Strejilevich, S. A. (2012). Social cognition in euthymic bipolar disorder: systematic review and meta-analytic approach. *Acta Psychiatr. Scand.* 125, 266–280.

Sergi, M. J., Rassovsky, Y., Widmark, C., Reist, C., Erhart, S., Braff, D. L., et al. (2007). Social cognition in schizophrenia: relationships with neurocognition and negative symptoms. *Schizophr. Res.* 90, 316–324.

Sparks, A., McDonald, S., Lino, B., O'Donnell, M., and Green, M. J. (2010). Social cognition, empathy and functional outcome in schizophrenia. *Schizophr. Res.* 122, 172–178.

Sprong, M., Schothorst, P., Vos, E., Hox, J., and Van Engeland, H. (2007). Theory of mind in schizophrenia: meta-analysis. *Br. J. Psychiatry* 191, 5–13.

Wagner, D. D., and Heatherton, T. F. (2012). Self-regulatory depletion increases emotional reactivity in the amygdala. *Soc. Cogn. Affect. Neurosci.* PMID: 22842815. [Epub ahead of print].

Young, A., Perrett, C., Calder, A., Sprengelmeyer, R., and Ekman, P. (2002). *Facial Expressions of Emotion: Stimuli and Tests (FEEST)*. Bury St Edmunds: Thames Valley Test Company.

Yurgelun-Todd, D. A., Gruber, S. A., Kanayama, G., Killgore, W. D., Baird, A. A., and Young, A. D. (2000). fMRI during affect discrimination in bipolar affective disorder. *Bipolar Disord.* 2, 237–248.

Conflict of Interest Statement: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Received: 15 August 2012; accepted: 19 December 2012; published online: 11 January 2013.

*Citation: Rowland JE, Hamilton MK, Vella N, Lino BJ, Mitchell PB and Green MJ (2013) Adaptive associations between social cognition and emotion regulation are absent in schizophrenia and bipolar disorder. Front. Psychology **3**:607. doi: 10.3389/fpsyg.2012.00607*

This article was submitted to Frontiers in Emotion Science, a specialty of Frontiers in Psychology.

frontiers in PSYCHOLOGY

HYPOTHESIS AND THEORY ARTICLE
published: 15 February 2013
doi: 10.3389/fpsyg.2013.00051

Social regulation of emotion: messy layers

Arvid Kappas*

School of Humanities and Social Sciences, Jacobs University Bremen, Bremen, Germany

Edited by:
Vera Shuman, University of Lausanne, Switzerland

Reviewed by:
Christian Von Scheve, Freie Universitaet Berlin, Germany
Antony S. Manstead, Cardiff University, UK

****Correspondence:***
Arvid Kappas, School of Humanities and Social Sciences, Jacobs University Bremen, Campus Ring 1, Bremen 28759, Germany.
e-mail: a.kappas@jacobs-university.de

Emotions are evolved systems of intra- and interpersonal processes that are regulatory in nature, dealing mostly with issues of personal or social concern. They regulate social interaction and in extension, the social sphere. In turn, processes in the social sphere regulate emotions of individuals and groups. In other words, intrapersonal processes project in the interpersonal space, and inversely, interpersonal experiences deeply influence intrapersonal processes. Thus, I argue that the concepts of emotion generation and regulation should not be artificially separated. Similarly, interpersonal emotions should not be reduced to interacting systems of intraindividual processes. Instead, we can consider emotions at different social levels, ranging from dyads to large scale e-communities. The interaction between these levels is complex and does not only involve influences from one level to the next. In this sense the levels of emotion/regulation are messy and a challenge for empirical study. In this article, I discuss the concepts of emotions and regulation at different intra- and interpersonal levels. I extend the concept of auto-regulation of emotions (Kappas, 2008, 2011a,b) to social processes. Furthermore, I argue for the necessity of including mediated communication, particularly in cyberspace in contemporary models of emotion/regulation. Lastly, I suggest the use of concepts from systems dynamics and complex systems to tackle the challenge of the "messy layers."

Keywords: dynamic systems, complex systems, feedback, auto-regulation, cyberemotions

SOCIAL REGULATION OF EMOTION: MESSY LAYERS

When I finished my PhD thesis on *control of emotion* (Kappas, 1989), the topic that is now commonly referred to as *emotion regulation* was considered somewhat peripheral to emotion science, but it clearly is not now (Tamir, 2011). Presently, there is much empirical research and, in consequence, a considerable number of publications on this subject. However, current views focus on emotion regulation as an intraindividual process. I will argue that there are benefits in reframing the concept of emotion regulation. Specifically, I will discuss emotions as multi-layered processes in which intraindividual processes are tightly coupled and often cannot be separated from interindividual processes. While the focus of emotion research arguably rests in the individual, I will briefly discuss the importance of embodiment and social interaction to prepare the key arguments of the present paper. I will argue that social layers are not only involved in the generation, as well as in the modulation/regulation of affective processes, but that social emotion generation and social emotion regulation can often not meaningfully be separated. This dynamic view has consequences on how we should think of emotion and emotion regulation, and how these should be studied. I will link the discussion of social emotion dynamics to the notion of auto-regulation that I have developed elsewhere (Kappas, 2008, 2011a,b) and also extend the range of social interaction to large numbers of individuals in cyberspace. I argue that emotions in this sense are self-regulating using social networks at different scales that provide not only empathic feedback but they direct the action of others in co-evolving social emotion cascades.

WHERE IS THE EMOTION?

Most of us think of emotions as *intraindividual processes*. Evidently, emotions are subjectively very personal in nature. They relate to who we are and how we see and interact with the world. In fact, several theorists have pointed out a close link between emotions and the emergence of the self and/or self-consciousness (e.g., Damasio, 1999; Cabanac et al., 2009)—*I feel, therefore I am*. This view can also be traced to formal definitions of emotions by researchers in the area. Unfortunately, despite a long history of research, the definition of emotions is still a point of contention (Izard, 2010; Kappas, 2011a). However, arguably most current theorists, as lay-people do, consider emotions private processes. I will give a brief overview of different possibilities how to conceive of emotions, including not only as intra- but also interindividual processes. Some researchers have argued that emotions are social in nature (e.g., Parkinson, 1996), but I will attempt to push the envelope further by considering emotions also as properties of a dyad, a group, or a collective.

Emotions provide (1) responses to external and internal events, (2) help to anticipate situations in the future, (3) help to adapt to events in the past, and in consequence (4) afford an impetus to engage with the social and non-social world. Nevertheless, while these processes provide an interface to the world, feelings, physiological changes, and changes in action readiness rest subjectively inside of us. In current (western) thought, emotions are in fact located *inside of the brain*. This is, of course, consistent with how emotions are mostly studied in experimental psychology and neuroscience. Where else should emotions be? However, it is important here to remember that locating emotions

exclusively in the brain is recent—and not, for example, seeing affect being a matter of the heart (e.g., Shweder, 1994)! As neuroscience shifts from its classical heritage in localizing faculties in specific brain areas (Uttal, 2001) to a more fruitful network paradigm (e.g., Bressler and Menon, 2010), the question emerges how large should the (bodily) networks be that we consider relevant for emotions? If the gut really plays a role in the *gut feeling*, should the gut then not be part of the network?

I argue that it may often be a useful analytical convention to locate emotions in the brain, but that at times it can be helpful to consider different perspectives. There is clear evidence that peripheral processes play an important part in cognition, motivation, and emotion—and this includes not only the nervous system, but also the endocrine system (e.g., Maier and Watkins, 1998). For the purpose of presenting these two ways of conceiving of the intrapersonal location of emotions, I will use the terms *centralist* (in the sense of brain-based) vs. *peripheralist* (in the sense of all-body) model. Note that both terms are not used consistently in the literature. The origin of the current *centralist view* of emotion can be anchored in the position of different theorists, particularly in the 19th and 20th century (see also Gendron and Barrett, 2009), but is still very much dominant, for example in current appraisal theories (see, Scherer et al., 2001; Ellsworth and Scherer, 2003) and neuroscientific approaches to appraisal theory (e.g., Ochsner et al., 2002). Peripheralist views are frequently associated with notions elaborated by William James. In his view (e.g., 1884), there could not be a normal *feeling*, or in current terminology, *subjective experience of emotion*, without the perception of bodily responses playing an important part (see also Frijda, 2009). In other words, according to this view, peripheral responses are extremely important to the *subjective component*—the feeling (Reisenzein et al., 1995; Dunn et al., 2010). This is notwithstanding that the typical route of emotion generation may pass from (1) external stimuli to (2) a perceptual process, to (3) the elicitation of behaviors, and peripheral responses, back to (4) perception of these changes (Ellsworth, 1994, but also Reisenzein et al., 1995). The body, according to this theory, is part of a regulatory loop that cannot be taken out of the experience of emotion. Today, interest in the peripheralist view is associated with three lines of research, namely (1) studies related to the facial-feedback hypothesis (see below), (2) Damasio's somatic marker hypothesis (e.g., 1999), and (3) the wide-spread recent interest in embodied processes, not only in emotion, but also in motivation and cognition have forcefully revived the idea that the body has an important part to play in emotion (Barsalou et al., 2003). In other words, while the brain might be necessary for all mental processes it often is not sufficient to explain all of, cognition, motivation, and emotion. Hence, these can be conceived of as intraindividual processes that are *inside of me-the-body*, and not just *inside of me-the-brain*. This is not only a question of phenomenology, but refers to numerous studies manipulating bodily posture, facial patterns, or temperature to impact emotion-related processes, frequently outside of participants' awareness.

While there are conditions where peripheral bodily processes are neither necessary nor sufficient for changes in phenomenology (see Reisenzein and Döring, 2009), this does not render the notion of emotion as bodily processes as useless, as there are many situations where they are (see Ohira, 2010). Furthermore, there are also affective behaviors or physiological changes that can be observed objectively apart from subjects' phenomenological awareness (e.g., Winkielman and Schooler, 2008). In summary, there is no question that brain activity is crucial for all affective processes. However, it is relevant for how we conceive of emotions (and emotion regulation) whether a model/theory should include the body as an integral part of or simply provide an entry point to ("this is where bodily feedback arrives") emotion. I argue that sufficient evidence has accumulated over the last decades that peripheral processes modulate, if not jump-start affective processes at times. Because there is a complex interplay of afferent and efferent pathways between the brain and the periphery—even the endocrine system (Maier and Watkins, 1998), it would appear, from a systems dynamics point of view, problematic to reduce these nested feedback loops within the body to a mere add-on. There are dynamic properties that relate to the physical representation of processes in the periphery that require the body to be an integral part of any emotion model. I will now consider whether one can conceive of emotion as an interindividual process.

THE SOCIAL NATURE OF EMOTION

DARWIN'S CONTRIBUTION TO THE CONCEPT OF SOCIAL FUNCTIONS OF DISPLAYS AND FEELINGS

Central to any discussion on the social nature of emotion is expressive behavior. A minimal consensus holds that emotions *may* be accompanied by expressive behavior and that expressions are often universally interpreted as signs of emotions (Russell, 1995; Kappas, 2003; Kappas et al., 2013). Some researchers hold much stronger views regarding the relationship of expression, feeling, and physiological activity—such as that there are innate links between affect programs and specific expression patterns and in turn the perception and interpretation of expressive behavior (see Russell and Fernández-Dols, 1997). This notion is arguably also a consequence of the history of emotion science.

Most current researchers would agree that a seminal point in the scientific study of emotions was the publication of Darwin's *The Expression of the Emotions in Man and Animals* (1872). It is noteworthy, that Darwin's in-depth discussion of origins and functions of expressive behavior was at the center of the birth of modern emotion research (see also Cornelius, 1996). In other words, the expression offered a different and more concrete approach to emotions than more abstract discussions of feelings or motivations that might have characterized much of the philosophical treatment of emotions pre-Darwin. Arguably, Darwin's observations and arguments have shaped much of the research and theory in the time since. While expressing and perceiving emotions seems to emphasize the social nature of emotions, curiously enough, Darwin's focus was *not* on interindividual processes. Instead, he spent many pages to explain how specific expressions could have evolved as a consequence of other (non-social) functional origins, such as regulating information inflow, respiration, or the intake of food. Only toward the end of the *Expression*, and frequently overlooked, Darwin mentioned two important ideas regarding the importance of expressions in the here-and-now. One refers to the social nature of expressions

and the second to intrapersonal emotion-regulation effects of controlling expressive behavior.

Since the publication of the *Expression*, Darwin has been invoked many times as a key emotion theorist. For example, the work of Paul Ekman and his collaborators in the late 1960's of the 20th century focused on the universality of certain expressions, inspired by Darwin. Using some much-cited experimental evidence (Ekman et al., 1969) they suggested that, for a limited number of emotions, strong universals in the expression and perception exist. Cultural differences that can be observed are, according to Ekman and Friesen (1969), due to learned *display rules*. While some of the inferences of these researchers are contested (see Russell and Fernández-Dols, 1997), there seems to be a widely shared consensus nowadays that there are biological constraints that are linked to certain facial movements that over the course of intrapersonal development are used and interpreted in the context of idiosyncratic as well as culturally shared norms and expectations (Scherer and Brosch, 2009; Averill, 2012; Boiger and Mesquita, 2012, see also Fogel et al., 1992). In other words, in this view emotional displays serve communicative purposes and social contexts have a modulatory function. But the emphasis is still on emotion as an intrapersonal process. This is also the view that is predominant in much of the emotion regulation literature (see below).

In the 1990's, an important reinterpretation of Darwin's view on "expressive behavior" was suggested. Fridlund (1991, 1994) argued that Darwin had not suggested that "expressive" behavior was primarily linked to emotion, but to social goals instead. In other words, expressive behavior, according to this view, is not a readout of emotions, but in the shape of *emotional displays* serves specific purposes in interaction. Fridlund's original research has inspired further studies. The current reading of the empirical data available suggests that facial behavior is associated with emotion as well as with social goals (Hess et al., 1995; see also Jakobs et al., 1999a,b, 2001; Parkinson, 2005)—moderated by the actual or only implied presence of conspecifics and their social relationships. Arguably, the notion of display rules is still relevant (see Matsumoto, 2009), but it is not sufficient to explain the low cohesion between what people feel, what they show, and their physiological activation (e.g., Mauss and Robinson, 2009). Nevertheless, few researchers focus on what emotional expressions *do* in social context (Parkinson, 1996, 2005). Instead, in my reading, most empirical studies on facial behavior today are interested in using expressions as a diagnostic tool to replace self-report of feeling states. In contrast, particularly in sociology there is the notion that emotions serve to bind individuals together (von Scheve and von Luede, 2005) and that individual emotions may mark relationships (Kemper, 2011). In these contexts expressive behavior is part of the mechanisms that achieve these interindividual goals. How can expressive behavior achieve such functions?

THE DEVELOPMENT OF EMOTIONS IN FACE-TO-FACE AND MEDIATED SOCIAL INTERACTION

Darwin already hinted at the possibility of a joint process of emotion elicitation in the interaction of mother and infant. I have previously referred to such preverbal dyadic evaluation and action processes as *distributed affective processing* (Kappas and Descôteaux, 2003) and suggested that several appraisal dimensions could be affected by manifest or imagined social context (Kappas, 1996). For example, a child may not have enough information to appraise whether an event or object is beneficial or harmful and thus, the appraisal is "outsourced" to mother by querying her expression. In other words, the cognitive process involved in dealing with a situation here transcends an individual brain. This mechanism involves the externalization and perception of expressive behavior that forms a bond in the face of a particular affordance—dealing with an unclear situation. Rochat and Striano (1999) have referred to such ontologically early social exchanges as the *cradle of social cognition*.

As the child grows up, there is much to learn regarding how to evaluate particular situations or events in order to thrive, adapt, and in the extreme, survive (see Fogel et al., 1992). There are apparently some types of stimuli that elicit universal behavioral responses (such as objects approaching us with very high speed) or attract attention (such as faces; see Kappas and Olk, 2008). Similarly, some types of stimuli might be easily associated with particular meanings, such as snakes or spiders when paired with affective expressions of others (e.g., Öhman and Mineka, 2001). However, the majority of affect-knowledge in humans will not be linked to direct personal experience with an eliciting situation, but to repeated and frequent exchanges with conspecifics, such as care-givers, friends, and others where relevant information is shared. Social sharing of emotions is prevalent in all cultures and plays an important part in managing relations throughout life as well as in distributing emotion-related knowledge (e.g., Rimé, 2009). Culture shapes these social processes in many ways. Specifically, culture affects how to appraise a particular event or may even impact what constitutes an emotion (see Shweder, 1994; Cornelius, 1996; Mesquita and Leu, 2007). Furthermore, differences in language impact how a particular syndrome of affective processes might be referred to (Wierzbicka, 2009; Kagan, 2010). Thus, a name for a particular script might be available in one language, but not the other (e.g., *Schadenfreude* in German or *amae* 甘え in Japanese). There is shared knowledge regarding when to feel a particular emotion or not (see Hochschild, 1983), or which emotions might be desirable *in a particular culture* (Mesquita and Ellsworth, 2001; von Scheve, 2012). All of these are relevant to social regulation of emotion.

Several contemporary authors argue that in humans the majority of emotional episodes typically occur in the context of social interactions (see Parkinson, 2011; Boiger and Mesquita, 2012). This relates to actual interactions, implicit interactions (e.g., Fridlund, 1991; Hess et al., 1995), or even when there is a perceived lack of interactions (Cacioppo and Patrick, 2008). Of particular importance for the study of these phenomena is the distinction between the flow of affective cascades occurring in real time and the epigenetic development and shaping of emotional rules and norms (see also Fogel et al., 1992; Campos et al., 2004; Boiger and Mesquita, 2012). Yet, both types of processes underscore the importance of emotions as social processes. The social shaping of emotions clearly is not only a function of experiences in the here-and-now, but also part of the sharing of emotions, as mentioned above in a personal context. However, social

influences go much further than person-to-person processes. In contemporary societies, we have to consider also mediated, and specifically mass-mediated contexts.

Recent developments in mass communication have a strong influence on normative processes relevant for the elicitation and the expression of emotional episodes (Bandura, 2009). Emotion portrayals and prototypical scripts of when a particular emotion might be appropriate or not have been shared via printed media for hundreds of years (see Mar et al., 2008; Hogan, 2010). Going back further, in the context of theatre and oral history there is an influence in the scale of thousands of years. However, it is the development of film and television that has lead to an explosion of the sharing of informative and normative material regarding emotions in the 20th century (see also cultivation analysis; e.g., Morgan et al., 2009). In this context, there are media that are frequently national (e.g., television: soap operas, tele-novelas, and film) as well as global, such as large-scale movie productions (which can also be distributed on TV and in cyberspace, but that originate in the movie format and are originally distributed for presentation in movie theatres). What is being communicated ranges from concrete observable responses (e.g., Carroll and Russell, 1997) to specific situations, to complex scripts and narratives that include issues such as if A does X_1 and B does X_2 then A might feel Y_1 which is expressed as pattern Z_1 in the presence of B, C, and D, but pattern Z_2 in the presence of E . . . etc. Just as the infant is engaging with the physical environment in practicing and building up categories of cause and effect loops, from childhood, frequent and repeated exposure to stories (socially shared, literature, film, TV) creates and reinforces knowledge structures regarding social interactions and particularly emotions which are at the heart of these processes. As opposed to literature where much imagination is required to fill in the blanks, we are now exposed to thousands of emotional expressions associated with specific elicitors, in specific social situations in mass media. The impact of mass-mediatized socialization of emotion rules and norms is likely rather under-than overestimated. In a way this is also a social regulation of emotions by defining the expectations and the stereotypes, but I will not focus on these slow processes in the present context.

The recent development of cyberspace (Boyd and Ellison, 2007) has complicated matters further by blending the boundaries between interpersonal communication and mass-communication. For example, in the context of blogs, individuals may share their emotional experiences with a large audience and may or may not include the possibility to respond with comments or other means, such as email, or messaging systems (e.g., Thelwall and Wilkinson, 2010). In the context of forums, exchange is part of the design, but many visitors to a forum might *lurk* without ever contributing. While much of the research on how emotions are communicated online is so far based on text-based computer mediated communication, there is an increasing amount of multimodal content, including the possibility for face-to-face communication in cyberspace (Kappas and Krämer, 2011). It is only very recently that large-scale research has started to investigate the exchange of emotions over thousands or even millions of online posts (e.g., Chmiel et al., 2011).

The rapid increase in cyberspace communication, specifically as regards the social web, is not only a technological phenomenon. Instead, the motivation to be socially connected interacts with the affordances of the Internet in rapidly evolving ways. Within few years, particular media come and go (e.g., MySpace, Facebook, Twitter), as they are differentially successful in catering to users' social needs and desires. However, regardless of the features of specific media, for example regarding modalities, speed, or anonymity, it is the online sharing of emotions (Rimé, 2009) that is common and central. Indeed, the prevalence of emotional terms online is considerable (Harris and Kamvar, 2009). There is no evidence that online exchanges are less emotional than online interactions (Derks et al., 2008). Thus, it appears imperative to include cyberspace in any contemporary discussion of the social nature of emotions, even if there are still local differences in Internet availability and usage. The complex tapestry of connecting with people that are not only geographically, but also culturally heterogeneous, is bound to affect local and personal norms in this and the coming decades. These developments relate to aspects of the generation, and as we will see later, the regulation of emotions.

In summary, there are numerous ways in which emotions are social: (1) the situations in which emotions are elicited are frequently social, (2) the contents of the events eliciting emotions are frequently social, (3) the acquisition, and shaping of rules and norms are largely social, (4) sharing of emotions is driven by social needs and serves a variety of social functions. Furthermore, (5) deficits in emotion expression or interpretation lead to social problems (e.g., if particular expressions cannot be perceived due to reduced vision or hearing; if particular expressions cannot be produced due to conditions such as Möbius Syndrome, or Parkinson's Disease; or if attention to and interpretation of non-verbal behaviors is challenged, such as in the context of Autism Spectrum Disorder).

Psychologists tend to slice the world into packages the size of individuals and occasionally see aggregates of $n > 1$ as simply the sum of individuals. This view of course ignores that there are processes that occur only (1) in actual or implied *interaction* and (2) due to the interaction of *specific individuals*, and that (3) in *specific contexts* (see also the principle of non-additive determinism in the context of multilevel analyses: e.g., Cacioppo and Decety, 2011). Popular concepts, such as an *angry mob*, as vague as they may be, reflect that there seems to be a conventional notion of *collective emotions*. At a scientific level, there has been some interest in recent years in understanding collective emotions. This does not only refer to theoretical advances (Huebner, 2011), but also attempts to tackle the complexity of empirical approaches to collective emotions (Schweitzer and Garcia, 2010). One area where there exists some systematic research comes from the workplace context. Here, for example, the concept of *emotional climate* is particularly relevant (e.g., Yurtsever and De Rivera, 2010). There might also be a climate in cyberspace which could be characterized by specific language use (Thelwall et al., 2010) reflecting implicit norms, or the dynamics with which emotional statements elicit emotions in subsequent emotions (e.g., Chmiel et al., 2011). The latter is particularly interesting because online communities are often much more

fluid with regard to who is a member and for how long (Trier and Bobrik, 2009). If indeed there exist emotional norms that evolve in this context, this may be relevant for a better understanding of how emotion norms develop and are communicated, because there are particular affordances for online research of emotions. For example, large bodies of data are already available for research. In turn, this begs the questions how norms migrate from place to place and or shape norms and behaviors in individuals.

INTERPERSONAL EMOTIONS

Above I argued that we could think of instances, where the emotion process should be located in the body as a whole. Can we conceive of instances where the emotion process should be considered as being truly interpersonal (Huebner, 2011)? I have already touched upon the concept of emotional climate—this seems to be a property of an institution which is instantiated in the brains of people—where the probability of emotions is skewed as a function of habitual interactions and norms. The same people might act differently in a different context—much in the way Goffman conceived of as roles. However, there is clearly something that exists only in the context of the institution.

At a smaller scale we might think of a small group, such as a family, where emotions are organized in the dynamic exchange between the members, or at a dyadic level there exist concepts such as attachment, or couples that clearly hint at a reality of emerging properties of aggregates of individuals in different relationships. The last decades of social psychology have been characterized by studying emotions in social isolation—this is due to two factors, (1) the dominant view of emotion regulation considers responses in social isolation to be genuine and untainted, and (2) the move from social psychology to social cognition has focused on implicit processes that can easily be studied in individuals in isolation. Increasingly there are calls for paradigms that study emotions in actual social interactions (e.g., Fischer and van Kleef, 2010). It is not enough to discover that the brain is social—we also need to study the brain in social contexts. The aforementioned research in the context of behavioral ecology (e.g., Fridlund, 1991) is a good case in point. It *does* make a difference whether someone is present, and it matters whether this is a stranger, or a friend (Hess et al., 1995). Why is the social context in the experiment so rarely considered? Even when using brain imaging, it is possible to manipulate the actual social situation, such as the work of Jim Coan and his colleagues on responses to pain when the hand of the person is held by the partner, a stranger or nobody—while the participant's brain is being scanned (Coan et al., 2006; see also Coan, 2011).

We are currently conducting experiments in my laboratory and in collaboration studying collective emotions in cyberspace (see www.cyberemotions.eu). In some of the recent experiments we had participants communicate in real time via a computer. They were physically separated, but online connected via text-based computer-mediated-communication. In one condition of one of the experiments we asked participants to get acquainted with each other, in the other we did not—this manipulation changed not only subjective experience, but also expression and electrodermal activation (Kappas et al., 2012) in these interactions. These are processes that emerge in real time and they apparently scale to e-communities of considerable size (Chmiel et al., 2011).

I suggest that we think of emotion generation and modulation (below) at different levels. In this case, the emotion can be a property of a dyad, a group, or the individual (see **Figure 1**). I believe there is an added advantage in not reducing our concept of emotion to whatever information enters a single brain and conceive of social interactions as the sum of individual processes. The word interaction is key here, as different levels of emotion generation (and regulation) are likely to act (1) concurrently and (2) in interaction (see also Butler and Gross, 2009). The work of John Cacioppo and his colleagues of conceptualizing multi-level analysis of psychological processes and behavior is particularly helpful here (e.g., Cacioppo et al., 2000). Nevertheless, I want to emphasize that the argument I am making here is to not look (only) at the emotions of individuals at different levels of social aggregation, but to actually consider emotions of a group, a company, or a dyad. This does not mean that all individuals perceive or express their emotions identically, but that there is a residual level at which the emotional processes that can be observed exist in the interaction. Consider the metaphor of a play. When you are watching a play, the play has a reality of its own and is not just a place in time and space where several actors give individual performances. A symphony is a score and complex interactions between musicians and conductor and audience, not a bunch of musicians acting out something in relative synchrony. While this might be a correct statement, it does not provide the same usefulness as the acknowledgement that the immaterial piece of music posesses a certain reality that transcends individuals.

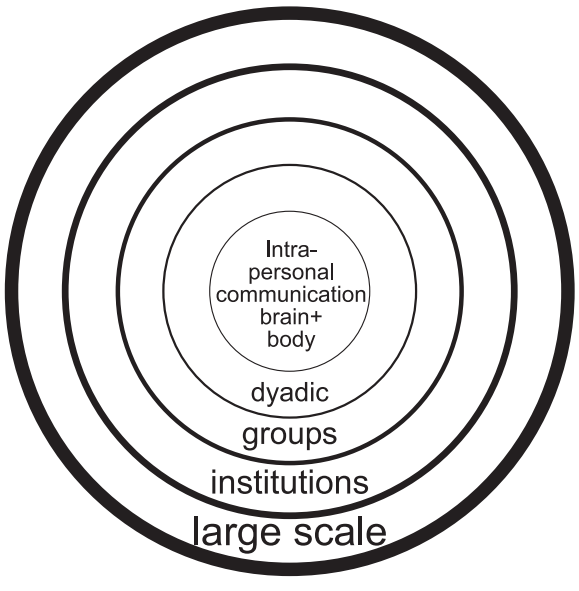


FIGURE 1 | "Onion layer" model suggesting emotions occurring at multiple nested levels. However, while the image suggests a clean hierarchical structure, in reality non-adjacent layers interact in complex ways in the generation (and regulation) of affective processes. Thus a "messy layer" model would be more appropriate as is argued later in the paper.

REGULATION OF EMOTIONS

Not much space needs to be dedicated here regarding what is currently thought of as *intrapersonal regulation* of emotions, due to the many recent publications on the issue, most of them authored or edited by James Gross and/or his collaborators (Gross, 2007; see also Vandekerckhove et al., 2008). Emotion regulation in this school of thought focuses primarily on (often) voluntary efforts to change ongoing or expected emotional episodes of individuals via effortful cognitive and expressive processes—"the process by which individuals influence which emotions they have, when they have them, and how they experience and express these emotions" (Gross, 1998, p. 275).

While emotion regulation is seen as a recent topic, most of the current empirical work in individuals goes straight back to Lazarus' notion of and empirical research on appraisal and reappraisal from the early 1960's (e.g., Lazarus and Alfert, 1964; Lazarus et al., 1970; Lazarus and Folkman, 1984) and Darwin's suggestions regarding feedback processes (Kappas, 1989) in the 19th century. With regard to expressive feedback Darwin wrote in the conclusion of *Expression*:

> The free expression by outward signs of an emotion intensifies it. On the other hand, the repression, as far as this is possible, of all outward signs softens our emotions. He who gives way to violent gestures will increase his rage; he who does not control the signs of fear will experience fear in a greater degree; and he who remains passive when overwhelmed with grief loses his best chance of recovering elasticity of mind. These results follow partly from the intimate relation which exists between almost all the emotions and their outward manifestations; and partly from the direct influence of exertion on the heart, and consequently on the brain. Even the simulation of an emotion tends to arouse it in our minds (1872, p. 366).

This is a rather remarkable list of proposals that foreshadow much of what current research on feedback and embodiment suggests. Initially (e.g., Tourangeau and Ellsworth, 1979), there was some skepticism regarding research suggesting an impact of expressive behavior on emotions, specifically the so called *Facial Feedback Hypothesis*. However, later reviews were more positive that feedback effects from expression on subjective experience and physiology (Adelman and Zajonc, 1989; McIntosh, 1996) exists and can be reliably demonstrated empirically. These findings are now discussed in a larger context of embodied emotion/motivational processes, where facial and bodily movements interact with affective processing (e.g., Niedenthal, 2007; Price and Harmon-Jones, 2010). There is no doubt that Darwin held already the view that volitional modulation of emotion components—particularly expression, would lead to modulation of the other components. This view is often erroneously dated later, for example, linked to William James or other authors later in the 20th century.

Particular interest in recent years regarded how automatic emotion regulation processes might be (e.g., Mauss et al., 2007; Koole and Rothermund, 2011) and to what degree emotion generation and emotion regulation can be distinguished (Gross et al., 2011a). I have argued in the past that these often cannot be distinguished (Kappas, 2008) and specifically in discussing the case of *auto-regulation* in the case of negative emotions (Kappas, 2011a,b) where the actions motivated by the emotion lead to its own termination by modifying the eliciting situation. Given that emotions typically involve a strong motivational component that involves modulation of the emotional state itself (decrease, increase, change, prolong the current state), this is not surprising. Whether or not a scientist wants to grant emotions the power to auto-regulate depends on how thin one slices the situation that is under study.

Consider the following scenario: a parent tells the child that it is already late and that it would be time to go to bed. The child starts to cry. The parent gives in and postpones bed time by 15 min. The child stops sobbing and smiles through the tears. For the sake of avoiding conceptual discussions about where the emotion here might be, I will frame this scenario for three different types of readers in three theoretical contexts: (1) having to go to bed violates the goals of the child, it feels that it cannot influence the situation and it starts to cry because it is sad (appraisal and basic emotions view). (2) Understanding that the end of play time is at hand, the child is frustrated and cries. Based on the context and the interpretation of the situation, the parent, and possibly the child view this as an episode of sadness (for a modern constructivist view see Barrett, 2011). (3) The desire to stay up leads (consciously or unconsciously) to the strong social motivation to change the parent's mind (behavioral ecology). However, you slice it—the behavior of the adult triggered an emotion/motivational process in the child in the course of which the behaviors of the child lead the adult to change the rules again, which in turn modulates the emotion/motivational process. In other words, the emotion auto-regulates itself by generating and modulating behaviors in both participants of the interaction. To me this is an example of auto-regulation—and it also nicely segues into the section how emotion regulation is often social and does not often permit to distinguish generation and regulation processes.

To be clear, I do not argue that all instances of emotion regulation could be reduced to auto-regulation. Instead, I hold that in many instances auto-regulation serves to terminate or modify the eliciting situation to self-terminate the emotion. In the case of pleasant states—positive emotions—there is a tendency to maintain or increase aspects of the situation to maximize pleasure. The voluntary regulation via cognitive or behavioral routes is the exception if auto-regulation fails. For example, if going to the dentist induces anxiety then avoiding the dentist auto-regulates the anxiety in the moment. However, because this is dysfunctional in the long-term voluntary emotion regulation strategies are employed to follow through with the anxiogenic situation, unless the fear is too intense. This is a case where auto-regulation does not help the goals of the individual, but I believe that these situations are less frequent then typically held in the literature and that emotions take care of themselves, metaphorically speaking.

THE SOCIAL REGULATION OF EMOTIONS

The neurocultural theory proposed by Ekman and his colleagues is particularly elegant in that it accounts for biological universals as well as cultural variants. While cultural rules modulating expressions have been discussed already in the 19th century by theorists such as Wundt, and indeed Darwin, it is the concept of

"display rules" (Ekman and Friesen, 1969) that has captured the imagination of many researchers in the field of emotion—even appraisal researchers.

I have argued earlier (e.g., Kappas and Descôteaux, 2003) that practical reasons would suggest that emotion regulation should be part of emotion theories and not a tool for *post-hoc* explanation of inconsistent findings. For example, if a given theory predicts that individual A, confronted with Situation S should show behavior X_1 then this should allow a simple empirical test of the theory: bring person A in Situation S, measure behavior, and if I find X_2 instead of X_1, then the prediction was wrong. The theory might need revision. However, this is not what happens frequently in emotion research apparently. All too often behavior X_2 is explained ex post facto as the consequence of variability in appraising S (appraisal theory), or X_2 being the consequence of display rules (e.g., neurocultural theory), or both. I argue that if (1) display rules are potentially interfering with displays, and (2) a theory is primarily regarding the relationship of displays, feelings, and other emotional components, then (3) the rules must be part of what needs to be modeled. Note, that the notion of display rules is an instance of social regulation of a component of emotion that is present in *all* social situations. In other words, there seems to be a large agreement that there are social rules governing displays in all social situations!

If Fridlund (1994) is right, then there is *always* a social context that influences expressive behavior, even if humans are physically alone. This would mean that one cannot interpret any display without taking social regulation into account. There is no expressive behavior that is not affected by social regulation. Furthermore, if *feeling rules* exist (Hochschild, 1979, 1983), then we are almost constantly affected by beliefs of what is proper and what is not. In fact, Scherer (2001) has embedded a comparison with social and own norms into his popular *Component Process Model* of emotion. According to this theory, every event, every situation, is also evaluated with regard to social norms. Taking these theoretical approaches seriously implies that the social aspect cannot be divorced from studying *any* emotion generation (see also Parkinson, 1996).

If regulating displays, be they facial, vocal, or postural, impacts subjective experience and physiology, then automatic or effortful regulation in the sense of *display rules* will also affect other emotional components. For example, if a culture holds that boys do not cry then this will via feedback processes impact feeling and physiological arousal. This is why it is important to conceive of emotions as embodied processes. Even if the effect sizes of such influences might be small, they might tip systems to go into particular states if they are not at a steady state. How can the social regulation then be denied to be part and parcel of all affective processes? I have proposed a *Superlens Model of Communication* (1991; Kappas and Descôteaux, 2003) that takes imitation and mimicry into account (see **Figure 2**).

If there are mimicry and imitation processes in interaction (regardless of the role of mirror neurons; see Decety, 2010; also Parkinson, 2011) and these in turn affect how we feel—again, it is not conceivable to imagine emotional processes in interaction that would not be potentially affected by social processes. To me it

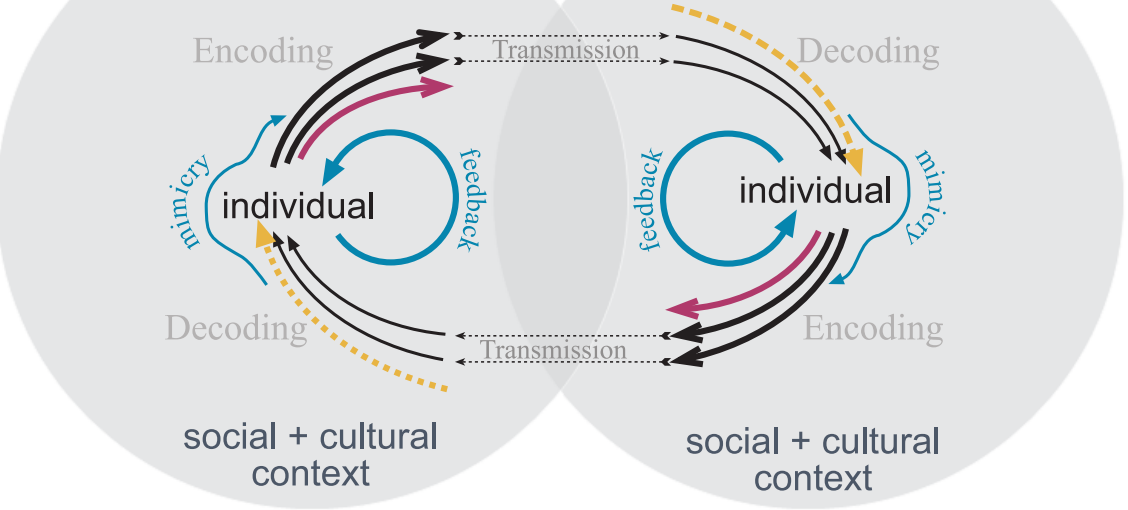


FIGURE 2 | Superlens model adapted from Kappas (1991) and Kappas and Descôteaux (2003). Communication pathways are indicated in black, expressive regulatory pathways in blue. Red arrows indicate objectively measurable displays that are not transmitted/received. Yellow arrows indicate erroneously perceived displays, for example due to stereotypes and expectations. Encoding and decoding of affective/motivational displays are a function of individuals' social and cultural context that are part of every individual. The intersection symbolizes the situationally shared context including all aspects that affect transmission, such as distance or noise.

is baffling how one could even conceive of "clean" or "untainted" emotional processes in the laboratory, or in the real world. Based on the notion of implicit sociality we can assume that even participants who are physically alone in an experiment are subject to social influences and like a *free monadic radical* will link to whatever social synapse that is available, e.g., the representation of the experimenter. Similarly, there is no situation in which an individual could be non-cultural. Instead, there are likely situational features that can prime and shape how culture affects mental processes and behavior. But we are always embedded in a cultural and social context.

In many settings more complex interaction topologies exist. **Figure 3** shows a hypothetical scenario where seven individuals interact.

The social regulation of emotions is a messy affair to analyze. It is all too easy to capitulate and argue that there is, speaking exaggeratedly, simply no sense in considering everything that ever happened as a cause of emotion and regulation. Of course not. This sounds like a reasonable comment. However, the question is where one should delineate the boundaries of episodes in a way that we can really describe, explain, and possibly intervene in real life situations. Layers are messy because they are *not* organized like an onion. Different layers of emotions and different layers of regulation interact in complex ways—whether this is the impact of cultural display rules on intraindividual regulatory processes via facial feedback or the fact that family-idiosyncratic use of facial gestures interacts with cultural rules when visiting another country. Nowhere perhaps is the situation as complex as when interpersonal communication and mass-communication intermingle in cyberspace. Here e-communities come into being, develop new rules of (n)etiquette that are constantly in flux and that cause easily miscommunication. Sudden flaming wars can easily erupt based on the subjective experience of being insulted without any bad intention. In the past, such misunderstandings would be considered a case of codes that are not shared between all participants. However, considering the dynamic unfolding of the (emotional) exchanges online can be seen as an instance of a complex, multipersonal interaction with different goals on the one hand, and different effects on the other. Certainly, there is much to do here, because of the ubiquity of mediated communication that is rather increasing than decreasing in years to come.

The notion of auto-regulation holds that the "regulation" of emotion is part of the brief of itself in a rather recursive manner. Social regulation is one important facet of auto-regulation in that expressive behavior not only informs others, it *moves* them to do

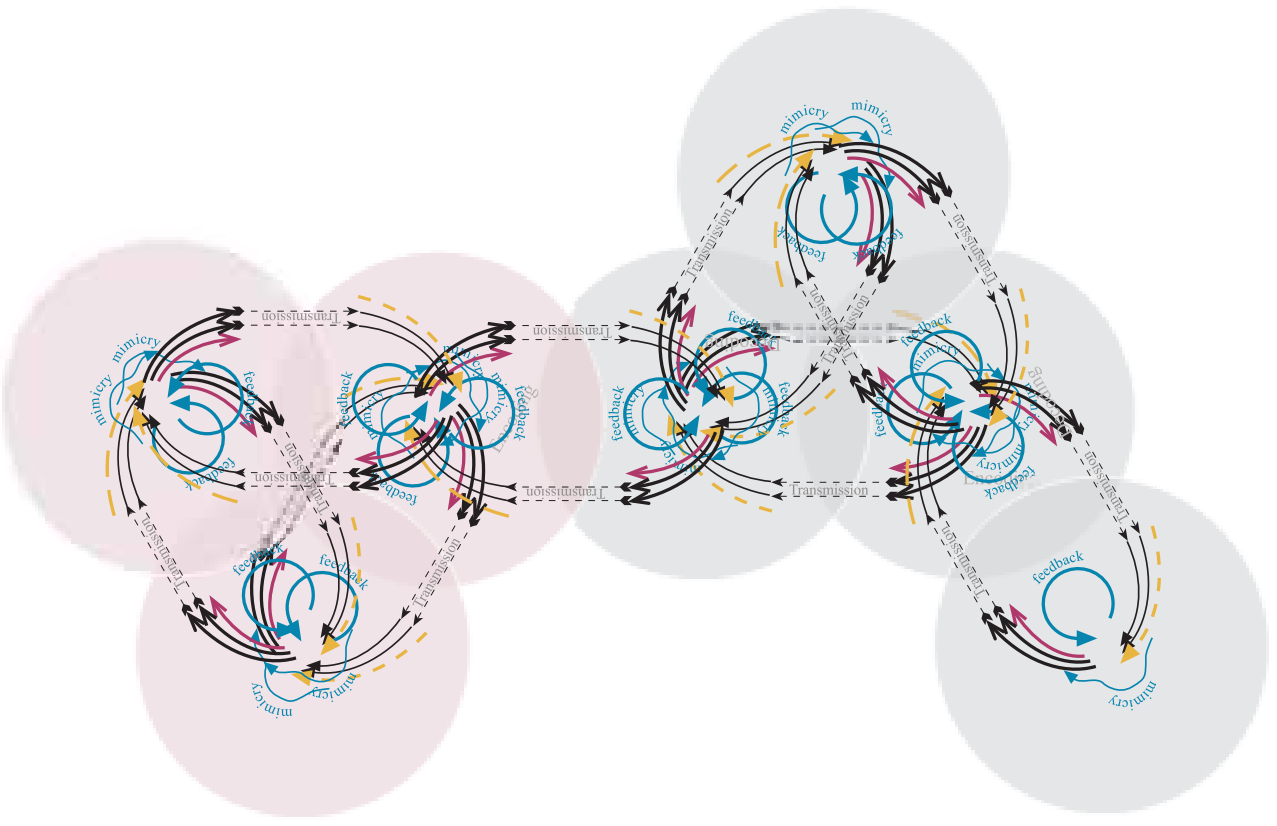


FIGURE 3 | Hyperlenses. Seven hypothetical individuals interact in a communication structure that involves several dyads and triads—for example in the context of a party. The color of the context circle suggests here two different groups participating. Hence, some interactants share a more similar context than others. The meaning of all arrows is analogous to that in **Figure 2**.

something, it *biases* their decisions, in this sense, negative emotions can impact others with the consequence of these emotions being terminated, as in getting support, or positive emotional states can impact others to reinforce themselves, as in amusement or desire. In this sense we are always embedded in social networks with different life-cycles (from the life-time of a family, to the brief minutes of a shared bus ride) where emotions are generated, moderated, regenerated, terminated, or reinforced as a function of how individuals affect each other in socio-cultural fields. It is because of this, that social layers should not (and cannot) be ignored in emotion research and that if the function of emotions involve their own regulation then generation and regulation of emotion are difficult to separate. Scenarios such as this appear messy because they do not easily lend themselves to the isolation of causes and effects that clean experimentation demands. However, they might help to understand the limitations of much of present emotion research, such as the challenges of low coherence between emotion components and the relationship of phenomena studied in the laboratory and those observed in the real world.

SUMMARY

I argue that there are many reasons to consider emotions not only a property of individual brains or bodies but of couples, families, cliques, teams, clubs, parties, companies, or e-communities. In my mind, this is one way in which emotions can be social. To study these types of emotions it is useful to take an interdisciplinary approach and collaborate with disciplines that naturally deal not with individuals, but with larger aggregates (von Scheve and von Luede, 2005).

In this view, it is natural that social forces are generative *and* modulating—in other words, the elicitation and the regulation of emotions are difficult to separate (see also Gross and Barrett, 2011). I have made this argument before in the context of individual emotions (e.g., Kappas, 2008, 2011a,b), and I extend it here to emotions of social entities. Typical counter arguments involve cases where generation and regulation can be (somewhat) cleanly separated (Gross et al., 2011b). However, I do not argue that *all* instances of emotion that we observe, whatever the mix of dependent measures is used, must be clearly linked to regulation. What I do point out, is that there are many instances in the classical, individual centered approach, as well as looking at more complex social structures (Rimé, 2009), where regulation and elicitation can best be described by nested layers of feedback loops. Because of this, theories of emotion should include these layers of regulation to permit the type of empirical testing that is necessary for a theory to be scientific. If any emotion theory is leaving regulation outside of their scope, there is no possibility to conduct proper tests regarding its validity. This calls for more real interaction in emotion studies (Rimé, 2009; Fischer and van Kleef, 2010). My colleagues and I have tried to achieve this either by manipulating social context in the laboratory, or by branching out into cyberspace and trying to assess the emotional behavior of large aggregates of individuals in e-communities (Chmiel et al., 2011).

Dealing with nested layers is messy because all layers can potentially influence emotional components (e.g., facial muscle activation). Research programs are required that can attempt to disambiguate the interaction of these layers. On the one hand, in the context of social neuroscience, there is much discussion of how to deal with the mutual interrelations of different layers (e.g., Cacioppo and Decety, 2011). On the other hand, as we start to deal with networks of people, we also need different ideas how to deal with these dynamic systems, and this calls for the science of complex systems (e.g., Chmiel et al., 2011; Garas et al., 2012). Combining these two approaches might be particularly fruitful in disambiguating the messy layers of emotion and emotion regulation.

ACKNOWLEDGMENTS

Part of this research was supported by a European Union grant in the context of the 7th Framework Programme, Theme 3: Science of complex systems for socially intelligent ICT. It is part of the CyberEmotions project (contract 231323).

REFERENCES

Adelman, P. K., and Zajonc, R. (1989). Facial efference and the experience of emotion. *Annu. Rev. Psychol.* 40, 249–280.

Averill, J. R. (2012). The future of social constructivism: introduction to a special section of Emotion Review. *Emot. Rev.* 4, 215–220.

Bandura, A. (2009). "Social cognitive theory of mass communication," in *Media Effects: Advances in Theory and Research, 3rd Edn*, eds J. Bryant and M. B. Oliver (New York, NY: Routledge), 94–124.

Barrett, L. F. (2011). Constructing emotion. *Psychol. Top.* 3, 359–380.

Barsalou, L. W., Niedenthal, P. M., Barbey, A. K., and Ruppert, J. A. (2003). "Social embodiment," in *The Psychology of Learning and Motivation, Vol. 43*, ed B. Ross (San Diego, CA: Academic Press), 43–92.

Boiger, M., and Mesquita, B. (2012). The construction of emotion in interactions, relationships, and cultures. *Emot. Rev.* 4, 221–229.

Boyd, D. M., and Ellison, N. B. (2007). Social network sites: definition, history, and scholarship. *J. Comput. Mediated Commun.* 13. Article 11. Available online at: http://jcmc.indiana.edu/vol13/issue1/boyd.ellison.html

Bressler, S. L., and Menon, V. (2010). Large-scale brain networks in cognition: emerging methods and principles. *Trends Cogn. Sci.* 14, 277–290.

Butler, E. A., and Gross, J. J. (2009). Emotion and emotion regulation: integrating individual and social levels of analysis. *Emot. Rev.* 1, 86–87.

Cabanac, M., Cabanac, A. J., and Parent, A. (2009). The emergence of consciousness in phylogeny. *Behav. Brain Res.* 198, 267–272.

Cacioppo, J. T., Berntson, G. G., Sheridan, J. F., and McClintock, M. K. (2000). Multi-level integrative analyses of human behavior: Social neuroscience and the complementing nature of social and biological approaches. *Psychol. Bull.* 126, 829–843.

Cacioppo, J. T., and Decety, J. (2011). Social neuroscience: challenges and opportunities in the study of complex behavior. *Ann. N.Y. Acad. Sci.* 1224, 162–173.

Cacioppo, J. T., and Patrick, B. (2008). *Loneliness: Human Nature and the Need for Connection*. New York, NY: W. W. Norton and Company.

Campos, J., Frankel, C., and Camras, L. (2004). On the nature of emotion regulation. *Child Dev.* 75, 377–394.

Carroll, J. M., and Russell, J. A. (1997). Facial expressions in Hollywood's portrayal of emotion. *J. Pers. Soc. Psychol.* 72, 164–176.

Chmiel, A., Sienkiewicz, J., Thelwall, M., Paltoglou, G., Buckley, K., Kappas, A., et al. (2011). Collective emotions online and their influence on community life. *PLoS ONE* 6:e22207. doi: 10.1371/journal.pone.0022207

Coan, J. A. (2011). "The social regulation of emotion," in *Oxford Handbook of Social Neuroscience* eds J. Decety and J. T. Cacioppo (New York, NY: Oxford University Press), 614–623.

Coan, J. A., Schaefer, H. S., and Davidson, R. J. (2006). Lending a

hand: social regulation of the neural response to threat. *Psychol. Sci.* 17, 1032–1039.

Cornelius, R. R. (1996). *The Science of Emotion: Research and Tradition in the Psychology of Emotion.* Upper Saddle River, NJ: Prentice Hall.

Damasio, A. (1999). *The Feeling of What Happens: Body and Emotion in the Making of Consciousness.* New York, NY: Harcourt.

Darwin, C. (1872). *The Expression of the Emotions in Man and Animals.* London, UK: Murray.

Decety, J. (2010). To what extent is the experience of empathy mediated by shared neural circuits? *Emot. Rev.* 2, 204–207.

Derks, D., Fischer, A. H., and Bos, A. E. R. (2008). The role of emotion in computer-mediated communication: a review. *Comput. Hum. Behav.* 24, 766–785.

Dunn, B. D., Galton, H. C., Morgan, R., Evans, D., Oliver, C., Myer, M., et al. (2010). Listening to your heart: how interoception shapes emotion experience and intuitive decision making. *Psychol. Sci.* 21, 1835–1844.

Ekman, P., and Friesen, W. (1969). The repertoire of nonverbal behavior: categories, origins, usage, and coding. *Semiotica* 1, 49–98.

Ekman, P., Sorenson, E. R., and Friesen, W. V. (1969). Pan-cultural elements in facial displays of emotion. *Science* 164, 86–88.

Ellsworth, P. C. (1994). William James and emotion: is a century of fame worth a century of misunderstanding? *Psychol. Rev.* 101, 222–229.

Ellsworth, P. C., and Scherer, K. R. (2003). "Appraisal processes in emotion," in *The Handbook of Affective Science*, eds R. J. Davidson, K. R. Scherer, and H. H. Goldsmith (New York, NY: Oxford University Press), 572–595.

Fischer, A. H., and van Kleef, G. A. (2010). Where have all the people gone? A plea for including social interaction in emotion research. *Emot. Rev.* 2, 208–211.

Fogel, A., Nwokah, E., Dedo, J. Y., Messinger, D., Dickson, K. L., Matusov, E., et al. (1992). Social process theory of emotion: a dynamic systems approach. *Soc. Dev.* 1, 122–142.

Fridlund, A. J. (1991). The sociality of solitary smiles: effects of an implicit audience. *J. Pers. Soc. Psychol.* 60, 229–240.

Fridlund, A. J. (1994). *Human Facial Expression. An Evolutionary View.* San Diego, CA: Academic Press.

Frijda, N. H. (2009). Emotion experience and its varieties. *Emot. Rev.* 1, 264–271.

Garas, A., Garcia, D., Skowron, M., and Schweitzer, F. (2012). Emotional persistence in online chatting communities. *Sci. Rep.* 2, 402.

Gendron, M., and Barrett, L. F. (2009). Reconstructing the past: a century of ideas about emotion in psychology. *Emot. Rev.* 1, 316–339.

Gross, J. J. (1998). The emerging field of emotion regulation: an integrative review. *Rev. Gen. Psychol.* 2, 271–299.

Gross, J. J. (ed.). (2007). *Handbook of Emotion Regulation.* New York, NY: Guilford Press.

Gross, J. J., and Barrett, L. F. (2011). Emotion generation and emotion regulation: one or two depends on your point of view. *Emot. Rev.* 3, 8–16.

Gross, J. J., Sheppes, G., and Urry, H. L. (2011a). Emotion generation and emotion regulation: a distinction we should make (carefully). *Cogn. Emot.* 25, 765–781.

Gross, J. J., Sheppes, G., and Urry, H. L. (2011b). Taking one's lumps while doing the splits: a big tent perspective on emotion generation and emotion regulation. *Cogn. Emot.* 25, 789–793.

Harris, J., and Kamvar, S. (2009). *We Feel Fine: An Almanac of Human Emotion.* New York, NY: Scribner Book Company.

Hess, U., Banse, R., and Kappas, A. (1995). The intensity of facial expression is determined by underlying affective state and social situation. *J. Pers. Soc. Psychol.* 69, 280–288.

Hochschild, A. (1979). Emotion work, feeling rules, and social structure. *Am. J. Sociol.* 85, 551–575.

Hochschild, A. (1983). *The Managed Heart: Commercialization of Human Feeling.* Berkeley, CA: University of California Press.

Hogan, P. C. (2010). Fictions and feelings: on the place of literature in the study of emotion. *Emot. Rev.* 2, 184–195.

Huebner, B. (2011). Genuinely collective emotions. *Eur. J. Philos. Sci.* 1, 89–118.

Izard, C. E. (2010). The many meanings/aspects of emotion: emotion definitions, functions, activation, and regulation. *Emot. Rev.* 2, 363–370.

Jakobs, E., Manstead, A. S. R., and Fischer, A. H. (1999a). Social motives and emotional feelings as determinants of facial displays: the case of smiling. *Pers. Soc. Psychol. Bull.* 25, 424–435.

Jakobs, E., Manstead, A. S. R., and Fischer, A. H. (1999b). Social motives, emotional feelings, and smiling. *Cogn. Emot.* 13, 321–345.

Jakobs, E., Manstead, A. S. R., and Fischer, A. H. (2001). Social context effects on facial activity in a negative emotional setting. *Emotion* 1, 51–69.

James, W. (1884). What is an emotion? *Mind* 9, 188–205.

Kagan, J. (2010). Some plain words on emotion. *Emot. Rev.* 2, 221–224.

Kappas, A. (1989). *Control of Emotion.* Unpublished PhD Thesis. Hanover, NH: Dartmouth College.

Kappas, A. (1991). The illusion of the neutral observer: on the communication of emotion. *Cahiers de Linguistique Française* 12, 153–168.

Kappas, A. (1996). "The sociality of appraisals: impact of social situations on the evaluations of emotion antecedent events and physiological and expressive reactions," in *Proceedings of the IXth Conference of the International Society for Research on Emotions,* ed N. H. Frijda (Toronto, ON: ISRE Publications), 116–120.

Kappas, A. (2003). "What facial activity can and cannot tell us about emotions," in *The Human Face: Measurement and Meaning,* ed M. Katsikitis (Dordrecht: Kluwer Academic Publishers), 215–234.

Kappas, A. (2008). "Pssssst! Dr. Jekyll and Mr. Hyde are actually the same person! A tale of regulation and emotion," in *Regulating Emotions: Social Necessity and Biological Inheritance*, eds M. Vandekerckhove, C. von Scheve, S. Ismer, S. Jung, and S. Kronast (Malden, MA: Blackwell Publishing), 15–38.

Kappas, A. (2011a). Emotion is not just an alarm bell—it's the whole tootin' fire truck. *Cogn. Emot.* 25, 765–781.

Kappas, A. (2011b). Emotion and regulation are one! *Emot. Rev.* 3, 17–25.

Kappas, A., and Descôteaux, J. (2003). "Of butterflies and roaring thunder: nonverbal communication in interaction and regulation of emotion," in *Nonverbal Behavior in Clinical Settings*, eds P. Philippot, E. J. Coats, and R. S. Feldman (New York, NY: Oxford University Press), 45–74.

Kappas, A., and Krämer, N. C. (2011). "Introduction: electronically mediated face-to-face communication: Issues, questions, and challenges," in *Face-to-Face Communication Over the Internet: Emotions in a Web of Culture, Language and Technology*, eds A. Kappas and N. C. Krämer (Cambridge: Cambridge University Press), 1–13.

Kappas, A., Küster, D., and Krumhuber, E. (2013). "Facial behavior," in *Handbook of Communication Science: Nonverbal Communication*, eds J. A. Hall and M. Knapp (New York, NY: Mouton de Gruyter), 131–166.

Kappas, A., Küster, D., Theunis, M., and Tsankova, E. (2012). Cyberemotions: an analysis of synchronous computer mediated communication and dyadic interaction. *Psychophysiology* 49, S49.

Kappas, A., and Olk, B. (2008). The concept of visual competence as seen from the perspective of the psychological and brain sciences. *Vis. Stud.* 23, 162–173.

Kemper, T. D. (2011). *Status, Power, and Ritual Interaction: A Relational Reading of Durkheim, Goffman, and Collins.* Farnham: Ashgate.

Koole, S. L., and Rothermund, K. (2011). "I feel better but I don't know why": the psychology of implicit emotion regulation. *Cogn. Emot.* 25, 389–399.

Lazarus, R. S., and Alfert, E. (1964). The short-circuiting of threat by experimentally altering cognitive appraisal. *J. Abnorm. Psychol.* 69, 195–205.

Lazarus, R. S., Averill, J. R., and Opton, E. M. (1970). "Towards a cognitive theory of emotion," in *Feelings and Emotions: The Loyola Symposium* ed M. B. Arnold (New York, NY: Academic Press), 207–232.

Lazarus, R. S., and Folkman, S. (1984). *Stress, Appraisal and Coping*. New York, NY: Springer.

Maier, S. F., and Watkins, L. R. (1998). Cytokines for psychologists: implications of bi-directional immune-to-brain communication for understanding behavior, mood, and cognition. *Psychol. Rev.* 105, 83–107.

Mar, R., Djikic, M., and Oatley, K. (2008). "Effects of reading on knowledge, social abilities, and selfhood," in *Directions in Empirical Literary Studies: In Honor of Willie Van Peer,* eds S. Zyngier, M. Bortolussi, A. Chesnokova, and J. Auracher (Amsterdam, Netherlands: Benjamins), 127–137.

Matsumoto, D. (2009). "Culture and emotional expression," in *Problems and Solutions in Cross-Cultural Theory, Research, and Application*, eds C. Y. Chiu, Y. Y. Hong, S. Shavitt, and R. S. Wyer (New York, NY: Psychology Press), 271–287.

Mauss, I. B., Bunge, S. A., and Gross, J. J. (2007). Automatic emotion regulation. *Soc. Pers. Psychol. Compass* 1, 146–167.

Mauss, I. B., and Robinson, M. D. (2009). Measures of emotion:

a review. *Cogn. Emot.* 23, 209–237.
McIntosh, D. N. (1996). Facial feedback hypotheses: evidence, implications, and directions. *Motiv. Emot.* 20, 121–147.
Mesquita, B., and Ellsworth, P. (2001). "The role of culture in appraisal," in *Appraisal Processes in Emotion: Theory, Methods, Research*, eds K. R. Scherer, A. Schorr, and T. Johnstone (New York, NY: Oxford University Press), 233–248.
Mesquita, B., and Leu, J. (2007). "The cultural psychology of emotions," in *Handbook of Cultural Psychology,* eds S. Kitayama and D. Cohen (New York, NY: Guilford Press), 734–759.
Morgan, M., Shanahan, J., and Signorielli, N. (2009). "Growing up with television: cultivation processes," in *Media Effects: Advances in Theory and Research, 3rd Edn*, eds J. Bryant and M. B. Oliver (New York, NY: Routledge), 34–49.
Niedenthal, P. M. (2007). Embodying emotion. *Science* 316, 1002–1005.
Ochsner, K. N., Bunge, S. A., Gross, J. J., and Gabrieli, J. D. E. (2002). Rethinking feelings: an fMRI study of the cognitive regulation of emotion. *J. Cogn. Neurosci.* 14, 1215–1299.
Ohira, H. (2010). The somatic marker revisited: brain and body in emotional decision making. *Emot. Rev.* 2, 245–249.
Öhman, A., and Mineka, S. (2001). Fears, phobias, and preparedness. Toward an evolved module of fear and fear learning. *Psychol. Rev.* 108, 483–522.
Parkinson, B. (1996). Emotions are social. *Br. J. Psychol.* 87, 663–683.
Parkinson, B. (2005). Do facial movements express emotions or communicate motives? *J. Pers. Soc. Psychol.* 9, 278–311.
Parkinson, B. (2011). Interpersonal emotion transfer: contagion and social appraisal. *Soc. Pers. Psychol. Compass* 5, 428–439.
Price, T. F., and Harmon-Jones, E. (2010). The effect of embodied emotive states on cognitive categorization. *Emotion* 10, 934–938.
Reisenzein, R., and Döring, S. A. (2009). Ten perspectives on emotional experience: introduction to the special issue. *Emot. Rev.* 1, 195–205.
Reisenzein, R., Meyer, W.-U., and Schützwohl, A. (1995). James and the physical basis of emotion: a comment on Ellsworth. *Psychol. Rev.* 102, 757–761.
Rimé, B. (2009). Emotion elicits the social sharing of emotion. *Emot. Rev.* 1, 60–85.
Rochat, P., and Striano, T. (1999). "Social-cognitive development in the first year," in *Early Social Cognition: Understanding Others in the First Months of life,* eds P. Rochat (Mahwah, NJ: Lawrence Erlbaum Associates), 3–34.
Russell, J. A. (1995). Facial expressions of emotion: what lies beyond minimal universality? *Psychol. Bull.* 118, 379–391.
Russell, J. A., and Fernández-Dols, J. M. (1997). "What does a facial expression mean?" in *The Psychology of Facial Expression*, eds J. A. Russell and J. M. Fernández-Dols (Cambridge, UK: Cambridge University Press), 3–30.
Scherer, K. R. (2001). "Appraisal considered as a process of multilevel sequential checking," in *Appraisal Processes in Emotion: Theory, Methods, Research,* eds K. R. Scherer, A. Schorr, and T. Johnstone (New York, NY: Oxford University Press), 92–120.
Scherer, K. R., and Brosch, T. (2009). Culture-specific appraisal biases contribute to emotion dispositions. *Eur. J. Pers.* 23, 265–288.
Scherer, K. R., Schorr, A., and Johnstone, T. (eds.). (2001). *Appraisal Processes in Emotion: Theory, Methods, Research.* New York, NY: Oxford University Press.
Schweitzer, F., and Garcia, D. (2010). An agent-based model of collective emotions in online communities. *Eur. Phys. J. B* 77, 533–545.
Shweder, R. A. (1994). "'You're not sick, you're just in love': Emotion as an interpretive system," in *The Nature of Emotion: Fundamental Questions*, eds P. Ekman and R. J. Davidson (New York, NY: Oxford University Press), 32–43.
Tamir, M. (2011). The maturing field of emotion regulation. *Emot. Rev.* 3, 3–7.
Thelwall, M., Buckley, K., Paltoglou, G., Cai, D., and Kappas, A. (2010). Sentiment strength detection in short informal text. *J. Am. Soc. Inform. Sci. Technol.* 61, 2544–2558.
Thelwall, M., and Wilkinson, D. (2010). Public dialogs in social network sites: what is their purpose? *J. Am. Soc. Inform. Sci. Technol.* 61, 392–404.
Tourangeau, R., and Ellsworth, P. (1979). The role of the face in the experience of emotion. *J. Pers. Soc. Psychol.* 37, 1519–1531.
Trier, M., and Bobrik, A. (2009). Exploring and searching social architectures in digital networks. *IEEE Internet Comput.* 23, 51–59.
Uttal, W. R. (2001). *The New Phrenology: The Limits of Localizing Cognitive Processes in the Brain*. Cambridge, MA: MIT Press.
Vandekerckhove, M., von Scheve, C., Ismer, S., Jung, S., and Kronast, S. (eds.). (2008). *Regulating Emotions: Social Necessity and Biological Inheritance*. Malden, MA: Blackwell Publishing.
von Scheve, C. (2012). Emotion regulation and emotion work: two sides of the same coin? *Front. Psychology* 3:496. doi: 10.3389/fpsyg.2012.00496
von Scheve, C., and von Luede, R. (2005). Emotion and social structures: towards an interdisciplinary approach. *J. Theory Soc. Behav.* 35, 303–328.
Wierzbicka, A. (2009). Language and metalanguage: key issues in emotion research. *Emot. Rev.* 1, 3–14.
Winkielman, P., and Schooler, J. (2008). "Unconscious, conscious, and metaconscious in social cognition," in *Social Cognition: The Basis of Human Interaction*, eds F. Strack and J. Foerster (Philadelphia, PA: Psychology Press), 49–69.
Yurtsever, G., and De Rivera, J. (2010). Measuring the emotional climate of an organization. *Percept. Mot. Skills* 110, 501–516.

Conflict of Interest Statement: The author declares that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Received: 31 July 2012; accepted: 23 January 2013; published online: 15 February 2013.
Citation: Kappas A (2013) Social regulation of emotion: messy layers. Front. Psychology ***4****:51. doi: 10.3389/fpsyg.2013.00051*
This article was submitted to Frontiers in Emotion Science, a specialty of Frontiers in Psychology.