Social Trauma: Consequences of Emotional Maltreatment on Physiological Reactions to Social Rejection in Subjects with Social Anxiety Disorder

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Hiermit versichere ich, dass ich die vorliegende Synopse selbständig, sowie die für den Kumulus vorliegenden Schriften als Erstautor verfasst habe. Damit trage ich die inhaltliche und methodische Verantwortung für die aufgeführten Schriften. Die Arbeit hat in der gegenwärtigen, oder in einer anderen Fassung keiner anderen Fakultät oder Universität vorgelegen.

Bielefeld, im Juni 2013

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Benjamin Iffland

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Table of Contents

1. Overview

1.1. Submitted Articles and Research Contributions

Article #1: Emotional but not physical maltreatment is independently related to psychopathology in subjects with various degrees of social anxiety: a web-based Internet survey

Benjamin Iffland[1], Lisa M. Sansen[1,2], Claudia Catani[1], Frank Neuner[1]

published 2012 in *BMC Psychiatry*, 12:49.

I was involved in the conception and design of the study and collected data. I performed the statistical analyses and interpretation of findings, and drafted the manuscript as first author.

Article #2: Rapid Heartbeat, But Dry Palms: Reactions of Heart Rate and Skin Conductance Levels to Social Rejection

Benjamin Iffland[1], Lisa M. Sansen[1,2], Claudia Catani[1], Frank Neuner[1]

submitted to *Biological Psychology*

I was involved in the conception and design of the study. I contributed to collection of data and pre-processing of physiological data. I performed the statistical analyses and interpretation of findings, and drafted the manuscript as first author.

Article #3: The trauma of peer abuse: Effects of relational peer victimization and social anxiety disorder on physiological and affective reactions to social exclusion

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Benjamin Iffland[1], Lisa M. Sansen[1,2], Claudia Catani[1], Frank Neuner[1]

submitted to *Journal of Anxiety Disorders*

I was involved in the conception and design of the study. I contributed to collection of data and carried out a large number of clinical interviews. I pre-processed physiological data. I performed the statistical analyses and interpretation of findings, and drafted the manuscript as first author.

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2. Integration of the Manuscripts

2.1. Introduction to the Context of this Research

2.1.1. Emotional Maltreatment

Child maltreatment refers to various forms of abusive and neglectful behavior resulting in actual or potential harm to the child's health, survival or development (Krug, Dahlberg, Mercy, Zwi, & Lozano, 2002; World Health Organization, 1999). Child maltreatment has been considered to be one of the most important social challenges worldwide and to be associated with substantial impairments of social wellbeing and health (Arnow, 2004; Dubowitz & Bennett, 2007; Egle, Hoffmann, & Joraschky, 2005; R. C. Kessler et al., 2010).

Several studies reported that a history of child maltreatment is associated with psychopathology, predominantly affective and anxiety disorders as well as substance abuse (Boney-McCoy & Finkelhor, 1995; Danielson, de Arellano, Kilpatrick, Saunders, & Resnick, 2005; Kendall-Tackett, Williams, & Finkelhor, 1993; Kilpatrick et al., 2003; Schneider, Cronkite, & Timko, 2008). Most of these studies focused on the consequences of physical abuse, sexual abuse, physical neglect or combinations of these types of maltreatment. However, besides physical and sexual transgressions, child maltreatment does also involve acts such as verbal hostility, taunting, belittling and rejection as well as emotionally neglectful parenting that is unavailable, detached, avoidant and unresponsive to one's needs and desires (Egeland, 2009). These types of maltreatment have been referred to as emotional maltreatment, which can be divided in two types, emotional abuse and emotional neglect (Barnett, Manly, & Cicchetti, 1993).

Although it was suggested that the consequences of emotional maltreatment might be as severe as the outcomes of physical or sexual maltreatment (Egeland, 2009; Wright, Crawford, & Del Castillo, 2009), there is little knowledge about the unique effects of emotional

maltreatment on psychopathology. However, some studies reported an association of emotional maltreatment by caretakers and psychopathology, particularly social anxiety (Gibb, Chelminski, & Zimmerman, 2007; Harkness & Wildes, 2002; Kuo, Goldin, Werner, Heimberg, & Gross, 2011; McCabe, Antony, Summerfeldt, Liss, & Swinson, 2003; Simon et al., 2009). Simon et al. (2009) indicated that a history of child maltreatment was associated with symptom severity and poorer quality of life, function, and resilience in patients diagnosed with social anxiety disorder. Moreover, social anxiety and symptom severity were predominantly related to emotional abuse and neglect. Accordingly, Gibb et al. (2007) indicated that emotional abuse was more strongly connected to diagnoses of depression and social anxiety disorder than physical and sexual abuse.

2.1.2. Emotional Peer Victimization

In addition to emotional maltreatment that involves abuse and neglect by parents and other caretakers, emotional abusive treatments (also referred to as emotional victimization) are highly prevalent among peers and may further contribute to a development of psychopathology in its victims (Storch, Masia-Warner, Crisp, & Klein, 2005). Emotional peer victimization is characterized by bullying, verbal threats or aggression, malicious manipulation of a relationship, friendship withdrawal and damaging another's peer relationships, such as through rumor spreading (Siegel, La Greca, & Harrison, 2009).

Similar to emotional maltreatment by parents or caretakers, emotional peer victimization contributes to various forms of general psychopathology (Storch et al., 2005). It has been shown that peer verbal abuse is linked to depression, anger-hostility, dissociation and drug use (Gladstone, Parker, & Malhi, 2006; Teicher, Samson, Sheu, Polcari, & McGreenery, 2010). Gladstone et al. (2006) found over a quarter of their sample of depressive outpatients having experienced bullying that was severe and traumatic. However, peer victimization is particularly associated with characteristics of sub-clinical social anxiety (La

Greca & Harrison, 2005; Siegel et al., 2009; Storch, Brassard, & Masia-Warner, 2003; Storch & Masia-Warner, 2004) and social anxiety disorder (Ranta, Kaltiala-Heino, Pelkonen, & Marttunen, 2009).

2.1.3. Social Anxiety Disorder

Social anxiety disorder (SAD) is a common anxiety disorder, with a lifetime prevalence of 12.1% (Kessler et al., 2005). SAD is characterized by persistent fear of social or performance situations, fear of negative evaluation, social avoidance of general and new situations, as well as physiological symptoms in social situations (American Psychiatric Association, 2000). Models of SAD assume that its development is a result of an interaction of a biological vulnerability with negative social learning experiences (Clark & Wells, 1995; Heimberg, Brozovich, Rapee, Hofmann, & DiBartolo, 2010; Rapee & Heimberg, 1997). Moreover, Rapee & Heimberg (1997) suggested social learning experiences to be a key environmental factor in the development of social anxiety disorder.

2.1.4. Models of Cognitive Vulnerability for Social Anxiety Disorder

However, the mechanisms that associate emotional maltreatment by caretakers as well as peers and social anxiety are still unknown. Recently, models of cognitive vulnerability (Beck, 2008; Beevers, 2005) that imply memory models of traumatic events (Foa & Kozak, 1986) and network models of emotional processing (Lang, 1979) have been provided. These models suggest that negative learning experiences establish associative information structures in memory that activate various stereotype and pathological behavioral programs in similar situations. In particular, repeated experiences of emotional maltreatment may enhance the development of cognitive vulnerability for social anxiety (Beck, 2008; Beevers, 2005; Smith & DeCoster, 2000). Later on, specific environmental features, i.e., social situations, may be

linked to traumatic events, i.e., experiences of emotional maltreatment, so that re-exposure to a similar environment activates associative information processing and produces a recurrence of symptoms of anxiety and fear (Beevers, 2005; Charney, 2004). As a consequence, several social situations are likely to elicit a spectrum of behavioral, autonomic, and endocrine responses that normally only occur in the context of danger (Blair, Schafe, Bauer, Rodrigues, & LeDoux, 2001). Accordingly, Hackmann, Clark, and McManus (2000) reported that the majority of patients with social anxiety disorder had a particular memory which they felt was closely linked to recurrence of symptoms of social anxiety.

This conceptualization predicts that social events may provoke more intense reactions in emotional maltreated subjects as such situations trigger associative response elements of social traumatic experiences. According to Lang (1979), associative processing and activation of associative networks evoked by presentation of trauma and fear relevant stimuli should be accompanied by measurable physiological responses. As a consequence, physiological responses to social situations that are similar to previous experiences should be more intense in subjects with a history of emotional maltreatment. In accordance, prior studies presented increased heart rate, skin conductance level and blood pressure in traumatized subjects after presentation of trauma relevant stimuli (Blanchard, Kolb, Gerardi, Ryan, & Pallmeyer, 1986; Dobbs & Wilson, 1960; Kolb, 1984; Malloy, Fairbank, & Keane, 1983; Pitman, Orr, Forgue, de Jong, & Claiborn, 1987; Van der Kolk & Ducey, 1989). However, there is currently minimal evidence that these findings can be transferred to non-physical types of maltreatment, and disorders other than PTSD.

2.1.5. Social Rejection as Essential Part of Emotional Maltreatment

A key element of emotional maltreatment is social rejection (Williams, 1997, 2001), which is associated with devastating long- and short-term consequences. It predicts the development of psychosomatic problems, health risk factors, i.e., smoking, obesity, or high

blood pressure, and a wide range of psychological disorders (Bell-Dolan, Foster, & Smith Christopher, 1995; Deater-Deckard, 2001; Hock & Lutz, 2001; Nolan, Flynn, & Garber, 2003; Reinherz, Giaconia, Hauf, Wasserman, & Paradis, 2000; Uchino, 2006). As negative short-term consequences of social rejection, negative mood, emotional distress, and reduced feelings of belonging, self-esteem, control, and meaningful existence have been established (e.g., Buckley, Winkel, & Leary, 2004; Gonsalkorale & Williams, 2007; Leary, Koch, & Hechenbleikner, 2001; Williams, 2007; Williams, Cheung, & Choi, 2000; Zadro, Williams, & Richardson, 2004).

Moreover, processing of social rejection activates neural networks that are associated with the processing of physical pain and negative emotional experiences (e.g., DeWall et al., 2012; Eisenberger, Inagaki, Muscatell, Haltom, & Leary, 2011; Eisenberger & Lieberman, 2004; Eisenberger, Lieberman, & Williams, 2003; Eisenberger, Taylor, Gable, Hilmert, & Lieberman, 2007; Kawamoto et al., 2012; Krill & Platek, 2009; Onoda et al., 2009; Onoda et al., 2010; Somerville, Heatherton, & Kelley, 2006; Yanagisawa, Masui, Furutani, Nomura, Ura, et al., 2011; Yanagisawa, Masui, Furutani, Nomura, Yoshida, et al., 2011), in particular the dorsal anterior cingulated cortex and the right ventrolateral prefrontal cortex. Activation of these networks was suggested to be involved in the regulation of social pain (e.g., Onoda et al., 2009; Onoda et al., 2010). In addition, social rejection elicits an alteration of cortisol levels (Blackhart, Eckel, & Tice, 2007; Stroud, Salovey, & Epel, 2002; Zwolinski, 2008). However, there remains a need for clarification of the impact and direction of social rejection on other physiological measures such as heart rate and skin conductance.

On the one hand, social rejection caused a transient slowing of heart rate in a social-judgment task (Moor, Crone, & van der Molen, 2010). On the other hand, social rejection was found to enhance rather than blunt bodily responses. As a consequence, socially rejected subjects exhibited increases in heart rate and respiratory sinus arrhythmia (RSA) withdrawal, suggesting sympathetic activation and parasympathetic withdrawal (Murray-Close, 2011).

Additionally, an episode of social rejection elicited physiological arousal as measured by skin conductance level (SCL; Kelly, McDonald, & Rushby, 2012; Murray-Close, 2011; Shoulberg, Sijtsema, & Murray-Close, 2011; Sijtsema, Shoulberg, & Murray-Close, 2011). However, in contrast to findings demonstrating that social rejection evokes physiological reactions, several studies could not find any changes in heart rate, RSA and cortisol levels in response to social exclusion (Krimsky, 2010; Sijtsema et al., 2011; Weik, Maroof, Zöller, & Deinzer, 2010; Zöller, Maroof, Weik, & Deinzer, 2010).

2.1.6. Consequences of Social Rejection in Socially Anxious Subjects

In socially anxious subjects, social rejection elicited immediate and delayed effects on psychological outcomes (Borland, Zadro, & Richardson, 2004; Zadro, Boland, & Richardson, 2006). Immediately after social exclusion, highly anxious subjects reported higher psychological distress than low anxious participants. Moreover, highly socially anxious subjects still reported higher levels of threatened needs 45 minutes after the episode of social rejection while low anxious subjects had returned to their baseline levels. Accordingly, Borland et al. (2004) showed that social rejection is immediately followed by a negative reaction in healthy controls as well as socially anxious subjects. Forty-five minutes later, however, healthy controls returned to baseline levels, whereas socially anxious subjects still reported lower (but slightly improved) levels on measurements. Additionally, social rejection elicits lower self-restraint, a marked response to stress (Krimsky, 2010; Oaten, Williams, Jones, & Zadro, 2008). However, self-regulatory deficits persisted only in highly anxious subjects (Oaten et al., 2008). Both, physiological reactions in healthy subjects as well as increased psychological reactions in socially anxious subjects were suggested in previous studies. However, a combination of these, i.e., an investigation of physiological reactions in socially anxious subjects, was not presented so far. This might be of specific interest, as fear of social rejection is one of the core components of social anxiety (Clark & Wells, 1995).

Clark & Wells's (1995) cognitive model of social phobia suggests that socially anxious subjects encode more threatening cues during social performances and ruminate about social interactions. Accordingly, socially anxious subjects should present stronger and prolonged physiological reactions to social rejection.

2.1.7. Aim of the Present Research

As stated above, there is so far minimal evidence that experiences of aversive social situations evoke an associative network and an activation of associative memory processing. The aim of the present work was to address this point and to explore the impact of prior emotional maltreatment on physiological reactions to social rejection. In addition, it was assumed that associative memory representations are potential links between maltreatment and social anxiety disorder. Thus, the effect of a history of emotional maltreatment on the experience of potential traumatic social events was expected to be even stronger for subjects with SAD.

2.2. Present Research

The present dissertation rests on three manuscripts. In Manuscript #1, the specific impact of emotional types of ill-treatment, including emotional abuse and neglect within the family as well as emotional peer victimization, on social anxiety was studied. In particular, we aimed to disentangle the independent contribution of emotional forms of maltreatment while controlling for physical types of abuse. Manuscript #2 addressed the ambiguous findings of physiological reactions to social rejection. It was explored whether subjects that were socially excluded showed higher or lower heart rate and skin conductance levels than socially included subjects. Moreover, subjects reported affective and emotional reactions to social rejection. In Manuscript #3, the specific impact of experiences of emotional maltreatment and social anxiety on physiological and psychological reactions to social exclusion were examined.

2.2.1. The Association of Emotional Maltreatment and Psychopathology in Socially Anxious Subjects

Taking into account that the three different kinds of childhood maltreatment, i.e., physical or sexual maltreatment, emotional maltreatment within the family, and peer victimization, are all associated with social anxiety, the aim of the first manuscript was to explore the specific impact of emotional types of maltreatment, including emotional abuse and neglect within the family as well as emotional peer victimization, on social anxiety. Previous studies focused either on physical or sexual abuse and neglect, emotional maltreatment by caretakers or emotional peer victimization. However, as different types of abuse and neglect are highly inter-correlated and co-occur in most populations (Capaldi et al., 2009; Dutton, Kaltman, Goodman, Weinfurt, & Vankos, 2005; McNutt, Carlson, Persaud, & Postmus, 2002; Wingenfeld et al., 2010), it is important to study the unique effect of single types of maltreatment. It was hypothesized that, while all types of abuse are associated with

psychopathology in this sample, the effects of physical maltreatment are to a large extent mediated by emotional maltreatment. Furthermore, we postulated an independent effect of emotional types of peer victimization. Moreover, it was examined whether varying kinds of child maltreatment lead to different profiles of psychopathology.

The study was conducted as a web-based Internet survey of participants (N = 995) who had social anxiety symptoms falling within the high range, and including many respondents who had scores in the clinical range. The survey was advertised through various popular German language web pages and newsgroups that attract high numbers of anxious subjects (e.g., http://www.panik-attacken.de, http://www.verrueckt.de, http://www.schuechterne.org). These advertisements were linked to a study web page that included the survey. The assessment included measures of child maltreatment, emotional peer victimization, social anxiety symptoms and general psychopathology.

Results showed that reports of emotional maltreatment were more directly and strongly associated with symptoms of social anxiety than physical types of maltreatment. Moreover, the analysis showed that the association of physical maltreatment and social anxiety was significantly mediated by emotional maltreatment. As well as emotional maltreatment by caretakers, emotional types of peer victimization seemed to be an additional unique predictor of social anxiety symptoms. Furthermore, compared to subjects who exclusively reported a history of physical maltreatment, subjects reporting exclusively emotional maltreatment showed higher rates on all types of broad-band psychopathology.

Findings of manuscript #1 were consistent with prior research that indicated an association of child maltreatment with psychopathology, and in particular, social anxiety symptoms. However, while previous studies postulated that physical and sexual abuse were a risk factor for mental disorders including social phobia (Nelson et al., 2002; Safren, Gershuny, Marzol, Otto, & Pollack, 2002), only a small independent relationship between sexual and physical maltreatment and social anxiety was found in manuscript #1. The impact

of physical maltreatment on social anxiety even disappeared when emotional maltreatment was controlled for, suggesting that emotional abuse and neglect has a greater role than physical maltreatment in the development of symptoms of social anxiety. In line with this, emotional maltreatment mediated the association of physical maltreatment with social anxiety and psychopathology. In addition to emotional maltreatment within the family, a history of emotional peer victimization was independently related to social anxiety symptoms. This finding was consistent with previous studies reporting that peer rejection and neglect were linked to social anxiety disorder (Sentse, Lindenberg, Omvlee, Ormel, & Veenstra, 2010; Storch & Masia-Warner, 2004; Storch et al., 2005).

Besides the impact of emotional maltreatment on social anxiety, influences of emotional maltreatment on various types of psychopathology were reported in manuscript #1. Subjects reporting exclusively emotional maltreatment in this study were found to have higher rates on almost all types of general psychopathology. Hence, emotional maltreatment rather than physical maltreatment was suggested to have negative implications on most domains of psychopathology.

In conclusion, manuscript #1 suggested that symptoms of social anxiety were mainly predicted by emotional types of victimization, either in childhood through caretakers, or during childhood and adolescence through peers. This finding indicated that more awareness should be paid to emotional forms of abuse and neglect during development to prevent psychological disorders and to identify children at risk.

2.2.2. Physiological Reactions to Social Rejection in Healthy Adults

Although the central and hormonal stress reaction in response to rejection has been documented in many studies (Åhs, Sollers, Furmark, Fredrikson, & Thayer, 2009; Critchley et al., 2003; Lane et al., 2009; Nagai, Critchley, Featherstone, Trimble, & Dolan, 2004; Wong, Massé, Kimmerly, Menon, & Shoemaker, 2007), the corresponding peripheral physiological

stress effects of social rejection on heart rate, skin conductance and other parameters of the autonomous nervous system (ANS) are still far from clear. On this background, manuscript #2 aimed to examine and specify effects of social rejection on physiological outcomes. The state of the literature did not allow a prediction of the direction of the physiological response, both increases and decreases in bodily responses as measured by skin conductance level and heart rate were plausible reactions to an episode of social rejection.

Participants were recruited through advertisements at the campus of Bielefeld University and included 50 (25 female) individuals. Assuming that they might be too suspicious of the experimental manipulation, subjects currently enrolled at the faculty of psychology at Bielefeld University were rejected from participation. Participants were assigned to either a social exclusion or inclusion condition of the so-called Cyberball paradigm (Williams et al., 2000; Williams & Jarvis, 2006). In this paradigm, participants are told that they would be playing an Internet ball-tossing game with two co-players on the computer. However, these players are in fact simulated by the computer and, in the exclusion condition, programmed to throw the ball to the subject only once and to ignore the subject as the game continues. If assigned to the inclusion condition, participants received the ball for roughly one-third of the total throws. The game lasted for a total of 30 throws. Immediate and delayed physiological reactions (skin conductance level and heart rate) were recorded. In addition, subjects reported levels of affect, emotional states and fundamental needs.

Results indicated that subjects who were socially rejected showed increased heart rates. However, social rejection had no effect on subjects' skin conductance levels. Both conditions showed heightened arousal on this measurement. Furthermore, psychological consequences of social rejection indicated the validity of the paradigm.

Generally, the increase of heart rate in comparison to a non-excluded control condition documents that social rejection as simulated by the Cyberball game elicits reactions of the ANS. This finding corresponds to previous experiments that also found an increase of arousal

caused by the exclusion condition in this paradigm. However, arousal response in these studies was limited to an increase of skin conductance levels (Kelly et al., 2012; Murray-Close, 2011; Shoulberg et al., 2011; Sijtsema et al., 2011) while in our study increases of SCL was found for excluded as well as for included subjects. Because most of the previous studies did not provide an inclusion condition for comparison (Murray-Close, 2011; Shoulberg et al., 2011; Sijtsema et al., 2011), it may be assumed that SCL reactions do not reflect a specific response to social rejection but result from an increase of participants' general level of activation/arousal while performing the task. In line with this assumption, SCL is known to reflect a general engagement of attention while heart rate reactions were found to distinguish more appropriate between emotional responses and task requirements (Frith & Allen, 1983). This may explain why a heart rate but not a skin conduction response to rejection was found in this experiment.

However, findings of manuscript #2 contrast with a recent report that indicated parasympathetic rather than sympathetic activation in response to social rejection including a deceleration of heart rate (Moor et al., 2010). A closer look at the study by Moor et al (2010) and manuscript #2 shows that the tasks that were applied to induce feelings of social exclusion differed in several aspects. It may be speculated that differences in emotional involvement, number of episodes of social rejection, and time intervals that were analyzed, may account for opposite patterns of heart rate reactions to social rejection.

Moreover, other confounding context characteristics that have a likely effect on the central stress response were not controlled in the experiments and may account for the inconsistency of findings. This includes the effect of expectancy violation that seems to result in larger heart rate responses after rejection (Moor et al., 2010) as well as in the modulation of social pain (Eisenberger & Lieberman, 2004; Ploghaus, Becerra, Borras, & Borsook, 2003). Additionally, it is likely that sample characteristics, e.g. psychopathology and prior negative experiences, have an impact on the reactions to social rejection (e.g., Borland et al., 2004;

Gomez, 2009; Oaten et al., 2008; Waldrip, 2007; Zadro et al., 2006). Moreover, physiological reactions to social rejection have recently been suggested to be gender-specific (Stroud et al., 2002; Weik et al., 2010). In line with this suggestion, explorative analyses revealed a significant time x gender interaction for SCL in manuscript #2. In line with Weik et al. (2010), women exhibited a greater reactivity towards social rejection.

In conclusion, social rejection evokes immediate physiological reactions. Although the effects of social rejection do not imply changes of skin conductance levels, the autonomic nervous system is affected by experiences of social exclusion indicating that behavior activation rather than inhibition is associated with socially threatening events. In addition, physiological reaction patterns might be influenced by inter-individual differences in life experiences, gender, and expectations of acceptance and rejection.

2.2.3. Effects of Peer Victimization and Social Anxiety on Physiological and Affective Reactions to Social Rejection

Social rejection elicits emotional distress, negative mood and physiological stress. Recent studies showed that these effects were more intense and persisting in socially anxious subjects. Manuscript #3 examined whether the abnormal reactions of socially anxious subjects to social rejection can be traced back to previous experiences of emotional maltreatment. For the purpose of this study, emotional maltreatment was restricted to experiences of peer victimization. Assuming that repetitive negative experiences generate associative memory networks, it was suggested that social rejection by co-players as it occurs in the Cyberball game (see manuscript #2) might be specifically linked to associative networks evoked by peer victimization. It was postulated that immediately after an episode of social rejection subjects reporting a history of relational peer victimization would show higher levels of physiological activation as well as less positive and more negative affect. It was hypothesized that these reactions would be stable over a waiting period of 15 minutes.

Furthermore, assuming memory representations are potential mediators between peer victimizations and psychopathology, the effect of a history of peer victimization was expected to be stronger for subjects with SAD.

Participants were recruited through the Outpatient Psychotherapy Clinic of Bielefeld University and bulletins at the campus of Bielefeld University. Participants included 37 (29 females) individuals who met DSM-IV-TR (American Psychiatric Association, 2000) criteria for a diagnosis of social anxiety disorder and 37 healthy controls (30 females). The patient and control groups were subdivided into two subgroups according to the subject's reports about previous relational peer victimization. Immediate and delayed physiological (skin conductance level and heart rate) and affective reactions to social exclusion in a ball-tossing game (Cyberball) were recorded.

Overall, subjects' immediate reactions to social exclusion were an increase in skin conductance and a reduction of positive affect. Regardless of the diagnostic status, subjects with a history of relational peer victimization showed a blunted skin conductance response that was accompanied by a more intense self-reported affective change. However, the mood of the subjects with a history of peer victimization recovered during a 15 min waiting period. A diagnosis of social anxiety disorder did not affect the reactions to social exclusion on any measure.

In general, the findings of manuscript #3 suggest that physiological responses to acute social exclusion are mainly predicted by previous experiences of peer victimization rather than social anxiety. This finding provides support for the assumption that repetitive exposure to negative social experiences causes associative memory processing that may be considered as social traumatization. In accordance with Lang (1979), responses to a social situation that reminded subjects of earlier negative experiences were accompanied with altered physiological reactions.

However, the physiological response of subjects with a history of peer victimization

was, contrary to expectations, attenuated rather than increased. Thus, it may be speculated that repetitive emotional maltreatment accounts for changes in quality rather than intensity of physiological reactions. This assumption corresponds to recent studies reporting that histories of childhood maltreatment and relational peer victimization were associated with blunted cortisol responses to psychological stress and diminished reactions to direct endocrine challenges (Carpenter et al., 2007; Carpenter et al., 2009; Carpenter, Shattuck, Tyrka, Geracioti, & Price, 2011; Elzinga et al., 2008; Klaassens et al., 2009; Kraft & Luecken, 2009; MacMillan et al., 2009; Ouellet-Morin, Danese, et al., 2011; Ouellet-Morin, Odgers, et al., 2011; Tyrka et al., 2008).

Moreover, results of manuscript #3 contrast with previous findings indicating that social anxiety influences psychological and physiological reactions to socially threatening situations (Borland et al., 2004; Cornwell, Johnson, Berardi, & Grillon, 2006; Lissek et al., 2008; McTeague et al., 2009; Oaten et al., 2008; Zadro et al., 2006). This finding suggests that the association of social anxiety and pathological responses with social exclusion may be produced by experiences of emotional maltreatment rather than psychopathology per-se.

In line with previous studies, an increase in skin conductance immediately after the exclusion simulation was observed across all subjects. Kelly et al. (2012) proposed that these higher skin conductance levels are linked to stress associated with social pain, arguing that brain regions associated with increases in SCLs (i.e. anterior cingulated cortex; Nagai et al., 2004) are also activated when subjects experience social exclusion (Eisenberger et al., 2003). In accordance with Krimsky (2010), however, no differences in heart rate variability between included and excluded subjects were found.

In conclusion, experiences of social exclusion cause immediate physiological reactions. Although the effects of being rejected are not linked to psychopathology or previous social experiences in general, the extent and continuity of affective and physiological responses is determined by prior experiences of peer victimization rather than social anxiety.

2.3. Discussion and Outlook

The present research aimed to explore the consequences of emotional maltreatment on psychopathology. Because emotional maltreatment and social anxiety share the experience of negative evaluation, e.g., acts of being rejected, being laughed at, and verbal threats or aggression, as a key element, it was assumed that emotional maltreatment would be particularly associated with social anxiety disorder. In order to examine the mechanisms that link negative social experiences to symptoms of social anxiety, physiological reactions to a socially challenging situation were recorded. With respect to models of cognitive vulnerability (Beck, 2008; Beevers, 2005) that stress the importance of memory models of traumatic events (Foa & Kozak, 1986) and network models of emotional processing (Lang, 1979), it was suggested that repeated experiences of emotional maltreatment establish associative memory representations. As a consequence, physiological reactions to social rejection should be enhanced in subjects with a history of emotional maltreatment. Assuming that these associative memory representations link emotional maltreatment to social anxiety disorder, effects of experiences of emotional maltreatment were expected to be more intense in subjects with social anxiety disorder.

In a first step, the association of emotional maltreatment with social anxiety was examined. Results indicate a relation of childhood maltreatment with psychopathology, and in particular, social anxiety symptoms. Moreover, it was demonstrated that the relative impact of emotional forms of abuse and neglect might even be higher than indicated by previous research on child maltreatment, which had mainly focused on physical and sexual types of abuse and neglect. Moreover, emotional maltreatment mediated the association of physical maltreatment and social anxiety. In addition to emotional maltreatment through parents and other caretakers, reports of emotional peer victimizations were independently related to social anxiety symptoms. Thus, it was concluded that symptoms of social anxiety are mainly predicted by emotional types of victimization, either in childhood through the caretakers, or

during childhood and adolescence through peers.

As a second step, physiological reactions to social rejection were examined in healthy subjects. Previous reports of physiological outcomes were found to be ambiguous (e.g., Kelly et al., 2012; Moor et al., 2010; Murray-Close, 2011; Sijtsema et al., 2011), therefore, an exploration of bodily reactions has been required. The results of manuscript #2 suggest that social rejection evokes reactions of the autonomic nervous system apparent in accelerated heart rates. Although the effects of social rejection did not imply changes of skin conductance levels, it was concluded that the autonomic nervous system is affected by experiences of social exclusion indicating that behavior activation rather than inhibition is associated with socially threatening events.

After having established the link between social rejection and physiological reactions in manuscript #2, the main goal of manuscript #3 was to examine whether these reactions are affected by histories of emotional maltreatment and symptoms of social anxiety. Data suggested that reactions to an episode of social exclusion were primarily influenced by the degree of relational peer victimization rather than by the diagnosis of SAD. While an increase in skin conductance immediately after the exclusion was observed for all groups of subjects, this physiological response was attenuated among the subjects with a history of peer victimization.

In general, the results provided evidence for the existence and significance of associative networks and associative memory processing that is established by experiences of emotional maltreatment. In line with memory models of traumatic events (Foa & Kozak, 1986) and network models of emotional processing (Lang, 1979), a history of emotional maltreatment altered physiological reactions to a social challenge. After having demonstrated in manuscript #1 that experiences of emotional maltreatment place individuals at risk for symptoms of social anxiety disorder, manuscript #3 indicated that associative information processing may account for an enhanced cognitive vulnerability for social anxiety (Beck,

2008; Beevers, 2005).

Although the mechanisms involved remain uncertain, it may be speculated that altered physiological reactivity in subjects with a history of emotional maltreatment contributes to the development of social anxiety. This alteration can be depicted in an inverted U-shaped relationship of emotional maltreatment and physiological reactions. As shown in manuscript #2, social rejection is initially associated with enhanced bodily responses. When exposed to recurrent, highly intense, and prolonged emotional maltreatment, however, physiological responses shift to attenuated reactions (see manuscript #3). This environmentally induced alteration of stress responses may account for the development of symptoms of social anxiety. Physiological reactivity contributes to behavioral adaptation to changing environments (Lupien, McEwen, Gunnar, & Heim, 2009) and affects emotional responses to threats, decreased inhibition of socially inappropriate behaviors, and negative mood under stress (Het & Wolf, 2007; LeDoux, 2000; Oosterlaan, Geurts, Knol, & Sergeant, 2005). Most notably, diminished physiological reactivity reduces the ability to maintain engagement in social environments (Gunnar & Vazquez, 2001). As social interactions require an integration of several cognitive and affective processes, it was suggested that altered functioning of brain structures that are involved in stress responses might disenable emotionally maltreated subjects to establish positive social relationships (Ouellet-Morin, Odgers, et al., 2011). As a consequence, diminished physiological reactions to social challenges may not result from, but precede symptoms of social anxiety. Accordingly, the extent and continuity of physiological and affective responses to social rejection were determined by prior experiences of peer victimization rather than social anxiety in manuscript #3.

While findings of manuscript #2 indicated enhanced heart rate levels in response to social exclusion in healthy subjects, physiological reactions of emotionally maltreated subjects were attenuated in manuscript #3. This finding suggests that repetitive experiences of emotional maltreatment may produce a qualitative rather than quantitative change of the

autonomic nervous system in response to social challenges. This idea is consistent with a large number of previous studies finding that experiences of adverse life events were associated with diminished stress responses (e.g., Blechert, Michael, Grossman, Lajtman, & Wilhelm, 2007; Carpenter et al., 2007; Cuthbert et al., 2003; Elzinga et al., 2008; Heim, Newport, Bonsall, Miller, & Nemeroff, 2001; Heim, Newport, Mletzko, Miller, & Nemeroff, 2008; Lovallo, Farag, Sorocco, Cohoon, & Vincent, 2012; McTeague et al., 2010; Ouellet-Morin, Danese, et al., 2011; Ouellet-Morin, Odgers, et al., 2011; Tyrka et al., 2008). However, so far, it is unclear whether the reduction of physiological response is caused by a single mechanism that controls the different stress axes (Lupien et al., 2009; Schulkin, 2003), or whether a simultaneous change of the functioning of the single axes themselves, as currently discussed for the hormonal HPA axis (Heim et al., 2001; Heim et al., 2008; Taylor, Karlamangla, Friedman, & Seeman, 2011) is responsible for this effect. However, the qualitative difference of the responses indicates that it is too simplistic to assume a single conditioning or associative mechanism to explain the effects of repeated aversive experiences like peer victimization.

The present research emphasizes the role of emotional maltreatment in the processing of social interactions and the etiology of social anxiety disorder. However, future research is needed to further elucidate changes in physiological as well as neural circuits involved in the processing of social rejection that are caused by child adversities. In particular, different physiological components were affected by social rejection in the presented manuscripts. While manuscript #2 indicated changes of heart rate in response to social rejection, effects of emotional maltreatment were found for skin conductance levels rather than heart rate reactivity in manuscript #3. As manuscript #3 lacks a control group of non-excluded subjects, it may be speculated that skin conductance levels and heart rate reactions reflect different processes. Thus, future studies should aim to distinguish conditions of electrodermal and cardiac activation in response to social rejection.

Beyond that, the present research used levels of skin conductance and heart rate as markers for physiological reactions to social exclusion. Although skin conductance and heart rate reactivity are associated with changes in brain regions regulating the HPA axis, a more direct assessment of HPA axis responses (e.g., cortisol measures, RSA, fMRI) in patients with SAD would be desirable in further research. Subsequent studies should also address previous reports of phasic heart rate changes in the processing of social feedback (Crone et al., 2003; Somsen, Van der Molen, Richard Jennings, & van Beek, 2000; van der Veen, van der Molen, Crone, & Jennings, 2004). It may be assumed that heart rate reactions to social rejection also exhibit a phasic change. This assumption predicts that a deceleration of heart rate may be followed by an acceleratory recovery to baseline. This bi-phasic reaction would be consistent to the pattern of stress response to pictures of physical stress that also involves an initial orienting response characterized by a decrease of heart rate that is followed by an increase of arousal (Bradley, Codispoti, Cuthbert, & Lang, 2001; Bradley & Lang, 2000; Levenston, Patrick, Bradley, & Lang, 2000). It is noteworthy, however, that the Cyberball task as it was conducted in the present study is not able to trace such phasic changes appropriately as it does hardly allow to assess small and transient as well as more prolonged reactions simultaneously. Therefore, more research using more appropriate paradigms and time intervals is needed to trace potential phasic reactions to social rejection. However, it should be emphasized that social rejection paradigms that involve a direct social interaction are hardly to standardize (Weik et al., 2010). Additionally, findings of the present studies should be expanded using additional paradigms that involve direct communication, negative evaluation and rejection. One example would be the Trier Social Stress Test (TSST; Kirschbaum, Pirke, & Hellhammer, 1993), which has been shown to cause increases in heart rate and cortisol as well as subjective reports of psychosocial stress (Kudielka, Schommer, Hellhammer, & Kirschbaum, 2004).

Recent approaches to understanding the association between child maltreatment and the

development of psychopathology have emphasized the role of attentional systems and information-processing (Pollak, 2003). Accordingly, relative to non-abused controls, abused children have been demonstrated to disproportionately attend to threatening social cues. More specifically, abused children showed greater difficulties in disengaging attention from angry faces (Pollak & Tolley-Schell, 2003), and spent more attentional resources to processing of angry faces (Pollak, Cicchetti, Klorman, & Brumaghim, 1997; Pollak, Klorman, Thatcher, & Cicchetti, 2001). However, most studies reporting biases in information and attention processing focused on the consequences of physical abuse (Shackman, Shackman, & Pollak, 2007). Further research should therefore examine whether these findings can be transferred to non-physical types of maltreatment. For instance, it may be examined whether experiences of emotional maltreatment alter the processing of socially threatening words. Additionally, the influence of acute social rejection on attention processes should be examined.

Importantly, the findings of the present research highlight the role of emotional forms of abuse and neglect in the development of a wide range of psychological disorders. Besides the impact of emotional maltreatment on social anxiety, the present research suggested influences of emotional maltreatment on various types of psychopathology. Consistently, previous studies reported a prominent role of emotional maltreatment in predicting eating disorders, depressive symptoms and risky health behaviors (Gibb et al., 2007; Kent, Waller, & Dagnan, 1999; Rodgers et al., 2004). Wright et al. (2009) found high rates of dissociative, anxious and depressive symptomatology in a sample of college students who reported emotional abuse and neglect. Hence, emotional maltreatment is suggested to have negative implications on most domains of psychopathology. These findings establish a cross-diagnostical perspective on the consequences of emotional maltreatment. Assuming that experiences of emotional abuse and neglect account for various forms of symptomatology, it may be speculated that a plurality of patients would benefit from treatments that address these experiences. Therefore, the development of therapeutic interventions that combine disorder-specific treatments with

an approach that focuses on adverse life experiences including social trauma should be a main goal of future clinical research.

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