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Emotional effects and neural correlates of empathic paraphrasing in social conflict situations

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Abstract

The present thesis investigates the emotional effects as well as psycho-physiological and neural correlates of empathic and unempathic social response, with a focus on empathic paraphrasing in social conflict situations. Empathy has as yet almost exclusively been studied referring to the empathic experience of the sender (the person feeling empathy), neglecting the side of the recipient of empathic behavior. This omission seems unfortunate given that empathic social response, especially in the form of empathic paraphrasing, is a prevalent professional intervention technique in psychotherapy, counseling, and conflict resolution. It seems expedient to test the effects of a technique so widely used, so that it can be applied in a goal-oriented way.

Three consecutive studies explored the effects of empathic and unempathic social response on the feelings and emotions of the participants. In the first study, a behavioral pilot, participants were interviewed on a real-life social conflict and offered empathic paraphrases alternated with a neutral control condition. The second study provided first insight into neural correlates and furthermore compared the effects of emotionally vs. cognitively empathic response utilizing a controlled experimental setting. Finally, in the third study, participants were again interviewed on a real-life social conflict, this time inside the MRI scanner. All three studies revealed a positive short-term effect of both cognitively and emotionally empathic social response on emotional valence. Psychophysiological measures indicated that this positive influence on valence was accompanied by increased physiological arousal. Functional magnetic resonance imaging captured neural activation in fronto-parietal networks for the processing of empathic, and in fronto-temporal networks for the processing of unempathic social response.

The results show that professional intervention techniques such as paraphrasing, which demonstrate cognitive empathy only, without expressing sympathy or personal concern, can be effective in down-regulating negative feelings and emotions in difficult situations. Besides conflict resolution, counseling, and psychotherapy, this has implications for all professions dealing with highly escalated negative emotions on a regular basis, such as judges, lawyers, and physicians. Offering emotional empathy can be at odds with role expectations directed at these professions. However, cognitive empathy in the form of paraphrasing is almost always acceptable and, as shown in this thesis, also effective.

Zusammenfassung

Die vorliegende Dissertation untersucht die emotionalen Effekte sowie die psychophysiologischen und neuronalen Korrelate von empathischem und unempathischem verbalen Sozialverhalten, mit Fokus auf empathischem Paraphrasieren in sozialen Konfliktsituationen. Empathie wurde bisher beinahe ausschliesslich mit Blick auf den Sender (die Person, welche die Empathie empfindet) erforscht, wobei die Seite des Empfängers der empathischen Reaktion vernachlässigt wurde. Angesichts der Prävalenz von Empathiebasierten Interventionstechniken, insbesondere des empathischen Paraphrasierens, in Psychotherapie, Beratung und professioneller Konfliktlösung, sollte diese Forschungslücke geschlossen werden. Es scheint angezeigt, die Effekte einer derart verbreiteten Technik zu bestimmen, um einen zielgerichteten Einsatz derselben sicherstellen zu können.

Drei aufeinander aufbauende Studien untersuchten die Effekte von empathischen und unempathischen sozialen Reaktionen auf die Gefühle und Emotionen der Studienteilnehmer_innen. In der ersten Studie, einem Verhaltenspiloten, wurden die Studienteilnehmer_innen zu einem reellen persönlichen Konflikt befragt und abwechselnd mit empathischen Paraphrasen und einer neutralen Kontrollbedingung konfrontiert. Die zweite Studie gab über einen kontrollierten experimentellen Rahmen erste Einblicke in die entsprechenden neuronalen Korrelate und verglich die Effekte von kognitiv vs. emotional empathischen sozialen Reaktionen. In der dritten Studie schliesslich wurden die Teilnehmer_innen erneut zu einem reellen persönlichen Konflikt befragt, dieses Mal innerhalb des MRT Scanners. Alle drei Studien ergaben einen positiven kurzfristigen Einfluss von sowohl emotional als auch kognitiv empathischen sozialen Reaktionen auf emotionale Valenz. Psychophysiologische Messungen zeigten, dass dieser positive Valenzeffekt von erhöhter autonomer Aktivierung begleitet wurde. Funktionelle Magnetresonanztomografie wies auf Aktivierungen in fronto-parietalen Netzwerken für die Verarbeitung empathischer Reaktionen, und in fronto-temporalen Netzwerken für die Verarbeitung unempathischer Reaktionen hin. Die Ergebnisse zeigen, dass professionelle Interventionstechniken wie Paraphrasieren, weder Sympathie noch persönliche Betroffenheit ausdrückend, in der extrinsischen Regulation negativer Gefühle und Emotionen effektiv sein können. Neben Psychotherapie, Beratung und professioneller Konfliktbearbeitung hat dies auch Implikationen für sämtliche Berufsgruppen, die regelmäßig mit hoch eskalierten negativen Emotionen konfrontiert sind, z.B. Richter_innen, Anwält_innen oder Ärzt_innen. Klient_innen gegenüber emotionale Empathie zu zeigen kann sich unter Umständen mit den

Rollenerwartungen an diese Berufsgruppen beißen. Kognitiv empathische Verhaltensweisen wie z.B. Paraphrasieren sind jedoch fast immer sozial akzeptiert und, wie in dieser Dissertation gezeigt, ebenfalls effektiv in der Deeskalation negativer Gefühle und Emotionen.

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Introduction

1.1. Empathic paraphrasing in conflict resolution

Showing empathy is a highly relevant social interaction pattern, and yet it is one that has almost exclusively been studied with a focus on the sender (i.e. the person feeling empathy for someone else), neglecting the effects on the recipient. What are the effects of empathic social responses on the feelings and emotions of the recipient of such responses, and do cognitively and emotionally empathic social responses exert the same effects on the recipient? This important aspect of social interaction has been widely neglected in social neuroscience research to date.

Empathic social response is crucial in most psychotherapeutic approaches as well as in conflict resolution. One of the main standard techniques in Alternative Dispute Resolution (ADR) practices, such as mediation, is empathic paraphrasing or active listening (Kraybill et al., 2001), which goes back to Carl R. Rogers Person-Centered Approach (Rogers, 1942; 1951). In its first, purely fact-based form, paraphrasing dates back to the Hellenistic rhetorical education in ancient Greece, and is still taught in rhetoric as a means to avoid misunderstandings through reflecting back a message in different words. Empathic paraphrasing, as it is used in ADR, involves mentally reconstructing an interlocutor´s thoughts and feelings and summarizing these in one´s own words, thereby demonstrating that one can follow the interlocutor´s perspective, without expressing sympathy or personal distress (e.g. "I understand that you are upset because you feel you have not been treated fairly"). Seen through the lens of the classic – though often criticized - transmission model of communication (Shannon & Weaver, 1949), paraphrasing would represent the receiver decoding the sender´s message and reflecting back their understanding in a feedback loop. A less mechanical explanation can be found in the phenomenological tradition of the communication theory field, in which Carl R. Rogers has been included, and which theorizes communication as dialogue or experience of otherness. In this tradition, the fundamental problem in communication is rooted in inter-subjective understanding (Craig, 1999). Theories in this tradition assume that people actively interpret and assign meaning to what happens around them, and this interpretation then constitutes that person´s reality (Littlejohn & Foss, 2011). Following this line of thought, empathic paraphrasing may be seen as a) an active and conscious attempt of a listener to tap into an interlocutor´s personal reality, and b) an accuracy check of that attempt through a feedback loop.

Active listening, i.e. empathic paraphrasing, features prominently in several schools of psychotherapy, especially in Humanistic therapy approaches, for instance in Process-Experiential / Emotion Focused Therapy (PE-EFT; Elliott & Greenberg, 2007), which combines Person-Centered, Gestalt, and existential therapy approaches; Family Focused Therapy for bipolar disorder (Miklowitz, 2006), as well as marital counseling and couple´s therapy (Stanley et al., 1999).

Despite the high prevalence of empathic paraphrasing in conflict resolution as well as in psychotherapy, its psychological effects on the recipient, as well as its psycho-physiological and neural correlates, have never been systematically investigated to date. The present research project aims to provide research groundwork on this topic in both experimentally controlled and real-life social interaction settings.

1.2. Intrinsic and extrinsic emotion regulation

One of the purposes of paraphrasing in mediation, besides structuring the conversation, is often to de-escalate the usually highly charged emotional situation of the disputants. Hence, when interested in the psychological effects of this technique, it seems expedient to investigate it within the framework of emotion regulation.

In the last few years, researchers in emotion regulation have started to expand their scope from a hitherto mainly individual-focused perspective (*intrinsic emotion regulation*) to a more comprehensive one, including social and interactive processes of emotion regulation. Nonetheless, 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. Rimé (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. A classification system for controlled interpersonal affect regulation strategies (differentiating between strategies used to improve versus those used to worsen others' affect, and between strategies that engaged the target in a situation or affective state versus relationship-oriented strategies) can be found in Niven, Totterdell, and Holman (2009).

Emotion generation has been mainly associated with amygdala, ventral striatum, ventromedial prefrontal cortex (vmPFC), and insula. The intrinsic cognitive regulation of emotion draws on dorso- and ventrolateral prefrontal coretx (dlPFC, vlPFC), inferior parietal lobule, dorsal regions of the anterior congulate cortex (dACC), and dorsomedial prefrontal cortex (dmPFC).

Intermediary or not yet clearly defined roles in this process are played by vmPFC/mOFC, superior- and middle temporal gyrus (STG/MTG), temporal poles (TP), and temporal parietal junction (TPJ) (Ochsner et al. (2012).

1.3. Empathy and effects of empathic behavior

Paraphrasing is a form of verbally expressing empathy with a focus on perspective taking, i.e. cognitive empathy. Definitions of empathy in research literature are plentiful. Within the field of social neuroscience, empathy is usually differentiated into cognitive empathy, emotional empathy, and motor empathy (Blair, 2005). Cognitive empathy, also called theory of mind, means the ability to recognize another person's mental and emotional state as well as behavioral dispositions by abstract inference (Bzdok et al., 2012). Emotional or affective empathy refers to an observer's emotional response to another person's emotional state (Dziobek et al., 2008). Motor empathy is the tendency to automatically mimic and synchronize facial expressions, vocalizations, postures, and movements with those of another person (Blair, 2005). It has been argued that cognitive empathy and emotional empathy constitute two independent systems with dissociable neuroanatomical bases (Fan et al., 2011). Emotional empathy has been proposed by some authors to rest on emotional contagion and motor simulation drawing on the putative mirror neuron system (MNS), whereas cognitive empathy engages the mentalizing network, comprising the bilateral vmPFC/dmPFC, precuneus, TPJ, TP, MTG, posterior superior temporal sulcus (pSTS), inferior frontal gyrus (IFG), and right MT/V5 (Bzdok et al., 2012). The putative human MNS has been located in pars opercularis of the IFG, the anterior part of the inferior parietal lobule, and the STS (Rizzolatti and Sinigaglia, 2010).

Verbal demonstrations of empathy can take the emotional or the cognitive route. Emotional empathy can be verbally expressed through voicing emotional resonance to another´s distress. Cognitive empathy can be verbally expressed through summarizing an interlocutor's thoughts and feelings in one's own words (i.e., paraphrasing).

It has been shown that interpersonal mimicry, i.e. synchronizing one's facial expression with an interlocutor (motor empathy), can increase affiliation, positive social judgment, and pro-social behavior not only towards the mimicker but also towards other people (Fischer-Lokou et al., 2011; van Baaren et al., 2004). In addition, language style matching, i.e. similarity in the use of function words, can predict relationship initiation and stability (Ireland et al., 2011). These findings demonstrate that empathic social behavior can generate changes in emotional experience and social response of the individual being empathized with. On the other hand, it seems unlikely that an interlocutor's empathic response alone (without cognitive reframing) leads to lasting emotional recovery of the recipient in the face of emotional distress. (Nils and Rimé, 2012; Rime, 2009). Nonetheless, empathic responses can buffer distress directly after an emotional event and help to build the necessary trust basis and rapport to enable effective cognitive work (Nils and Rimé, 2012). Further empirical support for the importance of perceived empathic behavior on therapeutic success comes from both psychodynamic and cognitive-behavioral psychotherapies (Bohart et al., 2002; Elliott et al., 2011; Norcross and Wampold, 2011), as well as from the field of medical care (Neumann et al., 2009).

2. Study questions and hypotheses

The main purpose of the present thesis was to explore the emotional effects of empathic paraphrasing in the context of social conflict, and thereby to put to the test a widely used intervention technique of ADR. Previous studies have demonstrated that empathic social behavior can have an effect on the recipient of that behavior. However, the neural and psychophysiological correlates of the processes triggered by empathic social response remain entirely unknown. Neither have cognitively and emotionally empathic social response been directly compared yet, nor have the effects of empathic paraphrasing as a specific empathy-based intervention been systematically investigated.

We hypothesize that processing empathic social response on the recipient´s side involves the processing and appraisal of social stimuli, social cognition, as well as self-reflective awareness and emotional response. It can be assumed that processing empathic and unempathic social responses will partially draw on neural regions involved in social cognition because the individual receiving these responses contemplates their meaning and adequacy as well as intention and sincerity of the speaker. Social cognition is the acquisition of knowledge about other persons' mental states as well as insight about the meaning of their behavior and verbal expressions (Przyrembel et al., 2012) and has been presumed to recruit the mentalizing network, shared networks as well as the putative MNS (Bernhardt and Singer, 2012).

Specifically, the studies presented here investigate three main questions.

2.1. Can negative feelings and emotions be influenced by empathic social response? (studies 1, 2, 3)

Hypothesis: Negative feelings and emotions (including in social conflict situations) can be positively influenced by both cognitively and emotionally empathic social response. This can be shown through self-reported emotional valence as well as psycho-physiological measures.

2.2. What are the neural correlates of processing empathic and unempathic social response? (studies 2, 3)

Hypothesis: At the neural level, processing empathic and unempathic social response engages social cognition networks*,* regions associated with self-reflective awareness, as well as emotion generation and processing networks.

2.3. How do cognitively and emotionally empathic social responses compare in neural correlates and emotional effects on the recipient? (study 2)

Hypothesis: As cognitive and emotional empathy draw on partially different neural systems on the experiential level, the same is expected for processing cognitively and emotionally empathic social response.

3. Methods and data analysis

Three logically consecutive studies were implemented to investigate these questions. The first was a behavioral study on real-life social conflict aimed at providing first evidence of emotional effects caused by empathic social response. The second study took the research questions into the MRI, while still utilizing a controlled experimental design to lay the foundation for more field-related research and to compare the effects of cognitively and emotionally empathic response. Building on the previous two, the third study broke new ground by implementing online interviews on real-life social conflict inside the MRI scanner.

The emotional effects of empathic and unempathic social response were examined through self-report valence ratings (studies 1, 2, 3), and psycho-physiological measures such as skin conductance response (SCR, studies 1, 2, 3), pulse/heart rate (HR, studies 1, 2), blood volume pulse (BVP, study 1), respiration (study 2), as well as voice analysis (study 1). Neural correlates were detected through hemodynamic response in functional magnetic resonance imaging (fMRI, studies 2, 3).

3.1. Participants

All studies were carried out in accordance with the Declaration of Helsinki and were approved by the ethical committee of the Charité Universitätsmedizin Berlin. Exclusion criteria in all three studies were psychiatric, neurological, or cardiological diseases, surgery performed on head, heart, or eyes, metal chips or implants, vessel clips, pregnancy, severe allergies and claustrophobia, as well as left-handedness. The three studies were done on different subjects. Twenty subjects [10 female; age: mean (M) = 27, standard deviation (SD) = 7.9] participated in study 1. 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. Study 2 was performed on 20 subjects [10 female; age: mean (M) = 26, standard deviation (SD) = 5.0]. 22 subjects [11 male; age: mean (M) = 36, standard deviation (SD) = 16] participated in study 3. Four subjects had to be excluded from fMRI data analysis due to head movement exceeding 3 mm. Hence, in study 3, 22 subjects entered analysis of behavioral and physiological data, and 18 subjects were included in fMRI analysis. All participants were native German speakers, and participants for studies 1 and 3 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 studies.

3.2. Study design

3.2.1. Study 1: Behavioral study on real-life social conflict

Study 1 consisted of an interview on a real-life social conflict the participants were currently experiencing or had recently experienced. Participants were told that the study investigates emotion in social conflict and that the interviewer would try to understand the participant´s 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 about the conflict situation and interaction with the other party. 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 feelings (valence). Interventions and control intervention were given alternately. Paraphrasing 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. All interviews were audiotaped. Interview length was 30.16 min on average (SD = 11.03). SCR and BVP were recorded with *Biofeedback* 2000$^{\text{X-pert}}$ (Schuhfried GmbH, Austria) during the entire interview.

3.2.2. Study 2: fMRI controlled experiment

Study 2 consisted of an fMRI experimental paradigm deploying a cognitive task (solving anagrams) combined with negative performance feedback to induce negative feelings and emotions. In addition, a high-level baseline condition with positive feedback was included. The negative feedback was followed by either empathic or unempathic interventions. Positive feedback was followed by empathic interventions only. Half of all interventions featured cognitive and half deployed emotional empathy / non-empathy, resulting in a 2 x 2 experimental design (empathy x empathy type) plus a high level baseline. Hence, four types of interventions were given: Cognitive Empathic (CE), Cognitive Unempathic (CN), Emotional Empathic (EE), Emotional Unempathic (EN). This design allowed us to compare the effects of empathic responses with unempathic responses, as well as with a baseline where no negative feelings and emotions were experienced by participants. The interventions were audio-taped and presented acoustically as well as visually. Each participant was given half of the interventions by a male speaker, and half by a female speaker. Participants were presented with the anagram task and had to choose the correct solution in a maximal time frame of 6 seconds. Each trial consisted of the anagram task, followed by negative or positive feedback, followed by an intervention, and concluded by a rating phase during which participants rated their present feelings (valence). In total, the experiment comprised 108 trials presented in randomized order over two separate runs. Total time spent in the scanner was 57 minutes. Pulse was recorded by a pulse plethysmograph placed on the left-hand thumb. Respiration was measured by a respiratory belt placed around the lower rips of the subject. SCR was detected using an MR-compatible ExG-amplifier (Brain Amp ExG MR, Gilching, Germany).

3.2.3. Study 3: fMRI interview on real-life social conflict

Study 3 replicated study 1 in the MRI scanner, utilizing a different control condition. Subjects were told that the study investigated emotional experience during the narration of a social conflict as well as emotional reactions to particular response modes of an interaction partner. They were informed that the interviewer would sometimes summarize the narrator's perspective, while at other times she would deliberately say that she could not relate. They were repeatedly reminded to keep their head as still as possible while speaking in the MRI scanner, and to avoid nodding or shaking their heads in response to the interviewer speaking. The interview consisted of twelve standardized open questions pertaining to the conflict situation and interpersonal interaction patterns. Half of the questions were followed by different standardized unempathic interventions expressing lack of understanding for what the participant had said. The other half of the questions were followed by individualized paraphrasing of what the participant had said. Paraphrasing interventions and unempathic interventions were randomized for each participant. The interviews took place in the scanner, lasting 25 min on average (M = 25.18; SD = 4.86). During the interview, SCR was detected using an MR-compatible ExG-amplifier (Brain Amp ExG MR, Gilching, Germany). After the interview, participants listened to the audiotape of their interview and rated how well understood and how positive or negative they had felt during each moment of the interview (valence).

3.3. Behavioral measures (valence ratings, questionnaires)

Valence ratings were obtained on an eight-point Likert scale from -4 to 4 in studies 1 and 2. In study 3, participants were presented with a two-dimensional visual analog scale with *feeling understood* on the x-axis, and *valence* on the y-axis. Participants also completed a battery of questionnaires to control for and test effects on a variety of variables that are described in the original publications.

All behavioral data were analyzed in IBM SPSS Statistics 20. For the valence ratings, two-tailed t-tests for repeated measures were used in studies 1 and 3. In study 2, valence ratings were analyzed with repeated measures ANOVAs. In addition, pre–post-intervention comparisons of feeling understood and emotional valence were conducted with repeated measures ANOVA in study 3.

3.4. Psycho-physiological measures (SCR, HR/pulse, BVP, respiration, voice 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). Similarly, tidal volume has been shown to decrease and respiration rate to increase with negative emotion such as anxiety (Kreibig et al., 2007), while pleasant emotions and relaxation decrease respiration frequency and increase tidal volume (Masaoka et al., 2005; 2012). 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).

In study 1, SCR was analyzed in a time frame of 25 s after the onset of the intervention or control intervention; BVP amplitude and HR were analyzed in a time frame of 23 s, also during the (control) intervention phase, and 4 s of the following question phase. Intervals of participants' responses to (control) interventions for voice analysis were selected manually in Audacity 1.2.6 and analyzed using seewave in R statistics. In study 2, the time frame for SCR, pulse, respiration rate, and tidal volume were the feedback and the intervention phases, each comprising 6 s. In study 3, SCR was analyzed within 7.5 s after (control) intervention onset.

In all studies, SCR data were prepared in Ledalab V3.3.1; all other psycho-physiological data were prepared in Matlab 7.1 (Mathworks Inc., Sherborn, MA, USA) and analyzed with two-tailed t-tests for repeated measures (studies 1, 3) or repeated measures ANOVAs (study 2) in IBM SPSS Statistics 20.

3.5. Functional magnetic resonance imaging (fMRI)

BOLD responses were modeled following the general linear model approach in SPM5, (Wellcome Dept. of Imaging Neuroscience, London, UK), with seven event-related regressors of interest in study 2 (positive /negative feedback, and interventions sorted by the five conditions). In study 3, two separate models were used, one following the structure of the interview with five block-related regressors of interest, the other one following the participants' ratings of valence and feeling understood (parametric regressors). Data were entered into repeated measures ANOVAs employing a flexible factorial design. In study 2, only clusters larger than 20 voxels and meeting a threshold of $p<0.05$ (FWE-corrected) are reported. For study 3, all reported activations survived a threshold of $p<.05$ after cluster-wise and family-wise error corrections for multiple comparisons over the entire brain at a cluster-defining threshold of $p < .001$, uncorrected.

4. Results

4.1. Behavioral results

In all three studies, participants reported less negative feelings during / after the empathic intervention, both in comparison to unempathic interventions (study 2: [main effect of empathy: $F(1,19)=15.014$, $p <0.001$]; study 3: [$t(21) = 5,48$; $p <0.001$]) and the neutral control condition (study 1: [$t\ (19) = 3.395$,$p <0.005$; effect size $d = 0.76$]). In addition, in study 3, participants felt more positive after compared to before empathic paraphrasing [$t(21) = 5.11$, p

<0.001], and more negative after the unempathic response compared to before [$t(21) = 2.32$, $p<0.05$]. Study 2 showed that the positive effect on participants' feeling was stronger for emotionally empathic response [$t(19)= 5.122$, $p<0.001$, effect size $d=1.15$] than for cognitively empathic response [$t(19)= 2.410$, $p<0.05$, effect size $d=0.54$], but both types of empathy achieved a significant and large effect.

4.2. Psycho-physiological results

Contrary to our initial hypothesis, SCR and HR data indicated that autonomic arousal was in fact higher during empathic paraphrasing than during unempathic interventions (study 1: SCR [t (15) = 2.589; p = 0.021; effect size d = 0.65]; HR [t (16) = 6.491; p = 0.000; effect size d = 1.57]; study 3: SCR [$t(21) = -2.15$; $p = 0.0449$]). Also, in study 1, BVP amplitude was lower during paraphrasing than during the control condition [t (16) = 2.119; p = 0.050; effect size d = 0.51], and also lower than during the subsequent interview question [t (13) = 2.381; p = 0.033; effect size d = 0.64]. Study 1 furthermore showed that mean intensity/volume of participants' voices was lower when they replied to an interview question following a paraphrase [$t(15)$=2,466; $p<0.05$; effect size d=0.62].

On the other hand, in study 2, tidal volume was larger during empathic interventions, both compared to unempathic interventions [main effect of empathy: $F(1,17)$=8,105, p=0.011], and to preceding negative performance feedback [cognitive empathy: $t(17)$= -3,681, p=0.002; emotional empathy: $t(17)$= -4,355, $p<0.001$]. Hence, participants breathed more shallowly when being given negative feedback or unempathic interventions, and more deeply when offered empathic responses.

4.3. fMRI results

In both fMRI studies, empathic social responses engaged fronto-parietal networks, while unempathic responses activated fronto-temporal networks.

In study 2, emotionally empathic comments induced activity in the left mOFC and left SPG. Cognitively unempathic comments activated the medial-orbital part of left SFG. All unempathic comments combined were processed in left STG and right putamen. When empathic interventions were contrasted against the high-level baseline condition, activity was found in right postcentral gyrus and left cerebellum. When separated into cognitive and emotional empathy, cognitively empathic comments contrasted with unempathic comments revealed activity in right postcentral gyrus and left cerebellum. Right precentral gyrus, left cerebellum, left opercular IFG, and left MTG responded to emotionally empathic interventions.

In study 3, contrasting paraphrasing with the unempathic intervention showed three clusters with peak activations in the right PrG, left MFG, and left IPG. The largest cluster peaked in the right PrG and comprised the right PoG, MeFG, bilateral supplementary motor area (SMA), and precuneus. The second cluster included the left MFG, left PrG/PoG, and left SFG. The third cluster peaked in the left IPG and expanded on the left SPG, precuneus, cingulate gyrus, left PoG, frontal lobe and paracentral lobule. To allow for the possibility that effects of paraphrasing might unfold over a longer period of time than the actual speaking time slot of the paraphrase, we also contrasted subjects answering periods following a paraphrase with answering periods following an unempathic intervention. This activated a large cluster with its peak in the right PoG, extending to the parietal, temporal and occipital lobes, cerebellum, precuneus, PrG, fusiform gyrus, angular gyrus, parahippocampal gyrus, The combined contrast of unempathic intervention + subject speaking after unempathic intervention over paraphrasing + subject speaking after paraphrasing showed activity in the right TP, extending to the STG, MTG and amygdala. Feeling ill understood in contrast to feeling understood (continuous model) activated five clusters with peaks in the IFG, left TP, left Heschl gyrus, IFGTr, and right precuneus.

Contrasting cognitively with emotionally empathic responses in study 2 yielded stronger activity in mOFC for emotionally empathic response. Contrasting unempathic interventions only, cognitively unempathic interventions activated right MFG, and emotionally unempathic interventions activated left / right STG.

5. Discussion

5.1. Extrinsic emotion regulation through empathic social response

As hypothesized, the studies showed that feelings and emotions in social conflict situations can be positively influenced by empathic social response. This effect was visible in direct comparison of valence ratings during and after paraphrasing and unempathic / control interventions as well as in pre–post-intervention ratings in study 3. Also, the relatively high effect sizes suggest that the effect is strong and practically relevant. This self-reported valence effect is also consistent with participants' lower voice intensity after paraphrasing compared to the control condition in study 1. Banse and Scherer (1996) have linked high voice intensity with negative affects or aggressive speaker attitudes. Hence, it may be assumed that the lower voice intensity after paraphrasing indicates reduced negative affect or reduced aggression compared to the control condition.

At the same time, and contrary to our expectations, SCR, HR, and BVP amplitude indicate higher autonomic activation during paraphrasing (study 1, 3). Here, it should be kept in mind that these measures were obtained during the intervention, while voice intensity was captured afterwards. It is therefore quite possible that participants were experiencing different states of autonomic arousal and possibly even emotional valence when these different measurements were taken. A possible explanation for the unexpected autonomic arousal during the empathic interventions might be that paraphrasing sets in motion a cognitive–emotional process which initially heightens emotional arousal and engagement by promoting a more concise focus on emotional and potentially unpleasant issues connected to the social conflict which might otherwise be ignored or remain fuzzy. In the long run, this process might contribute to a beneficial resolve of negative emotions connected to the social conflict, provided paraphrasing is complemented with cognitive reframing. This idea is roughly in line with Rogers' original claim of the supposedly empowering and growth-inspiring effects of empathy in Client-Centered Therapy (Rogers, 1942, 1951). However, our study design focused on short-term emotional effects and thus has to leave the investigation of this idea to future studies with a longer-range design. Also, the psycho-physiological results of study 2 are not perfectly compatible with the findings of the other two studies. Here, tidal volume data are inconsistent with the idea that autonomic arousal was higher during empathic compared to unempathic interventions. It is however unclear if these results reflect autonomic arousal or emotional valence, as tidal volume has been associated with both emotional valence and relaxation (Kreibig et al., 2007; Masaoka et al., 2012). Also, it should be kept in mind that study 2 employed a controlled experimental design, as opposed to the half-structured interview form of the other two studies. Therefore, empathic interventions had to be given in standardized form for all participants, which quite possibly does not quite produce the same results as a natural and tailored empathic response in a real-life conversation.

In sum, the psycho-physiological correlates of processing empathic social response seem to be quite complex and should be investigated further. The present results provide first indication that empathic paraphrasing sets in motion a strong and interesting psycho-physiological response in the recipient, which makes it a valuable professional technique for promoting psychological change.

Of course, paraphrasing is not the only possible way of providing an empathic social response. Empathy can also be conveyed nonverbally, for instance through mimicry, body language, or voice modulation. It has already been mentioned that mimicry has been found to increase affiliation, positive social judgment, and pro-social behavior. When measuring participants’ willingness to consider their respective disputant´s perspective on the conflict, we were unable to find a difference after receiving a paraphrase vs. a control intervention (study 3). Hence, it might seem that paraphrasing does not produce similar pro-social effects, although our studies cannot suffice to reject this claim. In view of this asymmetry, it may not be expedient to transfer the present results to nonverbal empathic social response at this point. However, other verbally empathic social responses, cognitive as well as emotional, can very well be assumed to produce similar effects on feelings and emotions of the recipient as have been measured for empathic paraphrasing.

5.2. Neural correlates of processing empathic social response

Processing empathic social response was hypothesized to engage social cognition regions, i.e. neural clusters associated with mentalizing or the putative mirror neuron network. Social cognition regions were hypothesized to play a role in the processing of empathic and unempathic comments in relation to participants assessing the interviewer's intentions and thought processes. In line with this assumption, in study 3, paraphrasing engaged a frontal-parietal network with peak activations in the right PrG, left MFG, left IPG, and right PoG, while unempathic responses engaged a frontal-temporal network with peaks in the left IFGTr and right TP, extending to the amygdala. Hence, both interventions differentially drew on social cognition regions. In addition, feeling ill understood as a presumed active factor in the effects of unempathic comments engaged the IFG and IFGTr, left TP, and right precuneus, all of which are part of the mentalizing network. Located in the medial parietal cortex, the precuneus is also part of a neural network of self-consciousness, involved in self-related mental representation during resting states (Cavanna and Trimble, 2006), self-reflection and episodic memory retrieval with self-representation (Kjaer et al., 2002; Lou et al., 2004), as well as awareness and conscious processing of visual and verbal stimuli (Kjaer et al., 2001; Vogt and Laureys, 2005). The activations elicited by feeling ill understood further extended to core regions for emotion generation and processing, i.e., the insula, amygdala, putamen, hippocampus, IFG, OFC, STG/MTG, ACC/PCC/MCC, and TP (Kober et al., 2008; Ochsner et al., 2012). Together with the negative valence ratings, the consistent involvement of these regions in processing unempathic interventions as well as in feeling ill understood suggests that the interviewer's unempathic responses resulted in distinct negative emotional experiences in participants, even though the unempathic response merely consisted of statements like “I cannot understand what you are going through right now.” Consistent with that idea, in study 2, processing empathic response activated mOFC and SPG. The mOFC is part of the reward network and central for hedonic experience (Kringelbach, 2005). The engagement of mOFC in the processing of empathic comments in this study cannot be regarded as evidence that being empathized with held a rewarding value for participants, as there was no correlation between emotional valence ratings and mOFC activation. However, it should be noted that feeling understood has recently been shown to activate regions associated with reward and social connection (ventral striatum and middle insula) in a similar study, whereas not feeling understood engaged the anterior insula, which has been linked to negative emotions (Morelli et al, 2014).

In line with our results, Morelli et al. (2014) likewise found that both feeling understood and not feeling understood activated parts of the mentalizing system, although the precise location of the activations differed (feeling understood: precuneus and TPJ, not feeling understood: dmPFC). It seems likely that the emotional impact of empathic comments depends significantly on their sincerity as well as their suitability to the given situation. Therefore, it can be assumed that hearing empathic statements fuels social judgment and inference processes. Empathic comments did not recruit the complete mentalizing network, however. Rather, empathic social responses appear to stimulate social-cognitive processes partly relying on mentalizing regions, while simultaneously invoking emotion processing regions. Both our studies suggest the significance of a fronto-parietal network for the neural processing of empathic social behavior, and a fronto-temporal network associated with the processing of unempathic social response. Future research will hopefully solidify and complement these findings to the effect of integrating a working model of how (un-) empathic behavior is processed on the side of the recipient into the existing models of empathy.

5.3. Cognitively vs. emotionally empathic response

In all three studies, cognitively empathic response had a beneficial effect on participants' feelings and emotions, although study 2 suggests that this effect is slightly weaker than that of emotionally empathic response. This is particularly interesting because cognitive empathy in the form of paraphrasing does not offer any emotional sympathy, nor does it entail agreeing with the narrator's point of view. Accordingly, the mere process of intent listening and cognitively following the narrator's perspective without consenting to it already brings about a beneficial effect on the narrator's emotional state in a negatively charged situation.

At the neural level, cognitively and emotionally empathic responses engaged partially different networks (study 2). Both stimulated cerebellar and post-/precentral activity, but emotional empathy in addition yielded activations in left IFG (opercular part), and left MTG. Emotionally empathic comments may have been evaluated as more salient or socially relevant by participants, which would explain the increased involvement of social cognition regions. However, as these activations resulted from a comparison with the high-level baseline condition and not a direct contrast of emotional and cognitive empathy, it is difficult to draw conclusions on this basis. In direct comparison with cognitive empathy, emotionally empathic response predominantly invoked the left mOFC.

6. Conclusion and outlook

Besides providing first evidence on neural and psycho-physiological correlates of processing empathic and unempathic social response, the present research has shown that empathic paraphrasing is effective in regulating the feelings and emotions of someone struggling with social conflict. As this thesis is dealing with new ground and is therefore largely exploratory, the results need to be confirmed by other studies. Future research should also investigate long-term emotional consequences of empathic social response, as well as the interplay between emotional buffering through empathic response and lasting psychological change, for instance through cognitive reframing.

The present results have potential implications for psychotherapy, conflict resolution and other professional settings dealing with highly emotional conflicts on a regular basis, e.g. court or medical procedures. In certain settings, professionals can be limited by their role when it comes to offering emotional empathy to agitated parties, for instance because they have to remain impartial in their dealings with several disputants. However, cognitive empathy in the form of paraphrasing is almost always acceptable. Our results show that this rather professional type of empathic behavior can be sufficient to buffer emotional distress, at least temporarily.

In conflict resolution settings such as mediation, paraphrasing is regularly used as a core technique to structure conversation and foster empathic dialog. The present research project put this technique to the test and yielded supportive results with regard to the effectiveness of paraphrasing, i.e., cognitive empathy, in buffering negative emotion. Based on these results, it may be suggested that paraphrasing be used more deliberately to de-escalate negative feelings and emotions in conflict mediation. As yet, many mediators are not aware of the regulative potential of empathic paraphrasing on emotions, and may therefore miss opportunities to de-escalate emotionally intense situations because they see paraphrasing merely as a dialog structuring tool. In psychotherapy, empathic paraphrasing can be deployed as an initializing basis for other, more change-oriented interventions, which may benefit from the positive emotional effect of paraphrasing, as well as from the heightened level of autonomic arousal that may support psychological openness to change. Also, paraphrasing might be deliberately used in psychotherapy when the client displays resistance to more confrontational or re-directing techniques or when the therapeutic relationship seems to falter. Paraphrasing can act as a parachute to fall back on when things go bad or emotions boil up too high, and, depending on the directivity of the paraphrase, may even trigger new insights. Different types of paraphrases may vary in their directivity, e.g. the amount to which a paraphrase aims at clarifying and sharpening what the client said as opposed to merely repeating it in different words. In the present studies, the interviewer always tried to listen “between the lines” and work towards greater clarity, which can include paraphrasing something the client only hints at, communicates through body language, or may even not be entirely clear on themselves. It is very possible that this type of paraphrasing exerts different effects from both one merely restating exactly what the client said, as well as from more directive paraphrases actually concealing an intervention. Antaki et al. (2005) point out that gist formulations of both what the client said and its implications offer an ideal vehicle for bringing out the elements of the situation which imply diagnosis, as well as providing for a transition between history-taking and psychotherapeutic interpretation, and that the format of paraphrase can even mask the non-neutrality of an intervention. Applied in this manner, a paraphrase loses its characteristic of pure wanting-to-understand and lends itself to subtly conveying covert challenges, corrections, extensions, and interpretative statements. Future research on empathic paraphrasing should take a closer look at the effects of paraphrases with varying degrees of directivity. In this respect, it may also be of interest to examine the effects of different wording pertaining to openness or rigidity of interpretations. Nugent and Halverson (1995) found that paraphrases pre-supposing that the client´s perspective is certainly correct can cause increased feelings of anger, anxiety, and depression in comparison to paraphrases that remain neutral or hint at the possibility of an alternative interpretation of the situation causing the distress. This effect was attributed to the possibility that a client´s maladaptive cognitive representation of the situation in question may be fortified by a paraphrase that does not leave open the possibility of a different interpretation. The type of paraphrasing used in the present studies was neutral in this respect, always using expressions like “from your perspective it seems like…” etc., which is a necessary precondition for following up empathic social response with cognitive reframing, and thereby promoting lasting psychological change and the freedom to act differently in the distressing situation. However, if paraphrasing is not done in this way, it may actually cause more harm than good, as the above-cited work suggests.

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Effects of empathic paraphrasing – extrinsic emotion regulation in social conflict

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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$^{\text{X-pert}}$, 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

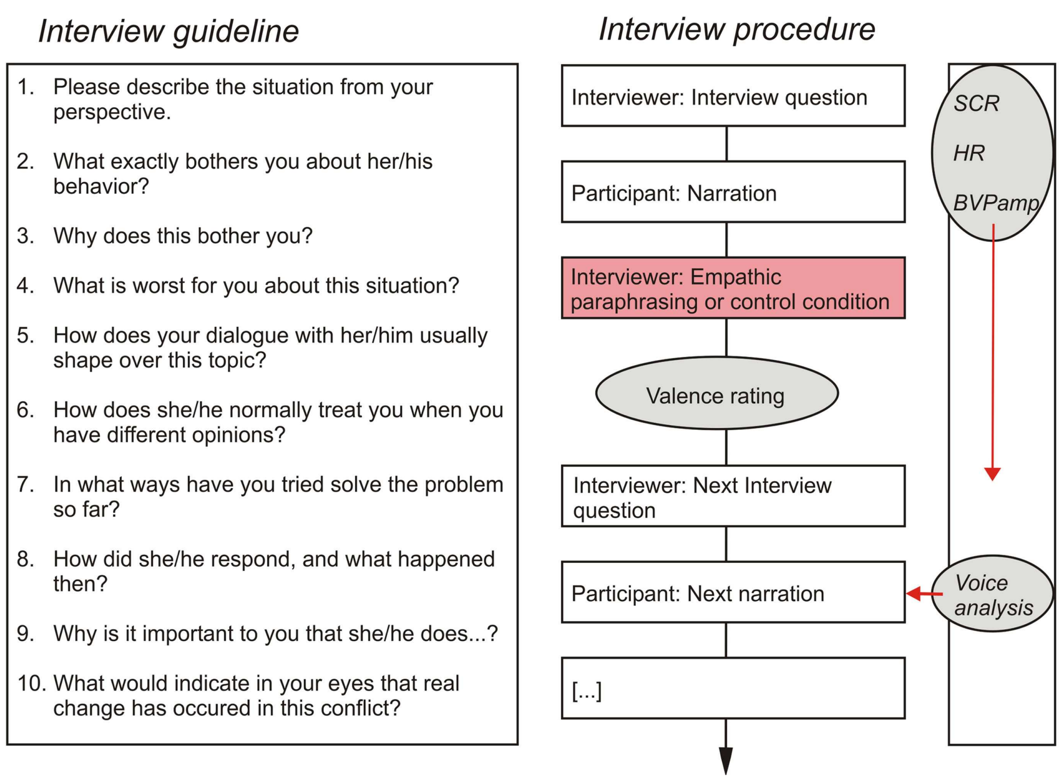

FIGURE 1 | Interview guideline and procedure.

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).

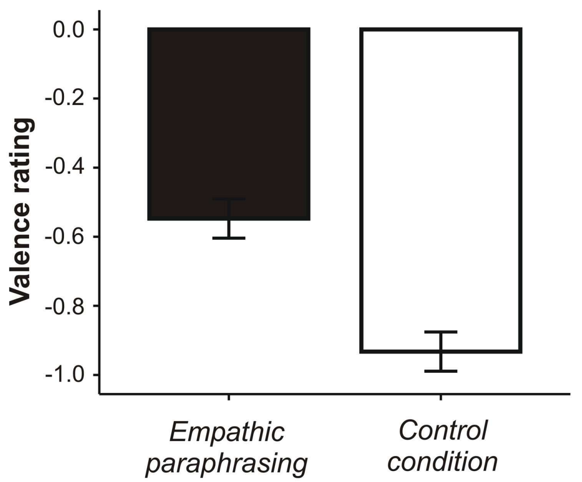

FIGURE 2 | Mean valence ratings (with standard error of the mean) after the empathic paraphrasing and control conditions.

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 $F(4, 72) = 1.489$; $p = 0.215$].

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

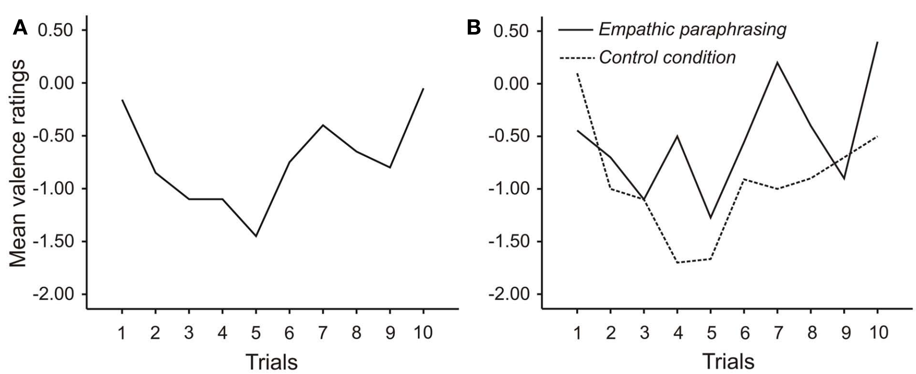

FIGURE 3 | Mean valence ratings over the course of the interview, averaged over both conditions (A) and split up into paraphrasing and control condition (B). At each of the 10 trials, 10 subjects received an intervention and 10 received a control intervention.

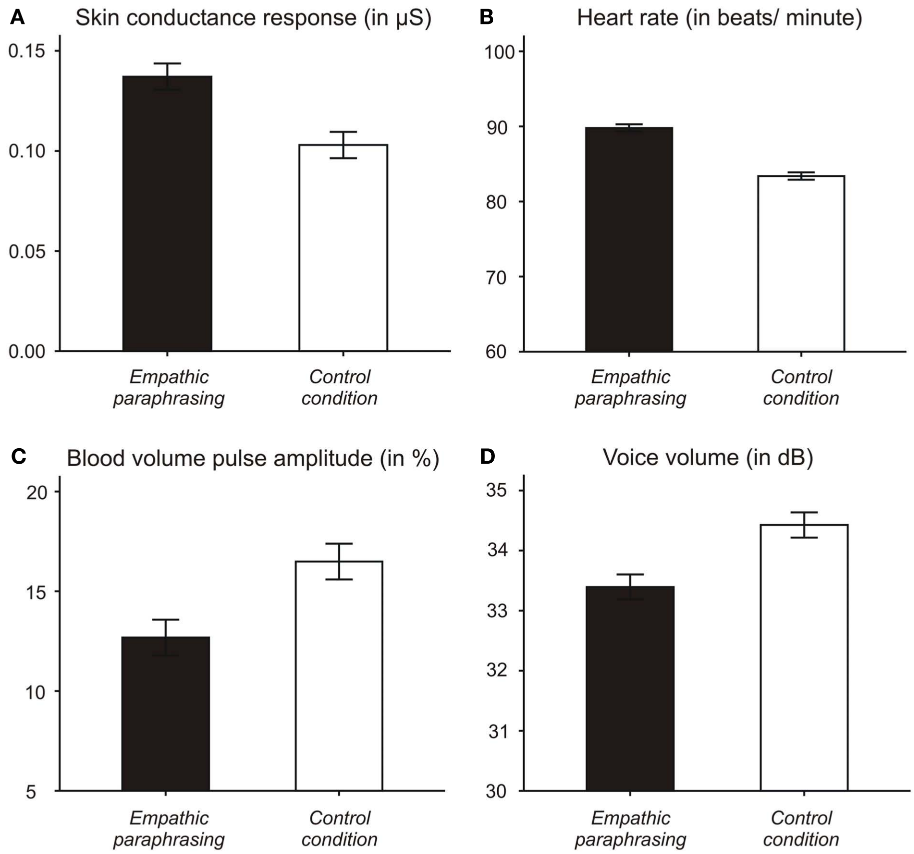

FIGURE 4 | Measures of sympathetic activation (mean values with standard error of the mean). (A) Skin conductance response (SCR; in μS), **(B)** Heart rate (in beats/minute), **(C)** Blood volume pulse amplitude (BVPamp in%), and **(D)** Voice volume (in dB) during empathic paraphrasing and control condition.

(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.

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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."

Studie 2

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Effects of empathic social responses on the emotions of the recipient

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ABSTRACT

Empathy is highly relevant for social behavior and can be verbally expressed by voicing sympathy and concern (emotional empathy) as well as by paraphrasing or stating that one can mentally reconstruct and understand another person's thoughts and feelings (cognitive empathy). In this study, we investigated the emotional effects and neural correlates of receiving empathic social responses after negative performance feedback and compared the effects of emotionally vs. cognitively empathic comments. 20 participants (10 male) underwent functional magnetic resonance imaging while receiving negative performance feedback for a cognitive task. Performance feedback was followed by verbal comments either expressing cognitive and emotional empathy or demonstrating a lack of empathy. Empathic comments in general led to less negative self-reported feelings and calmer breathing. At the neural level, empathic comments induced activity in regions associated with social cognition and emotion processing, specifically in right postcentral gyrus and left cerebellum (cognitively empathic comments), right precentral gyrus, the opercular part of left inferior frontal gyrus, and left middle temporal gyrus (emotionally empathic comments), as well as the orbital part of the left middle frontal gyrus and left superior parietal gyrus (emotionally empathic vs. unempathic comments). The study shows that cognitively and emotionally empathic comments appear to be processed in partially separable neural systems. Furthermore, confirming and expanding on another study on the same subject, the present results demonstrate that the social display of cognitive empathy exerts almost as positive effects on the recipient's feelings and emotions in states of distress as emotionally empathic response does. This can be relevant for professional settings in which strong negative emotions need to be de-escalated while maintaining professional impartiality, which may allow the display of cognitive but not emotional empathy.

1. Introduction

Showing empathy is a highly relevant social interaction pattern, and yet it is one that has almost exclusively been studied with a focus on the sender (i.e. the person feeling empathy for someone else), neglecting the effects on the recipient. What are the effects of empathic social responses on the emotions of the recipient of such responses, and do cognitively and emotionally empathic social responses exert the same effects on the recipient? This important aspect of social interaction has been almost completely neglected in social neuroscience research to date. The present study addresses this gap by exploring emotional effects and neural substrates of processing empathic comments offered by another person in response to an unpleasant situation.

Empathy has been studied from many different angles and under varying definitions, with a commonly accepted definition of empathy still wanting (Bernhardt & Singer, 2012). In the neuropsychological research literature, empathy is most often conceptualized as a complex and composite construct involving several, partially dissociable neuro-cognitive systems with 3 domains: cognitive empathy, emotional empathy, and motor empathy (Blair, 2005; Carr, Iacoboni, Dubeau, Mazziotta, & Lenzi, 2003; Decety & Meyer, 2008). Cognitive empathy, also called theory of mind (ToM) or mentalizing, means the ability to recognize another

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person's mental and emotional state as well as behavioral dispositions by abstract inference. Emotional or affective empathy refers to an observer's emotional response to another person's emotional state (Dziobek et al., 2008). It has been argued that the term empathy presupposes an emotional reaction that is isomorphic to another person's affective state (Vignemont & Singer, 2006), while others define it more broadly as an affective response more appropriate to another's situation than one's own (Hoffman, 2000). Motor empathy is the tendency to automatically mimic and synchronize facial expressions, vocalizations, postures, and movements with those of another person (Blair, 2005). An integrative multidimensional model of empathy has been proposed by Decety (2011), Decety and Jackson (2004) and Decety and Meyer (2008).

Empathy can be verbally expressed by voicing emotional resonance to another's distress (emotional empathy) as well as by paraphrasing or stating that one can mentally reconstruct and understand another person's thoughts and feelings (cognitive empathy). Expressing cognitive empathy through paraphrasing is regularly used in professional counseling settings such as Alternative Dispute Resolution (ADR; Kraybill, Evans, & Evans, 2001; Schreier, 2002). Daily interactions, on the other hand, most often contain verbal demonstrations of emotional empathy. However, we argue that in daily life, this typically expresses itself in verbally offering compassion, sympathy, and concern, rather than an isomorphic reflection of the other person's feelings and emotions (typical responses to another's distress may be "I'm sorry this happened to you" rather than "If you are sad, I am sad, too"). Therefore, and as we were interested in investigating empathic social response close to daily life, we shaped our emotional empathy interventions more toward expressing compassion than isomorphic emotional reactions. It is important to note, however, that emotional empathy and compassion have been associated with different emotional effects and neural activations in the sender (Klimecki, Leiberg, Ricard, & Singer, 2014), and can therefore not be used as interchangeable terms.

To date, very little research has been dedicated to investigating the emotional effects and neuroanatomical basis of processing these social responses and professional interventions expressing empathy. As a starting point, we have been able to show that cognitively empathic social response in the form of paraphrasing can positively influence the recipient's feelings and emotions in social conflict situations (Seehausen, Kazzer, Bajbouj, & Prehn, 2012; Seehausen et al., 2014). In Seehausen et al. (2014), we interviewed participants on a real-life personal conflict and contrasted emotional effects and neural correlates of cognitively empathic vs. unempathic social responses. We found that cognitively empathic social response in the form of paraphrasing positively influenced self-reported feelings, while at the same time increasing autonomic arousal reflected by skin conductance response (SCR). In a similar vein, feeling understood has also been shown to activate neural regions associated with reward and social connection (i.e. ventral striatum and middle insula), while not feeling understood engaged neural regions previously associated with negative affect (i.e. anterior insula) (Morelli, Torre, & Eisenberger, 2014)., Finally, motor empathy in the form of facial mimicry has been repeatedly found to increase affiliation and positive social judgment not only toward the mimicker but also toward other people (Van Baaren, Holland, Kawakami, & Van Knippenberg, 2004; Ashton-James, van Baaren, Chartrand, Decety, & Karremans, 2007; Fischer-Lokou, Martin, Guéguen, & Lamy, 2011; Guéguen, Martin, & Meineri, 2011; Stel & Harinck, 2011). Hence, it seems that empathic social response displaying different types of empathy can have an effect on the recipient's feelings and emotions. The present study directly compared the effects of verbally expressed cognitive and emotional empathy/compassion on the recipient, exploring potential differences in processing these two types of empathic social response at the neural level as well as differences in emotional effects on the recipient.

In general, the processing of empathic and unempathic social response is likely to recruit neural systems involved in social cognition, as the listener tries to decipher the speaker's intention and sincerity, as well as meaning and social adequacy of the utterances. Social cognition is characterized as the acquisition of knowledge about other persons' mental states as well as insight about the meaning of their behavior and verbal expressions (Przyrembel, Smallwood, Pauen, & Singer, 2012). Social cognition research approaches most often focus on the role of the mentalizing network, as well as of shared networks and the putative mirror neuron network (Bernhardt & Singer, 2012; Zaki, Weber, Bolger, & Ochsner, 2009). However, in the absence of visual stimuli, i.e. faces or body movements, subjects seem to rely mostly on the mentalizing system when making inferences about another's inner state (Lamm, Decety, & Singer, 2011).

The present study addressed the following research questions: (1) what are the effects of empathic social response on the feelings and emotions of the recipient during negative performance feedback? (2) How are empathic comments processed at the neural level? (3) How does the processing of emotionally and cognitively empathic comments differ regarding neural substrates and emotional effects?

To answer these questions, cognitively and emotionally empathic and unempathic comments were offered to study participants while they were trying to solve anagrams, and kept receiving negative performance feedback combined with financial loss. This was chosen as the context for empathic social response for three reasons. Firstly, goal failure in this form is relatively easy to create in an experimental setting. Secondly, goal failure has been shown to induce negative affect (Jones, Papadakis, Orr, & Strauman, 2013). And thirdly, failure is a common experience in everyday life, one that often elicits seeking and receiving empathic social support.

Neural data were complemented by self-report ratings of positive or negative feelings, as well as measurements of skin conductance (SCR), pulse, heart rate, and respiration data. These physiological parameters have repeatedly been shown to reflect emotional responses (Critchley, 2002; Kushki, Fairley, Merja, King, & Chau, 2011).

Due to a lack of comparable previous research, the present study was largely exploratory. Negative performance feedback was expected to result in activations in anterior insula and amygdala, as these are core regions of emotion generation and processing (Kober et al., 2008; Ochsner, Silvers, & Buhle, 2012). On a subjective experience level, we predicted less negative feelings following empathic compared to unempathic comments for both types of empathy. We have shown previously that negative feelings can be alleviated by empathic social response in the form of paraphrasing (expressing cognitive empathy) (Seehausen et al., 2012, 2014). We further hypothesized that hearing empathic comments would activate neural networks associated with social cognition, especially the mentalizing network. This is in line with findings from Morelli et al. (2014), who reported that both feeling understood and not feeling understood activated different components of the mentalizing system in their paradigm. Meta-analyses have shown a mentalizing network comprising bilateral ventromedial and dorso-medial prefrontal cortex, precuneus, temporoparietal junction, temporal poles, middle temporal gyrus, posterior superior temporal sulcus, and inferior frontal gyrus, as well as the right MT/V5 (Bzdok et al., 2012; Mar, 2011; Spreng, Mar, & Kim, 2009). In addition, empathic and unempathic comments were expected to stimulate regions associated with emotion generation and processing, involving amygdala, anterior insula, medial orbitofrontal cortex (mOFC) and striatum (Becker, Gandhi, & Schweinhardt, 2012; Ochsner et al., 2012). Furthermore, we expected cognitively empathic comments and emotionally empathic comments to be processed by partially different neural systems. Cognitive and emotional empathy have been shown to involve partially separate neural systems at the experiential level (Fan, Duncan, de Greck, & Northoff, 2011), hence it seems expedient to regard them as non-identical psychological processes that also trigger partially different stimulus processing in the recipient. It also seems likely that social responses such as "I understand why you are angry right now" provoke different emotional reactions from responses such as "I am sorry it is not going well for you", as these convey different messages about the social relationship in question.

2. Material and methods

2.1. Participants

20 healthy subjects [10 male; age: mean (M) = 26, standard deviation (SD) = 5.0] participated in this study. All participants were native German speakers, right-handed as assessed using the Edinburgh Handedness Inventory (Oldfield, 1971), and had no current or previous neurological or psychiatric disorder.

The study was carried out in accordance with the Declaration of Helsinki and was approved by the ethical committee of the Charité Universitätsmedizin Berlin. All participants gave written informed consent prior to investigation and received payment for participation.

2.2. Task and stimulus material

To elicit negative emotions in participants, we developed an experimental paradigm deploying a demanding cognitive task (solving anagrams) combined with negative feedback regarding participants' performance, by default given in two thirds of the trials ("That was bad"). In each trial in which participants were given negative feedback, they were informed that they had lost five cents of their study compensation. This was done to enhance negative emotional impact. In addition, a high-level baseline condition with positive feedback ("That was good") instead of negative feedback was included, where participants gained five cents per trial. The negative feedback was followed by either empathic or unempathic interventions. The high-level baseline condition featured empathic interventions only. Half of all interventions featured cognitive and half deployed emotional empathy/non-empathy, resulting in a 2×2 experimental design plus high level baseline. The factor "empathy", refers to empathic/unempathic interventions, the factor "empathy type", means cognitive/emotional empathy. Hence, four types of interventions were given: Cognitive Empathic (CE), Cognitive Unempathic (CN), Emotional Empathic (EE), Emotional Unempathic (EN). Examples[1] for the different types of interventions are: Cognitive Empathic (CE): "I can really understand how you are feeling now." Cognitive Unempathic (CN): "I don't understand what you are feeling right now." Emotional Empathic (EE): "Your feelings in this situation really touch me." Emotional Unempathic (EN): "I don't care what you are feeling right now." Correspondingly, in the high-level baseline condition half of the empathic comments were aligned with cognitive empathy ("I can understand that you are happy now.") and half were geared to emotional empathy ("It makes me happy to see you succeed in this."). This design allowed us to compare the effects of empathic responses with unempathic responses, as well as with a baseline where no negative feelings and emotions were experienced by participants, thus, empathic social support presumably being perceived as less emotionally relevant. Hence, we investigated two different psychological processes: Firstly, the reaction to empathic vs. unempathic social response when in a situation of emotional distress, and secondly, the reaction to empathic social response when in emotional distress vs. when feeling all right. These contrasts were split up into cognitive and emotional empathy and complemented by a direct comparison of CE and EE to differentiate between different types of empathic social response.

For the cognitive task, an anagram pool was generated using the freeware anagram generator Wordpool (http://www.wordpool-home.de). The anagrams were then manually supplemented by alternative wrong solutions similar to the correct solutions (Anagram example[2]: WINTERCOAT. Correct solution: ANTIC TOWER, wrong solution: ANTIQUE TOWER).

We designed 108 empathic and unempathic interventions (18 per experimental condition). The final intervention pool was rated by seven experts (psychologists) regarding the differentiation between cognitive and emotional empathy. The differentiation succeeded with an inter-rater consistency of 92.3%.

The interventions were audio-taped and presented acoustically as well as visually. All interventions were recorded by one female and one male speaker. Each participant was given half of the interventions by a male speaker, and half by a female speaker, with the order of who they heard first being alternated over participants.

2.3. Experimental procedure

Participants were presented with the anagram task and had to choose the correct solution in a maximal time frame of 6 s. Each trial consisted of the anagram task, followed by negative or positive feedback, followed by an intervention, and concluded by a rating phase during which participants rated their present feelings on a scale from −4 to 4 (see Fig. 1). In total, the experiment comprised 108 trials presented in randomized order over two separate runs, with a jittered event-related design and a trial duration of 23 s (plus jitter with a mean of 12 s). Total time spent in the scanner was 57 min.

2.4. Behavioral and psychophysiological data acquisition and analyses

During the fMRI experiment, individual valence ratings were obtained in each trial using an 8-point Likert scale from −4 to 4 ("How positive or negative do you feel right now?"). The subject's pulse was recorded by a pulse plethysmograph placed on the left-hand thumb. Respiration was measured by a respiratory belt placed around the lower rips of the subject. EDA was detected using an MR-compatible ExG-amplifier (Brain Amp ExG MR, Gilching, Germany). Data was acquired with a sampling rate of 5 kHz and recorded with Brain Vision Recorder software (Brain Products, Gilching, Germany). A cup electrode with internal impedance of 15 kΩ was attached to the intermediate phalanges of the index and middle fingers of the subject's left hand. Skin conductance (SCR) was measured with the constant voltage method. SCR data was analyzed in LedaLab V3.3.1, pulse and respiration data were analyzed in MATLAB 7.11.1 (Mathworks Inc., Sherborn, MA, USA). Time frames of analysis were the feedback phase as well as the intervention phase, each comprising six seconds. Parameters for analysis of respiration were tidal volume and respiration rate. Behavioral and psychophysiological data were analyzed with repeated measures ANOVAs (factors were "empathy" and "empathy type") in IBM SPSS Statistics 20.

[1] The actual interventions were in German.

[2] An English example is used in this manuscript for easier comprehension; the experiment deployed German anagrams.

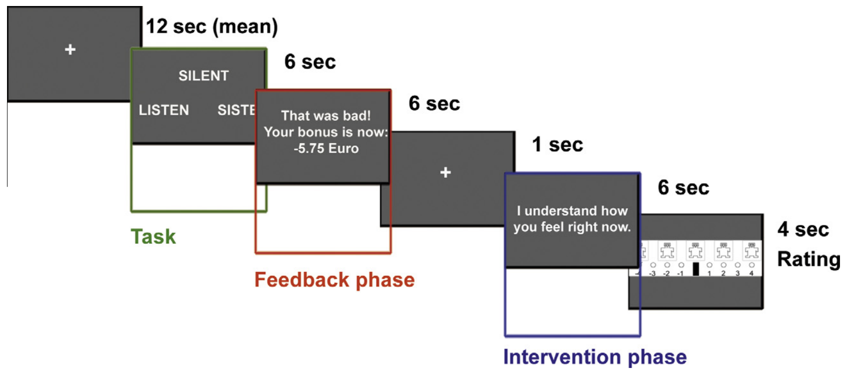

Fig. 1. Experimental paradigm. Participants were presented with the anagram task, followed by positive or negative feedback, followed by an intervention, followed by the rating phase.

2.5. fMRI data acquisition and analyses

fMRI measurements were performed on a 3 T Trio (Siemens, Erlangen) scanner, equipped with a 12-channel coil. The gradient echo sequence (Echo-Planar-Imaging) was used (T_E/T_R/flip angle/bandwidth = 30 ms/2000 ms/70°/2170 Hz) with 3 mm × 3 mm × 3 mm resolution, fat saturation prior to every slice and a GRAPPA acceleration factor of 2. Thirty-seven axially oriented slices with an interslice gap of 0.3 mm were acquired in an interleaved order, providing whole brain coverage. T1-weighted anatomical images (MPRAGE $T_E/T_R/T_I$/flip angle/bandwidth = 2.52 ms/1900 ms/900 ms/9°/170 Hz, 1 mm × 1 mm × 1 mm resolution) were acquired for each subject. Data were recorded in 2 runs each consisting of 752 volumes. The task was programmed in Presentation Software and presented on dual display goggles (VisuaStim, MR Research, USA). A fiber optic response device (2 × 4 Button Diamond, fORP-905, Current Designs Inc., Philadelphia, USA) was used to register the subjects' responses on an 8-point scale.

Data were analyzed using the Statistical Parametric Mapping software (SPM5, Wellcome Dept. of Imaging Neuroscience, London, UK) implemented in MATLAB 7.11.1. Before statistical analyses, functional images were slice-time corrected, realigned, co-registered to the individual anatomical images, segmented, spatially normalized to the Montreal Neurological Institute (MNI) space (voxel size: 3 × 3 × 3 mm^3), and smoothed using an 8 mm full-width at half-maximum Gaussian kernel.

After preprocessing, first-level single subject analyses were conducted to estimate BOLD responses following the general linear model approach. BOLD responses were modeled with 7 event-related regressors of interest (positive/negative feedback, and interventions sorted by the five conditions) and convolved with the canonical hemodynamic response function. As regressors of no interest we included the anagram processing phase terminated by the individual response of the participant, again sorted by conditions; the waiting phase for positive/negative feedback (this was the time left of the 6 s task phase after a participant had solved the anagram); positive/negative prediction error (i.e., deviation of actual feedback from expected feedback based on individual feedback history), and the rating phase. In trials where the actual feedback deviated from the mean feedback history, and therefore presumably from participants' expectations, negative and positive feedback was weighted more in our model than in mean-consistent trials. This was done to reflect the stronger emotional impact of unexpected feedback. Altogether, 17 regressors entered the analysis, modeling all phases of the trials. At second level, estimated beta weights were entered into a repeated measures ANOVA employing a flexible factorial design with the three factors "subject", "empathy" and "empathy type". Only clusters larger than 20 voxels and meeting a threshold of $p < 0.05$ (FWE-corrected) are reported in tables and text. Figures show uncorrected activity ($p < 0.001$). To plot the observed effects, parameter estimates averaged across all voxels in a functional region of interest (ROI; i.e., in a cluster found to be significant at whole brain level), were extracted using the RFXPLOT toolbox (Gläscher, 2009) for SPM.

3. Results

20 subjects entered the fMRI analysis (10 female). Pulse and respiration data of two subjects were lost due to technical reasons, leaving 18 subjects for complete physiological analysis.

3.1. Behavioral data

Valence ratings following experimental conditions (negative feedback) revealed more negative feelings than ratings following the high level baseline condition (positive feedback) [$t(19) = 8.290$, $p = 0.000$]. However, as the 2 ("empathy") × 2 ("empathy type") repeated measures ANOVA showed, participants reported less negative feelings when negative feedback was followed by empathic compared to unempathic comments [main effect of empathy: $F(1,19) = 15.014$, $p = 0.001$]. There was an "empathy" by "empathy type" interaction [$F(1,19) = 26.978$, $p < 0.001$], and post-hoc t-tests revealed that the effect of reducing negative feelings was stronger for emotional empathy/compassion [$t(19) = 5.122$, $p < 0.001$, Cohen's $d = 1.15$] than for cognitive empathy [$t(19) = 2.410$, $p = 0.026$, Cohen's $d = 0.54$]. However, both differences were significant and of large effect size (see Fig. 2). Participants needed $M = 2.7$ s to solve the anagrams ($SD = 0.7$ s), averaged over easy and difficult ones, and made one mistake on average.

3.2. Psychophysiological data

Skin conductance response (SCR) was higher during negative feedback than during positive feedback [$t(19) = -2.183$, $p = 0.042$]. No differences were found during the intervention phase, except a strong trend for "empathy type" [main effect of empathy type: $F(1,19) = 4.269$, $p = 0.053$], with SCR being lower during cognitive interventions than during emotional interventions.

Analyzing the respiration data showed that subjects breathed more shallowly during negative feedback than during positive feedback phases. This was visible in a larger amplitude of breath

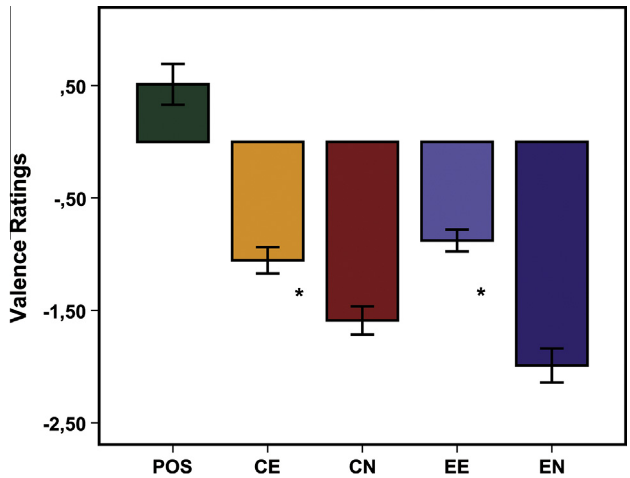

Fig. 2. Valence ratings over the conditions. Participants reported positive feelings in the high level baseline condition, slightly negative feelings after empathic comments (CE, EE), and stronger negative feelings after unempathic comments (CN, EN). Error bars represent standard error of the mean (SEM).

(i.e., tidal volume) during positive feedback [$t(17) = 2.799$, $p = 0.012$] as well as in higher respiratory rate during negative feedback [$t(17 = -3.162$, $p = 0.006$]. The repeated measures ANOVA over the intervention phase showed that tidal volume was also larger during empathic comments than during unempathic comments [main effect of empathy: $F(1,17) = 8.105$, $p = 0.011$], indicating deeper breathing in response to empathic comments. There was no interaction with type of empathy. Furthermore, tidal volume was larger during the intervention phase compared to the negative feedback phase for both types of empathy [cognitive empathy: $t(17) = -3.681$, $p = 0.002$; emotional empathy: $t(17) = -4.355$, $p < 0.001$]. Hence, subjects breathed more shallowly when being criticized, but more deeply when being empathized with. No effects were found for pulse and heart rate, neither in the feedback nor in the intervention phase. Table 1 shows means and standard deviations for all physiological parameters.

3.3. fMRI data

3.3.1. Neural activity during negative vs. positive feedback

Negative feedback compared to positive feedback elicited activity on whole brain level in right anterior insula, left putamen/pallidum, and left supramarginal gyrus, extending to precentral gyrus (see Table 2).

3.3.2. Neural substrates of processing empathic vs. unempathic comments

3.3.2.1. Empathic. Emotionally empathic comments induced activity in the orbital part of left middle frontal gyrus (mOFC) and left superior parietal gyrus (SPG) (EE > EN) (Fig. 3). Cognitively empathic comments (CE > CN) and the combination of both (EE + CE > EN + CN) resulted in no activations.

3.3.2.2. Unempathic. Cognitively unempathic comments activated the medial-orbital part of left superior frontal gyrus (CN > CE). All unempathic comments combined (EN + CN > EE + CE) were processed in left superior temporal gyrus and right putamen.

Activations of empathic comments compared with unempathic comments as well as the high-level baseline are shown in Table 3.

3.3.2.3. Vs. high-level baseline. When empathic interventions were contrasted against the high level baseline condition (CE + EE > base), activity was induced in right postcentral gyrus and left cerebellum. When separated into cognitive and emotional empathy, right postcentral gyrus and left cerebellum responded to cognitively empathic interventions (CE > base) (Fig. 4). Right precentral gyrus, left cerebellum, left opercular inferior frontal gyrus, and left middle temporal gyrus responded to emotionally empathic interventions (EE > base) (Fig. 5).

3.3.3. Neural substrates of processing cognitive and emotional empathy

When cognitive and emotional interventions in general were contrasted, emotional interventions (EE + EN > CE + CN) elicited more activity in the superior temporal gyrus. Contrasting only empathic interventions, emotionally empathic interventions (EE > CE) resulted in activity in the mOFC. Contrasting unempathic interventions only, cognitively unempathic interventions (CN > EN) activated right MFG, and emotionally unempathic interventions (EN > CN) activated left/right superior temporal gyrus. Table 4 shows the results of contrasting emotional and cognitive interventions. Activity resulting from emotional empathy contrasted with cognitive empathy is displayed in Fig. 6.

4. Discussion

The aim of our study was to explore and compare the emotional effects and neural correlates of cognitively and emotionally empathic comments after receiving negative performance feedback. The experiment yielded three main findings: (1) both cognitively and emotionally empathic comments led to less negative feelings and emotions compared to unempathic comments, visible in valence ratings and respiration data. (2) Emotionally empathic/compassion comments activated left mOFC and left SPG when contrasted against unempathic comments. Contrasted against the high-level baseline, cognitively empathic comments were processed in right postcentral gyrus and left cerebellum, whereas emotionally empathic/compassion comments induced activity in right precentral gyrus, left cerebellum, opercular part of left inferior frontal gyrus and left middle temporal gyrus. (3) The two types of expressing empathy were processed in partially separable clusters. Emotional interventions contrasted with cognitive interventions resulted in increased activity in left/right superior temporal gyrus (EE + EN > CE + CN), as well as mOFC for empathic interventions only (EE > CE). The findings are discussed below.

4.1. Emotion induction in the feedback phase

Empathic comments were offered based on the assumption that participants experienced negative feelings and emotions due to the negative performance feedback. The neural activations elicited during the feedback phase suggest that this indeed applied, although contrary to expectations, no amygdala activation was found. Most likely, this is due to the relatively weak stimulus intensity of negative performance feedback.

Negative feedback activated right anterior insula, left putamen/pallidum, and, surprisingly, left supramarginal gyrus, extending to precentral gyrus. Anterior insula activation was anticipated for this contrast, as the anterior insula plays a prominent role in the experience of emotion and physical and mental pain (Jackson, Brunet, Meltzoff, & Decety, 2006; Lamm, Batson, & Decety, 2007; Lamm & Singer, 2010). The right anterior insula has been suggested to be critical for the subjective awareness of feelings and involved in processing signals from the body (Craig, 2004, 2009; Kober et al., 2008). Anterior insula activation has been related to negative affective states such as disgust (Jabbi, Bastiaansen, & Keysers, 2008; Wicker et al., 2003), social exclusion (Eisenberger, Inagaki, Rameson, Mashal, & Irwin, 2009; Eisenberger, Lieberman, & Williams, 2003), and the rejection of unfair offers (Sanfey, Rilling, Aronson, Nystrom, & Cohen, 2003).

Table 1
Physiological measures in the feedback phase and during the different interventions. (a) Means and standard errors (S.E.) for tidal volume (amplitude) and respiration rate (breathing cycle). (b) Mean SCR with standard errors (S.E.).

	Pos. feedback	Neg. feedback	CE	CN	EE	EN
(a) Amplitude (mean)	2558.28	2492.77	2638.41	2576.75	2640.59	2538.77
(S.E.)	403.43	410.73	437.02	466.75	466.85	430.84
Breathing cycles (mean)	1.73	1.80	1.75	1.80	1.76	1.78
(S.E.)	0.44	0.38	0.41	0.51	0.41	0.44
(b) SCR (mean)	0.57	0.68	0.55	0.46	0.59	0.64
(S.E.)	0.51	0.60	0.50	0.48	0.73	0.57

Table 2
Negative vs. positive performance feedback.

Anatomical region	Side	MNI-coordinates			*z*-Score of local maximum	Number of voxels in cluster
		x	*y*	*z*		
Putamen/pallidum	L	−27	−6	−3	5.37	84
Supramarginal gyrus (extending to precentral gyrus)	L	−54	−24	33	5.20	4883
Insula	R	45	18	−9	5.16	1693

$p < 0.05$, FWE-corrected.

Ochsner (2008) concludes that the anterior insula plays a general role in negative affective experience. The putamen has also been implicated in negative emotions (Sass et al., 2012) as well as in the intention to suppress emotions and motor responses (Vanderhasselt, Kühn, & De Raedt, 2012). The left supramarginal gyrus together with left dorsal premotor gyrus has been associated with action reprogramming in response to environmental cues demanding rapid action reprogramming (Hartwigsen et al., 2012). In a study by Lamm et al. (2007), the supramarginal gyrus responded to subjects imagining the experience of a visually displayed painful injury together with insula, putamen, precentral gyrus, caudate nucleus, supplementary motor area, superior

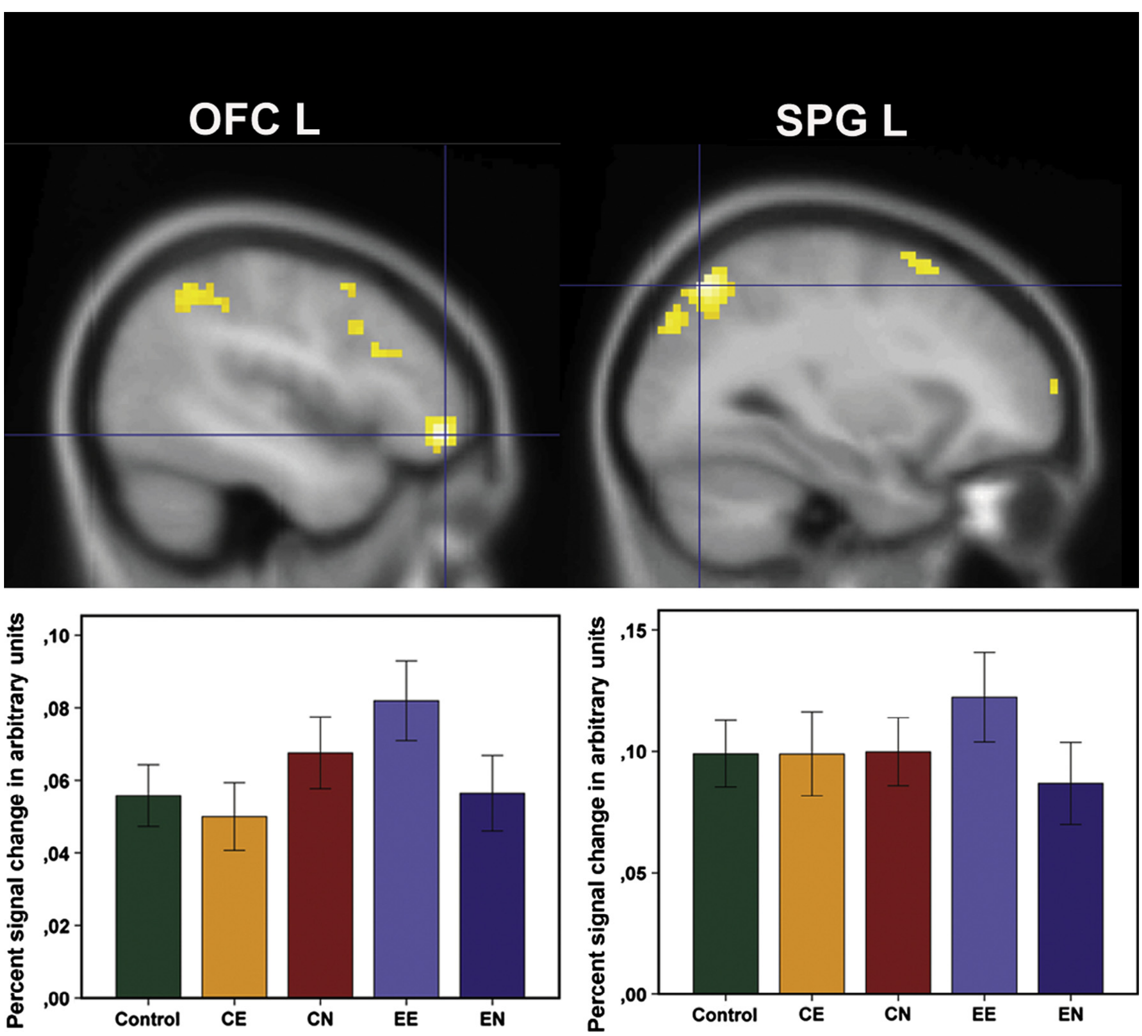

Fig. 3. Emotionally empathic > emotionally unempathic. For emotional empathy, contrasting empathic against unempathic comments resulted in activity in left OFC and left SPG (figure shows activations at $p < 0.001$).

Table 3
Effects of empathic comments.

Anatomical region	Side	MNI-coordinates x	y	z	z-Score of local maximum	Number of voxels in cluster
(A) Emotional empathic (EE) > emotional unempathic (EN)						
Middle frontal gyrus, orbital part	L	−45	45	−9	4.98	58
Superior parietal gyrus	L	−30	−72	51	4.73	284
(B) Unempathic (EN + CN) > empathic (EE + CE)						
Superior temporal gyrus	L	−51	3	−9	4.98	208
Putamen	R	27	−3	3	4.86	1197
(C) Cognitive unempathic (CN) > cognitive empathic (CE)						
Superior frontal gyrus, medial-orbital	L	−6	45	−15	4.82	22
(D) Empathic (EE + CE) > high level baseline						
Postcentral gyrus	R	39	−21	45	5.77	617
Cerebellum/Hemisphere/Lobule 4–5	L	−21	−51	−21	5.37	230
(E) Emotional empathic (EE) > high level baseline						
Precentral gyrus	R	39	−21	42	5.12	498
Cerebellum/Hemisphere/Lobule 4–5	L	−21	−51	−21	5.48	175
Inferior frontal gyrus, opercular part	L	−36	9	27	4.71	281
Middle temporal gyrus	L	−57	−33	−3	4.69	218
(F) Cognitive empathic (CE) > high level baseline						
Postcentral gyrus	R	39	−21	45	4.96	297
Cerebellum/Hemisphere/Lobule 4–5	L	−18	−48	−21	4.69	126

$p < 0.05$, FWE-corrected.

temporal gyrus, middle frontal gyrus, and rolandic operculum. In view of these findings, the involvement of the supramarginal gyrus in response to negative feedback in our paradigm is, while unexpected, not entirely implausible.

Overall, the neural activations caused by the negative performance feedback in combination with financial loss suggest that the induction of negative feelings and emotions was successful. This conclusion is also supported by the valence ratings, the higher respiration rate and lower tidal volume during negative compared to positive performance feedback, as well as by skin conductance data, which shows that participants had a higher SCR during negative than during positive feedback. Increased SCR is commonly associated with emotion-related sympathetic arousal, often in correspondence with negative emotions (Critchley, 2002; Kreibig, Wilhelm, Roth, & Gross, 2007).

4.2. Emotional effects of empathic comments

For both types of empathy, empathic comments led to less negative self-reported feelings in recipients. This was complemented by respiration data. While negative performance feedback induced faster and shallower breathing, empathic interventions re-established deeper breathing. Tidal volume has been repeatedly shown to decrease and respiration rate to increase with negative emotion such as anxiety (Kreibig et al., 2007), while pleasant emotions and relaxation decrease respiration frequency and increase tidal volume (Masaoka, Koiwa, & Homma, 2005; Masaoka, Sugiyama, Katayama, Kashiwagi, & Homma, 2012).

Hence, both types of empathic social response seem to have influenced the recipient's feelings and emotions in a positive way, slightly more so with emotionally empathic/compassion comments than cognitively empathic comments. However, it should be noted that the interaction with empathy type in the valence data seems to be primarily driven by a stronger reaction to emotionally unempathic comments than to cognitively unempathic comments. This suggests that social messages like "I don't care what you feel" induce negative feelings and emotions in the recipient, and to a larger degree than social messages along the lines of "I don't understand what you feel". Due to the design and exploratory nature of the study, we cannot at this point draw conclusions on the extent feelings and emotions were actually down- or up-regulated by the interventions. We propose that most likely a combination of two effects took place: While the unempathic interventions seem to have exacerbated the negative feelings and emotions induced by the negative feedback, empathic interventions alleviated them.

While the effects on feelings and emotions of the recipient may not be surprising for emotional empathy, it is notable in the case of cognitive empathy. Cognitive empathy offers no sympathy or help, but mainly displays that an observer is capable of reconstructing the thoughts and feelings of somebody in distress. The results confirm previous findings where expressing cognitive empathy through paraphrasing led to more positive feelings compared to an unempathic intervention, and that participants felt better after paraphrasing than before and worse after an unempathic intervention, compared to before. (Seehausen et al., 2012, 2014). One possible explanation for this effect is that subjects feel validated in their perception of a given situation when somebody else is able to see it the same way. Another possibility is that another person making an effort to understand someone's perspective communicates a message of social solidarity and connection. Several studies have suggested that feeling understood enhances both personal and social well-being (Cahn, 1990; Oishi, Krochik, & Akimoto, 2010; Reis, Clark, & Holmes, 2004; Reis, Sheldon, Gable, Roscoe, & Ryan, 2000; Swann, 1990).

4.3. Neural substrates of empathic comments

Empathic comments induced activations in right postcentral gyrus and precentral gyrus, left cerebellum, the opercular part of the left inferior frontal gyrus and left middle temporal gyrus when compared to the high level baseline. When contrasted with unempathic comments, emotionally empathic/compassion comments activated the mOFC and left SPG. This differentiation is interesting because it reflects different effects of empathic comments in relation to context, i.e. emotional state and necessity of social support.

Being empathized with vs. being denied empathy while being in a negative emotional state activated mOFC and SPG. The mOFC is part of the reward network and central for hedonic experience (Becker et al., 2012; Fett, Gromann, Giampietro, Shergill, & Krabbendam, 2012; Kringelbach, 2005). It has been suggested that the mOFC specifically processes magnitude of a received reward, or computes the subjective value of rewards, respectively (Diekhof, Kaps, Falkai, & Gruber, 2012; Padoa-Schioppa & Cai, 2011). In addition, the mOFC is involved in regulation of motivation and affect (Arnsten & Rubia, 2012), and in cultivating compassion (Beauregard, Courtemanche, Paquette, & St-Pierre, 2009; Immordino-Yang, McColl, Damasio, & Damasio, 2009; Klimecki, Leiberg, Lamm, & Singer, 2012). The engagement of mOFC in the processing of empathic comments in our study cannot be regarded as evidence that being empathized with held a rewarding value for participants, as there was no correlation between emotional valence ratings and mOFC activation. However, it should be noted that feeling understood has recently been shown to activate

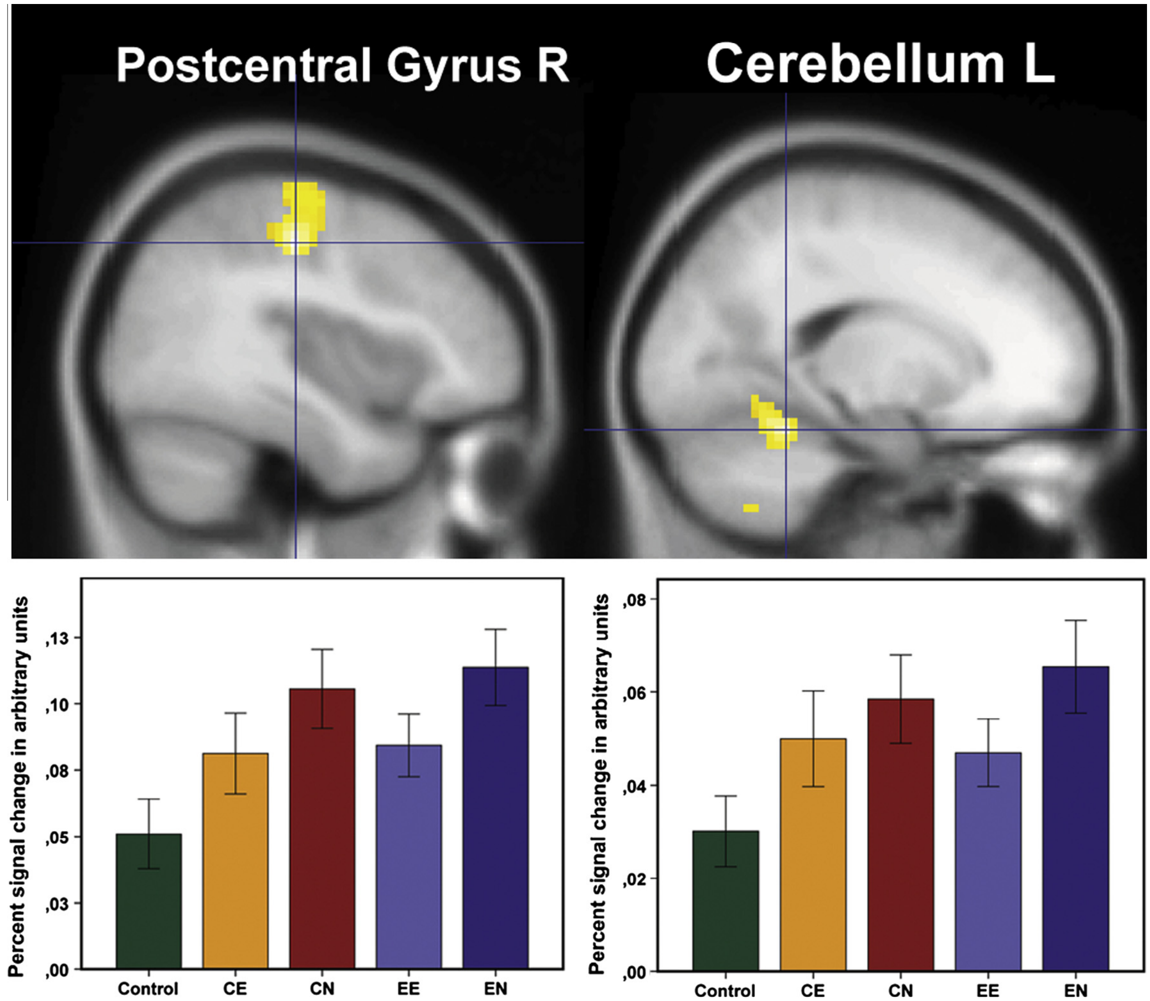

Fig. 4. Cognitively empathic > baseline. Cognitively empathic comments produced activity in right postcentral gyrus and left cerebellum when compared with the high level baseline (figure shows activations at $p < 0.001$).

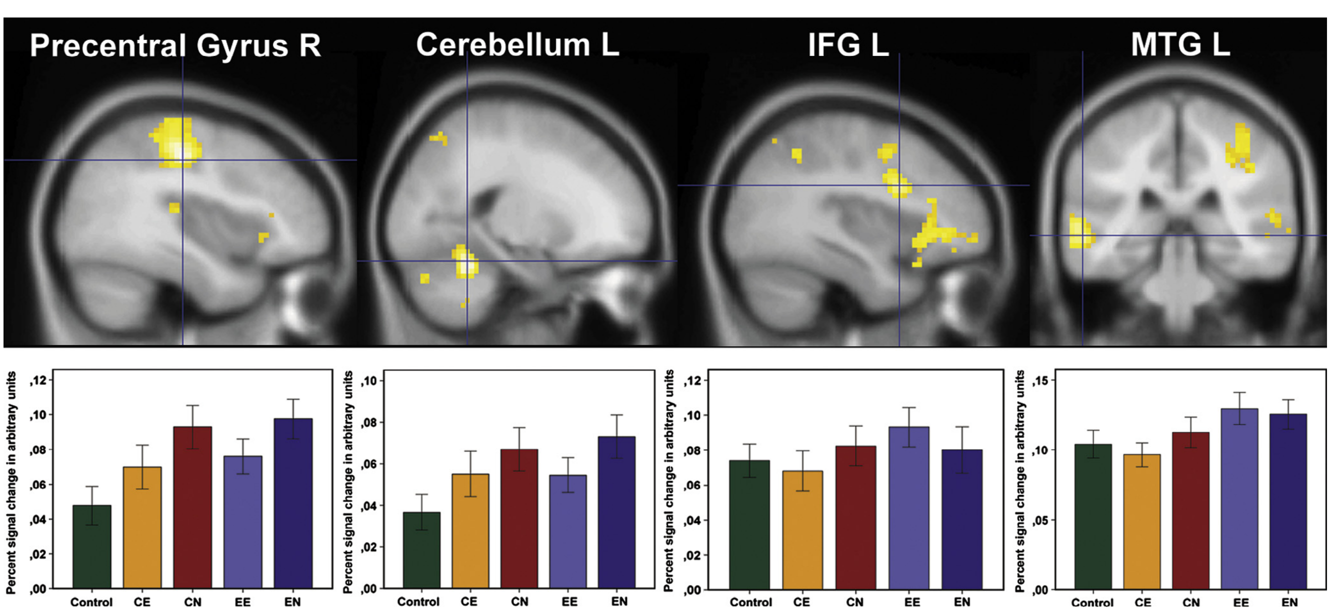

Fig. 5. Emotionally empathic > baseline. Emotionally empathic comments activated right precentral gyrus, left cerebellum, left inferior frontal gyrus and left middle temporal gyrus when contrasted against the high level baseline (figure shows activations at $p < 0.001$).

Table 4
Emotional vs. cognitive comments.

Anatomical region	Side	MNI-coordinates			z-Score of local maximum	Number of voxels in cluster
		x	y	z		
(A) Emotional (EE + EN) > cognitive (CE + CN)						
Superior temporal gyrus	L	−63	−24	3	5.93	298
Superior temporal gyrus	R	60	−3	−3	5.30	317
(B) Emotional empathic (EE) > cognitive empathic (CE)						
Middle frontal gyrus, orbital part	L	−45	45	−3	4.73	229
(C) Emotional unempathic (EN) > cognitive unempathic (CN)						
Superior temporal gyrus	L	−57	−6	−3	5.14	121
Superior temporal gyrus	R	60	−6	−3	4.87	139
(D) Cognitive unempathic (CN) > emotional unempathic (EN)						
Middle frontal gyrus	R	36	9	51	4.87	170

$p < 0.05$, FWE-corrected.

regions associated with reward and social connection (ventral striatum and middle insula) in a similar study, whereas not feeling understood engaged the anterior insula, which has been linked to negative emotions (Morelli et al., 2014).

The left SPG was not among our hypothesized regions, and its emergence in this contrast was surprising. Yet, our study being largely exploratory, unexpected activations are likely to be found to some extent. That being said, a parallel study done by our group on the same subject yielded engagement of the left inferior parietal gyrus in the processing of cognitive empathy in the form of paraphrasing during a live interview on social conflict in the MRT (Seehausen et al., 2014). Hence, both studies indicate the involvement of parietal regions in the processing of empathic social response. Our second study also found activation in the left middle frontal gyrus for the processing of cognitively empathic response, similar to the activation of the left mOFC in the present study. Both studies suggest the significance of a fronto-parietal network for the neural processing of empathic social behavior. Also, both studies located activation in a fronto-temporal network associated with the processing of unempathic social response. In the present study, unempathic comments engaged left superior temporal gyrus and right putamen, as well as left superior frontal gyrus for cognitively empathic comments. In our second study, unempathic responses stating that the listener found it impossible to understand the narrator's perspective involved peak activation in the left inferior frontal gyrus, pars triangularis, and right temporal pole (Seehausen et al., 2014).

Processing empathic social response during the experience of negative feelings and emotions compared to during the experience of positive feelings and emotions (high-level baseline) recruited clusters implicated in social cognition. Inferior frontal gyrus and middle temporal gyrus are part of the mentalizing network (Bzdok et al., 2012); pars opercularis and cerebellum have been associated with the putative mirror neuron network (Decety & Meyer, 2008; Molenberghs, Cunnington, & Mattingley, 2012; Rizzolatti & Sinigaglia, 2010). Hence, these activations are in line with our initial assumption that hearing empathic comments while in a negative emotional state fuels social-cognitive processes involving inferences about the speaker's intention, possibly combined with interpretation of meaning, comparison with social norms and weighing emotional significance of the empathic comments. In line with our results, Morelli et al. (2014) likewise found that both feeling understood and not feeling understood activated parts of the mentalizing system, although the precise location of the activations differed (feeling understood: precuneus and temporoparietal junction, not feeling understood: dorsomedial prefrontal cortex). It seems likely that the emotional impact of empathic comments depends significantly on their sincerity as well as their suitability to the given situation. Therefore, it can be assumed that hearing empathic statements fuels social judgment and inference processes. Social judgment, such as rating someone's trustworthiness, has been previously shown to rely on inferior frontal gyrus together with dorsomedial prefrontal cortex (Bzdok et al., 2012). Furthermore, Blackwood et al. (2000) demonstrated that left inferior frontal gyrus (BA 47) is recruited when pondering whether or not verbal statements of differing emotional valence are relevant to oneself.

The increased activation of these neural regions in processing empathic comments when subjects experienced negative feelings and emotions might be due to the above mentioned social-cognitive processes being more relevant for recipients of empathic support who are actually in need of such support. When individuals are in a balanced emotional state, empathic utterances from other people may easily be dismissed as nice but not particularly relevant. In contrast, when someone experiences negative affect, social support becomes a crucial source of emotional recovery. Hence, it is possible that the social cognition processes related to receiving empathic social support are triggered only, or to a greater extent, when the recipient experiences negative feelings and emotions, as indicated by our results. Empathic comments did not recruit the complete mentalizing network, however. Rather, empathic comments appear to stimulate social-cognitive processes partly relying on mentalizing regions, while simultaneously invoking emotion processing regions.

This may also account for the activation of right postcentral gyrus and precentral gyrus by empathic comments. These regions were also engaged in the processing of cognitive empathy in the form of paraphrasing in the above-mentioned second study (Seehausen et al., 2014). Hence, two studies using different paradigms consistently found activation in right precentral gyrus and postcentral gyrus for the processing of empathic social response during the experience of negative feelings and emotions. Postcentral gyrus and cerebellum have been linked to social emotion processing in connection with an embodied affective style (Saxbe, Yang, Borofsky, & Immordino-Yang, 2012). Right precentral and postcentral gyri, as well as the left frontal operculum, have also been previously implicated in recognizing other people's emotions (Adolphs, Damasio, Tranel, Cooper, & Damasio, 2000).

4.4. Processing cognitively vs. emotionally empathic comments

As hypothesized, cognitively and emotionally empathic comments for negative emotions were processed by partially separate neural clusters. Both stimulated cerebellar and post-/precentral activity when contrasted against the high-level baseline, but emotional empathy/compassion in addition yielded activations in left inferior frontal gyrus (opercular part), and left middle temporal gyrus. Emotionally empathic comments may have been evaluated as more salient or socially relevant by participants, which would explain the increased involvement of social cognition regions. However, as these activations resulted from a comparison with the high-level baseline condition and not a direct contrast of emotional and cognitive empathy, it is difficult to draw conclusions on this basis. In direct comparison with cognitive empathy,

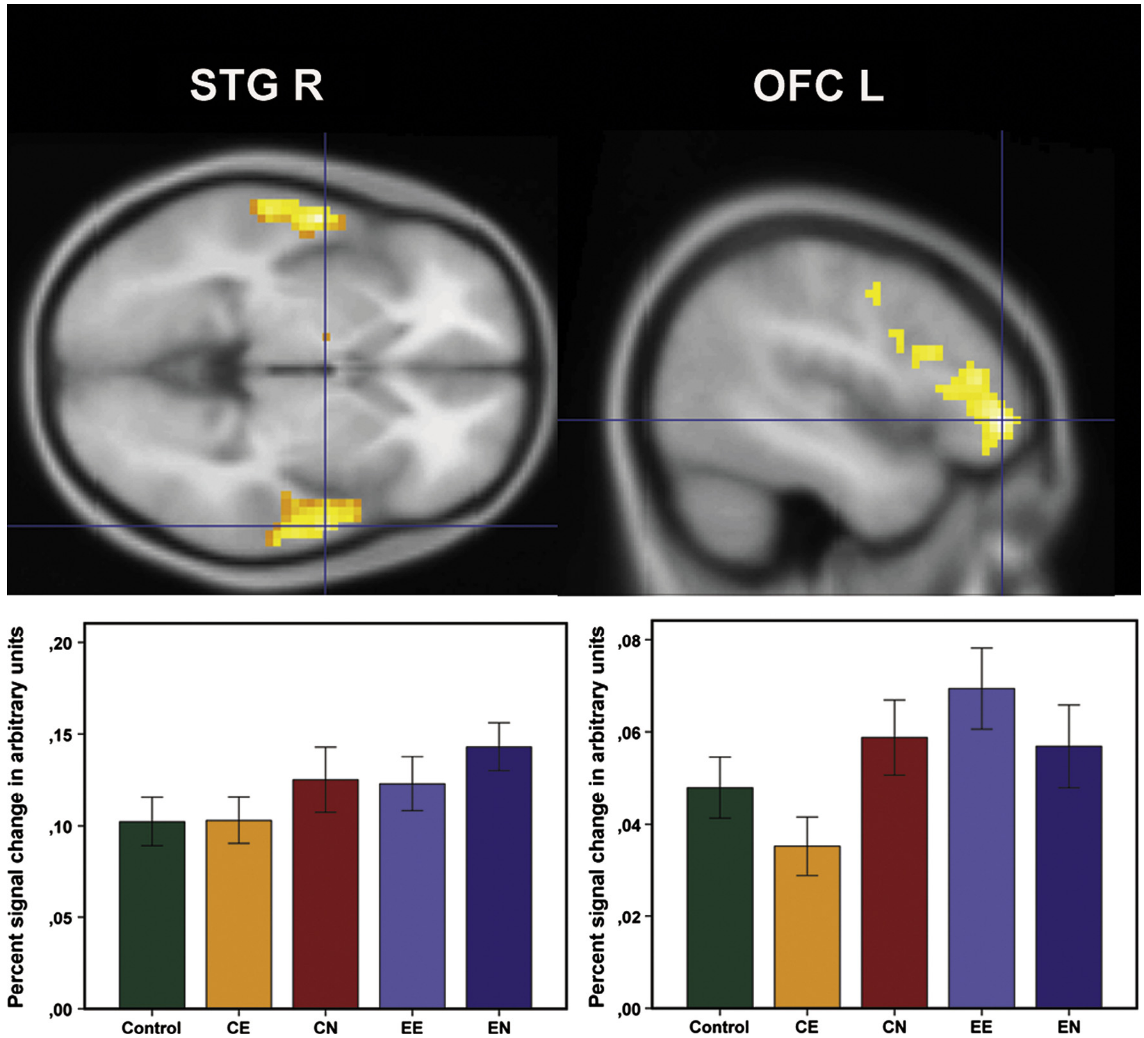

Fig. 6. Emotional > cognitive (left) and emotionally empathic > cognitively empathic (right). All emotional interventions contrasted against all cognitive interventions activated left and right superior temporal gyrus (left). Contrasting only empathic emotional vs. empathic cognitive comments stimulated left OFC (figure shows activations at $p < 0.001$).

emotionally empathic/compassion comments predominantly invoked the left mOFC.

Emotional interventions, contrasted with cognitive interventions, recruited right and left superior temporal gyrus, the latter of which was also activated by unempathic comments compared to empathic comments. The superior temporal cortex plays a critical role in hearing as well as speech, and contains multiple interconnected auditory areas (Howard et al., 2000). Blair (2005) argues that theory of mind, motor empathy, and emotional empathy all rely on the integrity of superior temporal regions. Our results suggest this region is also involved in processing empathic and unempathic behavior, especially unempathic verbal statements. However, this needs to be further explored.

4.5. Limitations of the current study

Due to lack of previous research on this topic, the present study was mainly exploratory. Results need to be repeatedly confirmed by several comparable studies before they can be regarded as definite. In particular, the present study cannot account for the actual online regulation of negative feelings and emotions. In order to not overstrain the participants with too many valence ratings, we did not collect any ratings directly following negative performance feedback, in addition to following the subsequent interventions. Therefore, no direct comparison can be made between participant's feelings before and after the interventions. The present study should be understood as laying a foundation for more field-oriented surveys. In addition, our emotional empathy interventions reflected compassion more than a narrow definition of emotional empathy as an isomorphic reaction to another's emotion. While we believe that this enhanced external validity, this needs to be kept in mind when appraising the neural findings caused by emotionally empathic and unempathic interventions.

5. Conclusion

Our study confirms and expands on the results of a parallel study by our group (Seehausen et al., 2014) on the effects of empathic social response. Both studies indicate the engagement of a fronto-parietal network in the processing of empathic social response, and the involvement of a fronto-temporal network in the processing of unempathic social response. In both studies, social cognition regions appear to play an important role in the processing of empathic and unempathic social response. The present study furthermore showed that cognitively and emotionally empathic comments engage partially different neural networks, however, both types of empathy exert a positive influence on feelings and emotions. This is potentially relevant for all professional groups who deal with and have to de-escalate strong negative feelings and emotions on a regular basis, e.g. lawyers, judges, mediators, and physicians. As has been discussed in Seehausen et al. (2014), it can be difficult for the above-mentioned groups to reconcile the often-needed display of empathy with the impartial stance their professional role requires. However, demonstrating cognitive empathy, e.g. in the form of paraphrasing the perspective of another person, is almost always acceptable, and, as has been shown here, also effective in de-escalating negative feelings and emotions.

Conflict of interest statement

The authors are not aware of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Studie 3

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Talking about social conflict in the MRI scanner: Neural correlates of being empathized with

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ABSTRACT

This study investigated the emotional effects and neural correlates of being empathized with while speaking about a currently experienced real-life social conflict during fMRI. Specifically, we focused on the effects of cognitive empathy in the form of paraphrasing, a technique regularly used in conflict resolution. 22 participants underwent fMRI while being interviewed on their social conflict and receiving empathic or unempathic responses from the interviewer. Skin conductance response (SCR) and self-report ratings of feeling understood and emotional valence were used to assess emotional responses. Results confirm previous findings indicating that cognitive empathy exerts a positive short-term effect on emotions in social conflict, while at the same time increasing autonomic arousal reflected by SCR. Effects of paraphrasing and unempathic interventions as indicated by self-report ratings varied depending on self-esteem, pre-interview negative affect, and participants' empathy quotient. Empathic responses engaged a fronto-parietal network with activity in the right precentral gyrus (PrG), left middle frontal gyrus (MFG), left inferior parietal gyrus (IPG), and right postcentral gyrus (PoG). Processing unempathic responses involved a fronto-temporal network with clusters peaking in the left inferior frontal gyrus, pars triangularis (IFGTr), and right temporal pole (TP). A specific modeling of feeling misunderstood activated a network consisting of the IFG, left TP, left Heschl gyrus, IFGTr, and right precuneus, extending to several limbic regions, such as the insula, amygdala, putamen, and anterior cingulate cortex/right middle cingulum (ACC/MCC). The results support the effectiveness of a widely used conflict resolution technique, which may also be useful for professionals who regularly deal with and have to de-escalate situations highly charged with negative emotion, e.g. physicians or judges.

Introduction

What are the effects of empathy on the person being empathized with? Despite the multitude of recent empathy studies there is very little neuropsychological research looking into the emotional and socio-cognitive consequences of being treated in an empathic way.

Definitions of empathy in research literature are plentiful. Within the field of social neuroscience, empathy is usually differentiated into cognitive empathy, emotional empathy, and motor empathy (Blair, 2005; Carr et al., 2003; Decety and Meyer, 2008). Cognitive empathy, also called theory of mind, means the ability to recognize another person's mental and emotional state as well as behavioral dispositions by abstract inference (Bzdok et al., 2012a, 2012b). Emotional or affective empathy refers to an observer's emotional response to another person's emotional state (Dziobek et al., 2008). Motor empathy is the tendency to automatically mimic and synchronize facial expressions, vocalizations, postures, and movements with those of another person (Blair, 2005). It has been argued that cognitive empathy and emotional empathy constitute two independent systems with dissociable neuroanatomical bases. Emotional empathy has been proposed by some authors to rest on emotional contagion and motor simulation drawing on the mirror neuron system (inferior frontal gyrus — IFG, and inferior parietal lobule — IPL), while cognitive empathy is thought to rely on the ventromedial prefrontal cortex — vmPFC, temporoparietal junction — TPJ, and medial temporal lobe (Shamay-Tsoory, 2011; Shamay-Tsoory et al., 2009). Similarly, Decety and colleagues have proposed a multidimensional model of empathy, which integrates three distinct and interactive components grounded in a number of dissociable neurocomputational mechanisms: 1) affective arousal, a bottom-up process based on

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perception–action coupling (amygdala, hypothalamus and orbitofrontal cortex — OFC), 2) emotion awareness and understanding, including theory of mind processing (anterior insula, medial prefrontal cortex — mPFC, vmPFC), and 3) top-down emotion regulation (OFC, mPFC, dorsolateral — dlPFC). In this empathy framework, motor resonance and affective resonance are considered automatic and non-reflexive processes which are mediated by reflexive metacognition and theory of mind to form an empathic experience and enhance flexible and appropriate responses (Decety, 2011; Decety and Jackson, 2004; Decety and Meyer, 2008).

Verbal demonstrations of empathy can take the emotional or the cognitive route. Emotional empathy can be verbally expressed through voicing sympathy and compassion. Cognitive empathy can be verbally expressed through summarizing an interlocutor's thoughts and emotions in one's own words (i.e., paraphrasing). Through paraphrasing, a listener mentally reconstructs an interlocutor's situation and verbally demonstrates that they can follow the interlocutor's perspective on a purely cognitive road, without expressing sympathy or personal distress (e.g. "I understand that you are angry because you feel you have been treated unfairly"). Paraphrasing exercises have been linked to developing cognitive empathy in the context of improving intergroup relations (Stephan and Finlay, 1999). Paraphrasing, also called active listening, goes back to Rogers' Client-Centered Approach (Rogers, 1942, 1951) and is regularly used in Alternative Dispute Resolution (ADR) practices such as mediation (Kraybill et al., 2001; Schreier, 2002). Demonstrating cognitive empathy through paraphrasing has been shown to positively influence the recipient's emotions in social conflict situations (Seehausen et al., 2012). On a similar vein, interpersonal mimicry, i.e. synchronizing one's facial expression with an interlocutor (motor empathy), can increase affiliation, positive social judgment, and pro-social behavior not only towards the mimicker but also towards other people (Ashton-James et al., 2007; Fischer-Lokou et al., 2011; Guéguen et al., n.d.; Stel and Harinck, 2011; van Baaren et al., 2004). Ashton-James et al. (2007) found that being mimicked during social interaction shifts self-construal towards becoming more interdependent and "other-oriented", and abets a feeling of closeness with other people in general. In addition, language style matching, i.e. similarity in the use of function words, can predict relationship initiation and stability (Ireland et al., 2011).

These findings demonstrate that cognitive and motor empathy can generate changes in emotional experience and social behavior of the individual being empathized with. On the other hand, it is unlikely that an interlocutor's empathic response alone leads to lasting emotional recovery of the recipient in the face of emotional distress. This seems to require cognitive reframing (Nils and Rimé, 2012; Rime, 2009). Nonetheless, empathic responses can buffer distress directly after an emotional event and help to build the necessary trust basis and rapport to enable effective cognitive work (Nils and Rimé, 2012).

We hypothesize that processing paraphrasing involves the processing and appraisal of social stimuli, social cognition, as well as self-reflective awareness and emotional response. It can be assumed that processing social responses of offering or denying empathy will partially draw on neural regions involved in social cognition because the individual receiving the empathic or unempathic responses contemplates their meaning and adequacy as well as intention and sincerity of the speaker. Social cognition is the acquisition of knowledge about other persons' mental states as well as insight about the meaning of their behavior and verbal expressions (Przyrembel et al., 2012) and has been presumed to recruit the mentalizing network, shared networks as well as the putative mirror neuron system (MNS) (Bernhardt and Singer, 2012). The mentalizing network comprises the bilateral ventro- and dorsomedial prefrontal cortex (vmPFC/dmPFC), precuneus, TPJ, temporal poles (TP), middle temporal gyrus (MTG), posterior superior temporal sulcus (pSTS), IFG, and right MT/V5 (Bzdok et al., 2012a, 2012b). The putative human MNS has been located in pars opercularis of the IFG, the anterior part of the inferior parietal lobule, and the superior temporal sulcus (STS; Rizzolatti and Sinigaglia, 2010). A recently proposed dual-process model for social cognition and action understanding links the MNS with automatic behavior identification, while controlled social causal attribution is allocated to the mentalizing system (Spunt and Lieberman, 2013).

More specific assumptions about potential neural substrates of processing empathic and unempathic responses can be derived from Premkumar et al. (2012), who found that viewing pictures displaying scenes of social rejection as compared to neutral scenes activated the left middle occipital and middle temporal gyri (MTG), left pre- and post-central gyri (PrG/PoG), right cerebellum, right superior temporal gyrus (STG) and MTG. Acceptance versus neutral scenes engaged the left medial frontal gyrus (MeFG) and left PoG. In a similar paradigm, Kross et al.(2007) identified the posterior cingulate cortex (PCC) and dorsal anterior cingulated cortex (dACC), MeFG, middle frontal gyrus (MFG), right IFG, PrG, and parahippocampal gyrus as engaged in rejection processing contrasted with acceptance processing. Premkumar et al. (2013) also reported that critical comments given by a relative contrasted with neutral comments activated the left superior frontal gyrus (SFG) and MFG as well as the bilateral PCC, while positive comments contrasted with neutral comments activated the right angular gyrus.

However, the neural processing of empathic behavior expressing cognitive or emotional empathy in real-life social interaction has not been looked into yet. The present study therefore explored the emotional effects and neural correlates of processing paraphrasing, i.e. cognitive empathy, in a face-to-face conversation. To this aim, study participants were interviewed on a currently experienced social conflict while they underwent functional magnetic resonance imaging (fMRI). Conducting fMRI while subjects are speaking poses certain challenges for both procedure and data analysis due to noise and possible head movement but has successfully been done before (Senhorini et al., 2011; Simmonds et al., 2011), including paradigms with free-form verbal communication (Stephens et al., 2010). The interviewer responded to participants' narrations with either paraphrasing or expressing a lack of understanding (unempathic intervention). During the interview, participants' skin conductance response (SCR) was measured as a psycho-physiological indicator of emotional arousal (Critchley, 2002; Kushki et al., 2011). Interviews were recorded and participants subsequently listened to their interview and gave a continuous rating of how well understood they had felt at each point in time during the interview, and how positive or negative they had felt. These ratings were later used in the analysis of neuroimaging data to detect neural substrates of feeling ill understood and well understood. In addition, after re-listening to each intervention, participants were asked to rate how inclined they had been to consider the other party's perspective on the conflict at that point in time.

Paraphrasing was hypothesized to result in more positive valence ratings and feeling understood than unempathic interventions. Also, we hypothesized that participants would be more open to the disputant's perspective following a paraphrase compared to the unempathic condition. In a previous behavioral study, listening to paraphrasing was found to be associated with higher autonomic arousal compared to a control condition consisting of the interviewer taking notes (Seehausen et al., 2012). These results suggest that paraphrasing may trigger an engaging cognitive–emotional process initially involving heightened autonomic arousal, while at the same time alleviating negative emotional valence. Based on these previous findings, SCR was hypothesized to show higher autonomic arousal during paraphrasing compared to the unempathic condition.

Based on the findings by Kross et al. (2007) and Premkumar et al. (2012, 2013), we further hypothesized that listening to paraphrasing as well as feeling understood would engage the PoG, MeFG and angular gyrus, and that unempathic interventions and feeling misunderstood would activate the STG and MTG, PCC/ACC, MeFG, MFG and IFG, PrG, parahippocampal gyrus and cerebellum. The PoG has been linked to social emotion processing connected with an embodied affective style (Saxbe et al., 2012) as well as to recognizing other people's emotions (Adolphs et al., 2000). The angular gyrus has been proposed to form a network of reflective self-awareness together with the precuneus and anterior cingulate gyri (Kjaer et al., 2002). The medial prefrontal gyrus is engaged in the processing of socially relevant stimuli (Fossati, 2012). Hence, with regard to our hypothesized model of processing paraphrasing, socio-emotional information associated with paraphrasing may engage the MeFG and PoG, while the appraisal and self-referential processing of that information may draw on the angular gyrus as well as the ACC/PCC. Processing unempathic social response, on the other hand, is hypothesized to engage areas associated with (negative) emotion generation to a larger extent than processing empathic response should. Thus, in addition to social stimuli processing and social cognition regions (MeFG, MFG, PrG, IFG) the involvement of the STG, MTG, PCC/ACC, parahippocampal gyrus, and cerebellum is hypothesized in connection with emotion generation and processing (see Kober et al., 2008; Ochsner et al., 2012). The PCC/ACC may also be engaged for self-awareness and appraisal of social information during the processing of unempathic response. The dorsal ACC is involved in conflict detection and social expectation violation (Carter et al., 2001; Somerville et al., 2006) as well as in decision-making (Walton et al., 2004, 2007) while the ventral ACC is responsive to social feedback (Somerville et al., 2006).

Both interventions were hypothesized to differentially draw on social cognition regions. Finally, we hypothesized that the effects of paraphrasing would be influenced by current emotional state, self-esteem, and individual differences in empathy, as it seems likely that the effects of empathic responses from an interaction partner depend on the recipient's social expectations and need for social support.

Material and methods

Participants

22 healthy subjects [11 male; age: mean (M) = 36, standard deviation (SD) = 16] participated in the study. All participants were native German speakers, right-handed, and had no current neurological or psychiatric disorder. All participants were currently experiencing or had recently experienced a social conflict with a long-term interaction partner like a friend, partner, family member, roommate or employer. Only conflict situations without physical or psychological violence were accepted for the study.

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.

Half-structured interview

The interview consisted of twelve standardized open questions regarding the history of the conflict and the interpersonal interaction pattern between the disputants (e.g., "How does he/she treat you from your point of view?"). Half of the questions were followed by different standardized unempathic interventions expressing lack of understanding for what the participant had said (e.g., "For that matter, I don't really understand your perspective. I cannot put myself in your position. I have never been in a situation like that and cannot relate to how that must feel for you."). The other half of the questions were followed by individualized paraphrasing of what the participant had said. Paraphrasing was done in such a way that after each answer to an interview question 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. At the end of each paraphrase, the interviewer asked if she had understood the participant's narration correctly (participants were asked to give yes or no answers). The questions were asked in the same order for all participants. Paraphrasing interventions and unempathic interventions were randomized for each participant. Mean unempathic intervention length was 20.2 s, SD = 6.4 s; mean paraphrasing length was 41.6 s, SD = 19.6 s.

To assess potentially different inter-individual effects of paraphrasing depending on current affective state, own empathy quotient, and self-esteem, participants completed a battery of questionnaires consisting of the Positive and Negative Affect Scale (PANAS-state; Watson et al., 1988), Cambridge Behavior Scale (EQ; Baron-Cohen and Wheelwright, 2004), and Rosenberg's Self-esteem Scale (RSS; Rosenberg, 1965, 1979). To exclude participants with manifest psychiatric disorders, the SKID-I screening (Wittchen et al., 1997) was done.

Experimental procedure

Previous to the main study, participants were briefly interviewed via telephone to ensure their conflict situation matched the study requirements. Eligible subjects were told that the study investigated emotional experience during the narration of a social conflict as well as emotional reactions to particular response modes of an interaction partner. They were informed that the interviewer would sometimes summarize the narrator's perspective, while at other times she would deliberately say that she could not relate. They were repeatedly reminded to keep their head as still as possible while speaking in the MRI scanner, and to avoid nodding or shaking their heads in response to the interviewer speaking. After completion of the PANAS-state, the interviews took place in the scanner, lasting 25 min on average (M = 25.18; SD = 4.86). After the interview, participants again filled out the PANAS-state together with the EQ, the RSS, and the SKID I-Screening, while the audiotape of their interview was prepared. Lastly, participants listened to the audiotape and rated how well understood and how positive or negative they had felt during each moment of the interview. The interview procedure is outlined in Fig. 1.

Behavioral and physiological data acquisition and analyses

Self-report ratings were obtained while participants listened to their recorded interview over headphones while placed in front of a computer

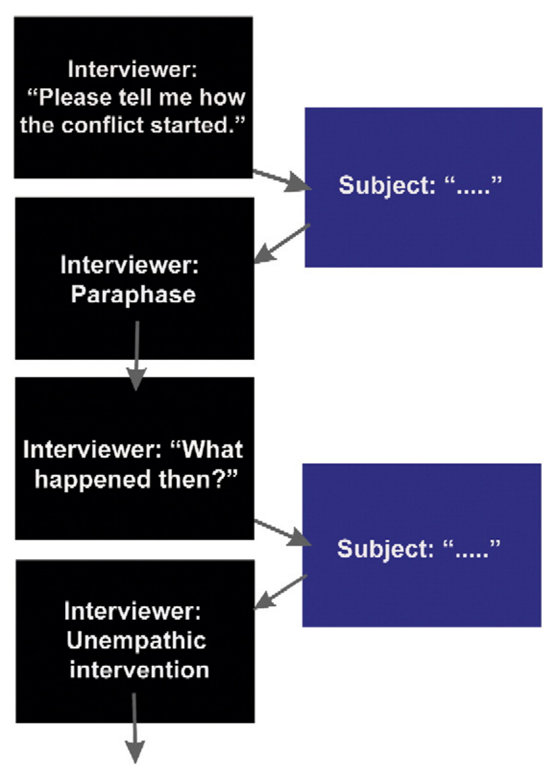

Fig. 1. Experimental procedure.

screen, utilizing a two-dimensional visual analog scale with *feeling understood* on the x-axis and *valence* on the y-axis (*Feeling understood*: "How well or badly understood did you feel in that moment?"/*Valence*: "How positive or negative did you feel in that moment?"). Participants were instructed to continuously move the PC mouse over the matrix according to how they had felt at the respective moment during the interview. Owing to the resolution of the computer screen (width 1024 pixel, height 768 pixel) the ratings were scored as pixel increments ranging from −512 to 511 on the x-axis and ranging from 382 to 381 on the y-axis. To detect differences in feeling understood and valence between the conditions, onsets and offsets of each condition were extracted from the recorded audio file of the interviewer's voice with the sound finder in Audacity software (http://audacity.sourceforge.net/). Paraphrasing and unempathic interventions were compared with two-tailed and paired *t*-tests for repeated measures in IBM SPSS Statistics 20. In addition, pre–post-intervention comparisons of feeling understood and emotional valence were conducted with repeated measures ANOVA (factors were time and condition).

During the fMRI interviews, SCR was detected using an MR-compatible ExG-amplifier (BrainAmp ExG MR, Gilching, Germany). Data was acquired with a sampling rate of 5 kHz and recorded with Brain Vision Recorder software (Brain Products, Gilching, Germany). A cup electrode with an internal impedance of 15 kΩ was attached to the intermediate phalanges of the index and middle fingers of the subject's left hand. SCR was measured with the constant voltage method. Data was extracted using the continuous decomposition analysis (CDA) of Ledalab 3.31 (Benedek and Kaernbach, 2010). CDA aims at retrieving the signal characteristics of the underlying sudomotor nerve activity by decomposing raw data into phasic and tonic components using an appropriate impulse response function. We compared averaged phasic activity during paraphrasing with unempathic comments using IBM SPSS Statistics 20. The time frame of analysis of SCR data was 7.5 s starting from intervention onset. The time window of 7.5 s was chosen because post-interview analysis revealed that this was the minimal duration paraphrasing had lasted without interruption during the interview. Hence, in this way it could be ensured that SCR data was not warped by participants' speech. The minimum amplitude criterion was set to 0.05 μS, so in total 8 trials were excluded across all subjects. For each subject on average 97% of the trials (SD = 6) in the unempathic condition and 96% of the trials (SD = 9) in the paraphrasing condition were subjected to the statistical analysis.

fMRI data acquisition and analyses

fMRI measurements were performed on a 3 T Trio (Siemens, Erlangen) scanner, equipped with a 12-channel coil. The gradient echo sequence (Echo-Planar-Imaging, EPI) was used (TE/TR/flip angle/bandwidth =30 ms/2000 ms/70°/2170 Hz) with 3 mm × 3 mm × 3 mm resolution, fat saturation prior to every slice and a GRAPPA acceleration factor of 2. Thirty-seven axially oriented slices with an interslice gap of 0.3 mm were acquired in an interleaved order, providing whole brain coverage. T1-weighted anatomical images (MPRAGE TE/TR/TI/flip angle/bandwidth = 2.52 ms/1900 ms/900 ms/9°/170 Hz, 1 mm × 1 mm × 1 mm resolution) were acquired for each subject. Data were recorded in 1 run consisting of 755 volumes on average, depending on the length of the interview (SD = 146 TR). Participants' voices were recorded with a bi-directional patient intercom microphone with active noise-cancelation (Serene Sound MRI Audio System). To improve the recording, we used online noise-reduction software Z-Noise (Waves Inc., Knoxville, TN, USA) in Cubase LE™ (Steinberg Media Technologies GmbH, Hamburg, Germany). We used a short EPI sequence of 30 TR to calibrate the filtering software, while the participant was counting from 1 to 20. The interviewer's voice was recorded separately using a highly directional headset microphone (AKG C520L Headset, Harman International Industries, Inc., CT, USA) which ensured the voice recording to be as clean as possible by canceling out most of the background noise. During the interview, participants were able to see the interviewer through a mirror fixed to the head coil.

fMRI-data was analyzed using the Statistical Parametric Mapping software (SPM8, Wellcome Dept. of Imaging Neuroscience, London, UK) implemented in MATLAB 7.11.1. A high pass filter with a cut off of 128 s was applied on the voxel time courses of fMRI data. Before statistical analyses, functional images were realigned, co-registered to the individual anatomical images, segmented, spatially normalized to the Montreal Neurological Institute (MNI) space (voxel size: 3 × 3 × 3 mm^3), and smoothed using a 8 mm full-width at half-maximum Gaussian kernel.

After preprocessing, first-level single subject analyses were conducted to estimate BOLD responses following the general linear model approach. We computed two separate models. The first model was based on the structure of the interview (paraphrasing and unempathic interventions blocks, participants speaking blocks). In contrast, for the second model we used the self-report ratings of the participants (feeling understood/valence) obtained during the playback of the interview, to detect specific neural substrates of feeling understood and misunderstood. These regressors were not included in model 1 because both feeling understood and valence were highly correlated with our conditions (paraphrasing and unempathic interventions), as can be seen in the behavioral data. As regressors of no interest we included 6 movement regressors in both models.

Model 1: block-model following the interview structure

In model 1, BOLD responses were modeled with 5 block-related regressors of interest (paraphrasing, unempathic intervention, interviewer speaking: unrelated content, subject speaking after paraphrase, subject speaking after unempathic intervention) and convolved with the canonical hemodynamic response function. To account for possible non-linear BOLD effects due to different durations of the conditions, all blocks were modeled as rapid series of events/brief bursts of neural/synaptic activity (delta functions) convolved with the HRF (see Wager et al., 2005). Model 1 was used to test our hypotheses on the neural processing of paraphrasing and unempathic interventions.

Model 2: continuous model of self-reported valence and feeling understood

In model 2, BOLD responses were modeled with one continuous regressor of interest covering the entire interview (valence ratings) and two event-related regressors (feeling well understood and feeling ill understood, only including events above the median rating of each individual subject of positive ratings of feeling understood and below the median of negative ratings of not feeling understood). Model 2 aimed at checking the quality of our neural data by replicating established findings pertaining to the neural substrates of emotional valence. At the same time, model 2 tested our hypotheses on the neural substrates of feeling well and ill understood by breaking up the originally continuous regressor in two event-related regressors only including events above or below the median (well understood and ill understood). This distinction of feeling well understood and ill understood was advisable for two reasons. First, valence and feeling understood were correlated and therefore would have caused large data overlap if both were left in original form. Secondly, the distribution of the ratings on feeling understood was bimodal with one maximum on the positive side and one on the negative side of the continuum. Thus, it was possible to investigate the neural substrates of well and ill understood separately. In contrast, the distribution of the valence ratings was unimodal with its maximum in the negative continuum; hence it was not expedient to divide the valence regressor in positive valence and negative valence. At second level, estimated beta weights were entered into random effects analyses employing paired t-tests.

Four subjects had to be excluded from fMRI data analysis due to head movement exceeding 3 mm. Hence, 22 subjects entered analysis of behavioral and physiological data, and 18 subjects were included in fMRI analysis. All reported activations survived a threshold of $p < .05$ after cluster-wise and family-wise error corrections for multiple comparisons over the entire brain at a cluster-defining threshold of $p < .001$, uncorrected (see Table 1). Labels for activated regions were obtained with the xjView toolbox (http://www.alivelearn.net/xjview). The contrasts spara > sunemp and sunemp > spara as well as the valence and feeling understood regressors cover sequences when participants were speaking. The contrasts para > unemp and unemp > para do not involve participants speech.

Results

Behavioral and physiological data

Two-tailed *t*-tests for repeated measures showed that participants felt better understood during paraphrasing than during the unempathic condition [$t(21) = 11.79$; $p < 0.001$]. Correspondingly, their valence ratings were more positive during paraphrasing than during the unempathic condition [$t(21) = 5{,}48$; $p < 0.001$]. Moreover, repeated measures ANOVA for feeling understood yielded a main effect of time (pre–post-intervention) [$F(1,21) = 140.77$, $p < 0.001$] and an interaction of time × condition [$F(1,21) = 91.45$, $p < 0.001$]. Post-hoc *t*-test showed that participants felt better understood after paraphrasing than before paraphrasing [$t(21) = 8.34$, $p < 0.001$] while they felt less understood after than before the unempathic intervention [$t(21) = 8.32$, $p < 0.001$]. Again, the same pattern was found for emotional valence. Here, the ANOVA displayed main effects of time [$F(1,21) = 18.60$, $p < 0.001$] and condition [$F(1,21) = 8.73$, $p = 0.008$] as well as a time × condition interaction [$F(1,21) = 27.63$, $p < 0.001$]. Post-hoc *t*-tests confirmed that participants felt better after paraphrasing compared to before paraphrasing [$t(21) = 5.11$, $p < 0.001$] and worse after the unempathic interventions compared to before [$t(21) = 2.32$, $p = 0.031$]. There was no difference in self-reported willingness to consider the disputant's perspective between the conditions. Ratings of feeling understood and emotional valence were correlated [Pearson's $r = 0.54$; $p < 0.001$], however, a closer look revealed a correlation only for the unempathic condition [$r = 0.69$; $p < 0.001$], but not for the paraphrasing condition.

Valence ratings in response to paraphrasing displayed a negative correlation with self-esteem measured with the RSS [$r = -0.52$; $p = 0.013$]. The analysis of covariance (ANCOVA) yielded a trend for an interaction between intervention condition and RSS [$F(1,20) = 3.59$; $p = 0.073$]. When RSS data was split along the median, the 2 (group) × 2 (intervention condition) ANOVA showed that paraphrasing led to more positive valence ratings in subjects with low self-esteem compared to subjects with high self-esteem [$F(1,20) = 4.45$; $p = 0.048$] (see Fig. 2A). There was no interaction between self-esteem and feeling understood.

In addition, subjects with a high empathy quotient as measured by the EQ reacted with more negative valence ratings to the unempathic condition than subjects with a low empathy quotient [$F(81,20) = 5.89$; $p = 0.026$] (see Fig. 2B). This was, however, only visible in the 2 × 2 ANOVA with EQ data split along the median, not in the ANCOVA using raw EQ data or in Pearson's correlation coefficient. Again, there was no interaction between EQ and feeling understood.

We also found a correlation between valence ratings and pre-interview emotional state as assessed by the PANAS-state. Specifically, high scores on negative affect before the interview were correlated with positive valence ratings in response to paraphrasing [$r = 0.46$; $p = 0.031$] (see Fig. 2C). Correspondingly, the ANCOVA showed a trend for an interaction between intervention condition and PANAS pre-interview negative affect scores [$F(1,19) = 3.71$; $p = 0.069$]. Finally, post-interview positive affect was correlated with feeling understood in the paraphrasing condition [$r = 4.55$; $p = 0.033$]. This was also visible in the 2 × 2 ANOVA with PANAS data split along the median [$F(1,18) = 13.41$; $p = 0.002$] (see Fig. 2D). In contrast, valence ratings during the interview were not correlated with post-interview affect. A comparison of pre- and post-interview PANAS scores showed that positive affect was lower after the interview compared to before [$t(21) = 2.12$; $p = 0.045$], while negative affect was higher after the interview [$t(21) = -3.02$; $p = 0.007$].

Mean phasic SCR was higher during paraphrasing compared to unempathic interventions [$t(21) = -2.15$; $p = 0.0449$]. Mean phasic SCR during paraphrasing was $M = 0.40$ µS ($SD = 0.30$ µS), mean SCR during unempathic intervention was $M = 0.30$ µS ($SD = 0.21$ µS).

Table 1
Neural activations induced by listening (1A), paraphrasing (1B), subject after a paraphrase (1C), unempathic + subject after unempathic (1D), and subject after unempathic condition (1E); neural activations induced by valence (2A) and feeling misunderstood (2B).

Anatomical peak region	Side	MNI-coordinates (x, y, z)			z-Score of local maximum	Number f voxels in cluster
1A) Listening						
Temporal sup	R	63	−10	−8	6.46	1711
Temporal mid	L	−60	−31	4	6.29	1499
Cingulum ant	R	6	41	10	5.25	1030
Frontal inf tri	R	51	26	22	4.58	177
Postcentral	R	54	−4	34	6.01	11119
1B) Para > unemp						
Precentral	R	30	−25	70	4.27	415
Frontal mid	L	−30	5	61	3.96	217
Parietal inf	L	−36	−43	40	3.86	270
1C) Spara > sunemp						
Postcentral	R	30	−37	40	5.43	4876
1D) Unemp + sunemp > para + spara						
Temporal pole mid	R	48	14	−26	4.64	150
1E) Sunemp > spara						
Frontal inf tri	L	−54	23	10	4.49	220
2A) Valence						
Frontal mid	L	−36	20	31	4.07	174
Undefined/putamen	R	24	2	19	3.96	171
2B) Mis > understood						
Frontal inf	R	27	26	−8	4.31	1313
Temporal pole sup	L	−33	17	−32	4.28	322
Heschl	L	−54	−16	7	3.95	219
Frontal inf tri	L	−36	26	28	3.88	277
Precuneus	R	9	−52	37	3.79	143

All reported activations survived a threshold of $p < 0.05$ after cluster-wise family-wise error correction for multiple comparisons over the entire brain at a cluster-defining threshold of $p < 0.001$, uncorrected. Critical cluster sizes for each contrast: 1A) = 177, B) = 217 C) = 4876, D) = 150, E) = 220, B1) = 171, B2) = 143.

fMRI data

Model 1: block-model following the interview structure

To check the quality of our neural data, we first tested activations induced by listening to the interviewer speak in general (paraphrase + unempathic + unrelated > rest). This contrast activated four neural clusters in bilateral auditory and language areas with peaks in the left MTG (BA22), right STG, right ACC, and right inferior frontal gyrus, pars triangularis (IFGTr, see Supplementary 3D data).

We then proceeded to test our hypotheses. Contrasting paraphrasing with the unempathic intervention (para > unemp) activated three clusters with peak activations in the right PrG, left MFG, and left inferior parietal gyrus (IPG). The largest cluster peaked in the right PrG and comprised the right PoG, MeFG, bilateral supplementary motor area (SMA), and precuneus. The second cluster included the left MFG, left PrG/PoG, and left SFG. The third cluster peaked in the left IPG and expanded on the left superior parietal gyrus (SPG), precuneus, cingulate gyrus, left PoG, frontal lobe and paracentral lobule. No supra-threshold activity could be detected for the opposite contrast (unemp > para).

To allow for the possibility that effects of paraphrasing might unfold over a longer period of time than the actual speaking time

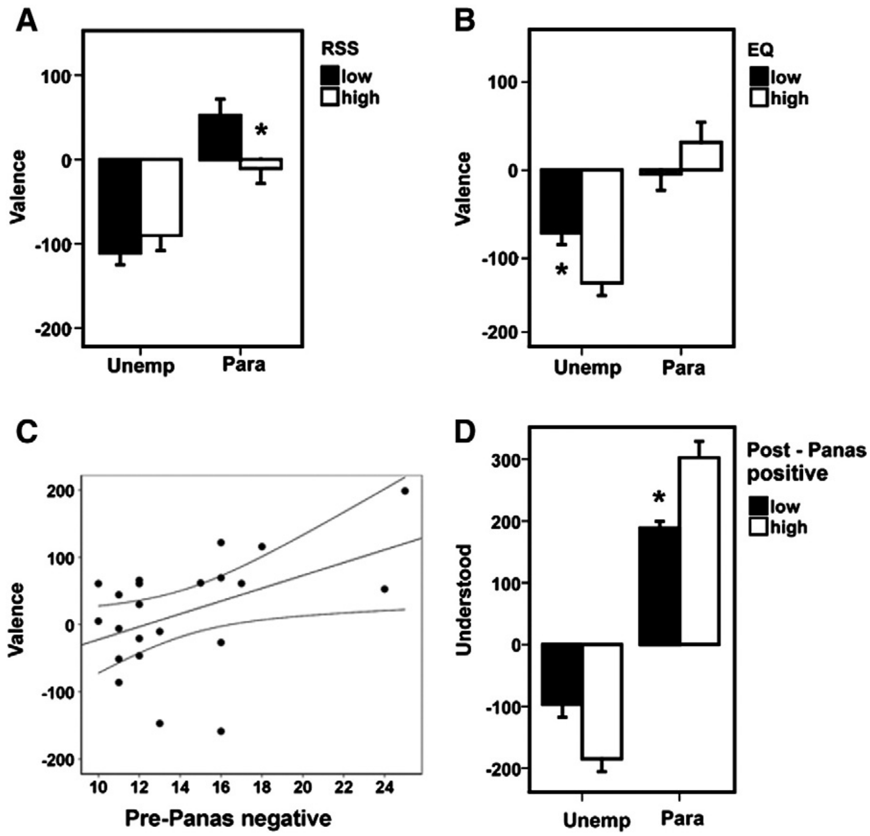

Fig. 2. Self-report ratings for valence and feeling understood during paraphrasing as opposed to unempathic interventions in relation to personality scores. The figure compares subjects with lower and higher scores in RSS, EQ, pre-PANAS negative affect, and post-PANAS positive affect (median split). A) Low RSS scorers reacted with more positive valence ratings to paraphrasing than high RSS scorers. B) The same is true for high scorers in pre-PANAS negative affect. C) High EQ scorers reacted with more negative valence ratings to the unempathic interventions than low EQ scorers. D) High scorers in post-PANAS positive affect felt better understood during paraphrasing than low scorers. Differences according to scores on pre-PANAS negative affect are depicted as a correlation, since the median split samples did not differ.

slot of the paraphrase, we also contrasted subjects answering periods following a paraphrase with answering periods following an unempathic intervention (spara > sunemp). This activated a large cluster with its peak in the right PoG, extending to the parietal, temporal and occipital lobes, cerebellum, precuneus, PrG, fusiform gyrus, angular gyrus, parahippocampal gyrus, cingulate gyrus, insula, and lingual gyrus, all right-hemisphere. The opposite contrast, speaking after an unempathic intervention (sunemp > spara) showed activity in a cluster in the left IFGTr, extending to the left PrG and left MFG.

The combined contrast of unempathic intervention + subject speaking after unempathic intervention over paraphrasing + subject speaking after paraphrasing (unemp + sunemp > para + spara) showed activity in the right TP, extending to the STG, MTG and amygdala. The opposite contrast (para + spara > unemp + sunemp) yielded no suprathreshold activations.

Fig. 3 displays FWE cluster level corrected activations from model 1. Peak activations surviving FWE cluster level correction from model 1 are listed in Table 1.

Model 2: continuous model of self-reported valence and feeling understood

Valence was reflected in two clusters. The first cluster included the right putamen and right insula, although its peak activation was located in white matter next to the putamen. The second activation extended from the left MFG to the PrG and the inferior frontal operculum (frOP).

Feeling ill understood in contrast to feeling understood (mis > understood) activated five clusters with peaks in the IFG, left TP, left Heschl gyrus, IFGTr, and right precuneus. The first cluster extended from the IFG to the MFG and the inferior orbital frontal gyrus (iOFC), insula, STG/MTG/ITG, TP, parahippocampal gyrus, hippocampus, amygdala, putamen, and ACC/MCC, all right-hemisphere. The second activation ranged from the left TP to the IFG, insula, inferior orbital frontal gyrus, putamen, and lentiform nucleus, all left-hemisphere. The third cluster comprised activity in Heschl gyrus extending to the STG/MTG, insula, and rolandic operculum, all left-hemisphere. Fourth, activity in the IFGTr extended to the MFG, IFG and precentral gyrus, also left-hemisphere. And finally, activation extended from the right precuneus to the right middle cingulum (MCC) and left PCC. No activations were found when contrasting feeling understood over feeling ill understood.

FWE cluster level correctable activations from model 2 are shown in Fig. 4. Peak activations surviving FWE cluster level correction from model 2 are also listed in Table 1.

Discussion

The aim of the present study was to confirm and further explore effects of cognitive empathy on emotion, as well as to identify neural clusters involved in processing cognitive empathy on the receiving end. The study produced the following main findings. (a) Compared to the unempathic interventions, paraphrasing led to higher ratings of feeling understood and more positive feelings. In addition, participants felt better after paraphrasing than before paraphrasing, and worse after the unempathic interventions than before. (b) While maintaining this chief effect, responses to paraphrasing and the unempathic interventions as indicated by the ratings varied in accordance with self-esteem, pre-interview negative affect and empathy quotient. (c) SCR indicated higher autonomic arousal during paraphrasing compared to the unempathic interventions. (d) Processing cognitive empathy engaged a frontal–parietal network with peak activations in the right PrG, left MFG, left IPG, and right PoG. Unempathic responses were processed in

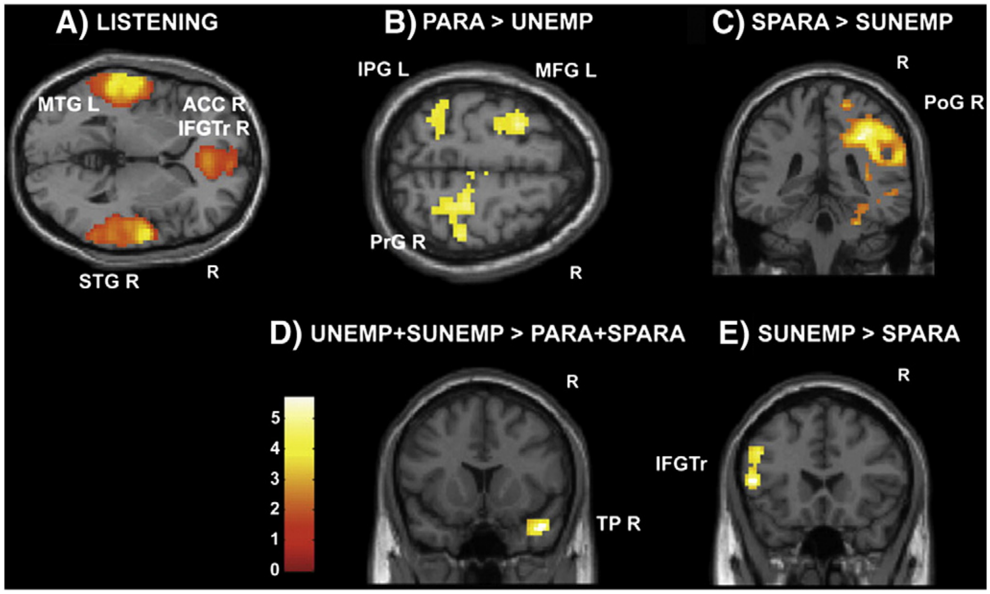

Fig. 3. Neural activations from model 1 for A) Listening, B) Paraphrasing > unempathic intervention, C) Subject after paraphrasing > subject after unempathic intervention, D) Unempathic intervention + subject after unempathic intervention > paraphrasing + subject after paraphrasing, E) Subject after unempathic intervention > subject after paraphrasing.

a frontal–temporal network with peaks in the left IFGTr and right TP. (e) Feeling misunderstood induced peak activity in the IFG, left TP, left Heschl gyrus, IFGTr, and right precuneus. Activations extended to several regions associated with emotion generation and processing, such as the insula, amygdala, putamen, and ACC/MCC.

Effects of cognitive empathy on emotion

The distinct differentiation of feeling well understood during paraphrasing and feeling ill understood during unempathic interventions as indicated by the self-report ratings can be used as a manipulation check, indicating that paraphrasing was successful in capturing participants' thoughts and feelings. The valence ratings show that paraphrasing induced mildly positive feelings in participants, while unempathic interventions induced negative feelings. This effect was visible in direct comparison of paraphrasing and unempathic interventions as well as in pre–post-intervention ratings. This replicates earlier findings demonstrating a short-term effect of cognitive empathy on feelings and emotions (Seehausen et al., 2012). This effect is particularly interesting because cognitive empathy in the form of paraphrasing does not offer any emotional sympathy, nor does it entail agreeing with the narrator's point of view. Accordingly, the mere process of intent listening and cognitively following the narrator's perspective without consenting to it already brings about a beneficial effect on the narrator's emotional state in a negatively charged situation.

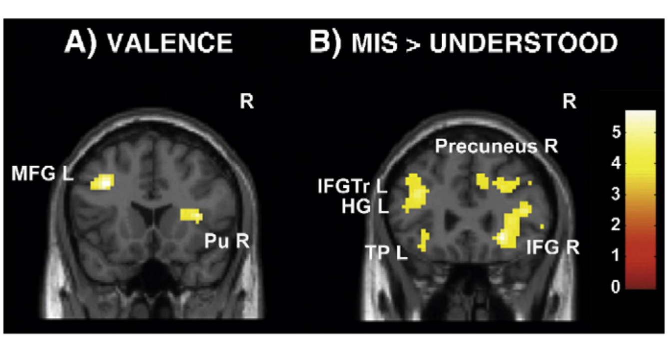

Fig. 4. Neural activations from model 2 for A) Valence, and B) Feeling misunderstood > feeling well understood.

The SCR data obtained in the present study also confirm previous findings. In both studies, participants experienced higher autonomic arousal as measured by SCR during paraphrasing compared to the unempathic condition, irrespective of the different nature of unempathic interventions. A possible explanation for this might be that paraphrasing sets in motion a cognitive–emotional process which initially heightens emotional arousal and engagement by promoting a more concise focus on emotional and potentially unpleasant issues connected to the social conflict which might otherwise be ignored or remain fuzzy. In the long run, this process might contribute to a beneficial resolve of negative emotions connected to the social conflict, provided paraphrasing is complemented with cognitive reframing. This idea is roughly in line with Rogers' original claim of the supposedly empowering and growth-inspiring effects of empathy in Client-Centered Therapy (Rogers, 1942, 1951). However, our study design focused on short-term emotional effects and thus has to leave the investigation of this idea to future studies with a longer-range design.

Contrary to our expectations, paraphrasing did not promote an increased inclination to consider the other party's perspective on the conflict compared to the unempathic intervention. This hypothesis was based on the findings that mimicry enhances pro-social orientation (Ashton-James et al., 2007; Fischer-Lokou et al., 2011; Guéguen et al., n.d.; Stel and Harinck, 2011; van Baaren et al., 2004), which suggests that an analog display of empathy through paraphrasing might have similar effects. Our present results do not support this idea but also do not suffice to refute it without further investigation.

Effects of cognitive empathy in relation to personality

While all participants gave more positive valence ratings in response to paraphrasing compared to unempathic interventions, a closer inspection of behavioral data showed differences in the ratings depending on personality variables, i.e. self-esteem and empathy quotient, as well as pre-interview emotional state (see Fig. 2). The fact that participants with relatively low self-esteem as well as participants experiencing relatively high levels of pre-interview negative affect responded to paraphrasing more strongly (with more positive valence ratings) suggests that cognitive empathy may be particularly beneficial when the recipient is in an emotionally unstable state and therefore in greater need of social support. Also interesting is the correlation of feeling understood and post-interview positive affect in relation to the lack of correlation between valence ratings and post-interview positive affect. Post-interview positive affect was influenced by how well understood participants had felt during the interview, but it was not influenced by how positive they had felt during the interview. This might indicate a delayed emotional effect of cognitive empathy, which manifests itself only after a certain time, in this case the end of the conversation, in addition to the immediate effect visible in the valence ratings.

One of the questions we were interested in concerned the relationship of being empathized with and one's own empathic disposition. In this respect, unfortunately, the present study could not provide many answers. However, participants with a high empathy quotient reacted more strongly to the unempathic condition in their valence ratings, that is, they felt more negative when confronted with unempathic comments than subjects with low empathy quotients. It may be speculated that this effect reflects possible expectations of wanting to be treated with empathy, and a negative emotional response when these expectations are violated. It seems likely that such expectations would be higher in people who themselves possess a relatively high level of social skills, including empathic abilities. However, this remains speculative.

Quality check on neuroimaging data

As our paradigm required participants to speak during fMRI and therefore entailed a potential hazard to reliable neuroimaging data due to head movement, we checked the quality of our neural data — in addition to screening individual movement parameters and excluding subjects with movements exceeding 3 mm — by trying to replicate established neural substrates of listening as well as emotional valence. Listening to the interviewer's voice in general induced distinct activity in the bilateral primary and secondary auditory cortices and language areas (Price, 2012; Schirmer et al., 2012). Valence was processed in two regions that have been identified as consistently responding to negative valence and withdrawal (insula, putamen) in a quantitative meta-analysis on neuroimaging studies on emotion (Wager et al., 2003). This is consistent with the predominantly negative distribution of valence ratings in our findings. Additionally, valence activated a cluster in the MFG, extending to the PrG and frOP. While the MFG and frOP are associated with emotion processing (Kober et al., 2008; Sabatinelli et al., 2011), the PrG is not a core emotion processing region but has been linked to recognising other people's emotions (Adolphs et al., 2000), as well as attributing events with positive or negative valence to an internal vs. external source (Blackwood et al., 2000). In sum, neural representation of listening and emotional valence was coherent with established neural substrates.

Neural substrates of being empathized with

Paraphrasing was hypothesized to engage social cognition regions, i.e. neural clusters associated with mentalizing or the putative mirror neuron network. In line with this presumption, paraphrasing (para > unemp) induced activity in a frontal–parietal network including a region counted among mirror neuron regions, namely the left IPG. However, the left IPG is also engaged in language processing (Gow, 2012), hence its response to empathic verbal statements does not necessarily suggest that listening to paraphrasing activates the putative MNS, although language processing activity should be largely canceled out by contrasting two verbal stimuli.

As hypothesized based on social acceptance and rejection studies (Kross et al., 2007; Premkumar et al., 2012, 2013), the PoG and MeFG were also activated by paraphrasing (para > unemp). The angular gyrus was only engaged in the time period directly after paraphrasing, when participants gave their next narration (spara > sunemp). In this time slot, we also found peak activity in the PoG. Consequently, processing cognitive empathy seems to engage a similar neural network as processing social acceptance scenes.

Unexpectedly, paraphrasing also activated the PrG extending to the bilateral SMA and precuneus, as well as the MFG, extending to the left SFG. The PrG and MFG have been previously associated with rejection processing (Kross et al., 2007; Premkumar et al., 2012). In the present study, several neural regions were involved in the processing of both empathic as well as unempathic verbal responses and feeling misunderstood, even though peak activations differed. Similarly, Premkumar et al. (2013, 2012), and Kross et al. (2007) reported engagement of the MeFG, PoG, and cerebellum in both social acceptance and rejection, depending on the respective paradigm deployed. Clearly, the neural substrates of processing empathic and unempathic behavior and of comparable social responses are quite complex and need to be studied further.

The involvement of core sensorimotor areas like the PrG and SMA in the processing of paraphrasing should be considered in relation to language processing theories. Previous evidence has reliably shown that the process of language comprehension engages primary and secondary motor areas. This evidence promotes the theory of embodied simulation, which stipulates that listening to a verbal description excites an internal simulation of the content described (Pulvermüller, 2005; Sakreida et al., 2013). The SMA has furthermore been identified as part of a core empathy network together with the dorsal ACC, anterior MCC, and bilateral insula in a quantitative meta-analysis of neuroimaging studies (Fan et al., 2011).

The time slot after paraphrasing (spara > sunemp) also induced activations in emotion processing regions, including the ACC, insula, fusiform gyrus, cerebellum, and middle occipital gyrus (Ochsner et al., 2012; Wager et al., 2003).

Feeling well understood contrasted with feeling ill understood did not produce any supra-threshold activity. Possibly, this may mean that feeling understood and feeling misunderstood engaged the same neural clusters, but with a stronger intensity in the case of feeling misunderstood. Hence, feeling understood might have to be compared with a neutral baseline in future studies.

Neural substrates of being denied empathy and feeling ill understood

Neural correlates of the unempathic interventions could not be observed during the interventions itself. The time frame following the unempathic interventions (sunemp > spara) induced activation in the left IFGTr, extending to the left PrG and left MFG. The left IFGTr corresponds to Broca's area (BA 45), which is involved in speech production and language comprehension but has also been implicated in fine motor acts from movement imagination and preparation to action production, visual spatial cognition, action recognition and imitation (mirroring), as well as, bilaterally, in hierarchical organization of human cognitive behavior in general (Burns and Fahy, 2010). The IFG in general is thought to be part of the human mirror neuron system (Rizzolatti et al., 2009), and has been engaged in social judgment, such as assessing somebody's trustworthiness (Bzdok et al., 2012a, 2012b), and deliberating the personal relevance of emotionally charged verbal statements (Blackwood et al., 2000). Furthermore, the IFG is part of the sensorimotor network (Sakreida et al., 2013), as well as involved in the cognitive control of memory (Badre and Wagner, 2007). Lesion studies have also demonstrated that the IFG is necessary for emotional empathy (Shamay-Tsoory, 2011; Shamay-Tsoory et al., 2009). Its involvement in the present paradigm was hypothesized within the framework of social cognition, i.e. mentalizing or simulation (MNS). As hypothesized, processing paraphrasing and unempathic interventions differentially involved regions associated with social cognition, although none activated a complete social cognition network.

Combining unempathic interventions and the subsequent time slot (unemp + sunemp > para + spara) produced activation in the right TP, extending to the MTG/STG, and amygdala. The TP is involved in social and emotional processes like theory of mind and face recognition and has been proposed to bind complex, highly processed perceptual information to visceral emotional responses (Olson et al., 2007). The amygdala as well as the TP, MTG and STG are core areas for emotion generation and processing (Kober et al., 2008; Ochsner et al., 2012).

Feeling ill understood as a presumed active factor in the effects of unempathic comments engaged the IFG and IFGTr, left TP, and right precuneus, all of which are part of the mentalizing network. These regions were hypothesized to play a role in the processing of empathic and unempathic comments in relation to participants assessing the interviewer's intentions and thought processes. Located in the medial parietal cortex, the precuneus is also part of a neural network of self-consciousness, engaged in self-related mental representation during resting states (Cavanna and Trimble, 2006), self-reflection and episodic memory retrieval with self-representation (Kjaer et al., 2002; Lou et al., 2004), as well as awareness and conscious processing of visual verbal stimuli (Kjaer et al., 2001; Vogt and Laureys, 2005). The activations elicited by feeling ill understood further extended to core regions for emotion generation and processing, i.e., the insula, amygdala, putamen, hippocampus, IFG, OFC, STG/MTG, ACC/PCC/MCC, and TP (Kober et al., 2008; Ochsner et al., 2012; Wager et al., 2003). Together with the negative valence ratings, the consistent involvement of these regions in processing unempathic interventions as well as in feeling ill understood suggests that the interviewer's unempathic responses resulted in distinct negative emotional experiences in participants, even though the unempathic response merely consisted of statements like "I cannot understand what you are going through right now."

The activations induced by the regressor modeling feeling misunderstood in our study are particularly interesting because they reflect neural substrates of a specific cognitive–emotional process triggered by cognitive empathy or the lack thereof, respectively, while activations during paraphrasing and control blocks may represent a number of different processes happening simultaneously, e.g. processing and evaluating verbal as well as visual input, mentalizing, emotional reactions, pondering a verbal response, and recalling details of the social conflict from episodic memory.

Neuroimaging data from our second model produced unexpected white matter activation for valence and feeling misunderstood. In a multi-study fMRI analysis, Yarkoni et al. (2009) described the characteristics of white matter HRF as similar as gray matter HRF, but lower in amplitude and delayed in latency. The second model tested in our experiment might be more sensitive to the profile of white matter signal, since we used a continuous post-rating as a regressor instead of clearly defined external events. It is plausible that post-rating of one's emotions during the interview entails a slightly delayed response compared to the original emotion, which might have led to capturing white in addition to gray matter activity when using this post-rating as a regressor.

Limitations of the present study

One shortcoming of this study is that paraphrasing interventions and unempathic interventions were not the same length (the average duration of the paraphrasing block was 41 s (SD = 19.6 s) while the average duration of the unempathic condition was 20.2 s (SD = 6.4 s)). Differences in length when contrasting two sequences might lead to artificial differences in neural activity due to non-linear effects of the BOLD response. However, to account for such unwanted effects, we modeled the conditions in a blocked design with rapid series of events "event model." On the single subject level, epochs during which the subject or the interviewer talked were modeled as single events on a 0.5 s time grid with duration of 0 s convolved with the hemodynamic response function (HRF). We used this approach instead of using a so called "epoch/block model" that would have consisted of blocks convolved with the HRF Support for this approach comes from Wager et al. (2005). The authors showed in a simulation that obtained beta estimates from two conditions with different durations (10 s and 20 s) did not differ when the "event" model was used, whereas modeling the conditions of unequal durations in an "epoch" model induced artificial differences between the two conditions.

It should also be noted that participants were told in advance that the interviewer would sometimes express lack of understanding due to the experimental procedure. Although they were asked to let these responses sink in, it is likely that this previous information mellowed participants' emotional reactions to the unempathic interventions. This was done to avoid interview break offs, which might have occurred if participants got too angry with the interviewer. However, this has to be kept in mind when assessing the neural correlates of the unempathic interventions. It is possible that neural activations of emotion generation areas associated with processing unempathic social response in real life might in fact be stronger than indicated by our results. It is also quite likely that participants realized that the purpose of the study was to investigate the effects of empathy. This may have influenced their emotional reaction to empathic responses, e.g. inducing them to consciously evaluate how empathic the interviewer was, or having them expect an empathic response. However, this situation is not so different from the real-life professional settings in which paraphrasing is used, such as mediation, where the purpose of paraphrasing is also usually made transparent. Cognitive empathy demonstrated through paraphrasing is less susceptible to lack of authenticity than demonstrated emotional empathy, as a correct paraphrase of somebody's thoughts and feelings proves to the recipient that their interlocutor does indeed understand their perspective. Hence, the effect of paraphrasing should be independent of the recipient being aware of its purpose or not.

Conclusion

Confirming previous results, the present study shows that cognitive empathy has a positive effect on feelings and emotions in social conflict situations. At the same time, cognitive empathy seems to increase immediate emotional arousal, possibly due to a more focused processing of the negatively beset social conflict. Furthermore, the correlations with personality variables indicate that cognitive empathy may be even more beneficial under certain circumstances, such as strong negative affect and low self-esteem on the side of the recipient.

Paraphrasing engaged a frontal–parietal network with peak activations in the right PrG, left MFG, left IPG, and right PoG, while unempathic responses engaged a frontal–temporal network with peaks in the left IFGTr and right TP, extending to the amygdala. Hence, both interventions differentially drew on social cognition regions. The limbic activations induced by unempathic responses and feeling ill understood in connection with the negative valence ratings suggest that when individuals talk about social conflict, a social response expressing lack of understanding results in a negative emotional reaction. At the same time, a strictly cognitive response demonstrating that one can follow the other person's perspective, without agreeing or offering sympathy, can induce positive feelings and emotions even in an unpleasant and negatively charged situation.

The results have potential implications for psychotherapy, conflict resolution and other professional settings dealing with highly emotional conflicts on a regular basis, e.g. court or medical procedures. In certain settings, professionals can be limited by their role when it comes to offering emotional empathy to agitated parties, for instance because they have to remain impartial in their dealings with several disputants. However, cognitive empathy in the form of paraphrasing is almost always acceptable. Our results show that this rather professional type of empathic behavior can be sufficient to buffer emotional distress, at least temporarily. In conflict resolution settings such as mediation, paraphrasing is regularly used a core technique to structure conversation and foster empathic dialog. Our study put this technique to the test and yielded supportive results with regard to the effectiveness of paraphrasing, i.e., cognitive empathy, in buffering negative emotion.

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Conflict of interest statement

The authors are not aware of any commercial or financial relationships that could be construed as a potential conflict of interest.

Appendix A. Supplementary data

Supplementary data to this article can be found online at http://dx.doi.org/10.1016/j.neuroimage.2013.09.056.

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Lebenslauf

Mein Lebenslauf wird aus datenschutzrechtlichen Gründen in der elektronischen Version meiner Arbeit nicht veröffentlicht.

Vollständige Publikationsliste

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