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The impact of empathy and reappraisal on emotional intensity recognition

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ABSTRACT
Empathy represents a fundamental ability that allows for the creation and cultivation of social bonds. As part of the empathic process, individuals use their own emotional state to interpret the content and intensity of other people's emotions. Therefore, the current study was designed to test two hypotheses: (1) empathy for the pain of another will result in biased emotional intensity judgment; and (2) changing one's emotion via emotion regulation will modulate these biased judgments. To test these hypotheses, in experiment one we used a modified version of a well-known task that triggers an empathic reaction We found that empathy resulted in biased emotional intensity judgment. To the best of our knowledge, this is the first demonstration of a bias in the recognition of emotional facial expressions as a function of empathy for pain. In experiment two, we replicated these findings in an independent sample, and further found that this biased emotional intensity judgment can be moderated via reappraisal. Taken together, our findings suggest that the novel task used here can be employed to further explore the relation between emotion regulation and empathy.

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Much of human behaviour entails interacting in social groups. Successful social interactions involve correctly interpreting the feelings, thoughts and actions of others (Singer, 2006). Studies suggest that empathy is what prevents individuals from harming others and encourages people to act altruistically and form large social groups (Decety & Jackson, 2004; Preston & De Waal, 2002; Singer, 2006). Here, we refer to empathy as a broad concept encompassing both the cognitive and the emotional reactions of an individual to what happens to someone else (Shamay-Tsoory, 2011). In this paper we specifically focus on empathy for pain, one of the components of emotional empathy that is defined as our ability to specifically understand and react to pain felt by others (Fitzgibbon, Giummarra, Georgiou-Karistianis, Enticott, & Bradshaw, 2010). Empathy for pain has been the major focus of research devoted to empathy in social neuroscience and other related fields, making it the most dominant neuroscientific domain in the study of empathy (Singer & Lamm, 2009). Similar to the case of basic emotions, facial expressions associated with pain are distinct and easy to recognise, constituting a key feature of basic emotions according to Ekman (1992). In line with this view, Craig (2003) has argued that pain should be considered both as a sensation and as an emotional state.

Zaki and Ochsner (2011) note that empathy has traditionally been studied along two lines: (1) empathic process—the mere formulation of the empathic reaction (i.e. whether or not a person developed an empathic reaction in a given situation); and (2) empathic accuracy—the skill to accurately understand and infer the private and subjective thoughts, feelings and states of another (Ickes, Stinson, Bissonnette, & Garcia, 1990). Most scientific attention to empathy has been devoted to investigating the empathic process, with less attention paid to empathic accuracy. Zaki and Ochsner (2011) contend that a full account of human empathy requires combining these related yet separate aspects. Because empathic accuracy plays a central role in facilitating supportive social

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relationships, it is important to understand the cognitive mechanisms underlying empathic accuracy and the ways of regulating it. For example, Gleason, Jensen-Campbell, and Ickes (2009) found that the ability to formulate accurate empathic judgments shielded children with poor peer relationships from adjustment problems. Similarly, Ickes and Hodges (2013) showed that reduced empathic accuracy can hurt close relationships between partners. Furthermore, empathic accuracy has been implicated in the manifestation of several psychopathologies, including autism, borderline personality disorder and abusive behaviours (Ickes, 2009). Broadening our understanding of the mechanisms affecting empathic accuracy could lead to the creation of novel intervention protocols and treatment procedures.

Ickes et al. (1990) further differentiated empathic accuracy into two types: (1) content accuracy represents the ability to accurately infer the content of someone else's experience, for example to be able to say that someone else is happy when he is indeed happy; (2) valence accuracy is the ability to accurately match the emotional tone or intensity of another. Furthermore, Ickes (2009) draws on the work of Carl Rogers, identifying empathic accuracy as the moment-to-moment change in one's ability to recognise the specific thoughts and feelings of another. In the current study we focus on the second type of empathic accuracy, namely valence accuracy, and measure the impact of empathy on valence recognition from emotional facial expressions. Valence recognition is the ability to accurately infer the intensity of an emotion felt by another person. Accordingly, empathic accuracy can be viewed as a series of valence recognition judgments. The processing of facial expressions, or the ability to identify the emotions of others solely by observing facial expressions, has been linked to the ability to share those feelings (Enticott, Johnston, Herring, Hoy, & Fitzgerald, 2008), which is a key concept in empathy (Blais, Roy, Fiset, Arguin, & Gosselin, 2012; Singer, 2006).

One factor shown to have an impact on empathic accuracy as well as on recognition of emotional intensity is our inclination to base our judgment of other people's emotions on our own emotional state (Emotional Egocentricity Bias; Silani, Lamm, Ruff, & Singer, 2013). For example, in one study participants performed a reward task in pairs. Results showed that participants rated the emotional state of their matched participant in congruence with their own state (i.e. the emotional state of the other was judged as more positive when they themselves won; Steinbeis, Bernhardt, & Singer, 2014; see also Shamay-Tsoory et al., 2005; Zaki, Weber, Bolger, & Ochsner, 2009 for similar findings regarding judgement of pleasant vs. unpleasant feelings).

Furthermore, Niedenthal, Halberstadt, Margolin, and Innes-Ker (2000) found that participants' own emotional state influenced the way they perceived neutral and emotional faces. Participants showed a tendency to interpret neutral facial expressions in congruence with their own emotional state. Similarly, Schmid and Mast (2010) found that inducing a positive mood resulted in a positive bias, and inducing a sad mood resulted in a bias towards sadness. Notably, these biases hampered recognition of incongruent expressions, while they did not affect recognition of congruent expressions. This bias, however, may be modulated by different factors. Ruben and Hall (2013) examined the predictors of pain detection accuracy and found that past and immediate experience with pain as well as higher scores on empathy questionnaires correlated with accuracy in judging the pain levels of other people. It is important to note that recalling a memory of self-experience with pain did not yield a similar effect on accuracy. It is therefore evident that our own emotional state affects our judgments, yet the extent of this effect remains unclear. This paper aims to broaden our knowledge about the interplay between self-emotion and accuracy judgments.

Considering the self-referential nature of empathy (Silani et al., 2013; Steinbeis et al., 2014) and the tendency to judge other people's facial expressions in congruence with our own emotional state (Niedenthal et al., 2000), we may assume that individuals' ability to regulate their own emotions will affect their reference point and consequently the accuracy of their empathic reaction. Emotion regulation is mainly understood as the process by which individuals shape their current emotions and the way they experience and express these emotions (Gross, 1998, 2014). Interestingly, evidence from psychopathologic populations suggests that emotion regulation is related to the ability to recognise other people's emotions. For example, it was found that women with anorexia nervosa performed poorly on an emotion recognition test and demonstrated more difficulties in emotion regulation, compared to healthy controls. Importantly, there was a negative correlation between their performance on the test examining emotion recognition and their scores on an emotion regulation

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questionnaire (Harrison, Sullivan, Tchanturia, & Treasure, 2009). Similar difficulties were found among individuals with alexithymia (Swart, Kortekaas, & Aleman, 2009), borderline personality disorder (Herpertz, 2009) and ADHD (see Bunford, Evans, & Wymbs, 2015 for a review on emotion regulation dysfunctions and Bora & Pantelis, 2016, for face recognition). In line with this view, Decety (2010) recently hypothesised that emotion regulation plays a role in empathy, claiming that empathy is constructed from three subcomponents—affective arousal, emotion understanding and emotion regulation—each with a unique developmental trajectory and neurological underpinnings.

Although we can hypothesise that empathic processes, the ability to regulate emotions and empathic accuracy are linked, we are not aware of any study that has examined this link directly. To fill this gap, we asked participants to empathise with painful scenarios. They were then shown emotional facial expressions expressing pain and other emotions and asked to judge the intensity of these emotions. Although we did not directly examine emotional empathy, based on the egocentricity bias (Silani et al., 2013) emotional empathy is expected to modulate the individual's own emotional state, which is hypothesised to result in biased judgments of other people's emotional faces (Figure 1). Specifically, we asked participants to judge the type and intensity of an emotional facial expression after their empathy for pain was provoked as a result of viewing painful scenarios. We hypothesised that empathic engagement with the painful scenario would generate empathy that would affect the participants' emotional state and lead them to judge other people's levels of pain inaccurately, but would not affect the accuracy of their judgment of emotions other than pain. Furthermore, we examined the possible moderating effect of reappraisal on the bias in emotional intensity recognition accuracy (Experiment 2). To this end, we instructed participants to reappraise their emotional reaction to the painful scenario, allowing us to demonstrate the effect of reappraisal on the accuracy of emotional intensity recognition. We also hypothesised that the use of reappraisal would downregulate the participant's own emotional state, resulting in more accurate empathic judgment. Our goal is to combine the separate lines of inquiry related to the empathic process and emotional intensity recognition, as well as to demonstrate the interplay among emotional intensity recognition, emotion regulation and empathy.

Experiment 1: does provoking empathy affect empathic accuracy?

The goal of Experiment 1 was to assess the accuracy of emotional intensity recognition of specific emotions following empathy-evoking stimulation. Specifically, we focused on how empathy for pain affected accuracy of emotional intensity recognition. Participants were shown either painful or non-painful scenarios and were asked to empathise with the person in the scenario. Each scenario presentation was followed by presentation of a face depicting a painful, happy or sad expression at various intensities (see below for details). Participants were asked to judge the intensity of the emotional facial expression. We expected that when participants were presented with a painful facial expression after witnessing a painful scenario, they would judge the intensity of the painful expression as higher than it actually is, and as higher than their intensity judgment for that same stimulus following a non-painful scenario. Moreover, given the assumption that this pattern of behaviour is the carryover result of empathy for pain, we expected it would be found only for painful facial expressions and not for expressions of other emotions, as was assessed by presenting happy and sad expressions.

Participants

Forty-one[1] healthy undergraduate students from the University of Haifa (16 males, age = 24.35, SD = 6) took part in this experiment. The experiment was approved by the local ethics committee (approval number 140/13). Two participants were disqualified due to failure to complete the task. Participants received the sum of 30 Israeli shekels or course credit for their participation. They all had normal or corrected-to-normal vision and no neurological or psychiatric history, and they each signed an informed consent form prior to participating.

Materials

Pain scenario stimuli

A set of 23 matched coloured pictures showing hands and feet in painful and non-painful scenarios served as the stimulus (Figure 2). The set was created in our lab and was based on a similar set used by Jackson, Meltzoff, and Decety (2005). The pictures were taken from an onlooker perspective rather than a first-person perspective. The scenarios were adapted to the study design and population. They were tailored to familiar, everyday

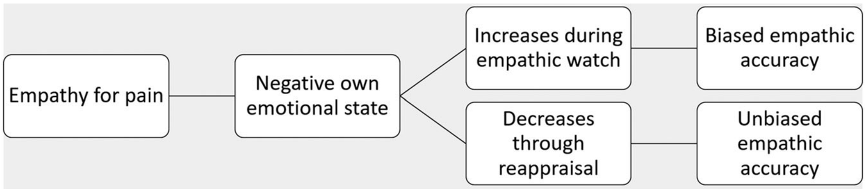

Figure 1. A model describing the effect of empathy for pain on empathic accuracy via modulation of one's own emotional state.

events in Israeli culture (e.g. ice skaters were removed and more agricultural tools were introduced), and various types of pain were portrayed (pressure, mechanical and thermal). Each painful scenario was matched with a non-painful scenario that involved all the components except the painful element. The picture set included two male models and two female models. Pictures were edited and cropped to the same size (400 × 300 pixels).

To validate the picture set, we asked 23 undergraduate students from the University of Haifa (5 males, age = 24.04, SD = 4.5) who did not participate in Experiments 1 or 2 to judge the pain intensity shown in each picture on a scale of 1–10 using the Wong-Baker FACES™ pain rating scale (Wong & Baker, 1988). Then, we asked them to judge the arousal level of the picture on a scale of 1–100 using an adopted version of the Self-Assessment-Manikin (SAM) scale (Bradley & Lang, 1994). Out of a larger sample of 31 pairs of matched painful and non-painful pictures (e.g. a man cutting a cucumber while injuring his finger (painful) or not causing any injury (not painful)), we chose only those for which the pain intensity score of the non-painful picture was lower than 1 (no pain) and the pain intensity score of the painful picture was at least 6 (severe pain).

Facial expression stimuli

The experiment used a well validated and highly recognisable set of the faces of ten Caucasian actor models (five females) (Blais et al., 2012). Both the database and the normative data appear at http://mapageweb.umontreal.ca/gosselif/ STOIC.rar. Drawing on a procedure used by Enticott et al. (2008) and Johnston, Mayes, Hughes, and Young (2013), we created a morphed static set using Abrosoft FantaMorph 5.0 software (www.fantamorph.com). Pairs of images showing the same actor displaying a neutral pose and an emotional expression were co-identified using a number of feature locations. These

Figure 2. Sample pictures of hands and feet in painful and non-painful conditions. Note that a corresponding non-painful stimulus is provided for each painful stimulus.

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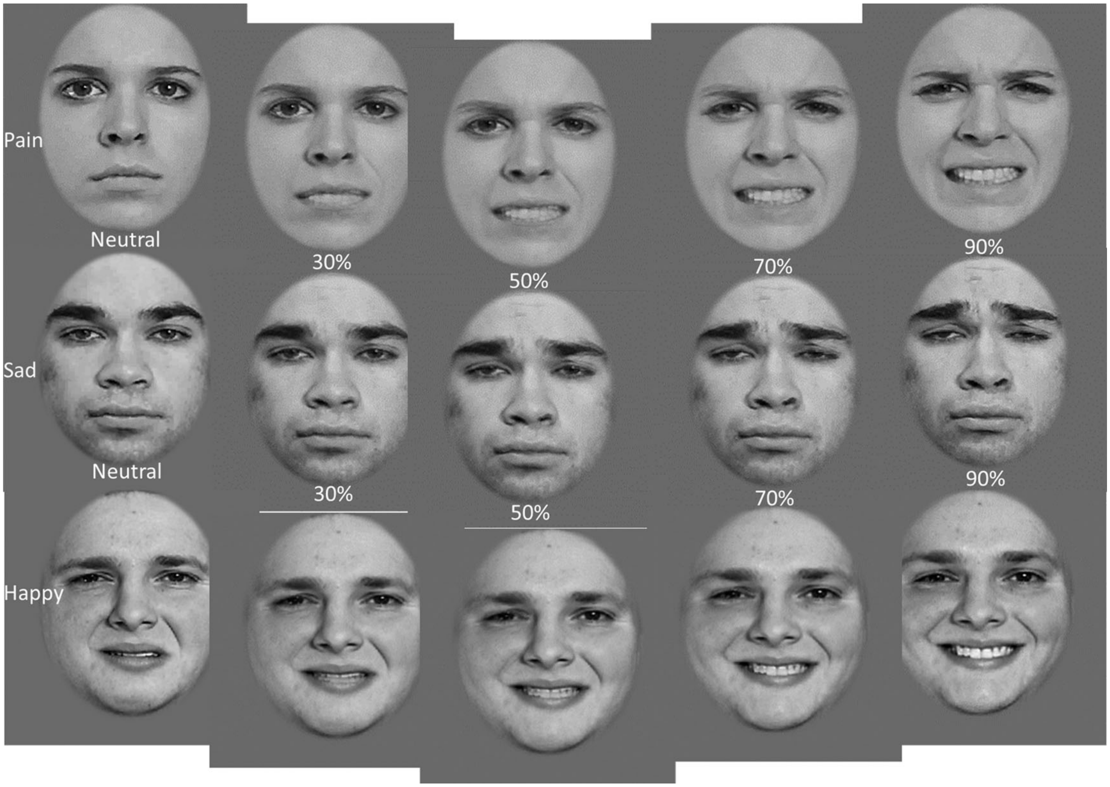

Figure 3. Examples of one female model showing a painful facial expression, one male model showing a sad facial expression and one male model showing happy facial expression. These models' expressions resulted in sequential morphed pictures ranging from 100% neutral to 90% of the respective emotion.

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locations included, but were not restricted to, the pupils of the eyes, the corners of the mouth, the nostrils and the chin. A sequential morph between each two pictures was then created, yielding 100 same-sized individual pictures (240×240 pixels; Figure 3). Fifty percent happiness, for example, was picture number 50 on the sequential morph between neutral expression and happy expression. Stimuli from two models, one female and one male, were discarded due to quality issues (e.g. photos were too grainy and blurred after the morphing procedure). The set we used included facial expressions portraying the six basic emotions—anger, sadness, happiness, disgust, fear and surprise—as well as pain.

The validation procedure involved showing the morphed faces to 23 undergraduate students from the University of Haifa (5 males, age = 24.04, SD = 4.5) who were asked to recognise the presented emotion and its intensity. To compare the percentage hit rate between emotions, we conducted a 5-level repeated measures ANOVA with emotion (angry, disgusted, happy, sad, and painful) as the independent variable. The dependent variable was the Hit Rate Ratio Arcsine Value across all judges per photo. Arcsine values range from 0 to 1.57, the arcsine equivalent of 1, indicating that a stimulus was always correctly identified and appropriately used. For example, for a happy facial expression, an Arcsine value of 1.57 would mean that participants always chose the emotion happy when a happy expression appeared, and never chose happy for a different expression (Wagner, 1993). Results revealed a main effect of emotion [$F(2.5, 52.8) = 49.75$, $p = .000$, $\eta_p^2 = .701$], demonstrating a variance in participants' ability to recognise the emotion, depending on the specific emotion depicted by the face. Bonferroni-corrected post hoc comparisons [$F(4,18) = 44.45$, $p = .000$, $\eta_p^2 = .910$] revealed that the percentage hit rate for happy pictures ($M = 1.113$, SD = .025) was significantly higher than for all the other emotions, whereas no noticeable difference existed in the percentage hit rate between disgust ($M = .689$, SD = .033) and pain ($M = .646$, SD = .052), and between sadness ($M = .852$, SD = .021) and anger ($M = .877$, SD = .021). These two couplings, however, did significantly differ from one another, indicating that participants were able to discriminate disgusted and painful expressions from sad and angry ones. Based on these findings, for Experiments 1 and 2 we chose happiness, pain and sadness, which were most differentiated from one another. For the current study, we used eight models (four female), each depicting three emotions (happy, sad and painful) at six levels of intensity (40%, 50%, 60%, 70%, 80%, and 90%), accounting for 144 faces.

Experimental procedure

Figure 4 shows the sequence of events in a sample trial. Each experimental trial began with a 3000 ms presentation of either a painful or a non-painful picture taken from the painful/non-painful pictures set. Empathy was evoked by instructing participants to look at the picture and imagine how the person in the picture was feeling based on how they themselves would feel in a similar situation. After the painful/non-painful picture disappeared, participants were shown a picture from the facial expression set. Participants were then asked to select the emotion represented by the face from a scale comprising the six basic emotions and pain, and then to judge the intensity of the emotion shown in the facial expression on a scale ranging from 1 to 100 (Figure 4). The effect of the target's gender on the ability to recognise non-verbal emotional cues is inconsistent. Yet, a recent meta-analysis by Thompson and Voyer (2014) showed that the target's gender had an impact on emotion recognition abilities, especially for males. Therefore, in order to control for gender differences in the empathy evoked for the individual in the painful scenario (Chun, Park, Park, & Kim, 2012), female participants were shown pictures depicting female models, while male participants were shown pictures depicting male models. Stimuli were presented using E-Prime 2.0 programming software (Psychology Software Tools, Inc., www.pstnet.com) and participants responded using the computer mouse. All pictures were presented twice in random order.

Results

Recognition of emotional facial expressions

The agreement between presented and selected emotions was higher than 75% (this rate is similar to other papers dealing with recognition of emotional facial expression, e.g. Langner et al., 2010) for all

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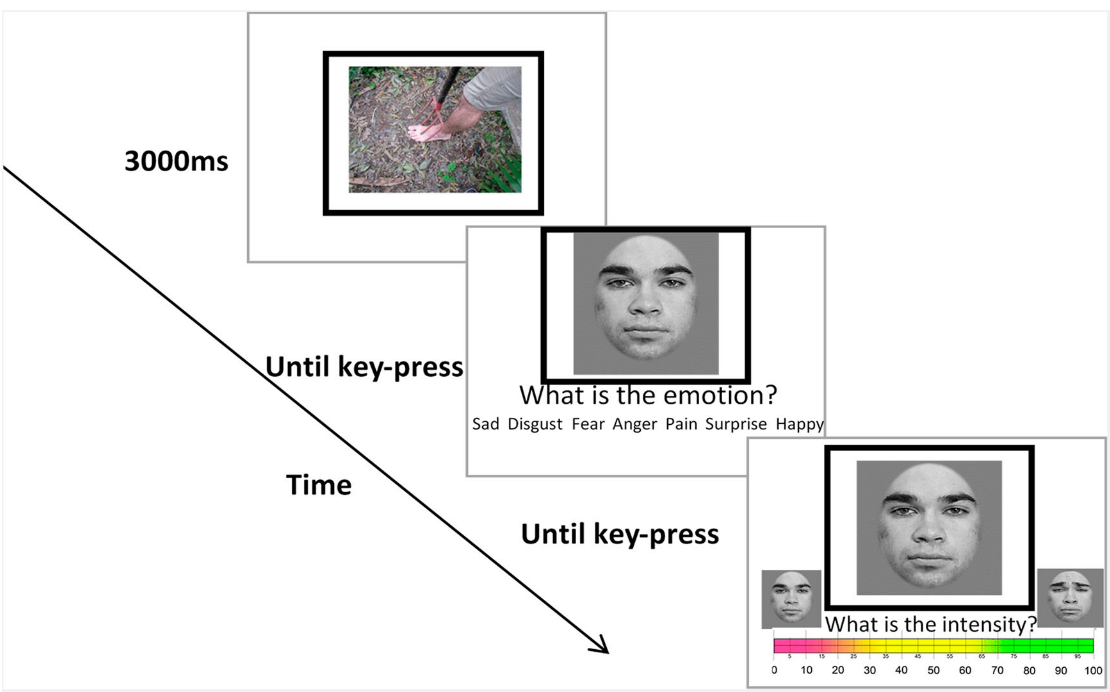

Figure 4. An example of a painful scenario with a neutral face trial in Experiment 1. A picture depicting either a painful or a non-painful scenario appears for 3000 ms, followed by a picture depicting an emotional version morphed between 100% neutral and 100% emotional.

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participants, except for two participants who were removed from the reset of the analysis. However, in order to avoid confusing selection accuracy with selection frequency, we used a procedure similar to the one described in the validation of pain scenario stimuli in which emotions percentage hit rate was calculated. A 3-level repeated measures ANOVA was calculated, with emotion (happy, sad, and painful) as the independent variable and the Hit Rate Ratio Arcsine Value (Wagner, 1993) as the dependent variable. Results revealed a main effect of emotion [$F(2, 76) = 27.751$, $p = .000$, $\eta_p^2 = .422$], clearly demonstrating that participants managed to recognise the different emotions as well as differentiate between them. Bonferroni-corrected post hoc comparisons [$F(2,37) = 26.819$, $p = .000$, $\eta_p^2 = .592$] revealed that the percentage hit rate for happy pictures ($M = 2.795$, $SD = .036$) was significantly higher than the percentage hit rate for pain ($M = 2.396$, $SD = .0.38$) and that both were significantly higher than the rate for sadness ($M = 2.267$, $SD = .05$). These results indicate that even though participants recognised happy faces better than they recognised other emotions, the recognition of all emotions was well beyond chance and there was no conflation between any of the emotions.

Empathy impact on emotional intensity recognition

A 3 × 2 repeated measures ANOVA of Scenario (painful/non-painful) and Facial expression (painful/happy/sad) was conducted in order to explore the empathic bias following painful vs. non-painful scenarios. Empathic bias was manifested by the deviation from the normative score for a given specific degree of an emotional expression as was created in the morphing procedure. For example, judging a picture depicting 60% sadness as 80% sadness represents a bias of 20%. This analysis revealed a higher bias for painful faces compared to happy or sad ones [$F(2,76) = 22.26$, $p = .000$, $\eta_p^2 = .37$; Mean bias: painful = 3.9, happy = −3.1, sad = −0.39], as well as a higher bias for judgments made following observation of painful scenarios compared to non-painful ones [$F(1,38) = 4.55$, $p = .04$, $\eta_p^2 = .107$]. More importantly, we found an interaction between the judged emotion and the scenario in their joint effect on the bias score [$F(2,76) = 9.42$, $p = .000$, $\eta_p^2 = .199$]. To explore this interaction, we conducted a series of subsequent paired *t*-tests. As predicted, a greater bias was revealed for painful facial expressions following observation of painful scenarios compared to non-painful ones ($t = 7.575$, df = 38, $p = .000$). Similarly, we found a greater bias for sad facial expressions following the observation of painful scenarios compared to non-painful ones ($t = 3.387$, df = 38, $p = .002$). A similar test for happy facial expressions following painful scenarios did not reach significance ($t = -1.836$, df = 38, NS) (Figure 5).

Discussion

To test whether exposure to empathy-provoking scenarios affects emotional intensity recognition judgments, we showed healthy participants scenarios evoking empathy for pain and asked them to assess the emotional intensity of facial expressions. After witnessing a painful scenario, participants assessed the intensity of a painful facial expression as greater than it actually was (for example, they rated a picture depicting 50% pain as 60%). This bias did not emerge after participants witnessed non-painful scenarios. It was also not visible in their judgments of happy and sad expressions. The specific bias for painful expressions shows that the bias is not due to general arousal evoked by the painful scenarios, which would have generated a similar trend across all emotions. However, although the procedure we used to elicit empathy is based on a rather common practice in the study of the empathic process, we did not directly examine our participants' empathic experience. Therefore we can only postulate, based on prior work, that empathy was initiated successfully and that the empathic experience is responsible for the resulting bias. This appears to be the first documentation of the *direct* impact of empathy for pain on emotional intensity recognition.

Experiment 2: the impact of emotion regulation on empathic accuracy

The findings from Experiment 1 indicate that empathy for pain biases the recognition of pain in others. Decety (2010) postulated that empathy comprises three intertwined subcomponents: affective arousal, emotion understanding and emotion regulation. He further notes that emotion regulation affects emotion understanding and affective arousal in a feedback loop. Based on this model, it is plausible to assume that valence recognition, which is closely linked to emotion understanding, is indirectly modulated by emotion regulation. If valence recognition is affected by the perceived intensity of a certain emotion, regulating this emotion should have an impact on valence

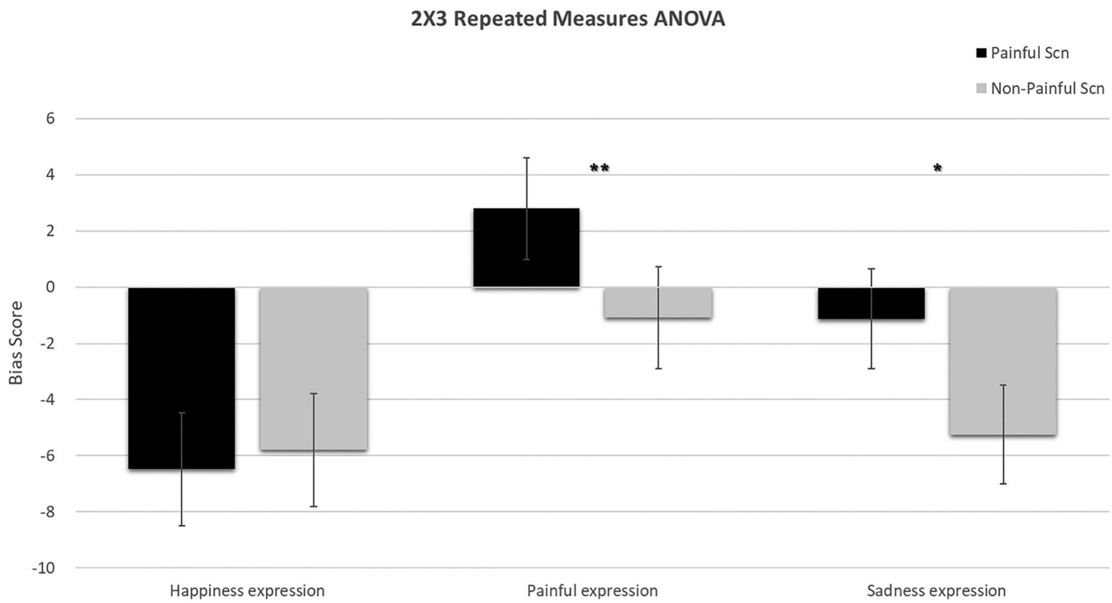

Figure 5. Bars represent the difference between the intensity of the presented emotion and the mean of intensity selected by participants for happy, painful and sad facial expression after painful or non-painful scenarios. Scores above the zero line of the Y axis represent overestimation of the observed facial expressions, whereas scores below that line represent underestimations. A significant difference in the effect of the scenario was found for painful and for sad facial expressions that were overestimated when presented after painful scenarios compared to non-painful ones. $^{*}p < .005$ $^{**}p < .001$.

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recognition. In a questionnaire-based study, Lockwood, Seara-Cardoso, and Viding (2014) demonstrated an association between emotional empathy, emotion regulation and pro-social behaviour. While empathy and pro-social behaviour showed a positive correlation in low and average reappraisers, high reappraisers did not exhibit such a relation. These findings highlight the role played by emotion regulation (specifically reappraisal) in the impact exerted by empathy on pro-social behaviour. However, as this finding is based on questionnaires, the relation may represent other factors correlated with the tendency to use a specific emotion regulation strategy.

Experiment 2 aimed to use direct manipulation to demonstrate a causal role for reappraisal in emotional intensity recognition. To this end, we examined the effect of the downward regulation of empathy for pain via reappraisal on the way participants assess the emotional intensity of emotional facial expressions after viewing painful and non-painful scenarios. We hypothesised that instructing participants to regulate their empathy downward via reappraisal would eliminate the bias seen in Experiment 1. Conversely, when participants were instructed to observe the situation in an empathic manner, we expected to replicate the findings of Experiment 1. To the best of our knowledge, this is the first *direct* examination of the impact of reappraisal on empathic accuracy, assessed as biases in judgments of emotional facial expressions.

Participants

Twenty-nine healthy students from the University of Haifa (7 males, age = 23.14, SD = 2.49) took part in this experiment. Exclusion criteria and sample size selection were similar to those in Experiment 1. Five participants were disqualified due to failure to understand the task. This relatively high exclusion percentage is probably due to the complexity of the reappraisal instructions in conjunction with the rather complex cognitive judgment task. The experiment was approved by the local ethics committee (approval number 140/13). As in Experiment 1, participants received the sum of 30 Israeli shekels or course credit for their participation. They all had normal or corrected-to-normal vision and no neurological or psychiatric history, and they each signed an informed consent form prior to participating.

Experimental procedure

Experiment 2 was designed to examine how the use of reappraisal for downward regulation of empathy for

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pain affects the way participants assess the intensity of emotional facial expressions after viewing painful and non-painful scenarios. Empathy was regulated via cognitive reappraisal—the process by which individuals construct an emotional situation in a way that alters its emotional impact, for example, by reconstructing a horror film as a parody (for elaboration, see Gross, 2001; Ochsner, Silvers, & Buhle, 2012). The reappraisal procedure was based on Thiruchselvam, Blechert, Sheppes, Rydstrom, and Gross (2011) and on Sheppes and Meiran (2007). After participants arrived and signed an informed consent form, the experimenter described the general concept of emotion regulation and provided a more detailed explanation of reappraisal and empathic watch. Following this explanation, participants applied both strategies through a number of practice trials, during which they were asked to describe aloud how they were implementing the intended regulation strategy at any given time. As outlined below, the experimenter ensured that participants were applying the correct strategy—reappraisal or empathic watch—and that they began regulating only at the intended moment and not earlier. Practice trials consisted of both REAPPRAISE and EMPATHIC WATCH conditions.

Under REAPPRAISE conditions, participants were asked to observe the scenario and tell themselves a story that would reduce the negative feelings they might be experiencing either by imagining that things would soon improve or by any other means that would help them feel less negative emotions, so long as they did not divert their attention from the scenario or imagine it to be fake (see Sheppes & Meiran, 2007; Thiruchselvam et al., 2011 for a detailed description). Conversely, under EMPATHIC WATCH conditions, participants observed the presented scenario and were asked to allow for the natural, uninterrupted flow of their emotions. This condition was termed "empathic watch" because participants were induced to feel empathy immediately prior to the regulation period. We hypothesised that instructing participants to regulate their empathy downwardly via reappraisal two seconds after exposure to the scenario would give them enough time both to understand the situation at hand and to complete the necessary regulation process, thus yielding little or none of the cognitive bias seen in Experiment 1. Conversely, when participants were instructed to observe the situation in an empathic manner, we expected to replicate the findings of Experiment 1. A colourful frame that appeared around the intended scenario picture two seconds after picture onset distinguished between the experimental and control conditions. The experimental session commenced after the practice trials and only if participants had successfully distinguished between cues and implemented the intended strategy (Thiruchselvam et al., 2011).

The experimental session was based on the procedure used in Experiment 1, with the following changes (Figure 6). First, the painful or non-painful scenarios were shown for four seconds, with the regulation cue appearing two seconds into the presentation (based on Ochsner, Bunge, Gross, & Gabrieli, 2002). This timeframe allowed participants to develop an understanding of the observed scenario and gave them enough time to regulate their emotions downward before they were asked to assess the intensity of facial expression. We made this change in order to separate between the initial empathy elicitation process and the subsequent regulation process and to allow for both these processes to run their course. Second, participants were not asked to identify the emotion but only to rate its intensity. As we saw in two previous experiments (experiment 1 and the validation of the facial expression stimuli), participants can easily recognise emotions and differentiate between them, thus making this section redundant. In addition, there is evidence that labelling emotions changes the emotional response (e.g. Lieberman et al., 2007; Rohr et al., 2016). Hence, such an alteration in the emotional response would limit our ability to learn about the effect of emotion regulation on bias in judgments. Finally, given the need for a sufficient number of trials in each of the emotion regulation conditions while avoiding a lengthy experiment, only two emotions were presented: happy and painful. Each stimulus of four same-sex models showing two different emotions, each at six intensity levels, was presented twice, yielding 96 trials. The faces used were the same as those used in the previous experiment, and as in the previous experiment, the order of the emotions presented in each trial was randomised.

Results

A three-way repeated measures ANOVA exhibited a greater bias for judgments of painful facial expressions [$F(1,23) = 16.807$, $p = .000$, $\eta_p^2 = .422$]. As predicted, the bias for painful facial expressions was higher for EMPATHIC WATCH compared to REAPPRAISE

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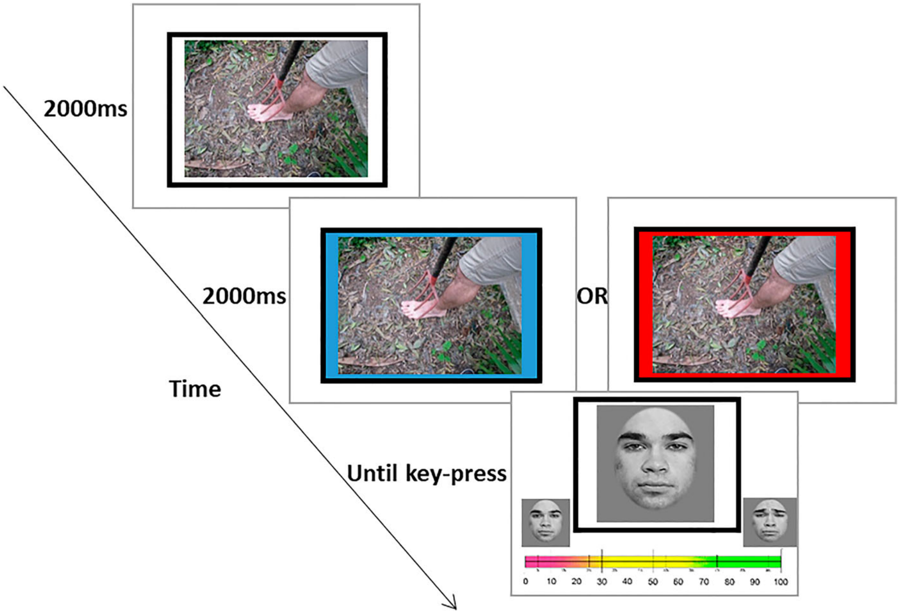

Figure 6. An example of a painful scenario with a neutral face trial in Experiment 2. A picture depicting either a painful or a non-painful scenario appeared for 2000 ms. Then, either a REAPPRAISE (blue frame) or a EMPATHIC WATCH (red frame) appeared for an additional 2000 ms. After participants viewed the scenario, they were shown a picture depicting a morphed emotional version between 100% neutral and 100% emotion (pain or happy) and asked to assess the emotional intensity presented by the face.

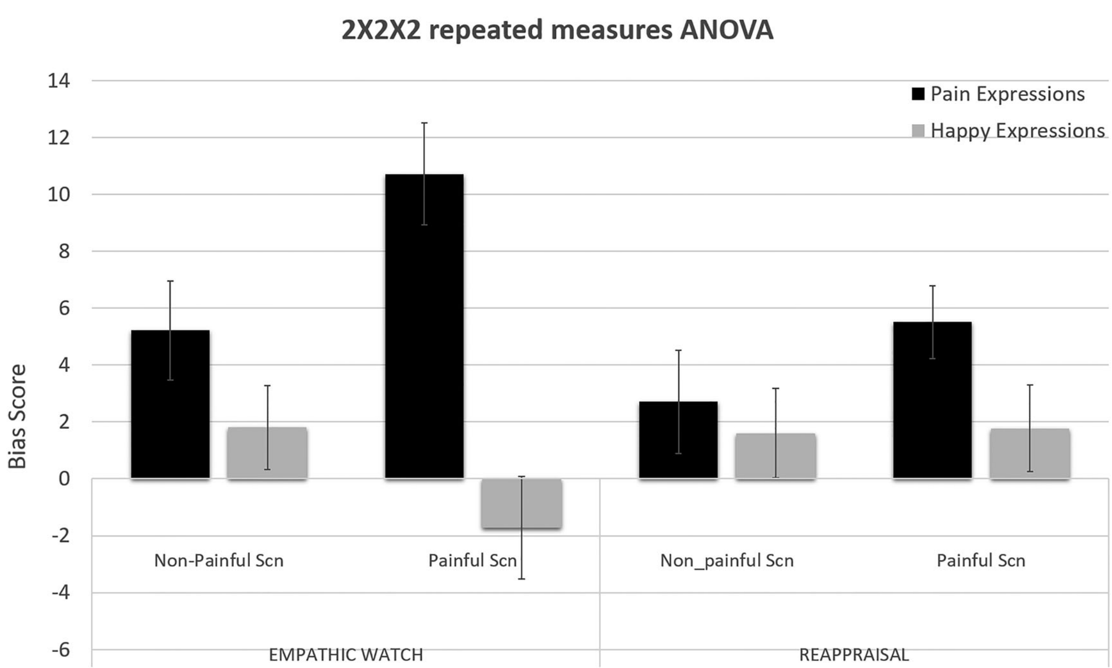

Figure 7. 3-way repeated measures ANOVA of regulation strategy (reappraise/empathic watch), scenario (painful/non-painful) and emotion (painful/happy) as within-subjects factors and bias score as a dependent variable. In a replication of Experiment 1, a greater bias emerged when empathy was evoked. The bias was delineated following reappraisal.

conditions [$F(1,23) = 8.309$, $p < .008$, $\eta_p^2 = .265$], and higher for conditions that followed painful scenarios compared to non-painful ones [$F(1,23) = 6.252$, $p = .02$, $\eta_p^2 = .214$]. Moreover, all three conditions also interacted, so that the greatest bias was found in the trials in which judgments of painful facial expressions were made following presentation of a painful scenario and implementation of the EMPATHIC WATCH instructions [$F(1,23) = 4.847$, $p = .038$, $\eta_p^2 = .174$]. Again, as predicted, there were no significant effects for instructions [$F(1,23) = 1.873$, N.S.], scenario [$F(1,23) = 1.947$, N.S.] or for the interaction between them [$F(1,23) = .311$, N.S.].

Figure 7 portrays the results of further testing the source of the 3-way interaction using a 2 × 2 repeated measures ANOVA. The testing trials under EMPATHIC WATCH conditions replicated the findings of Experiment 1, demonstrating a greater bias in judgments of painful facial expressions compered to happy facial expressions [$F(1,23) = 28.315$, $p = .000$, $\eta_p^2 = .552$]. In addition, an interaction between facial expression and scenario was found [$F(1,23) = 7.334$, $p = .013$, $\eta_p^2 = .242$]. Table 1 depicts the subsequent t tests conducted to examine the source of this interaction. As in Experiment 1, a paired sample t-test revealed a greater bias score for painful faces than for happy ones (Table 1). In addition, the bias for painful facial expressions was greater in judgments following painful scenarios than in judgments following non-painful scenarios (Table 1). As expected, a similar ANOVA for REAPPRAISE trials yielded no significant results for scenario [$F(1,23) = 2.489$, N.S.], emotion [$F(1,23) = 2.1$, N.S.] or the interactions between them [$F(1,23) = 1.735$, N.S.]. Moreover, the bias score for painful expressions following painful scenarios in EMPATHIC WATCH trials was significantly higher than in REAPPRAISE trials ($t = 2.955$, df = 23, $p = .004$). This comparison is not orthogonal and is shown only to demonstrate the full scope of the effect.

We further conducted JZS Bayes factor paired t-tests (Love et al., 2015; Morey & Rouder, 2015; Rouder, Speckman, Sun, Morey, & Iverson, 2009) to demonstrate the similarity in bias scores for painful expressions following non-painful scenarios in EMPATHIC WATCH trials and painful expressions following painful scenarios following REAPPRAISE instructions. In other words, we expected that when participants reappraised their empathy, exposure to painful scenarios would not lead to a bias in judging the painful expressions, similar to the case of exposure to non-painful scenarios without reappraising the empathic feelings. The JZS Bayes factor analysis is used to overcome the inability of standard significance tests to provide a reliable examination of the existence of the null hypothesis (Rouder et al., 2009). The test revealed no difference between the bias score when judging painful expressions following non-painful scenarios under EMPATHIC WATCH trials and when judging painful expressions following painful scenarios under REAPPRAISE trials (Bayes factor = 4.58). That is, the null hypothesis (similarity between the two conditions) is 4.58 times more likely than the alternative hypothesis (difference between the two conditions). Thus, the data provide evidence in favour of the hypothesis that reappraisal lowered the bias following painful scenarios to that of watching non-painful scenarios.

Discussion

Experiment 2 showed that downregulation of empathic feelings via reappraisal eliminates the bias exhibited after exposure to painful scenarios. The use of reappraisal led to a diminished bias for painful facial expressions following observation of painful scenarios, yielding a bias score similar to that shown for painful facial expressions following non-painful scenarios in the empathic watch condition.

Table 1. Bias scores, mean differences and t values for WATCH and REAPPRAISE.

Condition	Scenario	Emotion	Bias score (SD)	Difference	T-test value
Watch	Non-painful	Happy	1.804 (7.189)	3.41	1.891*
		Pain	5.213 (8.578)		
	Painful	Happy	−1.720 (8.858)	12.436	4.792**
		Pain	10.713 (8.740)		
Reappraise	Non-painful	Happy	1.606 (7.747)	1.107	.510
		Pain	2.713 (8.896)		
	Painful	Happy	1.777 (7.428)	3.732	2.211*
		Pain	5.508 (6.227)		

Note: While the interaction between emotion and scenario in WATCH trials was significant [$F(1,23) = 7.334$, $p = .013$, $\eta_p^2 = .242$], there was no similar interaction in REAPPRAISE trials [$F(1,23) = 1.735$, N.S.].
**$P < .001$, *$P < .05$.

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These findings are in line with the view that emotion regulation is one of the subcomponents of empathic processing (Decety, 2010) and further extend this view to the study of emotional intensity recognition and empathic accuracy. Furthermore, as expected, the empathic watch condition replicated the findings of Experiment 1. Under empathic watch conditions, after participants empathised with a painful scenario, they assessed the intensity of a painful facial expression as greater than it actually was. This tendency was specific to painful expressions and was not observed for happy facial expressions.

General discussion

Our results show a bias in participants' judgments of emotional intensity intensity following feelings of empathy for pain. Specifically, after empathising with a painful scenario, participants judged a painful facial expression as more painful than it actually was. Experiment 1 demonstrated that this accuracy bias was not observable in trials following non-painful scenarios or for faces depicting happy expressions. We did find a difference in the judgment of sad facial expressions as a function of the perceived scenario. Judgments of sad expressions following a neutral scenario resulted in severe underestimation of the presented intensity, whereas judgments made after painful scenarios were close to accurate. The only condition to result in overestimation of the facial expression following painful scenarios was the painful expression condition. In Experiment 2, the judgment bias was replicated in another sample. These findings are in line with the Emotional Egocentricity Bias (Silani et al., 2013), with previous findings from Niedenthal et al (2000), and with our hypothesised model (Figure 2), supporting the view that one's own emotional state influences one's judgment of someone else's emotion. Furthermore, this bias was reversed following down-regulation of the empathic reaction by reappraisal. Notably, we showed that regulating one's own emotional state via reappraisal can reduce the empathic bias to the degree of exposure to a non-painful scene. This is the first evidence that empathy for pain has a direct impact on emotional intensity recognition and that reappraisal can eliminate this bias. These findings suggest that emotional intensity recognition is modulated by emotion regulation and thus have theoretical importance for models describing empathic accuracy. The findings also offer a prism for devising future therapeutic tools and approaches for treating individuals with empathy-related disorders.

As noted in the introduction, we tested the effect of empathy on judgments of emotional intensity. In line with Carl Rogers' view of empathic accuracy as the moment-to-moment ability to recognise changes in others (as mentions in Ickes, 2009), we assumed that this represents a process of empathic accuracy. Understanding the different processes underlying empathy can help us better understand this complex social and cognitive process. The innovative paradigm we employed to study empathic accuracy has the potential to explain the mechanism of empathic accuracy and to help connect the study of empathic accuracy to the empathic process.

What mechanism underlies the observed bias? One possible though unlikely explanation is that the observation of painful scenarios led to overall arousal, which in turn caused a general exaggerated response tendency. This explanation seems unlikely as judgment patterns of happy faces were not affected by the preceding scenario. Another possible explanation is that the mere exposure to painful scenarios primed the participants' responses. While this may be a possible explanation, the results of the manipulation check seem to refute it. There are, however, two additional explanations for our results. Emotional engagement with the painful scenarios may have triggered a "negative-emotion-specific" arousal, an explanation that may account for the lack of change in judgments of happy faces and for the change found in judgments of sad faces. Additional research testing the effect of exposure to painful scenarios on other negative emotions (e.g. anger or fear) is needed, as our data neither support nor reject this possibility.

A fourth option, and the likeliest in our view, is that as a result of being exposed to painful scenarios, the participants themselves experienced pain. According to the theory of embodied cognition as put forth by Niedenthal (2007), the use of knowledge is based on reliving past experiences in some, or all, modalities. In line with this theory, when we asked our participants to try and imagine how the person in the scenario is feeling, they internalised the situation, reliving past experiences of being cut, burned, pinched or hit. Affected by those memories, they went on to judge the intensity of someone else's emotion.

Our results were obtained using healthy participants. It is therefore plausible to assume that our findings represent adaptive behaviour. However, this suggestion should be taken cautiously as we did not

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test it directly (see limitations and future directions section below). Aronfreed (1968) suggests that humans may be more likely to help others when the level of need or the potential benefit is greater. Evidence shows that humans are likely to underestimate the intensity of pain felt by others (Prkachin, Berzins, & Mercer, 1994). Our findings suggest that the opposite impact of empathy on pain judgment may counteract this underestimation. This bias in pain perception following an empathic reaction may be necessary to encourage people to act, in turn facilitating coordination and understanding. In our study, participants responded with biased emotional judgment, but they did report the correct emotion. Thus, there was no evidence of incorrect perception of the other's emotion, just of biased intensity. Lockwood et al. (2014) reported a positive correlation between emotional empathy and prosocial behaviour for participants presenting low or moderate use of reappraisal as assessed by questionnaires. Together, these results and our findings suggest that empathy leads to a bias in valence intensity judgment, which in turn leads to prosocial behaviour. Indeed, the primary function of empathy is to facilitate the formation of long-lasting social bonds between members of a social group and to ensure the survival and reproduction of the species (Preston & De Waal, 2002; Zaki & Ochsner, 2011). By facilitating a small bias in our judgments, empathy for pain in fact serves its purpose of strengthening social bonds, helping us understand others, coordinating individuals' actions and signalling solidarity (Preston & De Waal, 2002). Such prosocial help behaviour may take place only in situations that otherwise would not evoke behavioural action, for example when the perceived pain in a certain situation is not high enough, when the observer has other goals, or when the observer does not wish to help the person experiencing pain.

Furthermore, our results regarding the effect of reappraisal on emotional intensity recognition are congruent with the distinction between two forms of empathy, empathic concern and personal distress (Batson, Duncan, Ackerman, Buckley, & Birch, 1981). According to this view, empathic concern consists of compassion, warmth and softheartedness, whereas personal distress comprises shock, alarm, disgust, shame, and fear. Lebowitz and Dovidio (2015) recently studied the effect of different types of emotion regulation on empathic concern. They found that while instructed suppression led to a decrease in empathic concern, instructed reappraisal did not. It is therefore plausible to assume that the decrease in bias following reappraisal in our study was due to its effect on personal distress and not to empathic concern. This strengthens the hypothesis that using reappraisal can facilitate the social function of empathy as it reduces the individual's own distress but leaves the individual's concern intact.

Okon-Singer, Lichtenstein-Vidne, and Cohen (2013) discuss the importance of the interaction between observer, situation and stimuli factors in emotional situations. Similarly, the bias may affect behaviour differently depending on one's perceived control over a situation. Smith (1992) observed that individuals are likely to extend help only when they expect to be able to help. Thus, exaggerated bias may prevent individuals from helping based on a feeling they are unfit to help. It is further plausible to assume that in certain situations and/or populations, instead of coordinating actions, this empathic bias creates an exaggerated response that may lead to misunderstanding rather than understanding others. In support of this claim, Chikovani, Babuadze, Iashvili, Gvalia, and Surguladze (2015) showed that participants identified as "high empathizers" based on their scores on an empathy trait questionnaire demonstrated a greater tendency to judge the emotion of neutral faces as negative. Several types of cognitive biases are well known in emotional disorders, such as anxiety (for review see Aue & Okon-Singer, 2015) and depression (Everaert, Koster, & Derakshan, 2012), and are thought to play a significant role in their maintenance. Future studies are also warranted to examine empathic accuracy in pathological conditions. A number of mental disorders and extreme and/or abnormal emotional situations are known for deficits in emotional regulation, among them depression (Ehring, Tuschen-Caffier, Schnülle, Fischer, & Gross, 2010; Joormann & Gotlib, 2010; Kennedy, Koeppe, Young, & Zubieta, 2006), anxiety (Salters-Pedneault, Roemer, Tull, Rucker, & Mennin, 2006; Suveg & Zeman, 2004) and borderline personality disorder (Glenn & Klonsky, 2009).

Limitations and future directions

As this paper uses a novel paradigm to study the relation between empathy, intensity judgments and emotion regulation, future studies are warranted in order to resolve several limitations in our study. One limitation of the current study is its use of morphed intensities rather than self-reported pain levels, so that reported measures are not used as a baseline

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but rather predetermined intensity levels. In addition, we tested the effect of one emotion regulation strategy only. The effect of other strategies, such as affective suppression, distraction, rumination, mindfulness and others, remains unknown. Each of these may exert a unique and specific effect on empathy regulation. Based on previous work by Gross (2002), it is plausible to assume that the use of affective suppression, for example, would do very little to reduce the bias in judgment, as it fails to decrease emotion experience. Note, however, that as the main intention of using reappraisal was to demonstrate that changing one's emotion impacts valence recognition, the exact regulation strategy should not matter as long as it is effective.

An additional limitation is that we focused on empathy for pain, an issue that has been studied more than empathy for other emotions. Notably, the scenario pictures presented in this study depict physical pain in situations that may not be very common to all of our participants. Therefore, the findings are limited to such type of emotion, namely physical pain. Empathy to other emotions, such as anger, fear, or positive feelings of another, may lead to different behaviours. On the other hand, our view is that egocentricity bias leads to intensity judgment biases. According to this view, empathy toward other emotions should still result in a similar bias in the judgment of corresponding emotions (which are based on the participant's own emotional state). Future studies examining empathy to other emotions are warranted to determine between these two opposing possibilities. Furthermore, we did not directly ask participants about their empathic experience. We did, however, use a common procedure for eliciting and studying empathy (Jackson et al., 2005), and therefore we believe our participants had a similar experience. However, future studies are needed in order to verify this assumption. Finally, the link between empathy and prosocial behaviour was not tested in this study. As noted above, based on previous work (Lockwood et al., 2014) we hypothesised that the bias is intended to facilitate prosocial behaviour. However, at this point this is merely a hypothesis that should be tested in future research.

Conclusion

To conclude, in this paper we present a novel paradigm to manipulate empathy for pain and to test its influence on recognition of emotional intensity, a feature of empathic accuracy. Using this paradigm, we showed that eliciting empathy for pain yields a bias in judgments of pain intensity recognition. Furthermore, we found that using reappraisal can counteract the emotional burden of empathy for pain and thus reduce the resulting bias. This is the first direct evidence that the experience of empathy for pain has an effect on empathic accuracy.

Note

1. We used SPSS to calculate the observed power for each of the individual factors in our ANOVA design, as well as for all the possible interactions. As noted by Prajapati, Dunne, and Armstrong (2010), in a power analysis for multi-factorial designs, each factor and interaction yields a different power. All the conditions that reached significance also produced moderate or large effects (according to Cohen, 1992) of at least 0.5. According to Hoenig and Heisey (2001) and Yuan and Maxwell (2005), studies yielding significant effects do not require posteriori power analysis, which can even be erroneous. A similar posteriori power analysis was calculated for experiment 2, resulting in similar levels of significance.

Disclosure statement

No potential conflict of interest was reported by the authors.

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