Is Self-Other distinction malleable? Egocentric and altercentric biases in empathy are modulated by priming attachment style and similarity mindsets

RUNNING HEAD: MALLEABLE EMPATHY BIAS

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Abstract:

Empathic abilities are increasingly shown to be modulated by interpersonal and contextual factors. However, causal evidence regarding self-other distinction abilities in empathy, as measured by egocentric and altercentric biases, is virtually non-existent. This study aimed to demonstrate how malleable such biases are by investigating the impact of two priming manipulations. Prior to completion of an affective touch task, Experiment 1 primed a secure, avoidant, or anxious attachment style, whereas Experiment 2 primed a similarities or dissimilarities focus. We predicted that, unlike affect sharing, self-other distinction benefits from interpersonal distance primed by avoidant attachment and dissimilarities focus. Experiment 1 revealed a modulation of the altercentric bias: the extent the other person's feelings biased self-perspective judgments was significantly lower in the avoidant attachment group than in the secure and anxious attachment groups. Experiment 2 demonstrated that egocentric bias – the extent to which first-hand experienced emotion biases judgments of another person's emotion – was significantly lower in the group primed with a similarities focus. These findings suggest that self-other distinction abilities in empathy are modulated by interpersonal and contextual factors, but in ways that differ from affect sharing (in Experiment 1), and non-affective self-other distinction (in Experiment 2).

1. Introduction

Originating from the findings of mirror neurons and motor resonance, earlier research on empathy had operationalized empathy as being largely automatic and not malleable (Gallese, 2001; Iacoboni, 2009). In the last decade, we have seen an upsurge of studies documenting that empathic responses are modulated by a variety of contextual as well as interpersonal factors, for instance, when facing a target of the same versus different group membership (race: Avenanti, Sirigu, & Aglioti, 2010; Riečanský, Lengersdorff, Pfabigan, & Lamm, 2020; Riečanský, Paul, Kölble, Stieger, & Lamm, 2015; Xu, Zuo, Wang, & Han, 2009)(football team: Hein, Silani, Preuschoff, Batson, & Singer, 2010), a friend versus a stranger (Meyer et al., 2013), or someone who had behaved fairly or unfairly towards the empathizer (Singer et al., 2006)(for reviews, see Hein & Singer, 2008; Melloni, Lopez, & Ibanez, 2014). These modulations of the empathic response were mostly captured by changes in the sensitivity to other person's distress, as indexed by changes in neural activity within areas involved in pain processing, subjective distress ratings, and bodily physiological responses. These empathic responses however tap into the most basic empathic capacity, which is to share another person's emotion, here referred to as *affect sharing* (Lamm, Bukowski, & Silani, 2016). In contrast, empirical evidence of modulations for the possibly more ontogenetically advanced (for a review, see Adriaense, Koski, Huber, & Lamm, 2020) empathic capacity to tease apart the self-experienced emotional state from those of the other person, known as *self-other distinction*, is virtually inexistent. Hence, the present study aimed to modulate self-other distinction performance in empathy by experimentally manipulating each of two main types of situational interpersonal distance[1] factors: *socio-affective distance* (i.e., the affective attitude towards another person determined by norms and experience) and perceived *self-other similarity* (i.e., physical or psychological similarity; see also nurturance vs. similarity in Batson, Lishner, Cook, & Sawyer, 2005).

Self-other distinction is crucial for everyday social functioning as we regularly need to distance ourselves from other people's emotions but also to distance ourselves from our own emotional state when trying to understand another person's emotional state. Failures to put such distance from another's emotion(s) may result in *personal distress* (i.e., a distress perceived as self-experienced but actually stemming from another person's distress), as well as *altercentric* biases, or interferences (i.e., when another person's emotion contaminates our judgments of our own

[1] Interpersonal distance is here defined as a psychological distance rather than a spatial distance.

emotional state). Failed distancing from or regulation of our own emotion(s), on the other hand, can result in *egocentric* biases, or interferences (i.e., when our emotion contaminates our judgments of another person's emotion. This is also known as self-projection or anchoring in the self-perspective (Epley, Keysar, Van Boven, & Gilovich, 2004; Steinbeis & Singer, 2014), and it has been suggested that this may dampen accurate empathic understanding (Decety & Lamm, 2011; Lamm et al., 2016).

Self-other distinction performance is typically measured via perspective-taking tasks because these tasks require to flexibly and accurately shift between our first-hand self-centered – *egocentric* – perspective and another person's differing – *altercentric* – perspective, and failure to fully implement self-other distinction can be measured by the extent of egocentric and altercentric biases. Until recently (Bukowski, Tik, et al., 2020; Hoffmann et al., 2016), egocentric and altercentric biases were only measured in the non-affective domain, i.e., with tasks judging own and others' knowledge, beliefs, goals, or sensory experiences. The present study used a visuotactile affective perspective-taking task developed by Silani et al. (2013), which we here refer to as the affective touch task, to investigate self-other distinction performance in the domain of empathy. Specifically, our aim was to find out whether socio-affective distance and similarity modulate self-other distinction in empathy (i.e., in the affective domain) in a similar way as it has been previously reported for non-affective self-other distinction and affect sharing.

Regarding the known effects of socio-affective distance, existing manipulations varied the extent of emotional closeness (e.g., stranger vs. friend), induced integral social emotions (i.e., an emotion directed at the other person who caused our emotional state), or primed attachment styles. As predicted by the Perception-Action model of empathy (Preston & de Waal, 2002), higher emotional closeness led to higher empathy for the affect sharing component, as measured by neural, physiological and subjective responses (e.g., (Beeney, Franklin, Levy, & Adams, 2011; Cheng, Chen, Lin, Chou, & Decety, 2010; Engert, Plessow, Miller, Kirschbaum, & Singer, 2014; López-Solà, Koban, Krishnan, & Wager, 2017). Regarding the impact of integral emotions, one non-affective self-other distinction study has shown that inducing shame towards another person undermined self-other distinction performance (Bukowski & Samson, 2016). Regarding the effect of attachment primes, Mikulincer and Shaver (2001) found that transient induction of a secure attachment style diminished the tendency to negatively evaluate outgroup members (Mikulincer & Shaver, 2001), whereas Pan and colleagues (Pan, Zhang, Liu, Ran, & Teng, 2017) found that

priming secure attachment attenuated the initially high affect sharing empathic response of anxious attachment (also known as anxious-ambivalent insecure attachment) individuals. This suggests that affect sharing is higher for anxious individuals and that self-other distinction may have been enhanced by priming secure attachment. In addition, two studies have shown that priming secure attachment resulted in higher self-reported questionnaire scores in 'perspective taking' and 'cognitive empathy' than priming insecure attachment (Boag & Carnelley, 2016; Troyer & Greitemeyer, 2018). Some indirect findings also suggest distinct impacts of attachment styles on egocentric and altercentric biases: Regarding egocentric bias, two studies (Haggerty, Hilsenroth, & Vala-Stewart, 2009; Mikulincer & Shaver, 2001) suggest there are higher non-affective egocentric tendencies in both anxious attachment and avoidant attachment (also known as avoidant-dismissive insecure attachment) than in secure attachment. In contrast, indirect findings support the idea that the altercentric bias – the interference of another person's affect on perceiving one's own emotions – could be differently modulated by avoidant and anxious attachment: Anxious attachment is characterized by a strong preoccupation for social relationships and strong vicarious responses leading to personal distress (Joireman, Needham, & Cummings, 2002), whereas avoidant attachment is characterized by dismissive attitude towards social relationships and tendencies to avoid emotional closeness (Bartz & Lydon, 2004; Richman, DeWall, & Wolff, 2015). Moreover, anxious and avoidant attachment were associated with higher and lower personal distress, respectively (Monin, Schulz, Feeney, & Cook, 2010).

Building upon these previous findings, we hypothesized that unlike affect sharing, which is reduced by interpersonal distance, self-other distinction in empathy is better enforced better when interpersonal distance is increased, that is when an avoidant attachment style is present. **Experiment 1** used an attachment priming manipulation to test this hypothesis and for two objectives: First, to test whether attachment styles would differentially impact egocentric and altercentric biases. Second, to demonstrate the high malleability of self-other distinction in empathy, because priming could be considered as a particularly subtle manipulation, in contrast to inducing integral emotions, or changing the target of empathy as done in the literature review above. In line with the aforementioned literature, we predicted with high confidence that the altercentric bias should be lowest in the group primed with the avoidant attachment style (i.e., high distance priming) and the highest in the anxious group (low distance priming). In addition, based

on two studies (Haggerty et al., 2009; Mikulincer & Shaver, 2001), we expected with somewhat lower confidence that the egocentric bias would be the lowest in the secure attachment group.

Regarding the impact of self-other similarity, two non-affective self-other distinction studies have systematically manipulated perceived similarity (Simpson & Todd, 2017; Todd, Hanko, Galinsky, & Mussweiler, 2011) and found that perceived similarity undermined self-other distinction performance. In contrast, perceived similarity has been shown to enhance affect sharing (e.g., Carp, Halenar, Quandt, Sklar, & Compton, 2009; Heinke & Louis, 2009; Williams, Parker, & Turner, 2007). Between non-affective self-other distinction and affect sharing in empathy, how perceived similarity influences perspective taking for another person's *affect* – which taps directly into the self-other distinction component of empathy – has never been tested. **Experiment 2** of the present study used the similarities/dissimilarities focus priming manipulation previously used for non-affective self-other distinction (Simpson & Todd, 2017; Todd et al., 2011) for two objectives: First, to test the hypothesis that focusing on similarity or dissimilarity would differentially impact egocentric and altercentric biases. Second, to further corroborate the high malleability of affective self-other distinction by priming manipulations, as in Experiment 1. In line with the aforementioned literature, we predicted that, unlike affect sharing and alike non-affective self-other distinction studies (Simpson & Todd, 2017; Todd et al., 2011), egocentric bias should be lower in the dissimilarities focus priming group (i.e., high distance priming) than the similarities focus group (low distance priming). However, we acknowledge there are at least two competing predictions regarding how self-other similarity might influence the egocentric bias: First, self-other similarity might foster affective perspective taking by increasing the attentional focus on the target and/or the motivation to empathize with the target (Cialdini, Brown, Lewis, Luce, & Neuberg, 1997; Krebs, 1975), which leads to predict a reduced egocentric in the similarities focus group instead of the dissimilarity group. Second, perceiving the target as similar to the self could also dampen performance by increasing the natural inclination to project oneself onto the other and thus increases the extent of egocentric bias (Ames, 2004). Regarding the altercentric bias, the previous literature is not informative about the possible influence of self-other similarity; however, increased attentional focus on the other person and perceiving the other as similar should in both cases increase the altercentric bias, and thus lead to a distinct pattern than the egocentric bias. Hence, we expected with somewhat less confidence, but grounded in conceptually plausible assumptions, that the altercentric bias would be higher in the dissimilarity group.

To recap, this study aimed to demonstrate the malleability of self-other distinction in empathy, and to provide evidence on the causal impact of perceived similarity and attachment style on egocentric and altercentric biases in the affective domain. Experiment 1 primed either a secure, avoidant, or anxious attachment style, and we predicted that the altercentric bias would be lower in the avoidant attachment group while the egocentric bias would be lower in the secure attachment group. Experiment 2 primed either a similarities focus mind-set or a dissimilarities focus mind-set, and we predicted that egocentric bias would be lower in the similarities focus group whereas the altercentric bias would be higher in that group. In both experiments, priming was directly followed by the completion of the affective touch task inducing affective (pleasant or unpleasant) visuotactile stimulation in self and another simultaneously (Silani, Lamm, Ruff, & Singer, 2013).

Experiments 1 and 2 were conducted in parallel at the University of Vienna, at the Faculty of Psychology, and fully complied with local ethical regulations and the Declaration of Helsinki (2013, latest revision). The raw and processed data can be found online on https://osf.io/g7kz5/. None of the methods, procedures, and analyses were pre-registered.

2. Experiment 1

2.1. Material and methods

2.1.1. Sample:

Only female participants were recruited for consistency with previous work (Riva, Triscoli, Lamm, Carnaghi, & Silani, 2016; Silani et al., 2013) and to increase statistical homogeneity, because sex differences on this task had been documented as well (Tomova et al., 2014). The findings of this study are therefore limited to the female sex/gender. We ran a power analysis using effect size from the sole published study that manipulated a situational factor prior to completion of the affective touch task used in the present study (Tomova et al., 2014). The analysis conducted with G*Power 3.1 ($\alpha = 0.05$, $1\text{-}\beta = 0.95$) on the between-subject effect of stress ($f = 0.295$) indicated a requirement of at least 14 participants per group. Our sample included 60 healthy adults (M_{age} = 28.90; SD_{age} = 10.40) randomly and equally distributed between the 3 priming conditions: secure, anxious, and avoidant. Inclusion criteria were an absence of past or current psychiatric diagnosis and an absence of education background in psychology.

2.1.2. Materials:

Imagination task (priming manipulation): The attachment priming method had been created by Bartz and Lydon (2004) who adopted the attachment styles description of Shaver and Hazan (1987): secure, avoidant, anxious. Participants were told the task assessed emotional memory. They heard via headphones a recorded text corresponding to the description of one of the three attachment styles (English and German translated texts can be found in Appendix A). Then participants were instructed to think of a current or past relationship that fits the attachment description they had just heard. Participants were further instructed, that if they are not able to think of one particular relationship or person that fits the description, it is also possible to think about more than one person at the time, to get into the feeling of this kind of relationship. Participants were asked to take time to visualize a clear and vivid image of the person with whom they had the described relationship and to ask themselves a series of questions heard via the headphones. These questions were also adopted from Bartz & Lydon's (2004) priming technique and translated into German for this study. The instructions and stimuli can be found in Appendix B. The whole procedure lasted about five minutes.

Affective touch task: Completion of the empathy task (also known as the visuotactile empathy task or emotional egocentricity task), developed by Silani and colleagues (2013), requires that two paired participants judge either the other participant's emotional state or their own emotional state. After a fixation cross displayed on screen (range: 1800-5850 ms), the two participants receive distinct but simultaneous visuotactile stimulations eliciting feelings of pleasantness (e.g., a rose or a feather) or unpleasantness (e.g., a worm or a slug). Participants are informed of which stimuli each participant receives by a 3-seconds display of a photography (400 x 400 pixels) of each stimulus and a headline "You" or "Your colleague" above the respective pictures. During the visual display, the participants were touched by a material imitating the depicted stimulus below the "You" headline. Participants were told the materials were innocuous and inert but were instructed to imagine being touched by the depicted stimulus when rating their own perspective. In the congruent perspectives trials both participants receive stimuli of the same valence (e.g., pleasant for participants), and thus share a similar emotional state, whereas in the incongruent perspectives trials, they receive opposite valence stimuli, and thus experience different emotional states. Congruent and incongruent trials are mixed within two blocks, one block during which participants are instructed to systematically rate only the other person's emotional state –

the other-perspective block – and one block during which participants rate only her own emotional – the self-perspective block. Directly after three seconds of visuotactile stimulation, the participants rated the intensity and valence of the target emotional state via a finger touch on the screen along a visual analogue scale where the top-end was a manikin face expressing pleasantness and the bottom-end was a face expressing unpleasantness. Each block consisted of 40 trials, the congruency of the trials, the valence of the stimuli, the stimulus identity were equally distributed and the order of the trials was pseudorandomized to avoid more than two consecutive trials of the same type. The order of the perspective blocks was counter-balanced across subjects. Prior to completion of two blocks, participants completed a practice block of 30 trials (10 pleasant, 10 unpleasant, 10 neutral) in which they received and rated visuotactile stimuli solely from the self-perspective (there was no picture of the other person's stimulus). This block allowed the participants to train with the rating procedure and to get a first-hand experience with all pleasant and unpleasant stimuli before having to imagine how it would feel for another person in the other-perspective block.

Similarly to recently designed visual perspective-taking tasks (e.g., Samson, Apperly, Braithwaite, Andrews, & Bodley Scott, 2010; Surtees & Apperly, 2012), the empathy task has a 2 (congruency: congruent vs. incongruent) x 2 (perspective: self vs. other) design, with 20 trials per cell, allowing to assess the average rating difference between congruent versus incongruent trials separately in the other-perspective condition and the self-perspective condition to assess respectively the extent of egocentric bias and of altercentric bias – our two dependent variables of interest. Concretely, the extent the participant's own emotional state biases (i.e., egocentrically) her appreciation of her colleague participant's emotional state is expected to translate into lower intensity ratings in the incongruent perspectives trials than in the congruent trials in the other-perspective block. Conversely, the extent the colleague participant's emotional state (i.e., altercentrically) biases the participant's appreciation of her own emotional state is expected to translate into lower intensity ratings in the incongruent perspectives trials than in the congruent trials in the self-perspective block. This pattern is expected and has been systematically found (e.g., Bukowski, Tik, et al., 2020; Riva et al., 2016; Silani et al., 2013) irrespectively of the valence; hence to ease interpretations, all ratings of rated unpleasant stimuli were reversed scores to form a single continuous positive score of emotional intensity ranging from 0 (neutral) to 10 (strongest intensity).

Self-other distinction performance on the affective touch task was assessed by the extent of egocentric bias (i.e., median rating in congruent condition minus median rating incongruent condition within the other-perspective block) and altercentric bias (i.e., median rating in the congruent condition minus median rating incongruent condition within the self-perspective block). Medians were used instead of means (as in previous own work) based on preliminary descriptive analyses, which had revealed that the majority of the participants (78% in Experiment 1; 61% in Experiment 2) have produced at least one rating opposite to the expected valence (e.g., rating as unpleasant a trial that should be rated as pleasant), which excessively influences the mean but not the median. Note that previously published experiments using this task had similar percentages of participants who produced inverse ratings. Thus, we reanalyzed their main findings with medians instead of means, which numerically improved significance in two studies (age effect in Riva et al., 2016; rTMS effect in Silani et al., 2013) out of three (stress by gender interaction in Tomova et al., 2014). We thus adopted the medians as the most appropriate measure of the central tendency; in order to directly compare the present findings to previous published work, as well as their re-analyses, we present the results calculated with the means in Appendix C. Note that in terms of the major conclusions, the two analyses lead to qualitatively identical findings, both for the present and the previous studies.

Based on the literature documented in the Introduction we expected distinct effects of attachment style for the altercentric and egocentric biases. Hence, our analysis plan focused primarily on *a priori* planned comparisons to compare self-other distinction performance between the three attachment style priming groups separately for the altercentric and egocentric biases. Specifically, two planned comparisons were ANOVAs testing the congruency by priming interaction in the self-trials and the other-trials, respectively, and 3 planned comparisons for each bias were *t*-tests testing group differences. In addition to these *a priori* planned statistical tests, we also performed the full ANOVA to obtain an exploratory picture of the main effects and interactions.

For planned comparisons, Cohen's *d* effect size and Bayes Factor (BF) were computed to evaluate frequentist effect sizes, and (probabilistic) Bayesian evidence, respectively. For the Bayesian analyses of the ANOVAs, we used JASP (Wagenmakers et al., 2018) with the null hypothesis (H0) being the model devoid of the priming group x congruency interaction term (i.e., only the main effects model) and alternative hypothesis (H1) being the model with the interaction

term (i.e., Sebastiaan Mathôt's matched models comparison). For the Bayesian analyses of the *t*-tests, H0 is an absence of bias difference between two priming groups and H1 is the presence of a bias difference between two priming groups. We computed the BF via the calculator of Dienes (2014) and entered the highest bias difference ever reported with the affective touch task (i.e., rTMS effect on the egocentric bias in Silani et al., 2013: 1.257) as the upper limit of the expected distribution and 0 as the lower limit. To compare the respective impacts of priming (i.e., group differences) between the egocentric bias and the altercentric bias in Bayesian terms, we used the posterior distribution computed for the altercentric bias as informed prior to compute the BF of the egocentric bias, as calculated by a recent evidence updating method (Ly, Etz, Marsman, & Wagenmakers, 2019). A BF above 3 indicates substantial evidence for H1 over H0, a BF below 1/3 indicates substantial evidence for H0 over H1, and a BF between 1/3 and 3 indicates that the data collected does not conclusively distinguish H1 from H0.

PANAS: The Positive and Negative Affect Scale (Watson, Clark & Tellegen, 1988) is a self-report mood scale with 10 items assessing positive emotions and 10 items assessing negative emotions. The 20 items are rated on a 5-point scale ranging from 1 to 5 ("very slightly or not at all", "a little", "moderately", "quite a bit", and "extremely"). Participants' mood was tested twice prior priming and once directly after the priming as an indirect manipulation check, where anxious and avoidant attachment are both expected to increase negative affect and decrease positive affect.

ECR: The Experiences in Close Relationships (Brennan, Clark & Shaver, 1998), translated to German (Neumann et al., 2007), is a self-report questionnaire with 18 items measuring the avoidance dimension of romantic attachment and 18 items measuring the anxiety dimension. Participants rated their degree of agreement with the 36 statements, ranging from 1 "Strongly disagree" to 7 "Strongly agree".

ERQ-D: The Emotion Regulation Questionnaire (Gross & John, 2003) adapted in German (Abler & Kessler, 2009) is a self-report questionnaire assessing the extent one use reappraisal (six items) or suppression (four items) as a strategy to regulate emotions. Participants rated their degree of agreement with the 10 statements, ranging from 1 "Strongly disagree" to 7 "Strongly agree".

2.1.3. Procedure:

Participants were contacted prior to coming to the laboratory to inform them about the general information of study, to insure they fit inclusion criteria and to make an appointment paired

with another participant. Both participants followed the same procedure except for the priming condition allocation. The two participants were together while informed about the study procedure and their related rights and provided their informed consents. Then, participants were asked to refrain to talk to each other and sit back-to-back, each facing a table with a touch-screen and a small curtain through which their left hand would be laid on palm up during the empathy task. Once seated, the experiment started with following sequences of tasks completion: (1) the PANAS questionnaire (time 1), the single-self block of the empathy task, the PANAS again (time 2), the imagination task to induce the attachment priming, the PANAS (time 3), the two blocks of the empathy task (self-perspective and other-perspective blocks, order counterbalanced-across participants), a sociodemographic questionnaire, the German adaptations of the ECR and ERQ-D questionnaires, and the debriefing.

2.2. Results

2.2.1. Group differences

Group differences in age, education, trait attachment style and emotion regulation habits were inspected across the 3 priming groups by performing a one-way ANOVA for age, education, and each subscale of the ECR (anxiety and avoidance) and ERQ (reappraisal and suppression) with the priming group membership as between-subject factor. The ANOVA did not reveal any significant difference: age ($F(2,57) = 0.643$, $p = .530$), education ($F(2,57) = 0.650$, $p = .526$), avoidance ($F(2,57) = 0.182$, $p = .834$), anxiety ($F(2,57) = 0.167$, $p = .846$), suppression ($F(2,57) = 0.770$, $p = .486$) and reappraisal ($F(2,57) = 2.873$, $p = .065$).

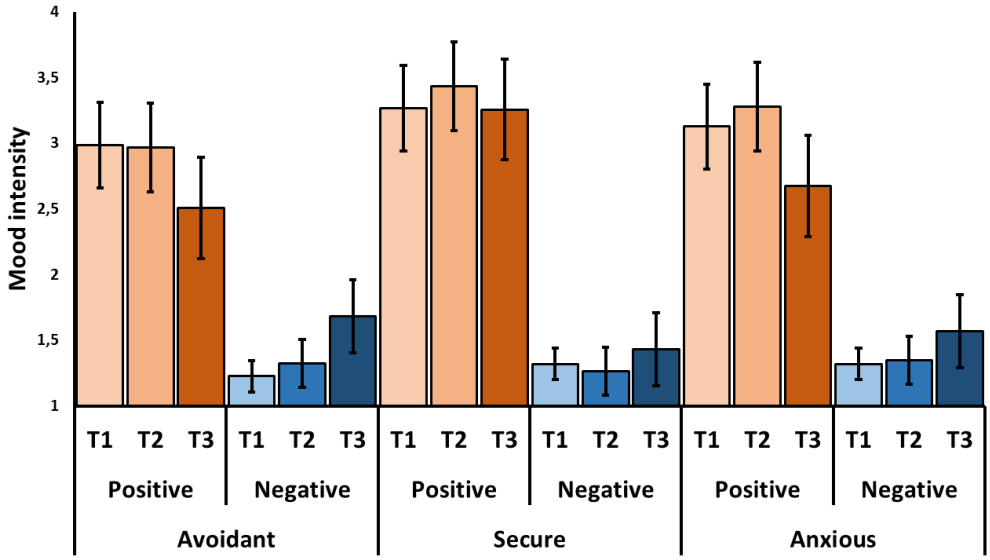

Figure 1. Mood changes measured with Positive and Negative Affect Scale before (T1, T2) and after priming (T3) of avoidant, secure, and anxious attachment style. Error bars indicate between-subject 95% confidence intervals.

2.2.2. Mood changes

The effectiveness of the priming manipulation was tested by inspecting the mood changes following priming as it was expected that priming an insecure relationship would deplete mood. An ANOVA was conducted on the scores of the positive and negative affect scales of the PANAS, which had been completed twice before priming and once directly after the priming. The model consisted of time (time 1, 2 and 3) and valence (positive and negative) as within-subject factors and the priming group (avoidant, secure, and anxious attachment) as a between-subject factor. The ANOVA revealed a significant main effect of valence ($F(1,57) = 249.778$, $p < .001$, $\eta_p^2 = .814$) indicating higher scores for positive affect than negative affect, a significant interaction between valence and time ($F(1,57) = 16.559$, $p < .001$, $\eta_p^2 = .225$) indicating a decrease of positive mood at time 3 contrasted with an increase of negative mood at time 3, a marginally significant interaction between valence and priming ($F(2,57) = 2.516$, $p = .090$, $\eta_p^2 = .072$) indicating a higher difference between positive and negative affect in the secure group, and a marginally significant linear triple interaction between time, valence, and priming ($F(2,57) = 2.815$, $p = .068$, $\eta_p^2 = .090$). The other interactions were not significant ($F(2,57) < 1.712$, $p > .189$). The triple interaction was further explored by comparing the global PANAS score (i.e., positive affect score minus negative affect score) at time 3 via a one-way ANOVA with the priming group as between-subject factor. The

ANOVA was significant ($F(2,57) = 3.390$, $p = .041$, $\eta^2 = .106$) and post-hoc analyses revealed a higher PANAS score in the secure attachment priming group than in the avoidant group ($p = .014$), and by trend in the anxious group ($p = .074$). Furthermore, pairwise *t*-tests comparing positive and negative affects between time 3 and time 1 or time 2 revealed significantly increases in negative affect and decreases in positive affective at time 3 in the anxious and avoidant priming groups (all $p < .05$) but no significant change in the secure group (all $p > .265$; see Figure 1).

In summary, as expected, priming avoidant and anxious attachment styles lowered positive affect and increased negative affect, whereas priming secure attachment did not affect mood.

2.2.3. Self-other distinction performance

Several ANOVAs were conducted on the ratings of the self-experienced emotional states and those experienced by the other person to compare self-other distinction biases across attachment priming groups. The full model consisted of perspective (self- vs. other person's emotional state) and congruency (congruent vs. incongruent self-other emotional states) as within-subject factors, and the priming group (avoidant, secure, and anxious attachment) as a between-subject factor. The ANOVA revealed a non-significant main effect of perspective, ($F(1,57) = 2.543$, $p = .116$, $\eta_p^2 = .043$), a non-significant main effect of congruency ($F(1,57) = 1.577$, $p = .214$, $\eta_p^2 = .027$), a non-significant interaction between perspective and congruency ($F(1,57) = 0.706$, $p = .404$, $\eta_p^2 = .012$), a non-significant interaction between perspective and priming ($F(2,57) = 1.117$, $p = .315$, $\eta_p^2 = .040$), a non-significant interaction between congruency and priming ($F(2,57) = 1.919$, $p = .156$, $\eta_p^2 = .063$), and non-significant triple interaction between perspective, congruency, and priming ($F(2,57) = 0.979$, $p = .382$, $\eta_p^2 = .033$).

Planned comparisons examined the impact of priming on the altercentric and egocentric biases, respectively. The ANOVA on self-trials revealed a significant interaction between congruency and priming ($F(2,57) = 3.859$, $p = .027$, $\eta_p^2 = .119$, $BF_{10} = 2.843$), indicating that the altercentric bias is differentially impacted by attachment styles. The ANOVA on other-trials revealed a non-significant interaction between congruency and priming ($F(2,57) = 0.261$, $p = .771$, $\eta_p^2 = .009$, $BF_{10} = 0.167$), indicating that the egocentric bias is not differentially impacted by attachment styles. The altercentric bias in the avoidant attachment group ($M = -0.591$, $SD = 1.971$) is significantly lower than in the secure attachment group ($M = 0.501$, $SD = 1.156$; $t(38) = 2.142$, $p = .039$, $d = 0.676$, $BF_{H(0,\ 1.257)} = 6.16$) and the anxious attachment group ($M = 0.426$, $SD = 0.767$;

$t(38) = 2.146$, $p = .038$, $d = 0.680$, $BF_{H(0, 1.257)} = 6.41$). The altercentric biases in the anxious and secure attachment were not significantly different ($t(38) = 0.244$, $p = .808$, $d = 0.076$, $B_{H(0, 1.257)} = 0.38$; see Figure 2). In contrast, for the egocentric bias, the avoidant attachment group ($M = 0.084$, $SD = 2.431$) did not differ from the secure attachment group ($M = 0.480$, $SD = 1.686$; $t(38) = 0.599$, $p = .553$, $d = 0.189$, $BF_{H(0, 1.257)} = 0.99$) and the anxious attachment group ($M = 0.376$, $SD = 0.976$; $t(38) = 0.499$, $p = .620$, $d = 0.158$, $BF_{H(0, 1.257)} = 0.85$) and the anxious and secure attachment groups did not differ either ($t(38) = 0.238$, $p = .813$, $d = 0.075$, $BF_{H(0, 1.257)} = 0.53$).

Hence, our hypothesis (H1) that priming distinct attachment styles would modulate the altercentric bias is supported by medium effect sizes and Bayes Factors favouring H1 over the null hypothesis (i.e., no modulation) with an evidence ratio of 6 (i.e., H1 is approximately 6 times more likely than H0). More specifically, individuals primed with an avoidant attachment style showed a significantly lower altercentric bias than the other groups. In contrast, the priming effects on the egocentric bias are not statistically significant and Bayes Factors suggest that the collected data cannot distinguish H1 from H0. Thus, the Bayesian evidence supporting the hypothesis according to which self-other distinction performance is different in the avoidant attachment group compared to the other two groups is at least 6 times higher for the altercentric bias than for the egocentric bias. However, direct Bayesian comparison of the priming group differences between biases (i.e., computing egocentric bias BF with the altercentric bias evidence as priors, as suggested by Ly et al., 2019) revealed a BF of 0.354 for anxious vs. avoidant attachment priming and 0.396 for avoidant vs. secure attachment priming, indicating that there is inconclusive evidence supporting distinct impacts of attachment priming between egocentric and altercentric biases.

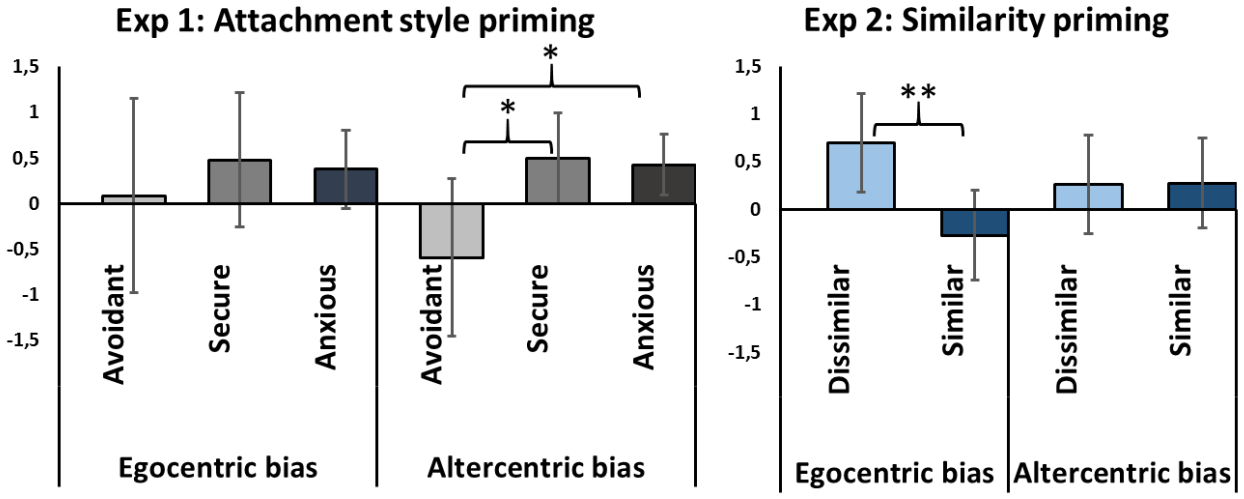

Figure 2. Impact of priming manipulations on emotional self-other distinction performance as indexed by egocentric bias (other-perspective: congruent – incongruent) and altercentric bias (other-perspective: congruent – incongruent) in Experiment (Exp) 1 and 2. Units are the extent of reduction of emotional intensity in participants' median ratings caused by the failure to suppress the biasing influence of the irrelevant emotional perspective. Error bars are 95% confidence intervals. * = $p < .05$, ** = $p < .01$.

3. Experiment 2

3.1. Material and methods

3.1.1. Sample:

For the reasons outlined for Experiment 1, only female participants were recruited as well. The power analysis using effect size estimates from the induced stress effect on visuotactile self-other distinction performance in women (Tomova et al., 2014) indicated a requirement of at least 14 participants per group, whereas the study that had used the same (dis)similarity priming manipulation on a non-affective self-other distinction (false belief) task indicated a requirement of at least 41 participants per group. We thus assumed roughly the average (27.5 participant per group) as providing optimal sample sizes, and recruited 60 healthy adults (M_{age} = 20.60; SD_{age} = 3.6) randomly and equally distributed between the two priming conditions: similarities focus and dissimilarities focus. Inclusion criteria were an absence of past or current psychiatric diagnostic and an absence of education background in psychology. Because there was a significant difference between priming groups on personal distress tendencies (p = .043), a key variable related to self-other distinction in empathy, we removed two participants with atypically low personal distress (self-other distinction findings were qualitatively identical without removal of these two participants). The first participant misunderstood the task instructions of the empathy task and was thus excluded of the sample.

3.1.2. Materials:

Pictures comparison task (priming manipulation): The similarity priming method had been created by Mussweiler (2001b) and instructed participants to write down three similarities or three differences on four pairs of pictures. Focus towards similarity was primed by instructing to look for similarities on the four pairs whereas focus on differences was primed by instructing too look for differences. Although previous studies have shown that the manipulation induces a generalized focus on either similarities or differences that carries over to subsequent tasks (e.g., (Mussweiler & Ockenfels, 2013; Todd et al., 2011), these tasks were shorter than the empathy task.

Hence, participants completed the picture comparison task again on four additional pairs before the second block of the task. This required to create new pairs of pictures which were pretested along the original pictures to make them equivalent in terms of time required to complete the comparison. The priming procedure lasted about five minutes.

Affective touch task: The task, effect sizes, and Bayesian analyses used are identical to Experiment 1. Regarding analyses, in line with Experiment 1, based on the literature documented in the Introduction we expected distinct effects of self-other similarity on the egocentric and altercentric biases. Hence we conducted four planned comparisons testing differences between the two similarity focus priming groups for the altercentric and egocentric biases, respectively. Specifically, two planned comparisons were ANOVAs testing the congruency by priming interaction for each bias, and two were *t*-tests of the group differences on each bias. We additionally provide the full ANOVA prior to the planned comparisons.

ERQ-D: Identical to Experiment 1.

IRI: the Interpersonal Reactivity Index (Davis, 1983) is a self-report questionnaire about empathic tendencies rated 5-point Likert scale ranging from "Does not describe me well" to "Describes me very well" divided in 4 subscales of seven items: Perspective taking, the tendency to consider the other person's point of view, Fantasy, the tendency to project into fictitious characters, Empathic concern, the tendency to be feel tenderness for unfortunate others, and Personal distress, the tendency to feel overwhelmed by others' negative emotions.

Additional exit questions: Eleven questions were created to ask about how they perceive their colleague (similarity, liking, and empathic competency), their own empathic performance, their strategy when comparing pictures, their familiarity with their colleague (questions can be found in Appendix D), and an open-ended question to provide feedback about the experiment.

3.1.3. Procedure:

Participants were contacted prior to coming to the laboratory to inform them about the general information of study, to insure they fit inclusion criteria and to make an appointment paired with another participant. Both participants followed the same procedure except for the priming condition allocation. The two participants were together while informed about the study procedure and their related rights and provided their informed consents. Then, participants were asked to refrain to talk to each other and sit back-to-back, each facing a table with a touch-screen and a

small curtain through which their left hand would be laid on palm up during the empathy task. Once seated, the experiment started with following sequences of tasks completion: a sociodemographic questionnaire, the ERQ-D, the IRI questionnaire, the PANAS (time 1), the single-self block of the empathy task, the pictures comparison task to induce the similarity/difference priming, the PANAS (time 2), the first block of the empathy task (self-perspective or other-perspective block, order counterbalanced-across participants), the pictures comparison task, the second block of the empathy task (self-perspective or other-perspective block, order counterbalanced-across participants), exit questions, and the debriefing.

3.2. Results

3.2.1. Group differences:

Group differences in age, education, emotion regulation habits and empathic tendencies were inspected between the two priming groups by performing a t-test for independent samples for age, education, and each subscale of the ERQ (reappraisal and suppression) and the IRI (Perspective taking, Fantasy, Empathic concern, and Personal distress) questionnaires with the priming group membership as between-subject factor. The ANOVA did not reveal any significant difference for age ($t(55) = 1.181$, $p = .243$), education ($t(55) = 0.581$, $p = .564$), reappraisal ($t(55) = 1.054$, $p = .297$), suppression ($t(55) = 0.924$, $p = .360$), perspective taking ($t(55) = 0.762$, $p > .455$), fantasy ($t(55) = 0.364$, $p = .717$), empathic concern ($t(55) = 0.863$, $p = .392$), and personal distress ($t(55) = 1.478$, $p = .145$). At last, responses did not differ significantly for the 10 questions about the other person (all $p >. 195$).

3.2.2. Mood changes:

An ANOVA was conducted on the scores of the positive and negative affect scales of PANAS, which had been completed before priming and directly after the priming of similarity and dissimilarly focuses. The model consisted of time (time 1 vs. time 2) and valence (positive and negative) as within-subject factors and the priming group (similarities vs. dissimilarities focus) as a between-subject factor. The ANOVA revealed a significant main effect of valence ($F(1,55) = 328.078$, $p < .001$, $\eta_p^2 = .856$), a significant main effect of time ($F(1,55) = 49.244$, $p < .001$, $\eta_p^2 = .472$) indicating a general reduction of mood scores at time 2, a significant interaction between valence and time ($F(1,55) = 4.971$, $p = .030$, $\eta_p^2 = .083$) indicating that positive affect decreased more than negative affective at time 2, a non-significant interaction between valence and priming

($F(2,56) = 0.163$, $p = .688$, $\eta_p^2 = .003$), a non-significant interaction between time and priming ($F(2,57) = 0.391$, $p = .534$, $\eta_p^2 = .007$), and a non-significant triple interaction between time, valence, and priming ($F(2,55) = 0.014$, $p = .906$, $\eta_p^2 = .001$).

In summary, priming similarities and dissimilarities focus resulted in reduced ratings of both positive and negative affect, and thus induced changes towards a more neutral mood in the two priming groups, and to a similar extent.

3.2.3. Self-other distinction performance:

In line with Experiment 1, several ANOVAs were conducted on the ratings of the self-experienced emotional states and those experienced by the other person to compare self-other distinction biases between the priming groups. The full model consisted of perspective (self- vs. other person's emotional state) and congruency (congruent vs. incongruent self-other emotional states) as within-subject factors and the priming group (similarities vs. dissimilarities focus) as a between-subject factor. The ANOVA revealed a significant main effect of perspective, ($F(1,55) = 20.233$, $p < .001$, $\eta_p^2 = .269$), a non-significant main effect of congruency ($F(1,55) = 2.370$, $p = .129$, $\eta_p^2 = .041$), a non-significant interaction between perspective and congruency ($F(1,55) = 0.111$, $p = .740$, $\eta_p^2 = .002$), a non-significant interaction between perspective and priming ($F(2,55) = 0.113$, $p = .738$, $\eta_p^2 = .002$), a non-significant interaction between congruency and priming ($F(2,55) = 2.378$, $p = .129$, $\eta_p^2 = .041$), and a significant triple interaction between perspective, congruency, and priming ($F(2,55) = 9.014$, $p = .004$, $\eta_p^2 = .141$).

Planned comparisons examined the impact of priming on the altercentric and egocentric biases, respectively. The ANOVA on other-trials revealed a significant interaction between congruency and priming ($F(2,55) = 7.739$, $p = .007$, $\eta_p^2 = .123$, $BF_{10} = 6.134$), indicating that the egocentric bias is modulated by priming. The ANOVA on self-trials revealed a non-significant interaction between congruency and priming ($F(2,55) = 0.001$, $p = .980$, $\eta_p^2 = .001$, $BF_{10} = 0.275$), indicating that the altercentric bias is not modulated by priming. The egocentric bias in the similarities focus group ($M = -0.273$, $SD = 1.243$) is significantly lower than in the dissimilarities focus group ($M = 0.700$, $SD = 1.396$; $t(55) = 2.782$, $p = .007$, $d = 0.736$, $BF_{H(0, 1.257)} = 26.35$; see Figure 2). In contrast, the altercentric bias in the similarities focus group ($M = 0.263$, $SD = 1.393$) is not significantly lower than in the dissimilarities focus group ($M = 0.272$, $SD = 1.292$; $t(55) = 0.025$, $p = .980$, $d = 0.007$, $BF_{H(0, 1.257)} = 0.36$).

Hence, our hypothesis (H1) that priming a dissimilarity versus a similarities focus would modulate the egocentric bias is supported by medium effect sizes and Bayes Factors favouring H1 over the null hypothesis (i.e., no modulation) with an evidence ratio of 26 (i.e., H1 is approximately 26 times more likely than H0). In contrast, the priming effects on the altercentric bias are not statistically significant and Bayes Factors suggest that the collected data cannot distinguish H1 from H0 (with however H0 being near 3 times more likely than H1). Thus, the Bayesian evidence supporting the hypothesis according to which self-other distinction performance is different in the similarities focus group compared to the dissimilarities group is 73 times higher for the egocentric bias than for the altercentric bias. Direct Bayesian comparison of the priming group differences between biases (i.e., computing altercentric bias BF with the egocentric bias evidence as priors, as suggested by Ly et al., 2019) revealed a BF of 0.072 for dissimilarities vs. similarities priming, indicating that there is strong evidence supporting distinct impacts of similarity priming between egocentric and altercentric biases.

4. Discussion

Feeling for the other, known as affect sharing, is a key empathic skill that has been consistently shown to be modulated by interpersonal distance with the other person. Teasing apart our own feelings from those of others, known as self-other distinction, is another key empathic skill for which the influence of interpersonal distance had never been examined. Across two experiments manipulating interpersonal distance by priming distinct attachment styles (Experiment 1) and focus on either similarity or dissimilarities (Experiment 2), we revealed that both priming manipulations modulated self-other distinction performance. Specifically, participants primed with avoidant attachment style showed improved performance via a lower altercentric bias whereas those primed with focus on similarities showed improved performance via a lower egocentric bias. Whether and how these effects differ from how interpersonal distance influence the affect sharing component of empathy and performance in non-affective self-other distinction is now discussed.

Attachment styles

Experiment 1 aimed to manipulate interpersonal distance by modifying the socio-affective distance with another person through the priming of distinct attachment styles. Attachment styles refer to distinct patterns of behaviours and cognitions observed in relation to an attachment figure such as a child's caregiver or an adult's romantic partner; for the scope of this study, we focused

on three styles: secure, avoidant, and anxious attachment. Secure attachment is characterized by positive views towards both oneself and the attachment figure, and self-views as interdependent with others. Avoidant attachment (also known as avoidant-dismissive insecure attachment) is characterized by negative views towards the other, especially a lack of trust, self-views as independent of others, perceptions of being dissimilar to the other, and drives for the least intimacy possible. Anxious attachment (also known as anxious-ambivalent attachment) is characterized by more positive views towards the other than oneself, self-views as dependent to others, perceptions of being similar to the other, and drives for a high-level of intimacy (Ainsworth, Blehar, & Waters, 1978; Mikulincer, 1998; Mikulincer, Orbach, & Iavnieli, 1998; Van Buren & Cooley, 2002). We therefore expected interpersonal distance to be increased by priming avoidant attachment and to be reduced by priming anxious attachment. We expected that increased self-other distance by avoidant attachment would be beneficial for self-other distinction performance as the self-other boundaries would be more clearly established, which would translate in lower self-other distinction biases following avoidant attachment priming than anxious attachment priming. Our results show that indeed the participants primed with avoidant attachment showed less bias than the other groups, but this was the case to a significant extent and with substantial Bayesian evidence only for the altercentric bias. Finding a modulation of the altercentric bias is congruent with that the observation that avoidant and anxious attachment are best differentiated in terms of personal distress, which conceptually similar to the altercentric bias as it is an unwanted and excessive emotional response towards others' distress (Joireman et al., 2002). Importantly, the size of the altercentric bias depends on the extent one manages to enforce self-other distinction (by suppressing, or regulating in other ways one's own affective response to the other person's feeling), but it also depends on the extent the other person's perspective is salient to our attentional system (Bukowski & Samson, 2017; Bukowski, Todorova, Boch, Silani, & Lamm, 2020). In other words, one can be good at putting aside irrelevant feelings, but the extent one pays attention to that person's feelings in the first place will greatly influence the overall extent of altercentric bias. The fact that the altercentric bias was lower in the avoidant attachment group is congruent with observations that the other person's perspective has less personal importance in avoidant than anxious attachment at the motivational and attentional levels (Mikulincer et al., 1998; Park, Troisi, & Maner, 2011). Hence, attachment style could have modulated the altercentric bias both via self-other distinction by increasing self-other distance and by reducing the attentional salience of the other person. Thanks

to an experimental priming manipulation, to our knowledge, this is the first time a causal link between attachment style and self-other distinction (and perspective taking in general) is demonstrated. The methodological advantage of priming manipulations is however counterpoised by its limited external validity: We cannot assert that we would find an identical influence with naturally developed attachment styles. Moreover, bearing in mind that the priming method required to think of past or current relationship (romantic or not) that fits description of the primed attachment style, it is likely that self-other distinction performance should vary depending on the attachment style developed towards the other person.

Besides finding a significantly lower altercentric bias following avoidant attachment priming, it is interesting to note that the altercentric bias did not differ between secure and anxious attachment styles (with a Bayes Factor indicating that the null hypothesis of absence of bias difference is near 3 times more likely than the alternative hypothesis). This fits with the fact that in both attachment styles the close other is positively viewed and some degree of dependence to the other is present. An alternative interpretation is that the priming was not successful for the anxious attachment priming, but this is unlikely since, unlike in the secure priming group, both insecure priming manipulations depleted participants' mood.

The egocentric bias was not significantly influenced by the priming modulation. Bayes Factors suggest a lack of conclusive evidence to support either the presence or absence of modulation by attachment styles. One possible interpretation is that, since the attachment priming consists in activating and maintaining through time representations of a previous relationship with a person, the other-perspective trials (which measure the egocentric bias) activate competing representations of how another person feels that therefore suppress the priming representations and its modulating effect. In contrast, the self-perspective trials (which measure the altercentric bias) activate non-competing representations of how oneself feels and thus does not suppress the primed representations about the other. Note however that we found inconclusive Bayesian evidence in support for distinct impacts between the two biases (although near threshold: BFs of 0.354 and 0.396 for < 0.333 threshold). Hence, overall this preliminary findings need follow-up and independent replication.

Self-other similarity

Experiment 2 aimed to manipulate interpersonal distance by modifying perceived self-other similarity. Experimental manipulations of self-other similarity typically compared performance at understanding or feeling for a person that is either similar or dissimilar in terms of group membership (ingroup/outgroup), personality traits, physical appearance, or political opinion (e.g., Hein et al., 2010; Majdandžić, Amashaufer, Hummer, Windischberger, & Lamm, 2016; Xu et al., 2009) but these manipulations are accompanied by distinct affects towards to the other person such that the similar other is more liked or cared about than the dissimilar other (Ajzen, 1974; Collisson & Howell, 2014). However, several studies have successfully replicated identical effects of self-other similarity without a confounded manipulation of the affect for the other person by priming a focus at either looking for dissimilarities or looking for similarities when judging another person (Mussweiler, 2001a; Todd et al., 2011). Specifically, Todd et al. (2011) consistently showed across five experiments that the participants primed with a focus on similarities and the participants who perceived the other as similar were more egocentrically biased, hence showing poorer self-other distinction performance on tasks requiring to accurately understand the other person's *non-affective* mental states (e.g. sarcasm detection, false belief reasoning, spatial mental rotation). These findings have been explained in two ways, the first being that perceived similarity fosters self-projection (Chambers & Davis, 2012; Heyes, 2018) and thus undermines performance when the other person's mental state is actually different. The second explanation is that self-other similarity undermines self-other distinction by reducing awareness of self-other differences, which is a key step to adjust or prevent the self-projection (Epley & Gilovich, 2006; Lamm et al., 2016). Hence, we expected that priming a focus on similarities prior to completion of the touch task would reduce self-other distinction performance in the *affective* domain as well, by finding a higher egocentric bias in the similarities focus group. Unexpectedly, we showed that the participants primed with a focus on similarities were less egocentrically biased than those primed with a dissimilarities focus. This finding suggests that self-other distinction in the affective domain is differently influenced by self-other distinction in the non-affective domain. In the affective domain, however, improved empathic performance for similar targets is already well-evidenced but for the affective sharing component of empathy (Avenanti et al., 2010; Hein et al., 2010; Meyer et al., 2013; Xu et al., 2009). Since the extent of egocentric bias reflects not only self-other distinction enforcement but also the relative attentional salience of the other person's perspective (in comparison to the salience of our own perspective) (Bukowski & Samson, 2017; Bukowski, Todorova, et al., 2020;

Majdandžić et al., 2016), it is likely that empathic performance in terms of affect sharing and egocentric bias are both improved because of the greater attentional salience of the other person's perspective when the other is perceived as similar. This explanation is in line with other views that similarity triggers other-oriented motives (acceptance, care, attraction for the other) caused by identification with the other (Cialdini et al., 1997) or interpersonal closeness (Aron, Aron, & Smollan, 1992). In other words, the affective nature of the stimuli might have enabled the perceived similarity to foster other-oriented motives which increased attention towards the other person's emotions and/or increased motivation to genuinely and effortful experience the other person's emotional experience and thus helped overcoming the egocentric perspective. This line of explanations is congruent with the observation that, given the consistency of the egocentric bias with the affective touch task, it is most likely the similarities focus that abolished the egocentric bias rather than the dissimilarities focus that increased the egocentric bias (see Figure 2). These interpretations however do not exclude the possibility that similarity diminishes the self-other distance needed for self-other distinction. Perceived self-other similarity is likely to have both beneficial and detrimental effects on the egocentric bias, which are expressed to different degrees depending on the paradigm, the manipulation, or the individual. This latter view fits well with two recent findings: First, Simpson and Todd (2017) showed that self-other similarity facilitated the computation of the other person's visual perspective while also undermined the ability to suppress the egocentric bias. Second, with the same visual perspective-taking task it was shown that the egocentric bias was reduced in the self-other similarity group (Schneider, Grigutsch, Schurz, & Zäske, 2018). Regarding why the egocentric bias was not increased by similarity (or reduced by dissimilarity) in the affective touch paradigm, one potential explanation is that differences between self- and another person's emotional experiences are visually highly noticeable, unlike in most non-affective perspective-taking tasks. Consequently, the self-other difference could have been so clear that the blurring of self-other difference by similarity was not effective enough to impact self-other distinction performance or that awareness of self-other difference could not be further increased by a dissimilarities focus.

While the egocentric bias differed between the dissimilarities and similarities priming groups to a significant extent and with strong Bayesian evidence, the priming groups difference for the altercentric bias was not significant and Bayesian evidence strongly support a lack of modulation. Moreover, we found substantial Bayesian evidence in support for distinct impacts

between the two biases. While previous studies clearly predicted an impact on the egocentric bias, no study had reported an impact of self-other similarity on the altercentric bias. One interpretation to these findings is that our priming manipulation specifically influence self-projection tendencies but not its regulatory mechanism, that is, self-other distinction. Future studies could better tease apart the effect of self-projection versus self-other distinction, by for instance including incidental measures of self-projection tendencies, that is without explicit demand on self-other distinction (e.g., Trilla, Weigand, & Dziobek, 2020).

To recap, these findings provide further evidence that self-other distinction performance is malleable and likely to vary depending on the perceived similarity of the other person. Integrated with previous affect sharing and non-affective self-other distinction literature, this study offers new insights regarding how self-other similarity might modulates the egocentric bias via several pathways causing the egocentric bias to become either increased or reduced. Nevertheless, it remains unclear whether it is the noticeability of self-other differences or the affective nature of the paradigm that allowed similarity to reduce egocentric biases. Future studies should aim to systematically decompose and manipulate the constituting elements of interpersonal contexts (e.g., self-other similarity, the affects felt for the other person) before examining how interpersonal distance influence to the respective components of empathy.

5. Conclusions

This study demonstrates for the first time the malleability of self-other distinction in empathy by manipulating two factors influencing social interactions: the socio-affective distance, by priming distinct attachment styles, and the perceived self-other similarity, by priming focus on either similarities or dissimilarities. By experimentally controlling attachment styles and similarity focuses, we provided causal evidence that even light manipulations such as priming influence self-other distinction performance as measured by the egocentric and altercentric biases in the affective touch paradigm. Given that empathized individuals are likely to vary in terms of attachment style and perceived similarity, the variability of self-other distinction performance should not be underestimated. Finally, our results highlights the manifold pathways through which interpersonal distance can enhance or dampen our capacity to reason about our own and others' thinking in an unbiased way.

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Appendix A

Priming materials of Experiment 1

Instructions

Original version (German): *"Liebe Versuchsteilnehmer, im folgenden Abschnitt soll es darum gehen Ihr emotionales Gedächtnis zu testen. Bitte folgen Sie dafür einfach den Anweisungen, die Sie gleich hören werden.*

Bitte denken Sie nun an eine vergangene oder aktuelle Beziehung, welche den nachfolgend beschriebenen Kriterien ungefähr entspricht. Nehmen Sie sich dafür ruhig Zeit und versuchen Sie sich die Person, mit welcher Sie diese Beziehung haben oder gehabt haben, genau vorzustellen. Diese Person kann ein Lebenspartner, ein guter Freund oder gute Freundin oder ein Familienmitglied sein. Wichtig ist, dass die Beziehung den gleich beschriebenen Kriterien ungefähr entspricht"

English version: *"Dear participant, the following task will test your emotional memory. Please just follow the following instructions. We would like to ask you to think about a past or current relationship, which fits the criteria described later. Take your time to do that and try to picture the person, with whom you had that kind of relationship, very precisely. This person can be a close friend, a family member or a romantic partner. Important is, that the relationship and the person you think of, fits the criteria, described later*"

Secure description

Original version (German): "*Denken Sie nun an eine Beziehung, in welcher es relativ einfach für Sie war der anderen Person nahe zu kommen und in der Sie sich dabei wohl gefühlt haben sich auf*

die andere Person zu verlassen. In dieser Beziehung haben Sie sich nicht oft Sorgen gemacht von der anderen Person verlassen zu werden und Sie haben sich auch nicht darum gesorgt, dass Ihnen die andere Person zu nahe kommen könnte"

English version: "*Please think about a relationship you have had in which you have found it was relatively easy to get close to the other person and you felt comfortable depending on the other person. In this relationship you didn't often worry about being abandoned by the other person and you didn't worry about the other person getting to close to you*" (Bartz & Lydon, 2004, p. 1394)

Avoidant description

Original version (German): "*Denken Sie nun an eine Beziehung, in welcher Sie sich auf die eine oder andere Art unwohl gefühlt haben der anderen Person zu nahe zu kommen. In dieser Beziehung fanden Sie es schwer, der anderen Person komplett zu vertrauen und sich auf die andere Person zu verlassen. In dieser Beziehung fühlten Sie sich nervös wenn die andere Person versucht hat Ihnen zu nahe zu kommen und Sie spürten, dass die andere Person intimer oder näher mit Ihnen sein wollte als es Ihnen angenehm war"*

English version: "*Please think about a relationship you have had in which you have found that you were somewhat uncomfortable being too close to the other person. In this relationship, you found it was difficult to trust the other person completely and it was difficult to allow yourself to depend on the other person. In this relationship you felt yourself getting nervous when the other person tried to get too close to you and you felt that the other person wanted to be more intimate that you felt comfortable being*" (Bartz & Lydon, 2004, p.1394)

Anxious description

Original version (German): *"Denken Sie nun an eine Beziehung, in welcher Sie gespürt haben, dass die andere Person Ihnen nicht so nahe sein wollte, wie Sie es sich gewünscht hätten. In dieser Beziehung sorgten Sie sich, dass die andere Person Sie nicht wirklich gern hatte oder geliebt hat und sie machten sich Sorgen, dass die Person nicht bei Ihnen bleiben möchte. In dieser Beziehung wünschten Sie sich, der anderen Person sehr nahe zu kommen, hatten aber gleichzeitig Angst, dass dies die andere Person abschrecken könnte"*

English version: "*Please think about a relationship you have had in which you have felt like the other person was reluctant to get as close as you would have liked. In this relationship you worried that the other person didn't really like you, or love you, and you worried that they wouldn't want to stay with you. In this relationship you wanted to get very close to the other person but you worried that this would scare the other person away*" (Bartz & Lydon, p.1394)

Questions

Original version (German): "*Nehmen Sie sich nun einen Moment Zeit um ein gutes geistiges Bild dieser Person zu bekommen. Wie sieht die Person aus? Wie ist es mit der Person zusammen zu sein? Vielleicht können Sie sich an einen bestimmten Moment erinnern, als Sie mit der Person zusammen waren. Was würde sie oder er zu Ihnen sagen? Was würden Sie antworten? Wie fühlen Sie sich wenn Sie mit dieser Person zusammen sind? Wie würden Sie sich fühlen wenn sie oder er jetzt hier wäre?*"

English version: "*Now, take a moment and try to get a visual image in your mind of this person. What does this person look like? What is it like being with this person? You may want to remember a time you were actually with this person. What would he or she say to you? What would you say in return? How do you feel when you are with this person? How would you feel if they were here with you now?"* (Bartz & Lydon, 2004, p. 1393)

Appendix B

Priming materials of Experiment 2

Instructions in German (original) for similarity and dissimiarly focus priming:

Bitte nennen Sie 3 Punkte in denen sich die folgenden zwei Bilder GLEICHEN. Sobald Sie damit fertig sind, heben Sie bitte ihren Arm um den Testleiter zu informieren.

Bitte nennen Sie 3 Punkte in denen sich die folgenden zwei Bilder von einander UNTERSCHEIDEN. Sobald Sie damit fertig sind, heben Sie bitte ihren Arm um den Testleiter zu informieren.

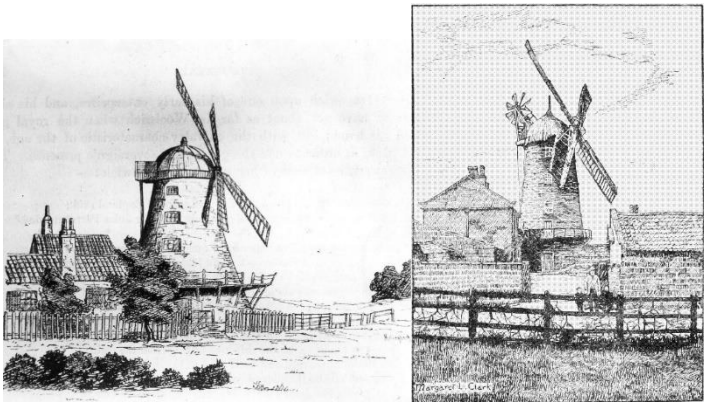
Instructions in English:

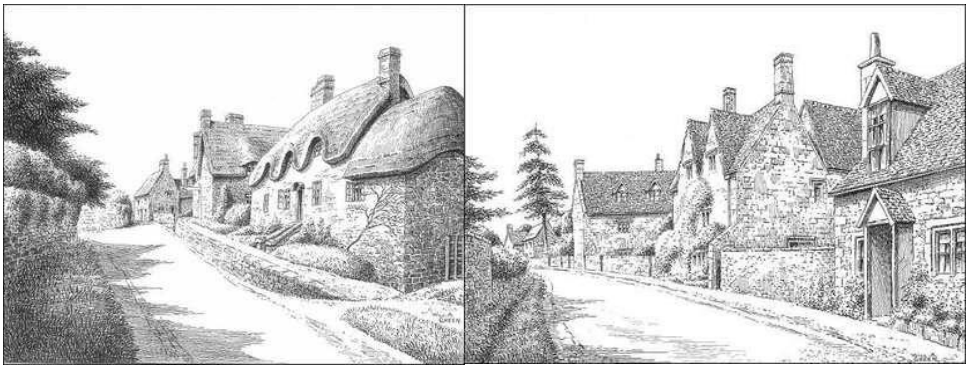
Please list 3 points in which the following two pictures are SIMILAR. As soon as you have finished, please lift your arm to inform the test leader.

Please list 3 points in which the following two pictures are DIFFERENT. As soon as you have finished, please lift your arm to inform the test leader.

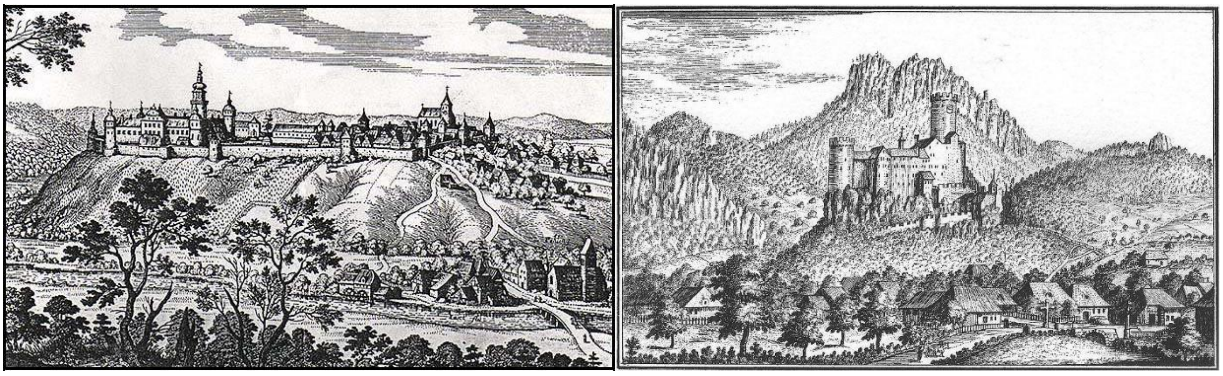
Pictures:

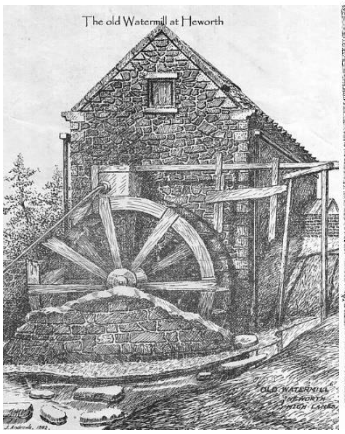
Set 1:

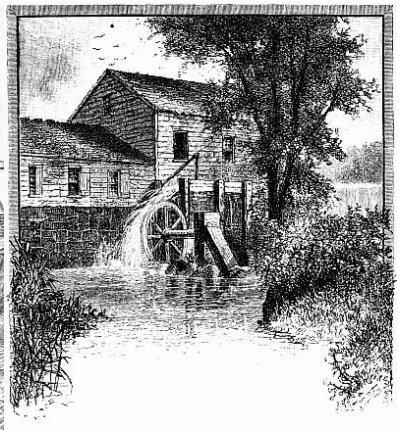


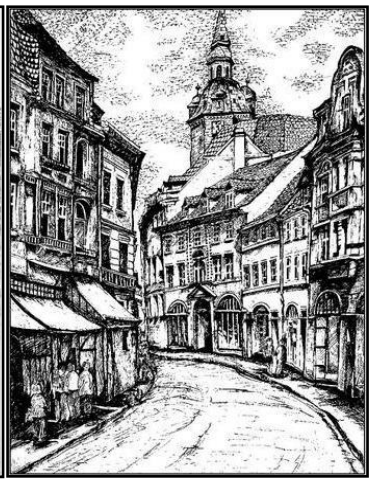


Set 2:




The old Watermill at Heworth





Appendix C

Self-other distinction results calculated with the means:

Experiment 1

The one-way ANOVA revealed a non-significant effect of Priming group on the egocentric bias ($F(2,57) = 0.041$, $p = .959$, $\eta^2 = .001$) but a marginally significant effect on the altercentric bias ($F(2,57) = 3.087$, $p = .053$, $\eta^2 = .098$). The altercentric bias in the avoidant attachment group ($M = -0.178$, $SD = 0.823$) is significantly lower than in the secure attachment group ($M = 0.3474$, $SD = 0.402$; $p = .016$) but the difference with the anxious attachment group is non-significant ($M = 0.132$, $SD = 0.402$; $p = .151$).

Experiment 2

The one-way ANOVA revealed a marginally significant effect of Priming group on the egocentric bias ($F(1,55) = 2.929$, $p = .093$, $\eta^2 = .051$) but non-significant effect on the altercentric bias ($F(2,56) = 0.216$, $p = .644$, $\eta^2 = .004$). The egocentric bias in similarity priming group ($M = -0.061$, $SD = 1.082$) tends to be lower than in the dissimilarities focus group ($M = 0.474$, $SD = 1.269$; $t(55) = 1.712$, $p = .093$).

Appendix D

Questions after experiment about the other person:

Likert scale ranging from 1 ("not at all") to 7 ("completely"):

1 To what extent did you identify with your colleague?

2 How much did you like your colleague?

3 To what extent did you perceive your colleague as physically similar to you?

4 To what extent, in your opinion, did your colleague have the same emotional reactions as you during the experiment?

5 How easy was it for you to put yourself in your colleague's shoes and empathize with her emotional experiences?

6 Do you think your colleague's experiences during the study's tasks were simular to yours?

7 To what extent, in your opinion, is your colleague's personality similar to yours?

8 How easy do you think it was for your colleague to put herself in your shoes and empathize with your emotional experiences?

Open questions:

9 How did you approach the task of comparing the pictures for similarities/ dissimilarities? Did you apply a specific strategy?

10 Is there anything you would like to let us know concerning the experiment? (Feedback, criticism…)

Multiple choices questions:

11 Have you ever seen the other participant prior to this study?

1: Yes
2: No/ I don't know

12 How well do you know your colleague?

1 Not at all
2 I think I have seen her before/ not sure
3 I have seen her before (e.g. at university)
4 I have spoken to her before
5 We have a class together
6 We have met before in a non-academic context
7 She is an acquaintance
8 She is a friend
9 She is my best friend
10 Other (please specify):