Inhibition of personally-relevant angry faces moderates the effect of empathy on interpersonal functioning

Vanessa Iacono

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By: Vanessa Iacono

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Signed by the final Examining Committee:

_____ Chair

Wayne Brake, Ph.D.

_____ Examiner
Mark A. Ellenbogen, Ph.D.

_____ Examiner
Karen Z.H. Li, Ph.D.

_____ Examiner
Michael Conway, Ph.D.

Approved by

_____
Jean-Roch Laurence, Ph.D.
Chair of Department

_____ 2013

_____
Brian Lewis, Ph.D.
Dean of Faculty

ABSTRACT

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Vanessa Iacono

Empathy has been linked to the accurate perception and understanding of another's emotions. As such, empathy is typically assumed to promote effective social interactions. However, empathy can sometimes hinder interpersonal functioning when it is unrestrained and overgeneralized. In the present study, we sought to examine whether cognitive inhibition would moderate the effect of empathy on the quality of social functioning both concurrently and over time. Eighty healthy young adults (ages 18-32; 50 females) underwent two assessments six months apart. Participants' ability to suppress interference from distracting emotional stimuli was assessed using a Negative Affective Priming Task that included both generic and personally-relevant facial expressions of emotion (i.e., anger, sadness, and happiness). The UCLA Life Stress Interview and Empathy Quotient were administered as measures of interpersonal functioning and trait empathy respectively. Multilevel modeling demonstrated that higher empathy was associated with better concurrent interpersonal outcomes, but only for those who were able to successfully inhibit the distracting personally-relevant depictions of anger (b = -.555, SE = .206, $t_{(75)}$ = -2.691, p =. 007). These data suggest that cognitive inhibition might be necessary to restrain excessive empathizing with others and ensure adaptive social functioning. Implications regarding our understanding of empathy and the social skills deficits that characterize certain clinical populations (i.e., depression) are discussed.

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Inhibition of personally-relevant angry faces moderates the effect of empathy on interpersonal functioning

Introduction

Interpersonal relationships are essential in that they serve fundamental needs and contribute to overall health and well-being (Baumeister & Leary, 1995). Interpersonal problems, such as difficulties being assertive, intimate, or sociable, are associated with maladaptive patterns of interpersonal functioning (e.g. social withdrawal; McDonald & Linden, 2003), higher mortality rates (Cacioppo, Hawkley, & Bernston, 2003; Holt-Lunstad, Smith, & Layton, 2010; Seeman, 2000), and increased mental health concerns (Salzer et al., 2008; Zians, 2007). Given the range of negative outcomes associated with interpersonal problems, understanding the causes and consequences of interpersonal dysfunction has become an important and timely research endeavor. In this regard, personality patterns have emerged as one key factor that might predispose certain people to experience problems when interacting with others (Clifton, Turkheimer, & Oltmanns, 2005; McDonald & Linden, 2003; Ostiguy, Ellenbogen, & Hodgins, 2012). Specifically, empathy is one such trait that has been closely linked to interpersonal functioning and has received considerable attention from investigators (Eisenberg & Miller, 1987; Lange & Couch, 2011; Preston & de Waal, 2002; Riggio, Tucker, & Coffaro, 1989).

Empathy is defined as encompassing two qualitatively distinct yet interacting components. The first, affective sharing, describes an individual's ability to vicariously experience an emotional response to another's expressed emotions. The second, cognitive perspective-taking, refers to an individual's capacity to adopt the subjective perspective of another (Decety, 2007; Knafo, Zahn-Waxler, Van Hulle, Robinson, & Rhee, 2008;

Preston & de Waal, 2002; Singer & Lamm, 2009). While empathy is likely to vary as a function of a person's current mood state (Baron-Cohen & Wheelwright, 2004), it is considered to be relatively stable across time, contexts, and its affective and cognitive components (Knafo et al., 2008). Empathic responding has also been associated with enhanced well-being (Shanafelt et al., 2005), self-esteem (Laible, Carlo, & Roesch, 2004), and mental health (Decety & Moriguchi, 2007), all of which have been implicated in adaptive social functioning.

Because empathy is linked with the perception and understanding of emotional cues, it is often assumed that empathy will evolve into behaviors that promote effective social interactions (Eisenberg & Eggum, 2009). In fact, the ability to communicate one's own emotions and understand those of another is an inherent part of interpersonal functioning (de Waal, 2008). Individuals high in empathy show proficiency in a number of basic social skills, including the capacity to interpret non-verbal communication and understand the norms that regulate social behaviors (Riggio et al., 1989). Ultimately, by urging us to help rather than hurt others, empathy has clear adaptive advantages (e.g. altruism) and, as such, can be especially important to the creation and maintenance of social relationships (Decety, 2007). While the majority of research links empathy to a wide range of relationship-enhancing effects, there is also evidence that empathy can be associated with adverse outcomes. For instance, recent studies have reported greater levels of empathy in aggressive children (Lovett & Sheffield, 2007), adolescents with conduct disorder (Decety, Michalska, Akitsuki, & Lahey, 2009), and adults suffering from depression (Thoma et al., 2011) relative to healthy controls, showing that high levels of empathy can occur in populations prone to experiencing poor interpersonal

outcomes. The question remains as to what factors might influence the nature of empathy-related outcomes.

One hypothesis is that the effect of empathy on social functioning might depend on one's ability to regulate the vicarious experience of another's emotion (Decety & Jackson, 2004; Decety, 2007, 2011; Eisenberg & Eggum, 2009). In the absence of such control, excessive empathizing could lead to emotional overarousal, with the desire to alleviate one's own discomfort taking precedence over the urge to attend to the other's emotion (Batson, 1991; Decety & Jackson, 2004; Eisenberg & Eggum, 2009). Where empathy evolves into self-focused rather than other-focused behaviors, the ability to perceive and understand another's emotions will not necessarily promote effective social interactions. Because well-regulated individuals are believed to have control over the sharing of emotions between themselves and others, they may be better equipped to reach and maintain optimal levels of emotional arousal when empathizing with others (Eisenberg & Eggum, 2009).

One integral component of self-regulation is the ability to control the allocation of attention to the various stimuli present in the environment (Posner & Rothbart, 2007). Attentional control involves both a capacity to attend to selected, relevant information as well as ignore or inhibit unselected, irrelevant information (Bargh, 1982). Ultimately, both biases in the selection of information for further processing and difficulties ignoring incoming irrelevant information can contribute to poor social outcomes (Dandeneau & Baldwin, 2004; Gotlib, Krasnoperova, Yue, & Joorman, 2004; Reed & Derryberry, 1995). Of particular interest to the present study is the latter process, termed cognitive inhibition. Cognitive inhibition is defined as the ability to suppress interference from

distracting information in the current environment. It is a component of executive functioning that regulates the content of working memory (Joorman, 2010). Because working memory has a limited capacity, its efficient functioning depends on inhibitory processes that limit the access of irrelevant information into consciousness. When the capacity for cognitive inhibition is weakened, too much irrelevant information enters into working memory, hindering one's ability to respond flexibly and adapt their behavior and emotional responses to the environment (Hasher, Zacks, & May, 1999).

Individual differences in cognitive inhibition can be estimated with a negative priming paradigm (Tipper & Cranston, 1985; Joorman, 2004). In the modified version of the task, which assesses inhibition of emotional stimuli (Goeleven, De Raedt, Baert, & Koster, 2006; Joormann, 2006), participants are instructed to respond to an emotional target stimulus while simultaneously ignoring or inhibiting an emotional task-irrelevant distractor. The negative priming effect refers to the delay in response latency that occurs when the distractor that was inhibited on a previous trial becomes the target on the subsequent trial. Ultimately, this delay is believed to represent the strength of inhibition of the distractor or how difficult it was for individuals to suppress interference from the distractor during an ongoing activity (Joorman, 2010).

Certain stimuli are harder for individuals to inhibit than others (Bargh, 1982; Joorman, Talbot, & Gotlib, 2007; Schlosser et al., 2011). Depictions of human faces are a notable example of a salient biological and visual stimulus that tends to attract attention in an automatic, largely unconscious manner (Lundqvist & Ohman, 2005). Specifically, certain individuals tend to present a bias towards, as well as difficulty disengaging from, facial expressions that denote negative emotions such as sadness and anger (Ellenbogen

& Schwartzman, 2009; Gotlib et al., 2004; Joorman et al., 2007; Van Honk, Tuiten, De Haan, Van Den Hout, & Stam, 2001; see also Mathews & MacLeod, 2005, for a review). Few studies, however, have compared the ways individuals attend to generic and personally-relevant information, which are likely to be processed differently. In fact, prior research has shown differences in the neural circuits involved in the processing of familiar and unfamiliar faces. For instance, familiar faces tend to elicit greater neural responses in the regions implicated in emotional processing, such as the amygdala and insula, compared to unfamiliar faces (Arsalidou, Barbeau, Bayless, & Taylor, 2010; Bartels & Zeki, 2004; Gobbini & Haxby, 2007, Leibenluft, Gobbini, Harrison, & Haxby, 2004; Taylor et al., 2009). In spite of this, the vast majority of work on emotional information processing has been limited to generic facial expressions of emotions as selected from validated databases, with the few existing studies having observed biases for self-relevant information with regards to auditory (Bargh, 1982) or written cues (Wingenfeld, 2006).

Control Variables

Neuroticism and lifetime diagnosis were included into the statistical analyses as two variables that might influence the association between empathy and social functioning. Neuroticism, a personality trait characterized by emotional instability and a tendency to experience negative affect, has been associated with the quality of social functioning as well as empathy. Specifically, individuals high in neuroticism have been shown to experience higher levels of interpersonal problems (e.g., difficulties being assertive) (Mcdonald & Linden, 2003; Ostiguy et al., 2012) as well as emotional overarousal and distress when empathizing with others (Lee, 2009).

With regards to lifetime diagnosis, both past and present externalizing and internalizing problems have been related to difficulties creating and maintaining healthy social relationships (Alden, Wiggins, & Pincus, 1990; Decety & Moriguchi, 2007). For instance, depression has been demonstrated as a proximal risk factor for interpersonal problems across the lifespan (Harkness, Washburn, Theriault, Lee, & Sabbagh, 2011; Thoma et al., 2011).

Finally, emotional intelligence can be conceived as the ability to perceive, understand, and regulate emotions (Mayer & Salovey, 1997). Because empathy is linked to efficient analysis of the emotions of others, it is central to most conceptions of emotional intelligence (Mayer, Caruso, & Salovey, 2000). Given the overlap between empathy and emotional intelligence, analyses were also conducted to determine the specificity of the present findings to the relation between empathy and social functioning.

Present Study

Of primary interest to the present study was to determine whether cognitive inhibition moderates the relation between empathy and social functioning. Specifically, we were interested in whether difficulty inhibiting distracting emotional stimuli during a negative affective priming task could explain why some individuals with elevated levels of empathy experience negative interpersonal outcomes. Healthy young adults completed a negative affective priming task and were assessed at two time points, six months apart. The current study also expanded on previous research by investigating inhibition to pictures of both generic and personally-relevant (i.e. participant's intimate partner) facial expressions of emotions (i.e. angry, sad, and happy). To the best of our knowledge, this is

the first study to explore differences in inhibition to pictures of generic and personally-relevant emotional facial expressions.

Two predictions were put forth. First, it was hypothesized that elevated levels of empathy would be associated with better interpersonal outcomes, but only for participants who could successfully inhibit the distracting emotional stimuli during the negative affective priming task. For those who showed difficulty inhibiting the emotional distractors, high empathy would be inversely related to social functioning. We examined these patterns at baseline, using concurrent measures, and prospectively by examining the relation between empathy and inhibition on interpersonal functioning six months later and its change over time during this period. Second, it was hypothesized that both personal-relevance and negative emotional expression (i.e. sad and angry faces) would elicit more inhibition compared to generic and happy pictures respectively. Accordingly, it was also expected that the moderation effect described in the previous hypothesis would be more pronounced for distractors that were especially difficult to inhibit. Although we had no specific hypotheses, gender differences in empathy and cognitive inhibition, and their influence on social functioning, were assessed in the study. To test for the specificity of the relation between empathy and interpersonal functioning, secondary analyses using trait emotionality and emotional intelligence as predictors of interpersonal functioning were examined. In addition, analyses using the quality of participants' functioning in non-interpersonal domains (e.g., work, academic, health, finances) as the outcome were conducted for comparison.

Method

Participants

Healthy young adults between 18 and 32 years of age (M = 23.35, SD = 3.63) were recruited through advertisement in web-based services (i.e. Craigslist.com) and local community newspapers in the region of Montreal, Canada. For inclusion, participants were required to be in a romantic relationship of six months or longer. All participants were administered the Structured Clinical Interview for DSM-IV (SCID-I), Patient edition (First, Spitzer, Gibbon, & Williams, 2002) by experienced doctoral-level psychology students. Any past or present diagnosis of psychosis, schizophrenia, bipolar disorder, pervasive developmental disorder, or current substance abuse/dependence warranted exclusion from participation. Individuals were also excluded from participation if they had a visual impairment, major medical illness within the past three weeks, or were using psychotropic medication at the time of the study. Out of the 82 individuals initially contacted for this study, three had to be excluded because they met criteria for current substance/alcohol abuse. In the remaining study sample, eleven participants (14%) met criteria for either a current anxiety or mood disorder at the time of testing.

Assessments were made at two time points, six months apart. The initial sample consisted of 79 healthy young adults (50 females) and their intimate partners. Sixty-seven participants returned for assessment six months later, consisting of 85% of the original sample. The majority of participants reported being in a heterosexual relationship (94%), with approximately 50% being in their relationship for two years or more. Seven (10%) of the returning participants had separated from their intimate partners in the interim

between the first and second measurement occasions. No differences were observed between the original sample and those who dropped out six months later with regards to age, relationship length, lifetime diagnosis, neuroticism, empathy, inhibition, and social functioning (all $p > .05$). This study was conducted as part of a larger multidisciplinary longitudinal investigation of the biases in emotional information processing that underlie poor interpersonal functioning, and their relation to adrenal hormones and characteristics of the individual.

Measures

Individual differences in trait empathy were assessed through self-report using the short form of the Empathy Quotient (EQ-Short; Wakabayashi et al., 2006). Participants were asked to indicate the degree to which each of 22 statements accurately described them using a 4-point scale with anchors ranging from *strongly agree* to *strongly disagree.* In the current sample, the EQ-Short showed high internal consistency (α=. 898), which is similar to what has been obtained in other studies using the same instrument (Baron-Cohen & Wheelwright, 2004; Wakabayashi et al., 2006). Neuroticism was measured using the Revised NEO Personality Inventory (Costa & McCrae, 1992). Emotional intelligence was assessed using the Mayer-Salovey-Caruso Emotional Intelligence Test (MSCEIT; Mayer, Salovey, & Caruso, 2000; Mayer, Salovey, & Caruso, 2002).

The chronic stress module of the UCLA Life Stress Interview (Hammen, Shih, Altman, & Brennan, 2003) was used to evaluate participants' functioning in four interpersonal (social life, close friendships, romantic relationships, and relationship with family members) and five non-interpersonal domains (education, work, finances, health of self, and health of family) over the previous six months. Each domain was coded on a

five-point scale by the interviewer using behaviour-specific anchor points and summed separately to create total interpersonal and non-interpersonal functioning scores. Higher scores reflect worse circumstances and social impairment. Interviewers were senior graduate students in clinical psychology that underwent extensive training on the instrument. Life domains comprising the interpersonal and non-interpersonal functioning composites showed moderate internal consistency (α=. 686). Using independent interviewers' ratings of 20 participants, intra-class correlation coefficients revealed moderate to high inter-rater reliability for all domains, with a mean of 0.813.

Personally-Relevant and Generic Stimuli

Using materials from the Facial Action Coding System (FACS; Ekman, Friesen, & Hager, 2002), the intimate partner of the participant was trained to generate three different facial expressions (angry, sad, and happy). Facial features particular to each emotional expression were demonstrated by the research assistant and described in detail (e.g., wrinkling of the nose, bearing of the teeth). Partners were also encouraged to use imagery to help evoke the required emotion and had a mirror at their disposal for practice. Approximately seven to ten pictures were taken of each facial expression using a digital camera mounted on a tripod. Five lab members then provided a global rating for each picture on a scale of 1 (*low*) to 10 (*high*) based on the degree of emotional intensity and genuineness conveyed by the facial expression. The two pictures with the highest average ratings for each emotion were included as stimuli in the study.

The personally-relevant pictures were processed using Adobe Photoshop CS4 editing software. The pictures were reduced to a size of 170 by 231 pixels and a color palette was applied to ensure that they were of the same brightness and hue as the generic

pictures. With regards to the generic pictures, a total of 48 pictures were selected from the Karolinska Directed Emotional Faces database (Lundqvist, Flykt, & Ohman, 1998) in sets of 16 (8 male, 8 female actors, all Caucasian) angry, sad, and happy facial expressions.

Negative affective priming (NAP) task

Derived from the original negative priming paradigm (Tipper & Cranston, 1985) and its recent adaptation (Goeleven et al., 2006; Taylor, Ellenbogen, Washburn, & Joober, 2011), a computerized cognitive task was designed to assess participants' ability to inhibit generic and personally-relevant facial stimuli depicting sad, happy, and angry emotional expressions. Participants were instructed to use a two-key response box to identify whether the stimulus presented in the white frame (target) depicted a positive or negative facial expression, while ignoring the stimulus presented in the black frame (distractor). Target and distractor stimuli were presented simultaneously at either the top or the bottom of the screen and were preceded by the presentation of a centered fixation cross. Participants' reaction time was recorded digitally (see Figure 1). Response times to negative priming and control test trials for generic and personally-relevant angry, sad and happy pictures are presented in Appendix A (see Table A1).

Specifically, the NAP task consisted of fixed consecutive pairs of "prime" and "test" trials. Prime trials always preceded the test trials. In the negative priming condition, the emotional expression of the target picture during the test trial was the same as the emotional expression of the previously ignored distractor in the prime trial. In the control condition, the emotional expression of the target picture during the test trial was unrelated to the emotional expression of the previously ignored picture in the prime

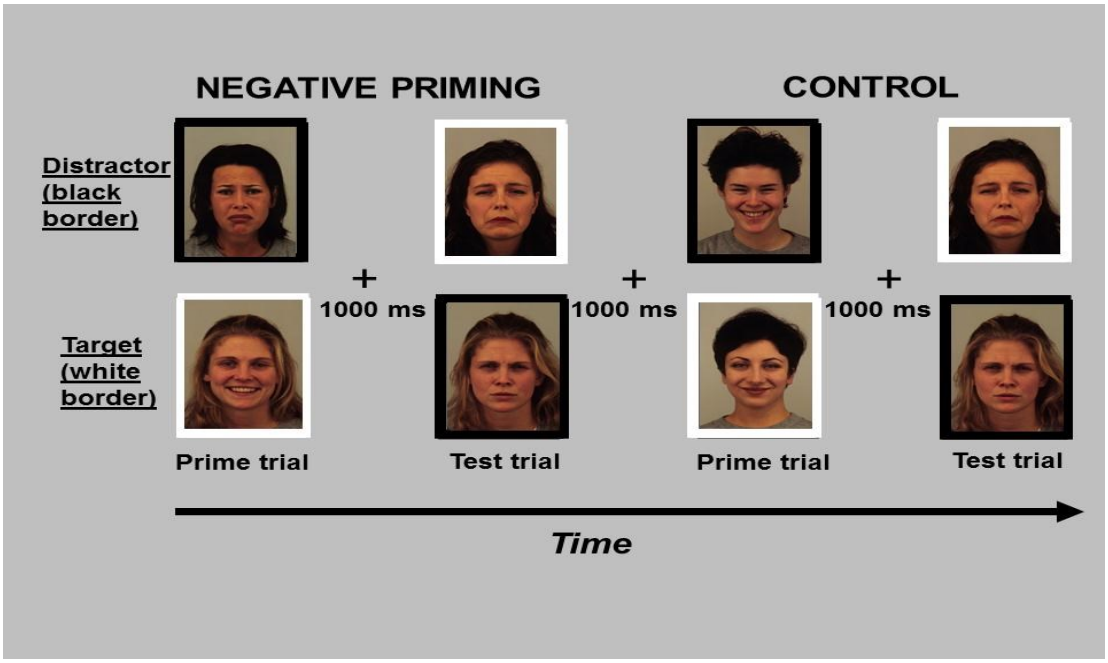

Figure 1. The NAP task was designed to assess participants' ability to inhibit generic and personally-relevant facial stimuli depicting sad, happy, and angry emotional expressions. Target (white frame) and distractor (black frame) stimuli were presented simultaneously at either the top or the bottom of the screen and were preceded by the presentation of a centered fixation cross (1000 ms). Each paired trial consisted of a "test" presentation (columns 2 and 4) preceded by a "prime" presentation (columns 1 and 3). If the emotional expression of the distractor stimulus presented during the prime presentation (sad; top column 1) became the target emotional stimulus on the following test presentation (sad; top column 2), the trial was considered to be negatively primed. If both the target and distractor stimuli in the preceding prime presentation (happy; column 3) differed in emotional content from the target stimulus on the test presentation (sad; top column 4), the trial was regarded as a control. The design of the NAP task was identical for both the personally-relevant and generic stimuli. Reprinted from " Intranasal oxytocin impedes the ability to ignore task-irrelevant facial expressions of sadness in students with

depressive symptoms" by M.A. Ellenbogen, A-M. Linnen, C. Cardoso, R. Joober, 2012, *Psychoneuroendocrinology.* Advance online publication.

trial. Importantly, the pictures presented during the test trial of the negative priming and control conditions were identical; the conditions only differed in the pictures presented in the prime trials. Inhibition was assessed by measuring differences in reaction time between the negative priming test trials, where the emotion type of the target was previously ignored, and control test trials, where the emotion type of the target was unrelated to pictures in the previous trial. In order to counterbalance the type of emotional stimulus used as targets in prime and test trials, as well as distractors in test trials, two sequences of negative priming and control manipulations were used. Thus, half of the paired trials assessing the inhibition of each emotional category were designed according to the first sequence, and the other half were designed according to the second sequence (see Appendix B, Table B1). Trials were also counterbalanced for the spatial location of the pictures. The design of the NAP task was identical for both the personally-relevant and generic stimuli, and differed only in the number of distinct actors conveying the emotional expressions (i.e., the emotional expressions in the personally-relevant pictures were all conveyed by the participant's intimate partner).

Given that the sole purpose of the prime trial was to vary the response to the test trial (Joorman, 2004), only response times to the test trials were included in the statistical analyses. An index of inhibition was computed by subtracting mean reaction time on matched control test trials from mean reaction time on matched negative priming test trials. Calculations were performed separately for trials assessing the inhibition of personally-relevant and generic pictures of angry, sad, and happy facial stimuli. A positive index value indicates inhibition, meaning that the emotional expression of the distractor presented during the prime trial led to a slower reaction time during the test trial of the same emotion. Conversely, a negative index value indicates reduced

inhibition, or positive priming, because the distractor presented during the prime trial prompted a faster reaction time during the test trial.

One hundred and ninety-two stimulus presentations were paired into 96 trials (48 negative priming trials and 48 control trials), which were viewed by each participant following a random sequence. Participants were presented with an equal number of paired trials for each emotional expression (32 sad, 32 happy, 32 angry), half of which consisted of personally-relevant pictures (16 personally-relevant and 16 generic sad, happy, angry faces respectively) (Figure 1). Pictures remained on the screen until a response was provided or for a maximum of 7500 ms. Each trial was separated by an inter-stimulus interval of 1000 ms during which time a centered fixation cross would appear on the screen. The NAP task was run on an IBM-compatible computer with a with a 17-inch *NEC* color monitor. The STIM Stimulus Presentation software (version 7.584) created by the James Long Company (Caroga Lake, NY) was used to program the task as well as to record participants' response times. The image resolution for the computer monitor was set to 800 x 600 pixels.

Procedure

Following completion of the screening protocol, participants and their intimate partners were scheduled to come to the laboratory. Once signed informed consent had been provided, participants were administered the SCID-I/P and UCLA Life Stress Interview while their partner took part in a photography session in a separate room. Partners were instructed to wear a large grey t-shirt as to match the clothing in the personally-relevant pictures to that in the generic pictures. Once the photography session was completed, partners were debriefed and remunerated $20 CAN. The partners' pictures would constitute the personally-relevant stimuli to which the participants would

respond during the NAP task, an addition to the task that the participants were made aware of during the process of obtaining informed consent.

Approximately one week following their first appointment, participants were scheduled to return to the laboratory. Upon arrival, participants completed the EQ-Short, Revised NEO Personality Inventory, and MSCEIT. Following completion of the questionnaires, participants completed the NAP task described above. Participants were instructed to use a chin rest throughout the task to ensure that they remained seated at a distance of 57 cm away from the computer monitor.

Six months later, participants were contacted by telephone or e-mail and scheduled to return to the laboratory. Upon arrival, the quality of participants' functioning during the six-month period since their last visit was assessed using the UCLA Life Stress Interview. One week following their first appointment, participants returned to the laboratory to complete the NAP task and were debriefed. Participants were remunerated $80 CAN per assessment for their participation in the study. All procedures were approved by the Human Research Ethics Committee of Concordia University (Montréal, Canada).

Data Analysis

NAP reaction times below 300 ms and above 2000 ms as well as incorrect responses to test trials (5.5% of all reaction times) were excluded from the analyses. Data were screened for outliers and distributional anomalies that may have violated statistical assumptions. For the inhibition index scores (negative priming test trial minus control test trial reaction times), three deviant values were transformed to the next most extreme score within the normal range (mean ± 3 standard deviations (SD)). Missing data for interpersonal functioning at the second measurement point (12.7%) were handled through

multiple imputations using PASW version 19 (SPSS, Inc., 2010). This was considered preferable to omitting these cases altogether, which could lead to an unwarranted loss of statistical power.

A two-way repeated-measures analysis of variance (ANOVA) was initially performed to test whether emotion type (i.e., happy, sad, and angry facial stimuli) and personal-relevance (pictures of intimate partner versus pictures of strangers from a generic picture set), alone and in interaction, would impact individuals' ability to inhibit distracting facial stimuli during the NAP task. Given the non-independence inherent in longitudinal data, the main analyses were conducted using a mixed effect model with maximum likelihood (ML) estimation using PASW version 19 (Heck, Thomas, & Tabata, 2010). In these analyses, individual data points for each participant were "nested" within each individual. While the time-dependent data served for within-subject comparisons (the level 1 units of analysis), the between-subject factors represented the level 2 units of analysis. In the within-subject analyses, participants' total interpersonal functioning score was used as the dependent variable and the timing of the data collection was used as the predictor. Linear effects of time were tested. In the between-subject analyses, individual differences in empathy and inhibition index scores for the generic and personally-relevant facial expressions of anger, sadness, and happiness were used to account for variability observed in the within-subject effects.

The multilevel analyses were conducted as follows. First, variables used as statistical controls (neuroticism and lifetime diagnosis) were entered into the model. Next, empathy, inhibition index scores for the generic and personally-relevant pictures of angry, happy or sad facial expressions, and their interactions were entered into the model. Three separate multilevel models were analyzed for the personally-relevant and generic

pictures of angry, sad, and happy faces respectively. A significant interaction was followed-up with a test of simple slopes, which assessed whether the slope depicting the relation between empathy and interpersonal functioning at baseline was significantly different from zero in participants who were able to inhibit the emotional distractors and those who were not (Aiken & West, 1991). Hierarchical multiple regression was used for analyses that included a single data point as the dependent variable (i.e. predicting time 2 functioning). All of the multilevel and regression analyses were conducted with the NAP data collected during the baseline assessment.

Results

Effects of emotion type and personal-relevance on inhibition index scores

Mean inhibition index scores and their standard deviations are presented by measurement occasion in Table 1. An Emotion Type X Relevance repeated-measures ANOVA was performed on the index of inhibition scores obtained during the first measurement occasion. The main effects for Emotion Type ($F_{(2,156)} = 13.166$, $p < .001$, $\eta^2 = .012$) and Relevance ($F_{(1,78)} = 4.049$, $p = .048$, $\eta^2 = .053$) were significant, but no interaction was found ($F_{(2,156)} = 1.497$, $p > .05$, $\eta^2 = .007$). The results indicated that angry facial stimuli elicited greater inhibition than both happy and sad expressions of emotion. In addition, personally-relevant depictions of facial emotions were associated with increased inhibition compared to the generic pictures. However, variations in inhibition as a function of a particular emotional expression did not vary depending on whether the depiction was personally-relevant or generic.

The same analyses were conducted on the inhibition index scores obtained during the second measurement occasion, six months later ($n = 67$). The main effect of

Relevance ($F_{(1,66)} = 5.108$, $p = .027$, $\eta^2 = .012$) was significant, such that depictions of personally-relevant emotional expressions elicited greater inhibition than the generic pictures. In contrast to the first measurement assessment, the main effect for Emotion Type was non-significant ($F_{(2,132)} = 2.616$, $p > .05$, $\eta^2 = .012$), nor was the Emotion Type X Relevance interaction($F_{(2,132)} = 2.935$, $p > .05$, $\eta^2 = .022$). Additional analyses found no evidence that the effects of Emotion Type and Relevance on inhibition index scores was moderated by gender ($p > .05$). Test-retest reliability of inhibition index scores across the two assessments was computed. Correlation coefficients were .137, .117, and -.148 for angry, sad, and happy personally-relevant pictures, and -.102, .045, and -.148 for angry, sad, and happy generic pictures.

Table 1

Means and standard deviations for inhibition index scores for generic and personally-relevant facial expressions of sadness, happiness, and anger reported by measurement occasion in milliseconds.

	Generic Stimuli		Personally-Relevant Stimuli	
	Mean (SD)	95% CI	Mean (SD)	95% CI
Time 1 (baseline)[a]				
Sad	-320 (98)	[-540, -100]	140 (107)	[-100, 390]
Happy	190 (107)	[-6, 440]	270 (107)	[2, 520]
Angry	460 (124)	[190, 730]	540 (107)	[310, 780]
Time 2 (six months)[b]				
Sad	-240 (90)	[-450, -3]	320 (90)	[100, 540]
Happy	130 (98)	[-100, 360]	120 (98)	[-150, 310]
Angry	240 (196)	[-2, 510]	300 (90)	[9, 510]

Note. [a] $n = 79$; [b] $n = 67$; CI = confidence interval

Preliminary analyses of interpersonal functioning over time

A within-subject "unconditional" model was initially assessed that included only the dependent variable (i.e. interpersonal functioning). An intra-class correlation revealed that 43.14% of the total variability in interpersonal functioning occurred between individuals, with the rest due to within-subject variability over the six months. Next, the time variable (level 1) was added as a linear predictor of interpersonal functioning. There was no significant linear change in interpersonal outcomes over time (b = -.162, SE =. 284, $t_{(74)}$ = -.569, p > .05), indicating that the quality of participants' interpersonal functioning remained stable over the two measurement occasions.

Predicting interpersonal functioning at baseline and change over time

Next, between-subject effects (level 2) were examined. There was a significant amount of variability in the intercept for baseline interpersonal functioning ($\chi^2_{(1)}$ = 13.724, p < .001), meaning that participants differed in the quality of their interpersonal functioning at the beginning of the study. However, the between-subject variability in the linear effect of time (slope) was not statistically significant ($\chi^2_{(2)}$ = 1.084, p > .05), indicating that between-subject effects did not influence the slope of interpersonal functioning across the two time points. Accordingly, the slope was set as fixed at level 2 such that the model made no attempt to explain variability in this effect.

Between-subject control variables (neuroticism and lifetime diagnosis) were added as predictors of the variability in the baseline interpersonal functioning intercept. Only neuroticism had a statistically significant effect (b = .032, SE = .008, $t_{(75)}$ = 3.859, p < .001), which explained 17.44% of the variability in baseline interpersonal functioning. Then, empathy and indices of inhibition for the generic and personally-relevant facial expressions of anger were added to the model. There was no significant main effect of

empathy (b = .028, SE = .022, $t_{(75)}$ = 1.29, p > .05) or inhibition of angry faces (b = -3.01, SE = 1.71, $t_{(75)}$ = -1.76, p > .05) on the baseline interpersonal functioning intercept. Next, the interaction between empathy and inhibition of generic and personally-relevant facial expressions of anger was included in the model. There was a significant empathy by inhibition of personally-relevant angry faces interaction (b = -.555, SE = .206, $t_{(75)}$ = -2.691, p =. 007), which explained an additional 8.38% of the between-subject variability on the baseline interpersonal functioning intercept.

Simple slopes analyses were conducted to examine the effect of empathy on baseline interpersonal functioning among participants who showed difficulty inhibiting (1 SD below the mean) and those who successfully inhibited (1 SD above the mean) the distracting personally-relevant facial expressions of anger. For individuals who showed difficulties inhibiting the distracting angry face of their partner, the slope depicted a positive relation between empathy and interpersonal functioning, which was significantly different from zero (b = .057, $t_{(71)}$ = 2.393, p = .019). That is, elevated levels of empathy were associated with poor interpersonal outcomes for individuals who showed difficulty suppressing interference from the personally-relevant depictions of anger (see Figure 2). For those who successfully inhibited the distracting angry face of their partner, the slope was not statistically different from zero (b = -.061, $t_{(71)}$ = -1.632, p > .05). However, further probing of simple slopes revealed a statistically significant negative relation between empathy and interpersonal functioning when inhibition was calculated at 2 SD above the mean (b = -.119, $t_{(71)}$ = -2.158, p = .034). That is, elevated levels of empathy were associated with better interpersonal outcomes, but only for participants with an inhibition index score that fell at the high end of the mean distribution of inhibition index scores for the full sample.

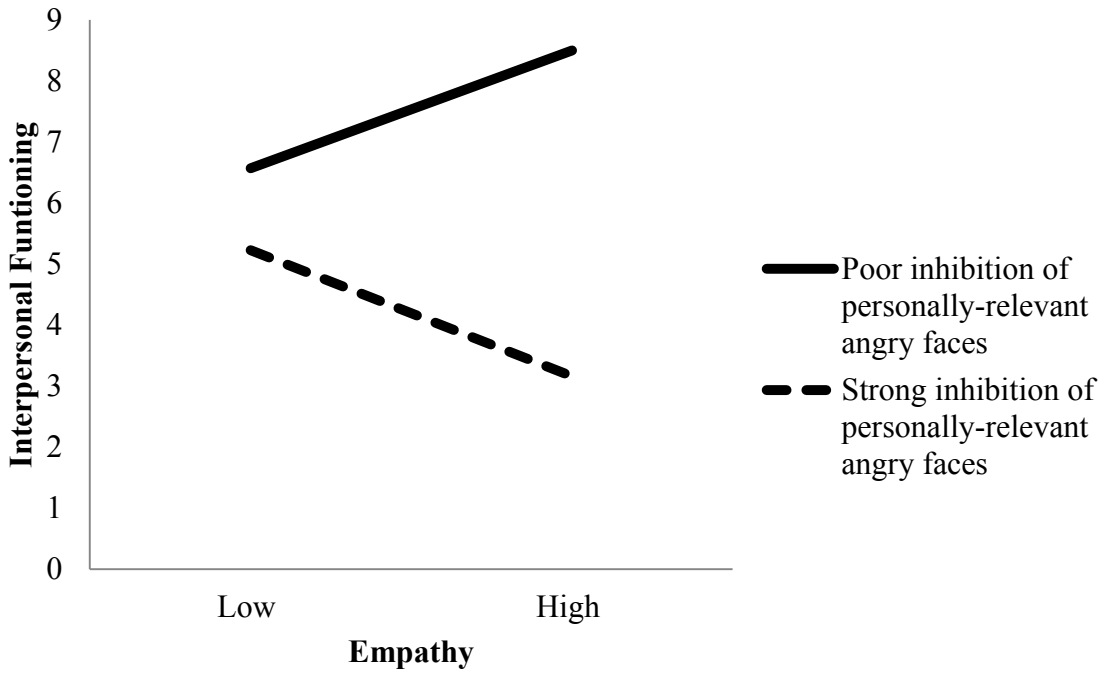

Figure 2. Simple slopes depicting the relation between empathy and baseline interpersonal functioning for individuals who successfully inhibited (1 SD above the mean) the distracting personally-relevant facial expressions of anger and those who did not (1 SD below the mean). The analyses indicated that the slope for those who showed difficulties inhibiting the personally-relevant depictions of anger was significantly different from zero (b = .057, $t_{(71)}$ = 2.393, p = .019), yielding a positive relation between empathy and baseline interpersonal functioning. Conversely, for those who successfully inhibited the distracting stimuli, the slope did not differ significantly from zero (b = -.061, $t_{(71)}$ = -1.632, p > .05). However, when calculated for indices of inhibition falling within the high end of the mean distribution of inhibition index scores for the full sample (2 SD above the mean), the slope depicted a significant negative relation between empathy and baseline interpersonal functioning (b = -.119, $t_{(71)}$ = -2.158, p = .034). Note that higher interpersonal functioning scores indicate greater impairment.

The multilevel analyses described above were repeated with the indices of inhibition for the generic and personally-relevant facial expressions of happiness and sadness as moderator variables, and participants' functioning in non-interpersonal domains (i.e. work, academic, health, finances) as the outcome. Inhibition of personally-relevant facial expressions of happiness had a significant positive main effect on the baseline interpersonal functioning intercept (b = 5.05, SE = 1.79, $t_{(73)}$ = 2.83, p =. 005) and explained an additional .77% of the remaining between-subject variability in baseline interpersonal functioning. None of the other analyses yielded statistically significant results (all $p > .05$).

Predicting interpersonal functioning at the second assessment

Although there was no evidence that inhibition and empathy predicted change in interpersonal functioning over time (see previous section), we examined whether these variables could predict prospective interpersonal functioning. Hierarchical multiple regression analyses were conducted in order to investigate whether empathy and inhibition at baseline would predict interpersonal outcomes at the six-month follow-up. Similar to the previous analyses, the main effects for empathy and inhibition were non-significant (all $p > .05$). However, inhibition index scores for generic and personally-relevant emotional distractors did not moderate the effect of empathy on the quality of social functioning at the six-month follow-up (all $p > .05$). Thus, the interaction between inhibition and empathy predicted concurrent, but not prospective, interpersonal functioning.

Supplementary analyses

Additional analyses were carried out using the neuroticism scale of the NEO-PI-R and managing emotions scale of the MSCEIT to examine whether the observed

interaction effect was specific to empathy rather than general trait emotionality or emotional intelligence. The interaction between neuroticism and inhibition of generic and personally-relevant facial expressions of anger, sadness, and happiness, as well as their interaction with emotional intelligence, did not significantly predict interpersonal functioning at baseline (all $p > .05$), suggesting that the present findings are specific to empathy. Finally, supplemental analyses found no evidence that the effect of empathy or inhibition index scores on interpersonal functioning was moderated by gender (all $p > .05$).

Discussion

In the present study, we examined whether cognitive inhibition of emotional content could explain, in part, why elevated levels of empathy are associated with both positive and negative interpersonal outcomes. In contrast to the vast literature of studies using pictures from validated databases (Ellenbogen et al., 2012; Goeleven et al., 2006; Joorman, 2004), the present study was among the first to include pictures of emotional facial expressions that were personally-relevant and meaningful to the participant, in addition to the use of generic pictures. Moreover, participants were evaluated at two time points, six months apart, to test the relation between empathy, cognitive inhibition, and social functioning using a prospective design.

Two noteworthy results were found in this study. First, inhibition was greatest for pictures that were personally-relevant relative to generic pictures and for pictures depicting anger relative to pictures of sad and happy faces. Second, elevated levels of empathy were related to positive social outcomes, but only for individuals who were able to inhibit the distracting personally-relevant facial expressions of anger. For those who showed difficulty inhibiting the angry distractors, high empathy was associated with poor

interpersonal functioning, confirming our hypothesis that high empathy can be maladaptive when there is insufficient inhibitory control over the processing of emotional information. This finding is consistent with a proposal put forward by Decety and colleagues (2004, 2007, 2011) that self-regulation is required to optimize levels of empathy during interpersonal encounters. In the absence of such restraint, individuals' ability to separate the other's emotional experience from their own is blurred, resulting in self-soothing rather than other-oriented behaviors. Importantly, this finding was only observed for the inhibition of personally-relevant facial expressions of anger. This suggests that differences in the quality of interpersonal functioning might only manifest when people are required to inhibit stimuli from which interference is especially difficult to suppress and, accordingly, more taxing on their cognitive resources. That is, individuals' capacity for self-regulation might need to be challenged in order for differences in empathy-related outcomes to surface.

In contrast, cognitive inhibition at baseline did not moderate the relation between empathy and interpersonal functioning at the six-month follow-up, nor did the interaction predict change over time in social functioning. Thus, while the interaction between empathy and cognitive inhibition predicted concurrent social functioning, it failed to predict future interpersonal outcomes. It is possible that variability in the measurement of inhibition and empathy may have adversely influenced the prediction of later social functioning. Test-retest reliability for inhibition index scores was low. Empathy was measured only at the first assessment. As such, it could not be determined if its measurement was stable over time. Although empathy is considered to be a stable trait (Lawrence, Shaw, Baker, Baron-Cohen, & David, 2004), it has been shown that it can change according to a person's current mood state (Baron-Cohen & Wheelwright, 2004).

Given the measurement variability and loss of power at the second assessment, future studies may require larger samples to adequately test prospective relationships between empathy, cognitive inhibition, and social functioning.

The contextual, social, and emotional cues that elicit empathy are complex. The experience of empathetic concern depends on the nature of the feelings being shared, the relationship of the individuals sharing the emotion, and the context in which the social interaction occurs. As such, the ability to understand another's emotion does not necessarily imply that one will act in a supportive or sympathetic way (Decety & Jackson, 2006; Decety & Lamm, 2009; Eisenberg & Eggum, 2009). In the current study, high empathy was associated with poor interpersonal functioning, at least among individuals who showed difficulty inhibiting the distracting angry faces. The present findings therefore not only highlight the complex nature of empathy, but also add to our understanding of the various factors that might affect empathy-related outcomes. For instance, previous studies have demonstrated high levels of empathy in individuals at risk for and suffering from depression, a disorder that is characterized by difficulties establishing and maintaining healthy interpersonal attachments (Harkness et al., 2011; O'Connor, Berry, Lewis, Mulherin, & Crisostomo, 2007; Thoma et al., 2011). Dysphoric and depressed individuals also tend to show inhibitory deficits on cognitive measures such as the NAP task (Ellenbogen, Linnen, Cardoso, & Joober, 2012; Goeleven et al., 2006; Joorman, 2004). Accordingly, cognitive inhibition might be a key variable in elucidating the counterintuitive notion that "caring too much" can sometimes be detrimental to interpersonal relationships, and might be especially relevant for understanding the social skills deficits present in depression.

There were two important findings in this study that speak to variations in methodology. First, an important goal of the current study was to examine whether the use of social stimuli having personal meaning and relevance to the participant is important in the study of emotional information processing. As expected, personally-relevant stimuli elicited greater inhibition compared to the generic stimuli at both measurement points, implying that it was more difficult for participants to suppress interference to ongoing, conscious activity from personally-relevant than generic stimuli. This finding supports the use of personally-relevant stimuli in future investigations of cognitive inhibition. However, the present study did not yield a significant interaction between emotion type and personal-relevance, indicating that the degree of inhibition did not differ by the emotional content of the personally-relevant pictures. Second, angry facial stimuli elicited greater inhibition than both happy and sad facial stimuli, consistent with previous work using the NAP task (Ellenbogen, et al., 2012; Taylor et al., 2011).

Some degree of caution should be employed in interpreting the results of the present study. First, although we interpret these data from a self-regulatory perspective (Joorman, 2010), only one aspect of self-regulation, namely cognitive inhibition, was assessed in this study. Self-regulation refers to a number of processes including planning, integration of information, and activation/inhibition of behaviors (Eisenberg & Eggum, 2009). Future research should consider the role of other self-regulatory mechanisms in modulating empathy levels during social interactions. Similarly, the NAP task was designed to assess individuals' ability to prevent irrelevant emotional information from entering into working memory. As such, the present findings are limited to one specific component of cognitive inhibition and fail to address other inhibitory mechanisms including individuals' ability to remove previously relevant material from working

memory or to withhold a pre-potent response (Friedman & Miyake, 2004; Nigg, 2000). Third, despite the widespread use of negative priming as a measure of cognitive inhibition (Goeleven et al., 2006; Gotlib et al., 2005; Joorman, 2010; Taylor et al., 2011), there is some debate as to whether slowed reaction times on negative priming trials actually reflect inhibitory mechanisms (MacLeod, Dodd, Sheard, Wilson, & Bibi, 2003). Alternative explanations include an episodic retrieval account (Neill, Valdes, Terry, & Gorfein, 1992) and a temporal discrimination account (Milliken, Joordens, Merikle, & Seiffert, 1998), all of which have been previously addressed and rebutted (Tipper, 2001). However, to increase construct validity, future research should assess cognitive inhibition using multiple tasks.

Fourth, individual differences in empathy were assessed through self-report, the validity of which has been questioned (Downey, Godfrey, Hansen, & Stough, 2006; Matthews, Zeidner, & Roberts, 2002). Yet, studies support the EQ-Short as a valid measure of trait empathy, exhibiting good concurrent validity with other well-established measures of empathy (e.g., 'Reading the mind in the eyes' test; Baron-Cohen, Wheelwright, Hill, Raste, & Plumb, 2001) as well as no association with indices of social desirability (Baron-Cohen & Wheelwright, 2004; Lawrence et al., 2004; Muncer & Ling, 2006; Wakabayashi et al., 2006). Future studies might consider adopting more objective measures of empathy including computerized (Dziobek et al., 2008) and laboratory (Knafo et al., 2008) simulations of interpersonal encounters. Fifth, total empathy scores, as opposed to separately considering the cognitive and affective components of empathy, were used as predictors in this study. Because the items that comprise the EQ-Short (Wakabayashi et al., 2006) tend to tap into both cognitive and affective aspects of empathy, assessing the unique contribution of each component on interpersonal

functioning was not feasible in the current study. It is, however, an interesting avenue for future research.

Sixth, our findings on personal-relevance are specific to pictures of the participants' intimate partner and do not necessarily generalize to other types of personally-relevant stimuli (e.g., autobiographical descriptors). Moreover, during the NAP task, participants were exposed to generic pictures of emotions as portrayed by 16 different actors. Conversely, the personally-relevant stimuli were represented by a single person; the participant's intimate partner. Therefore, participants were exposed to more repetitions of personally-relevant faces than generic faces, which might have led participants to more readily habituate to the personally-relevant compared to the generic pictures throughout the task. Although possible, the data are not consistent with this hypothesis as the strongest inhibitory effects occurred with personally-relevant pictures. Finally, our ability to conclusively establish the directionality of the results is limited. For example, it is also plausible that empathy moderated the effect of cognitive inhibition on interpersonal functioning or that the presence of interpersonal problems alters cognitive inhibition and ratings of empathy.

Despite these limitations, the findings of the present study expand on a growing body of literature attesting to the pivotal role of self-regulation in determining the effect of empathy on the quality of social outcomes. The current research also supports the use of personally-relevant stimuli in the study of social information processing. Ultimately, because interpersonal relationships are essential to health and well-being, knowledge of the personality and cognitive factors implicated in social functioning is crucial to the creation of prevention and treatment strategies aimed at lonely, depressed, and isolated individuals.

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Appendix A

Table A1

Response times (RTs) to negative priming and control test trials for generic and personally-relevant angry, sad and happy pictures in milliseconds.

	Negative Priming test trials		Control test trials	
	Generic	Personally-Relevant	Generic	Personally-Relevant
Time 1 (baseline)[a]				
Sad	809 (147)	877 (155)	842 (153)	863 (168)
Happy	829 (151)	853 (175)	811 (151)	826 (153)
Angry	848 (184)	899 (192)	802 (161)	841 (161)
Time 2 (six months)[b]				
Sad	717 (138)	785 (139)	742 (129)	751 (145)
Happy	752 (107)	748 (136)	734 (117)	739 (134)
Angry	724 (118)	773 (139)	711 (115)	745 (149)

Note: Mean RTs (ms) are shown with standard deviations in parentheses.

Appendix B

Table B1

Negative affective priming (NAP) task design for the generic and personally-relevant stimuli.

		Prime trials		Test trials	
		Distractor	Target	Distractor	Target
Angry 1	*Negative Priming*	A	H	S	A
	Control	H	H	S	A
Angry 2	*Negative Priming*	A	S	H	A
	Control	S	S	H	A
Sad 1	*Negative Priming*	S	H	A	S
	Control	H	H	A	S
Sad 2	*Negative Priming*	S	A	H	S
	Control	A	A	H	S
Happy 1	*Negative Priming*	H	S	A	H
	Control	S	S	A	H
Happy 2	*Negative Priming*	H	A	S	H
	Control	A	A	S	H

Note. A = Angry; S = Sad; H = Happy. In order to counter-balance the type of emotional stimulus used as targets in prime and test trials, as well as distractors in test trials, two sequences of negative priming and control manipulations were used to assess the inhibition of each type of emotion (accordingly, emotional conditions are labeled Angry1 and Angry2, Sad1 and Sad2, etc.). Thus, half of the trials assessing the inhibition of each emotional category were designed according to the first sequence, and the other half were designed according to the second sequence. The same design was used for the generic and personally-relevant stimuli, and differed only in the number of distinct actors conveying the emotional expressions.