Reduced empathic responses for sexually objectified women: An fMRI investigation

Carlotta Cogoni [a,b,*], *Andrea Carnaghi* [c] *and Giorgia Silani* [d,**]

[a] *Department of Psychology and Cognitive Science, University of Trento, Rovereto, Italy*
[b] *Scuola Internazionale Superiore di Studi Avanzati, Neuroscience Sector, Trieste, Italy*
[c] *Dipartimento di Scienze della vita, Università degli studi di Trieste, Trieste, Italy*
[d] *Department of Applied Psychology: Health, Development, Enhancement and Intervention, University of Vienna, Austria*

A R T I C L E I N F O

Accepted 28 November 2017

Keywords:
Sexual objectification
Empathy
Social exclusion
fMRI
Anterior insula

A B S T R A C T

Sexual objectification is a widespread phenomenon characterized by a focus on the individual's physical appearance over his/her mental state. This has been associated with negative social consequences, as objectified individuals are judged to be less human, competent, and moral. Moreover, behavioral responses toward the person change as a function of the degree of the perceived sexual objectification. In the present study, we investigated how behavioral and neural representations of other social pain are modulated by the degree of sexual objectification of the target. Using a within-subject fMRI design, we found reduced empathic feelings for positive (but not negative) emotions toward sexually objectified women as compared to non-objectified (personalized) women when witnessing their participation to a ball-tossing game. At the brain level, empathy for social exclusion of personalized women recruited areas coding the affective component of pain (i.e., anterior insula and cingulate cortex), the somatosensory components of pain (i.e., posterior insula and secondary somatosensory cortex) together with the mentalizing network (i.e., middle frontal cortex) to a greater extent than for the sexually objectified women. This diminished empathy is discussed in light of the gender-based violence that is afflicting the modern society.

1. Introduction

Gender-based violence disproportionately affects women, and it constitutes an extensive human rights abuse that the modern society cannot afford to overlook. Whereas violence against women has always existed, it is only in the last two decades or so that the international community has begun to highlight and systematically sharpen the problem (European Union Agency for Fundamental Rights, 2014; Walby, Towers, & Francis, 2016). In an attempt to examine and understand

* *Corresponding author*. Scuola Internazionale Superiore di Studi Avanzati, Neuroscience Sector, via Bonomea, 265, 34136, Trieste, Italy.
** *Corresponding author*. Department of Applied Psychology: Health, Development, Enhancement and Intervention, University of Vienna, Liebiggasse 5, 1010, Vienna, Austria.
E-mail addresses: carlottacogoni.ca@gmail.com (C. Cogoni), giorgia.silani@univie.ac.at (G. Silani).

this phenomenon, it has been theorized that behind the tendency to act violently likely stands, among other factors, a dramatic dampening of the perpetrator's empathic feelings toward the victim of the violence (Baron-Cohen, 2011; but see also Vachon et al., 2014 for a different interpretation). Specifically, empathy has been defined as a social emotion triggered by the perception or imagination of someone else's emotional state. It has been mostly operationalized as the similarity between oneself and other emotions' representations, in terms of reported subjective feelings and shared neural activations (de Vignemont & Singer, 2006; Singer & Lamm, 2009; but see also Woo et al., 2014 for a different interpretation). Empathy is a crucial skill for human and animal social interaction, as it plays a fundamental role in the understanding of others' intentions and actions and in the regulation of our behavior toward the target of empathy. For this reason, research on the malleability of our empathic responses (i.e. the investigation of the conditions under which people behave empathically and which specific features of the target are able to modulate it) is receiving increasing attention in the scientific community. In particular, it has been shown that empathy diminishes if the target of the empathic judgment is perceived as unfair (Singer et al., 2006) or dissimilar from the self (Majdandzic, Amashaufer, Hummer, Windischberger, & Lamm, 2016). Also, the perception of the suffering of an outgroup member (i.e. soccer fan of a rival team), compared to the perception of the same emotional state experienced by an ingroup member (i.e. soccer fan of the same team), leads to a reduction of the affective shared representations between the perceiver and the target, with a concomitant reduction of helping behavior (Hein, Silani, Preuschoff, Batson, & Singer, 2010). To the same extent, a race bias can induce a negative modulation of the empathic feeling toward different ethnical group members as compared to same ethnical group members (Avenanti, Sirigu, & Aglioti, 2010; Cosmides, Tooby, & Kurzban, 2003; Forgiarini, Gallucci, & Maravita, 2011; Johnson et al., 2002; Xu, Zuo, Wang, & Han, 2009). In the domain of gender-based violence, it has been previously reported a negative relationship between self-report level of empathy and violence of sexual nature (Abbey, Parkhill, BeShears, Clinton-Sherrod, & Zawacki, 2006; Cailleau, Thirioux, Mery, Senon, & Jaafari, 2016), thus suggesting that behind this class of violent behaviors possibly lies a reduction/lack of the ability to represent and share the suffering of the recipient of the violent act (Baron-Cohen, 2011; but see Vachon et al., 2014, for a critical review on the association between empathy and aggression). In order to better understand this phenomenon, a fundamental step is to examine which specific features of the target are responsible for the different degree of empathic feeling in the observer. Sexual objectification, in particular, stands as one of the possible mechanisms behind this reduction of empathic feelings towards victimized women.

1.1. *Women sexual objectification*

Objectification of an individual is a phenomenon that has been theorized and described by philosophers since Immanuel Kant's "*The Metaphysical Elements Of Ethics*" (1780). Broadly, it refers to the perception of people as instruments useful only to achieve specific goals (Nussbaum, 1995). A specific form of objectification is sexualization or sexual objectification. When an individual target is sexually objectified, the appraisal of the target is mainly driven by the target's physical appearance with a concomitant denying of the target's capacity for actions and decision making (American Psychological Association, 2007). Sexual objectification can occur not only when perceivers are exposed to women (or men) that are portrayed in a sexualized manner (e.g., revealing clothes, seducing poses, etc.), but also when perceivers shift the focus of their attention from the target's mind toward the target's physical attributes (Bartky, 1990). As a result, sexualized targets are judged to be less competent (Heflick & Goldenberg, 2009), less moral (Loughnan, Pina, Vasquez, & Puvia, 2013), less human (Loughnan et al., 2010), and less agentic (Gray, Knobe, Sheskin, Bloom, & Barrett, 2011) as compared to non-sexualized targets. Furthermore, sexualized women elicit less concern when victimized (Holland & Haslam, 2015), they are perceived as more responsible for being raped (Loughnan et al., 2013), while their rapists are less blamed (Bernard, Loughnan, Marchal, Godart, & Klein, 2015). Interestingly, women depicted in a sexually objectified fashion (i.e. with appealing bodily parts such as hip and breast prominently displayed) are perceived as having greater ability to experience emotions and bodily sensations in comparison to personalized women (i.e. with appealing body parts more covered), suggesting a misattribution solely due to the visual appearance of the target (Gray et al., 2011). In spite of this misattribution, preliminary studies on the relationship between empathy and sexual objectification have shown higher willingness to administer hypothetical painful tablets to objectified targets (i.e. pictures of shirtless men and women in bikinis) as compared to non-objectified targets (i.e. pictures of men and women fully clothed), suggesting altered empathic responses toward the former (Loughnan et al., 2010). Given the increasing sexual objectification of (especially) women in the modern media coverage (American Psychological Association, 2007) and the paucity of studies exploring how objectification of a target modulates empathy in the observer, the aim of the present study is therefore to unravel the behavioral and neurobiological mechanisms underlying this phenomenon, as a first attempt to understand the link between empathy and gender-based violence. Specifically, we intend to investigate how the vicarious experience of social pain may be affected by perceived sexual objectification of the target. Said otherwise, we intend to assess the behavioral and neurobiological mechanisms that are differently involved when the target of the social exclusion is a sexually objectified woman and a personalized woman.

To this end, feelings of empathy for social pain will be elicited in participants by witnessing exclusion from a ball tossing game, under functional magnetic resonance imaging (fMRI) investigation. In the next section, the neurophysiological underpinning of first person and vicarious experience of social exclusion will be briefly introduced.

1.2. *Empathy for social exclusion*

The feeling of social pain has been defined as the '*unpleasant experience that is associated with actual or potential damage to one's* *sense of social connection or social value'* (Eisenberger, 2012). Among others, it may arise from the loss of a close person (Kersting et al., 2009), a romantic rejection (Fisher, Brown, Aron, Strong, & Mashek, 2010) or the experience of being excluded or ostracized (Masten, Telzer, Fuligni, Lieberman, & Eisenberger, 2012). In experimental settings, social pain has been mainly investigated through the use of the cyberball paradigm, an interactive virtual ball tossing game which has been argued to elicit more lifelike experience of exclusion and negative affect (Williams, Cheung, & Choi, 2000; Williams, 2003). The cyberball paradigm has been used both in behavioral (Van Beest & Williams, 2006; Zadro, Williams, & Richardson, 2004) and in neuroimaging studies (Dewall et al., 2010; Eisenberger, Lieberman, & Williams, 2003; Eisenberger, Gable, & Lieberman, 2007a; Eisenberger, Taylor, Gable, Hilmert, & Lieberman, 2007b; Masten, Eisenberger, Pfeifer, & Dapretto, 2010), and it has revealed to be particularly useful to study not only the first person but also the vicarious experience (empathy) of social pain (Masten, Morelli, & Eisenberger, 2011; Novembre, Zanon, & Silani, 2015). While the first-hand experience of social pain has been associated with activity of brain regions usually related to the affective processing (affective component) of aversive experiences (especially physical pain) such as the anterior insula (aINS), the anterior middle cingulate cortex (aMCC), the posterior anterior cingulate cortex (pACC), and the ventral cingulate cortex (vCC) (Bolling et al., 2011; Dewall et al., 2010; Eisenberger, 2012; Eisenberger et al., 2003), empathy for social pain has been associated with brain regions underlying the affective processing (aINS and aMCC) as well as the representation of other mental states, such as the dorsomedial prefrontal cortex (DMPFC), the medial prefrontal cortex (MPFC) and the precuneus (PC) (Masten et al., 2010). Recently, Novembre et al. (2015) observed that empathy for another person undergoing social ostracism, when the ostracism is vividly elicited, recruits also brain regions that are involved in the processing of the somatosensory-discriminative component of pain, such as the secondary somatosensory cortex (SII) and the posterior insula (pINS) (Avenanti, Bueti, Galati, & Aglioti, 2005; Hein & Singer, 2008; Keysers, Kaas, & Gazzola, 2010).

Following the literature on sexual objectification, in the present study we hypothesized that the vicarious experience of social exclusion would be modulated by the level of sexual objectification of the target. Specifically, we put forward that sexually objectified women would trigger lower empathic reactions both on a behavioral and neurophysiological level, by dampening the level of shared representation in the affective (aINS and aMCC) as well as in the somatosensory-discriminative brain networks (SII and pINS).

2. Methods

2.1. Subjects

A total of 41 participants (20 women) with a mean age of 23.2 years (*S.D.* = 3.51, range = 18–34) were recruited via an online recruitment platform and took part in the fMRI experiment in exchange for monetary reimbursement. Sexual orientation of the participants was assessed via an open question. The sample resulted in 37 heterosexual, 2 homosexual and 2 bisexual individuals.[1] All participants gave informed consent and the study was approved by the Ethics Committee of 'Santa Maria della Misericordia' hospital, Udine, Italy. Three participants were excluded from the analysis due to anatomical anomalies, while two participants were excluded due to acquisition problems during the fMRI scanning, thus reducing the number of participants included in the final analysis to thirty-six (19 women).

Instructions about the experiment were provided to the participants outside the scanner. Immediately after the scanning session, manipulation check and self-report questionnaires were administered to measure general empathic traits (Interpersonal Reactivity Index - IRI (Davis, 1980)), degree of preference for inequality among social group (Social Dominance Orientation - SDO (Pratto, Sidanius, Stallworth, & Malle, 1994)), ambivalent attitudes toward women (Ambivalent Sexism Inventory - ASI (Glick & Fiske, 1996)), and level of self-objectification (Self-Objectification questionnaire (Noll & Fredrickson, 1998)). Note that three participants completed only the front page of the questionnaires, leaving the questionnaires analysis sample to 34.

2.2. Social pain task

The paradigm consisted of one session entailing 4 runs, performed on the same day. Each run was organized in a 3 (target: self, other objectified, other personalized) × 2 (condition: inclusion, exclusion) within-subjects factorial design.

2.2.1. Stimuli

The social pain task was based on the original Cyberball task (Williams et al., 2000), with the peculiarity of replacing the animated cartoons playing the game with more ecologically valid videos of real people tossing the ball to each other (see also Novembre et al. (2015), for a similar version of the cyberball game). Videos were recorded using a Digital Video Camcorder (Canon Legria FS406, Tokyo, Japan) and then edited with iMovie'11 (version 9.0.9 (1795)).

The videos had an average duration of 18.18 sec (range 15–21 sec). In each video the ball was tossed every two seconds for a total of 10 or 11 passes. The trials where participants were involved in the game (self condition) were characterized by the presence of the hands in front of the camera (see Fig. 1). The trials in which participants watched the game played by the three other participants (other objectified condition, other personalized trials) were characterized by the presence of only one body at the center of the screen and two pairs of hands on the right and left side of the screen. The person whose body was fully displayed was a confederate either dressed in a sexually objectified manner (other objectified condition) or in a non-sexually-objectified fashion (other personalized condition). The objectified outfit consisted of a short dress, heels and heavy makeup. The personalized outfit consisted of comfortable trousers, a jersey, ballet flat shoes and a light makeup (see Fig. 1). Both outfits were pretested on

[1] Data analyzed including only the heterosexual participants did not change from analyses of the full sample.

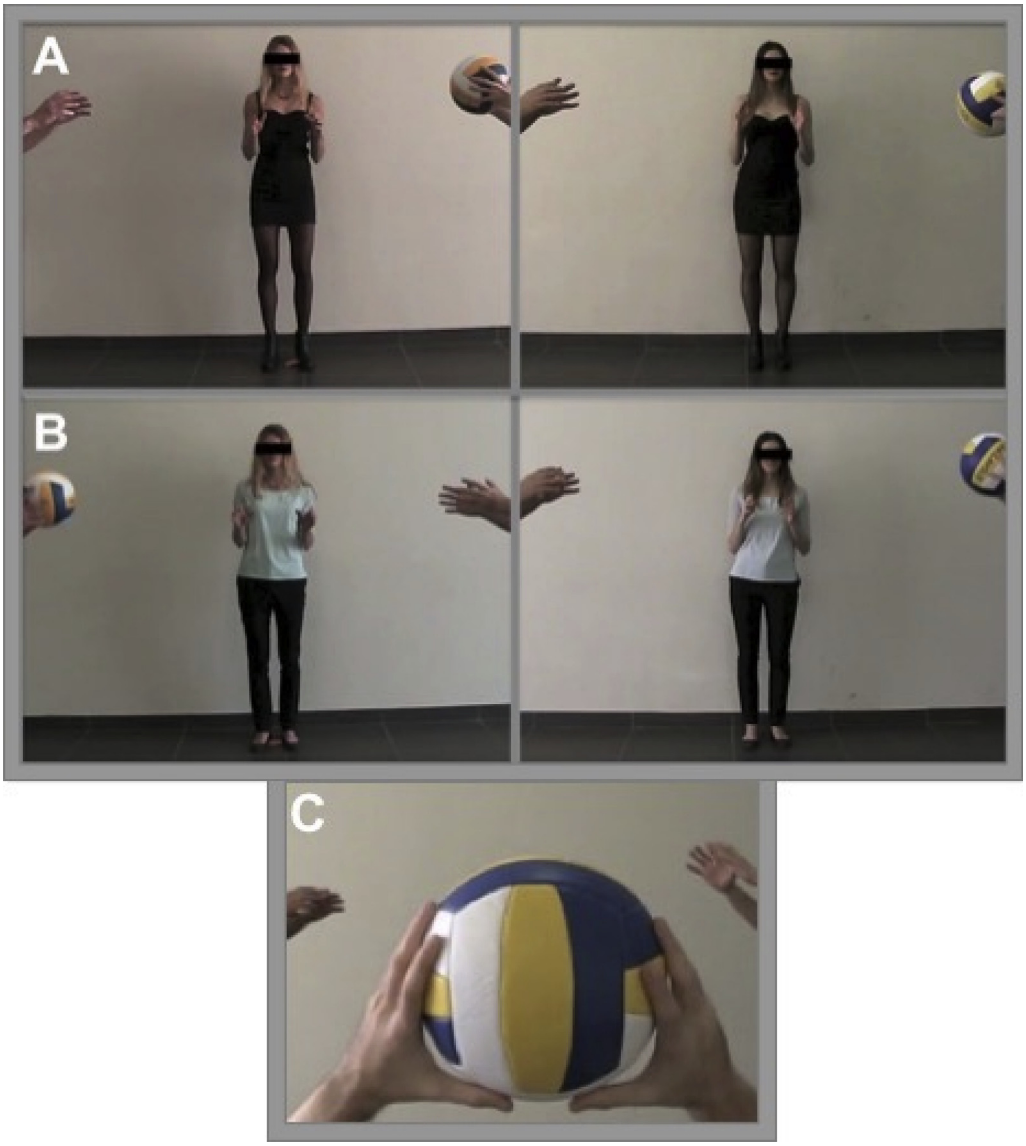

Fig. 1 — Exemplar images of the "self condition" videos and of the "other condition" videos. Objectified condition in the upper part of the figure (A), personalized condition in the lower part of the figure (B), self condition (C). Note that in the videos the confederates were displayed without the black bar on the face.

Sexiness, Attractiveness, Intelligence, and Familiarity scores and also on Agency and Experience (i.e. defined as the capacity to act and feel respectively) following the mental state attribution scale (Gray et al., 2011). The confederates were two young adult women unknown to the participants, one blonde and one brunette, of similar age, height and weight. Each participant saw through the entire game the same combination of confederate (i.e. if the blonde confederate was wearing an objectified outfit, the brunette was wearing the personalized ones and vice versa). This combination was randomized across participants.

2.2.2. *Procedure*

Participants were told that they were connected via internet to other three participants controlling the decisions of the players visible in the videos, located in another university building outside the hospital scanning unit, and thus would not meet the other players. This ensured that their responses towards the targets were not contaminated with reputational and image concerns.

The videos could belong to one of the three possible conditions (self, other objectified, other personalized), but no cues were given to the participants before the presentation of each of them. During the self condition, participants were directly involved in the game and they had to decide to whom to throw the ball every time they were in possession of it by pressing either the left or the right key on the pad that they held in the right hand. In the other objectified and the other personalized conditions, they watched the game played by the three other participants located in the university building (while in reality all the decisions were preregistered). They were told that due to the small size of the university room, the camera would be able to record only one participant in the full body dimension while only the hands of the other two participants would be visible in the video. Each video displayed either a 'social inclusion' or a 'social exclusion' trial. The 'social inclusion' trials were the trials in which the player, either the participant or the confederate, received the ball among all the passes. The 'social exclusion' trials were characterized by no passes received by the player. At the end of each trial, the participant was asked to rate the valence of the emotion felt by themselves (self condition), or by the other person (other conditions), during the game on a Likert-type rating scale going from -10 = 'very negative' over 0 to $+10$ = 'very positive'. The response was given using the same keys used for throwing the ball, within a time frame of 4 s (see Fig. 2). In each run, two videos for each condition (self, other objectified, other personalized) and each type of trial (exclusion, inclusion) were displayed in a pseudorandomized order (see Novembre et al., 2015 for a similar randomization), resulting in a total of 48 trials for the entire session.

2.3. fMRI data acquisition

A 3 Tesla Philips Achieva whole-body MR Scanner at the Hospital 'Santa Maria della Misericordia' (Udine, Italy), equipped with an 8-channel head coil, was used to acquire both T1-weighted anatomical images and gradient-echo planar T2-weighted MRI images with blood oxygenation level-dependent (BOLD) contrast. Functional images were acquired using a T2*-weighted echo-planar imaging (EPI) sequence with 33 transverse slices covering the whole brain (slice thickness 3.2 mm; interslice gap .3 mm; TR/TE = 2000/35 ms; flip angle = 90°, field of view = 230 × 230 mm^2; matrix size = 128 × 128, SENSE factor 2). Structural images were acquired as 180 T1-weighted transverse images (.75 mm slice thickness).

2.4. fMRI data preprocessing and analysis

Data were analyzed with SPM12 (Wellcome Department of Imaging Neuroscience, London, UK), running on Matlab R2012b. The scans were not slice timing corrected because the relatively short TR (2 s) it could lead to artifacts (Poldrack, Mumford, & Nichols, 2011). All functional volumes were realigned to the first functional image, co-registered to each individual's structural MRI scan, segmented in gray matter, white matter and cerebrospinal fluid tissues, normalized to a template based on the 152 brains from the Montreal Neurological Institute (MNI), and then smoothed by convolution with an 8 mm full-width at half-maximum (FWHM) Gaussian kernel.

Motion and artifact analysis of the movement-related variance was performed using the Art toolbox (www.nitrc.org/projects/artifact_detect). In each run, outlier scans were identified based on two measures: (a) if the TR-to-TR composite motion was more than 2 mm and/or (b) if the scan-to-scan global BOLD signal normalized to z-scores deviated from mean more than z = 3. Each time-point identified as an outlier was regressed out as a separate nuisance covariate in the first-level design matrix. All participants display a percentage of outlier scan inferior to the cutoff (25%), therefore no one was excluded from the analyses.

Following pre-processing, data were analyzed using the general linear model framework (Kiebel & Holmes, 2003). Low-frequency signal drifts were filtered using a cutoff period of

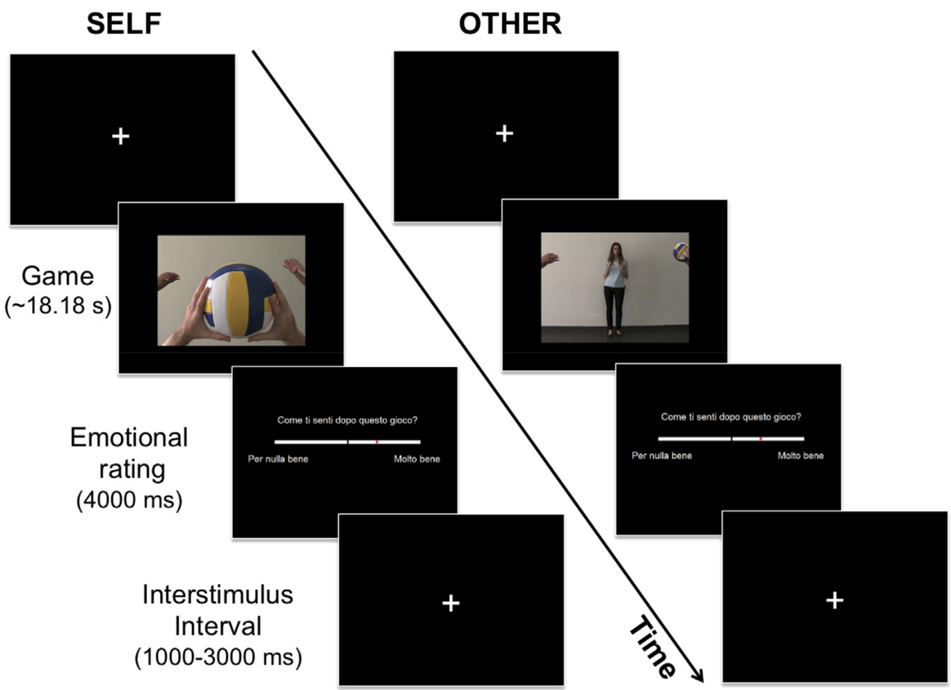

Fig. 2 — Schematic illustration of the social pain task. In each trial, participants could be involved in the game (self), observe sexually objectified targets involved in the game (other objectified) or observe personalized targets involved in the game (other personalized). For illustrative purposes, only the self (on the left) and other personalized (on the right) trials are presented. At the end of each trial, they were asked to judge their own/other emotion on a Likert-type rating scale.

128 sec. Regressors of interest were convoluted with a canonical hemodynamic response function.

In the first-level analysis, data were analyzed separately for each subject. Two separate first-level regressors (video and rating) were defined for each condition (self, other objectified, other personalized) and for each type of trial (inclusion and exclusion) for a total of twelve regressors for each of the four runs. Images were then fed into a flexible factorial design with a within-subject factor of six levels using a random effects analysis (Penny, Holmes, & Friston, 2003). Linear contrasts of the repeated measure ANOVA with two within-subject factors: condition (self, other objectified, other personalized) and type of trials (inclusion, exclusion) were used to assess main effects and interactions. Difference in the vicarious experience of social pain between other objectified and other personalized condition were calculated as the interaction effect (exclusion, inclusion) in (other personalized, other objectified).

Due to the unbalanced motor actions between self and other inclusion blocks, a conjunction analyses (Nichols, Brett, Andersson, Wager, & Poline, 2005) of the contrasts exclusion versus inclusion for the 'self' and 'other'-related conditions could not be used to identify brain regions commonly activated during the direct and the vicarious experience of social pain. Nevertheless, results of the self condition will be reported to check the validity of the paradigm in inducing responses to the first person social exclusion. Whole brain analysis are reported with a threshold of $p < .05$ FWE-corrected for the whole brain. The MRIcron software package (Rorden, Karnath, & Bonilha, 2007) was used for anatomical and cytoarchitectonic interpretation.

3. Results

3.1. *Behavioral results*

3.1.1. *Pilot test on the pictures*

To assess the efficacy of our experimental manipulation a pilot test was conducted. Twenty participants (10 women, selected from an independent pool issued from the same population as the experimental sample), age ranged from 21 to 31 ($M = 25.2$, $SD = 2.73$), rated the pictures of the two confederates in the objectified and personalized outfit on mental (i.e. intelligence) and physical appearance (i.e., attractiveness and sexiness) dimensions, by means of a 6-point scale, ranging from 1 (= not at all) to 6 (= completely). The familiarity with the confederates was also measured by means of the same 6-point scale as above. Finally, the confederates were also rated with respect to their capacity in terms of agency and experience, through 12 items of the mental state attribution scale (Gray et al., 2011).

The physical appearance and intelligence rating scores were separately analyzed by means of a repeated measures ANOVA with the condition (objectified, personalized) as a within-subject factor and the gender (male, female) as a between-subject factor. Results revealed that higher intelligence was attributed to the personalized women ($M = 4.10$, $SE = .27$) than to the objectified women ($M = 3.10$, $SE = .25$) F (1,19) $= 14.29$, $p = .001$, $\eta_p^2 = .44$. The main effect of gender and the interaction were not statistically significant (*p.s* > .46). Furthermore, participants attributed less sexiness to the personalized women ($M = 3.05$, $SE = .22$) than to the objectified women ($M = 4.20$, $SE = .24$) F (1,19) $= 11.87$, $p = .003$, $\eta_p^2 = .40$. A tendency to attribute less attractive characteristics to the personalized condition ($M = 3.20$, $SE = .33$) than to the objectified condition ($M = 3.85$, $SE = .27$) F (1,19) $= 3.58$, $p = .075$, $\eta_p^2 = .17$ was also observed. Objectified and personalized conditions did not differ in terms of familiarity F (1,19) $= .41$, $p = .53$, $\eta_p^2 = .02$. The main effect of gender and the interaction of gender with the condition were not statistically significant, consistently throughout the different dimensions (*p.s.>.26*).

As previously reported (Gray et al., 2011), agency and experience rating scores were analyzed by means of a 2 (dimension: agency, experience) by 2 (condition: objectified, personalized) by 2 (gender: male, female) repeated measures ANOVA with the first two variables as within-subject factors and the latter as a between-subject factor. Results revealed a marginally significant effect of the condition F (1,19) $= 3.69$, $p = .076$, $\eta_p^2 = .17$, indicating that agency and experience attributed to the objectified condition ($M = 3.03$, $SE = .06$) were overall reduced as compared to the personalized condition ($M = 3.20$, $SE = .10$). A significant interaction of the condition with the dimension was also found F (1,19) $= 22.58$, $p < .001$, $\eta_p^2 = .55$. This interaction revealed that greater experience was attributed to the objectified women ($M = 3.21$, $SE = .09$) than to the personalized women ($M = 2.93$, $SE = .12$) $p = .02$, and more agency was attributed to the personalized women ($M = 3.46$, $SE = .13$) than to the objectified ones ($M = 2.84$, $SE = .09$) $p < .001$. The main effect of gender and the interactions of gender with the different factors were not statistically significant, consistently throughout the different dimensions (*p.s.>.49*).

The pilot test results indicated that, in line with the operationalization of objectification already used in the literature (Bartky, 1990; Vaes, Paladino, & Puvia, 2011) confederates in the objectified condition were perceived with greater physical appearance characteristics but less intelligence than in the personalized condition. Moreover, in line with Gray and colleagues' results (2011), the confederates in the objectified condition were perceived as having less agency and more experience than in the personalized condition. Experience and agency are two basic features that differentiate human from non-human entities (Fiske, Cuddy, Glick, & Xu, 2002; Gray, Gray, & Wegner, 2007), with agentic traits overlapping with the *human uniqueness* dimension, which distinguish human from animals, while experience traits resembling the *human nature* dimension, which distinguish human from objects (Haslam, Loughnan, & Holland, 2013). Hence we can affirm that in our experiment objectified and personalized women differ also in terms of perceived humanness (Haslam, 2006; Haslam, Loughnan, Reynolds, & Wilson, 2007; Haslam, Loughnan, & Holland, 2013).

3.1.2. *Post scan picture ratings*

To assess the validity of our experimental manipulation also for the fMRI study, namely that the objectified and the personalized targets were perceived in line with the experimental purpose, post scan picture ratings were analyzed by mean of the previously reported ANOVAs. Furthermore, in order to assess the replicability of the findings between the two assessments (pilot, post scan), an additional factor was introduced: experiment (pilot, post scan).

Results revealed that higher intelligence was attributed to the personalized women (M = 4.13, SE = .17) than to the objectified women (M = 3.26, SE = .16) F (1,49) = 20.23, p = .001, η_p^2 = .29. Furthermore, participants attributed less sexiness to the personalized women (M = 2.98, SE = .17) compared to the objectified women (M = 3.85, SE = .20) F (1,49) = 11.53, p = .001, η_p^2 = .19. A tendency for the three way interaction between condition, gender and experiment was also found F (1,49) = 3.86, p = .06, η_p^2 = .07, in that the female participants attributed less sexiness to the personalized condition in the post scan (M = 2.22, SE = .28) as compared to the pilot experiment (M = 3.30, SE = .38) p = .03. Finally, the objectified condition (M = 2.84, SE = .15) was found to be less familiar than the personalized condition (M = 3.36, SE = .19) F (1,49) = 4.45, p = .04, η_p^2 = .08.

All the other main effects and interactions were not statistically significant (p.s > .08).

Regarding agency and experience rating scores, results revealed a main effect of the dimension F (1,49) = 5.76, p = .02, η_p^2 = .10, indicating that more agency (M = 3.22, SE = .06) than experience (M = 3.04, SE = .08) was attributed independently of the condition. A significant interaction of the condition with the dimension was also found F (1,49) = 20.02, p < .001, η_p^2 = .28. This interaction revealed that more experience was attributed to the objectified condition (M = 3.15 SE = .10) than the personalized condition (M = 2.93, SE = .10) p = .08, although this pattern was not statistically significant but it showed a trend in the expected direction. Also, participants attributed more agency to the personalized condition (M = 3.46, SE = .08) than to the objectified condition (M = 2.96, SE = .08) p < .001. All the other main effects and interactions were not statistically significant (p.s > .10).

Overall, the data suggest that our experimental manipulation was effective and stable across the two experiments, as indicated by the significant higher scores on physical appearance attributed to the objectified women and intelligence to the personalized ones. Furthermore, partially in line with Gray et al. (2011), the confederates in the objectified condition were perceived as having less agency than in the personalized condition. See Table 1 for the mean rating scores.

3.1.3. *Social exclusion task*

For each subject, the average emotional rating was calculated from the four runs. A two-steps analysis procedure was used: 1) to test for difference in valence, the emotional ratings recorded were analyzed using a *linear mixed effect* model (*lmer* R package) with an independent random intercept for every subject and with condition (self, other objectified, other personalized), and type of trial (inclusion, exclusion) as fixed effects. Participants were treated as random effect to control for the individual variability on the emotional ratings (See Fig. 3 and Table S1 for β, z, p values and Cis.). The *lmer* was performed using the *mixed* function of the package for Analysis of Factorial Experiments (afex, v.0.13–145), running on lme4 (v.1.1–7).

2) To test for difference in intensity, the average emotional ratings for the exclusion trials were multiplied for [-1] in order to carry the same direction of the inclusion trials. The analysis described before was then applied.

We used two tailed p-values for significance estimates of *lmer*'s fixed effects and parameters. Statistical analyses were performed with R software.

In the first step, results showed a main effect of the type of trial F (1,863) = 2112.13, p < .001, indicating that the inclusion (M = 3.67, SE = .26) and the exclusion from the game (M = −6.09, SE = .27) were able to elicit different emotions (different in valence, see Fig. 3).

The participant gender per se did not influence the emotional ratings F (1,863) = .31, p = .58, with male participants (M = −1.35, SE = .36) experiencing the same affect than the female participants (M = −1.08, SE = .34).

In the second step, results showed a main effect of the type of trial F (1,863) = 189.95, p < .001, indicating that the exclusion from the game (M = 6.06, SE = .38) was able to elicit higher intensities of emotions than the inclusion (M = 3.63, SE = .38).

A main effect of the condition was also found F (2,862) = 29.00, p < .001, indicating that the emotional intensity in the self (M = 5.62, SE = .39) is higher than both the other personalized (M = 4.96, SE = .39) p = .01, and the other objectified (M = 3.98, SE = .39) p < .001; the other personalized is also higher than the other objectified p < .001. Moreover a significant type of trial by condition interaction F (2,862) = 64.57, p < .001 was found. Pairwise comparisons indicated that in the exclusion condition the emotions related to the self (M = 5.72, SE = .42) were equally intense to the other objectified (M = 6.52, SE = .42) p = .10 and to the other personalized (M = 5.97, SE = .42) p = .96, and that the emotions related to the other objectified were equally intense to the other personalized p = .47. On the contrary, in the inclusion condition the emotions related to the self (M = 5.51, SE = .41) were more intense than both the objectified target (M = 1.44, SE = .42) p < .001 and the personalized target (M = 3.95, SE = .42) p < .001. Also, the emotions

Table 1 – Mean Rating scores.

Group	*Gender*	*Condition*	*Intelligence*		*Sexyness*		*Familiarity*		*Attractiveness*		*Agency*		*Experience*	
			M	*(SD)*	*M*	*(SD)*	*M*	*(SD)*	*M*	*(SD)*	*M*	*(SD)*	*M*	*(SD)*
Pilot	*Women*	*Obj*	3.10	(.37)	4.30	(.44)	2.70	(.34)	3.90	(.43)	2.85	(.18)	3.22	(.23)
		Pers	3.90	(.37)	3.30	(.38)	3.40	(.42)	3.30	(.43)	3.42	(.18)	3.00	(.22)
	Men	*Obj*	3.10	(.37)	4.10	(.44)	3.00	(.34)	3.80	(.43)	2.83	(.18)	3.20	(.23)
		Pers	4.30	(.37)	2.80	(.38)	2.80	(.42)	3.10	(.43)	3.50	(.18)	2.85	(.22)
Post-Scan	*Women*	*Obj*	3.06	(.27)	3.67	(.33)	2.56	(.25)	3.56	(.32)	3.08	(.13)	2.94	(.17)
		Pers	3.78	(.27)	2.22	(.28)	3.67	(.31)	2.61	(.32)	3.46	(.13)	2.78	(.16)
	Men	*Obj*	3.80	(.30)	3.33	(.36)	3.00	(.28)	3.67	(.35)	3.09	(.14)	3.26	(.18)
		Pers	4.53	(.30)	3.60	(.31)	3.60	(.34)	4.27	(.35)	3.50	(.14)	3.07	(.17)

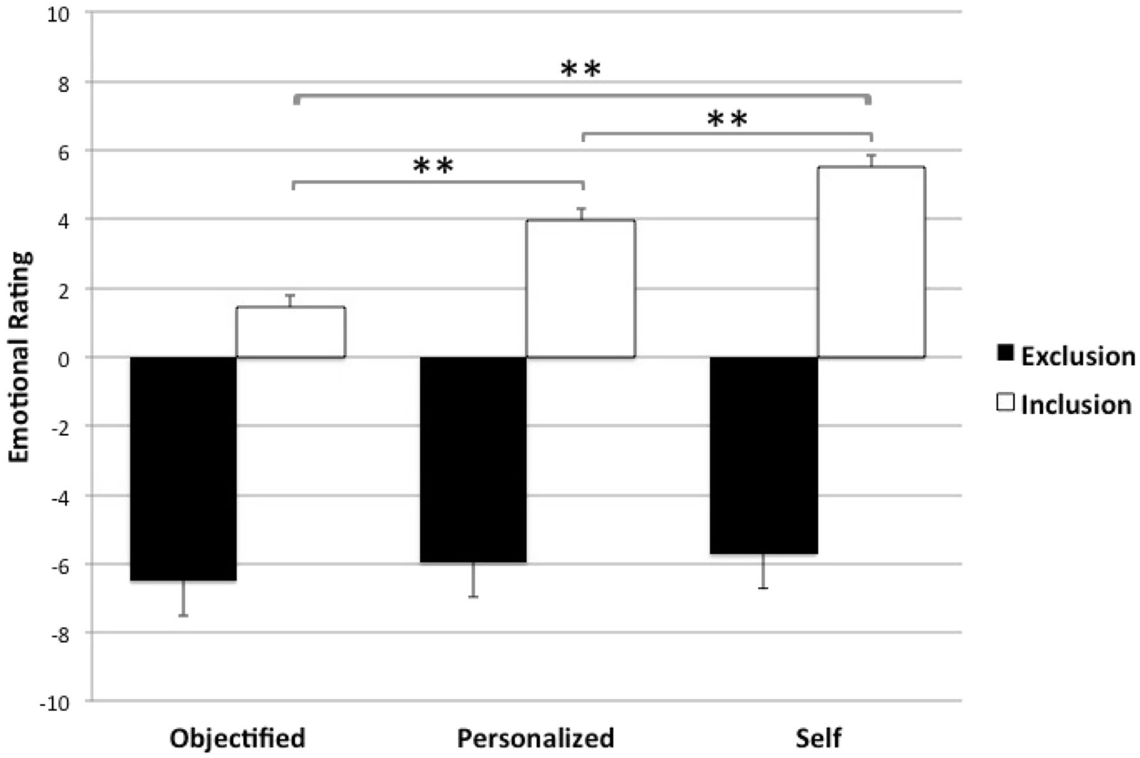

Fig. 3 — Mean and standard deviation of the emotional ratings, divided by the type of trial (inclusion, exclusion) and the three conditions (self, objectified, personalized). Significant differences are marked with two asterisks ($p < .001$).

related to the other personalized were more intense than the emotions related to the other objectified $p < .001$.

The participant's gender per se did not influence the emotional ratings F (1,863) = 2.12, $p = .15$, with male participants ($M = 4.31$, $SE = .54$) experiencing the same intensity than the female participants ($M = 5.39$, $SE = .51$). However it qualified the type of trial by condition interaction F (2,862) = 4.19, $p = .02$: both the male and female participants displayed no differences between conditions in the exclusion trials (p.s > .49), while in the inclusion trials the emotion's intensity associated with the self condition did not differ from the other personalized condition for the female participants ($p = .12$) but not for the male participants ($p = .002$), while significant differences were still displayed between the other conditions (p.s. < .001). See Table 2 for separate values. Moreover, given that our main effect of interest (objectified *vs.* personalized) is not affected by the gender of the participants in any of the rating scores, this factor was not considered further in the fMRI analyses.

3.2. *Correlation with self-report questionnaires*

Associations between behavioral scores of the empathy for social exclusion task and both measures of objectification of

Table 2 — Emotion intensity scores.

Gender	Type of trial	Condition	lsmean	SE	df	L.CL	U.CL
Male	Exclusion	Objectified	6.34	.61	59.18	5.12	7.56
		Personalized	5.33	.61	59.18	4.11	6.55
		Self	5.33	.61	59.18	4.11	6.55
	Inclusion	Objectified	.28	.61	59.18	−.94	1.50
		Personalized	3.37	.61	59.18	2.15	4.59
		Self	5.24	.61	59.18	4.02	6.46
Female	Exclusion	Objectified	6.69	.58	59.18	5.53	7.84
		Personalized	6.61	.58	59.18	5.46	7.77
		Self	6.11	.58	59.18	4.96	7.27
	Inclusion	Objectified	2.61	.58	59.18	1.46	3.76
		Personalized	4.53	.58	59.18	3.38	5.69
		Self	5.78	.58	59.18	4.63	6.94

Note. lsmeans: estimate mean from the model; SE: Standard error; df: degrees of freedom; L.CL, U.CL: Lower and Upper confidence level respectively.

the targets (physical appearance, intelligence, agency and experience) and self-reported questionnaire (IRI, SDO, ASI, self-Objectification) were investigated. Results revealed that the differential empathic ratings (calculated as the difference between the personalized and objectified condition when subtracting the inclusion from the exclusion ratings) showed no association with any of the aforementioned subscale.

4. fMRI results

4.1. *Main effect of social pain: self (exclusion > inclusion)*

We focus on the main effect of social pain given by the comparison of the hemodynamic responses between exclusion vs. inclusion trials in the 'self' condition. This contrast revealed enhanced activity in the following regions: a) areas belonging to the mentalizing network: Left Precuneus, Left Medial Superior Frontal Cortex, Left Superior Frontal Lobule, Left Superior Frontal Medial Lobule; b) areas belonging to the somatosensory component of pain: Bilateral Rolandic Operculum extending also to Posterior Insula; c) other areas: Right precentral Gyrus, Right Heschl, Left Inferior Temporal Gyrus, Right Superior Temporal Gyrus, and Right Supplementary Motor Area ($p < .05$, FWE corrected, see Table 3). See also Table S2 for the reverse contrast.

4.2. *Main effect of empathy for social pain: other (exclusion > inclusion)*

A whole-brain contrast between the neural activity during observed exclusion vs. observed inclusion revealed that participants displayed greater activity in the following regions: a) areas belonging to the mentalizing network (as defined in the recent meta-analysis of Mar, 2011): Right Middle Frontal Gyrus; b) areas belonging to the somatosensory component of pain (Price, 2000): Right Rolandic Operculum; c) areas belonging to the affective component of pain (Price, 2000): Left Anterior Insula, Left Middle and Anterior Cingulate Cortex; d) other areas: Left Calcarine cortex, Left Postcentral Gyrus, Bilateral Putamen, Left Superior Temporal Gyrus, Bilateral Precentral Gyrus, Right Postcentral Gyrus, Right Superior Temporal Pole, ($p < .05$, FWE corrected, see Table 4). See also Table S3 for the reverse contrast.

4.3. *Effect of objectification on empathy for social pain*

4.3.1. *Other personalized (exclusion > inclusion) > other objectified (exclusion > inclusion)*

Following the a priori hypothesis that the empathy for social pain network should be more active for the personalized as compared to the objectified women, we looked at the difference between personalized and objectified targets for the contrast exclusion vs. inclusion.

The Whole brain analysis revealed a network that comprised: a) areas belonging to the mentalizing network: Bilateral Middle Frontal Cortex; b) areas belonging to the somatosensory component of pain: Left Posterior Insula and Left Rolandic Operculum; c) areas belonging to the affective component of pain: Bilateral Supplementary Motor Area extending to the Anterior and Middle Cingulate Cortex but also Bilateral Anterior Insula; d) other areas: Bilateral Putamen, Left Lingual Gyrus, Right Fusiform, Right Calcarine, Left Postcentral Gyrus, Bilateral Precentral Gyrus, Bilateral Thalamus, Right Superior Temporal Gyrus, Bilateral Middle Occipital Cortex, Left Caudate ($p < .05$, FWE corrected, see Table 5 and Fig. 4).

4.3.2. *Other objectified (exclusion > inclusion) > other personalized (exclusion > inclusion)*

The difference between objectified and personalized targets for the contrast exclusion vs. inclusion was also investigated. A whole-brain analysis revealed that participants displayed greater activity in the Middle Occipital Cortex, See Table 6.

4.3.3. *Regressions with questionnaires*

As a final step, a whole-brain regression analysis was performed in order to examine association between neural activity during observed exclusion vs. inclusion in other personalized vs. other objectified and self-reported empathy, SDO, ASI, Self-Objectification scale, agency and experience

Table 3 – Self (exclusion > inclusion).

	Anatomical region	cluster K	*p* (FWE-corr)	T	Z score	x,y,z [mm]
L	Precuneus	234	.001	8.58	7.82	−21 -49 11
R	Superior temporal gyrus	14	.001	5.7	5.45	57 -13 -7
L	Medial superior frontal cortex	14	.003	5.39	5.18	−9 47 35
L	Medial superior frontal cortex	14	.013	5.06	4.88	−9 56 23
L	Rolandic operculum	4	.005	5.3	5.1	−54 -4 8
L	Superior frontal cortex	4	.021	4.94	4.77	−15 35 41
L	Medial superior frontal cortex	7	.026	4.89	4.72	−6 59 11
R	Precentral gyrus	265	.001	8.29	7.6	39 -16 44
R	Precentral gyrus	265	.001	7.31	6.82	42 -22 59
R	Postcentral cortex	265	.001	6.37	6.03	27 -25 59
R	Rolandic operculum	161	.001	7.7	7.14	39 -16 17
R	Heschl gyrus	161	.001	7.23	6.75	51 -7 8
L	Inferior temporal gyrus	42	.001	6.57	6.2	−45 2 -34
L	Posterior insula	42	.001	6.46	6.11	−36 -16 20

Note. Flexible factorial: Whole brain analysis Peak level (FWE-corrected, $p < .05$).

Table 4 – Other (exclusion > inclusion).

	Anatomical region	cluster K	*p* (FWE-corr)	T	Z score	x,y,z [mm]
R	Middle frontal cortex	4	.023	4.92	4.75	27 35 32
R	Superior temporal pole	13	.022	4.93	4.77	60 -4 -1
R	Rolandic operculum	13	.03	4.85	4.69	57 2 11
L	Anterior insula	19	.002	5.5	5.28	−33 8 8
L	Middle cingulate cortex	1012	.001	6.91	6.49	−3 -1 44
L	Anterior cingulate cortex	1012	.001	6.83	6.42	−6 23 26
L	Anterior cingulate cortex	1012	.001	6.7	6.31	−3 35 14
R	Precentral gyrus	13	.01	5.13	4.94	39 -10 53
L	Precentral gyrus	6	.013	5.06	4.88	−51 2 29
R	Postcentral gyrus	7	.017	4.99	4.82	45 -19 41
L	Superior temporal gyrus	32	.001	5.63	5.39	−48 -19 11
R	Putamen	2	.02	4.95	4.78	15 14 -10
L	Calcarine cortex	1665	.001	9.35	Inf	−12 -82 2
R	Calcarine cortex	1665	.001	8.21	7.54	15 -82 5
R	Calcarine cortex	1665	.001	8.16	7.5	18 -61 11

Note. Flexible factorial: Whole brain analysis Peak level (FWE-corrected, $p < .05$).

Table 5 – Other personalized (exclusion > inclusion) > other objectified (exclusion > inclusion).

Anatomical region		cluster K	*p* (FWE-corr)	T	Z score	x,y,z [mm]
R	Middle frontal cortex	4	.026	4.89	4.73	30 41 23
L	Middle frontal cortex	25	.001	5.72	5.47	−27 41 23
L	Anterior insula	9	.013	5.07	4.89	−33 14 8
R	Anterior insula	163	.011	5.1	4.92	30 26 5
R	Anterior insula	163	.023	4.92	4.75	36 14 8
L	Anterior insula	13	.001	5.69	5.44	−27 26 2
L	Posterior insula	14	.011	5.11	4.93	−36 -22 14
L	Rolandic operculum	14	.012	5.08	4.9	−45 -22 14
L	Caudate	7	.008	5.2	5.01	−15 26 23
L	Putamen	204	.001	7.6	7.06	−21 8 -1
R	Putamen	163	.001	6.85	6.44	24 14 2
L	Supplementary motor area	420	.001	7.46	6.94	−6 8 47
R	Supplementary motor area	420	.001	6.4	6.06	9 8 47
R	Superior temporal cortex	13	.002	5.47	5.25	54 -19 2
R	Precentral gyrus	53	.001	6.46	6.11	57 5 29
L	Precentral gyrus	35	.001	5.86	5.59	−48 -1 32
L	Postcentral gyrus	168	.001	6.72	6.33	−39 -19 50
L	Thalamus	36	.001	6.25	5.93	−6 -19 2
R	Thalamus	18	.002	5.55	5.32	9 -16 2
L	Lingual gyrus	905	.001	7.47	6.95	−12 -85 -1
R	Fusiform gyrus	905	.001	7.33	6.84	30 -52 -10
R	Calcarine cortex	905	.001	7.11	6.66	15 -85 5
R	Middle occipital cortex	18	.006	5.25	5.05	36 -79 14
L	Middle occipital cortex	22	.009	5.15	4.97	−33 -82 20
L	Middle occipital cortex	22	.011	5.11	4.92	−30 -76 26

Note. Flexible factorial: Whole brain analysis Peak level (FWE-corrected, $p < .05$).

scores, and behavioral scores of the empathy for social exclusion task. Results reveal no significant associations between the neural activity and all the aforementioned variables.

5. Discussion

The goal of the present study was to investigate the effect of perceived sexual objectification on the behavioral and the neurophysiological underpinning of empathy for social pain. To this aim, a modified version of the original cyberball game (Williams et al., 2000) displaying videos of sexually objectified and personalized real women playing the game was utilized.

In line with previous research using the cyberball game to induce feelings of social rejection, the game was able to elicit negative emotions following exclusion trials and positive emotions following inclusion trials, as indicated by a significant main effect of type of trial on the emotional ratings. Importantly, in line with our initial predictions, we observed reduced empathic reactions toward objectified women as compared to personalized ones. In particular, a significant main effect of condition on the emotional ratings was detected, indicating that the emotional intensity reported for the

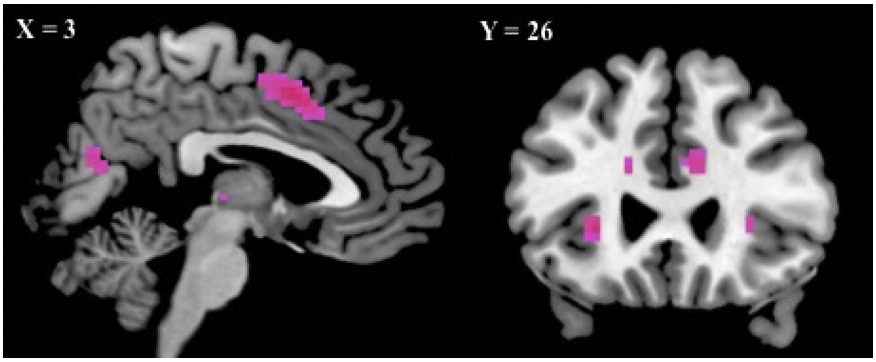

Fig. 4 – Difference in neural activation between empathy for social exclusion toward personalized and objectified targets (contrast: other personalized (exclusion > inclusion) > other objectified (exclusion > inclusion)). Statistical maps are derived with a threshold of $p < .05$ FWE corrected and superimposed on a standard T1 template (Coronal and sagittal views are displayed).

Table 6 – Other objectified (exclusion > inclusion) > other personalized (exclusion > inclusion).

	Anatomical region	cluster K	*p* (FWE-corr)	T	Z score	x,y,z [mm]
L	Middle occipital cortex	51	.001	6.29	5.96	−45 -73 5

Note. *Flexible factorial*: Whole brain analysis Peak level (FWE-corrected, $p < .05$).

self was the highest, followed by the personalized targets, and the objectified targets as the lowest. Interestingly, the stronger difference between conditions was observed for the inclusion trials, as indicated by the condition by type of trial interaction. In the current study, participants attribute similar negative emotions during the exclusion trials among the three conditions, but the positive emotions during the inclusion of the objectified women were perceived as less intense than for the personalized ones. Notably, the intensity of emotions attributed to the personalized women were always more similar to the emotions that participants are attributing to the self, compared to the objectified women. Such positive-negative asymmetry (PNAE) has been already documented in previous literature (Gaertner & Mclaughlin, 1983; Mummendey & Otten, 1998). It might be plausible that the explicit exhibition of different negative emotions when facing the exclusion of another individual, be this a sexually objectified or personalized woman, can be perceived to be socially inacceptable, and this might prompt participants to exert an intentional control over their responses. By contrast, modulating a positive emotional reaction as function of the target of inclusion might be construed as less at odds with social norms of non-discrimination and less triggering self-presentation concerns.

At the neural level, we chose to focus on the areas related to the firsthand and vicarious experience of social exclusion, as this is the standard procedure adopted in research investigating social pain (and empathy for). We were able to replicate the initial findings observed using a similar modified version of the cyberball game (Novembre et al., 2015). In particular, the firsthand experience of social exclusion revealed enhanced activity in brain regions related to the somatosensory-discriminative component of pain (pINS and SII). Contrary to the majority of studies on the neural basis of social exclusion, we did not observe activation of areas related to the affective component of pain, such as aINS and aMCC (Eisenberger, 2012). This result is in line with the study by Novembre et al. (2015), in which the lack of activation of the affective component has been related to the comparable activation of these regions observed both in inclusion and exclusion trials (therefore canceling each other out during the main differential contrast).

Empathy for social pain, on the other hand, revealed an enhanced activation in areas involved not only in the processing of the affective experience of social pain, such as aINS and aMCC (Bolling et al., 2011; Dewall et al., 2010; Eisenberger et al., 2003; Masten et al., 2010), but also in areas belonging to the mentalizing network such as the MFC (Amodio & Frith, 2006; Frith & Frith, 2006; Mitchell, Banaji, & Macrae, 2005). More importantly, empathy for social exclusion of personalized women as compared to the objectified ones was characterized by an increased activity in these regions (aINS, aMCC, and MFC), extending to the sensory-discriminative component of pain, such as pINS, therefore suggesting a modulatory role of the perceived objectification of the target on the neural marker of empathy.

These results align neatly with the previous evidence indicating dampening of interpersonal sensitivity towards sexualized women. For example, failure to empathize has recently been hypothesized as the motivator for the higher willingness to administer hypothetical painful tablets to objectified women compared to non-objectified ones (Loughnan et al., 2010). Recent unpublished work from our group investigating empathy for pleasant and unpleasant emotions towards women with different degree of sexualization (Cogoni, Carnaghi, & Silani, in preparation) also revealed similar reduction in shared representations while empathizing with sexualized women. On top of this behavioral evidence, the present study is the first that explores the neural basis of this behavioral effect and, as expected, shows a reduction of empathic responses while witnessing sexualized women in (social) pain. In our study, the neural pattern of empathy was not associated with the degree of self-objectification of the participants, their level of dispositional empathy, their level of hostile or benevolent sexism, or their social dominance attitudes. However, the empathic modulation both at the neural and behavioral level can be explained, at least in part, by the different evaluation of the targets provided by participants immediately after the scan. In line with previous research (Cikara, Eberhardt, & Fiske, 2011; Gray et al., 2011), objectified women were indeed seen as less intelligent and with diminished agentic characteristic (hallmark of human abilities to act in the world) as compared to the personalized women. Therefore, social processes typically elicited by human targets such as empathy can be disrupted if the target is seen as the objects of actions as opposed to being the agent enacting actions. Notably, a reduction of empathic feelings may also lead to a change of people's behavior toward a target, which in turn may influence social interactions (Batson, Polycarpou, Harmon-Jones, & Imhoff and a, 1997; Haslam & Loughnan, 2014). For example, it can result in a biased judicial decision on a defendant (Johnson et al., 2002) or in a reduced motivation to act prosocially (Hein et al., 2010) or willingness to let the other participant receiving more pain in exchange of monetary compensation (Feldmanhall, Dalgleish, & Mobbs, 2013). Therefore, the failure to empathize with sexually objectified targets, observed in the present study both on a behavioral and neural level, may indicate a possible mechanism behind the motivation of gender-based violent behavior.

There are two main considerations relative to this study that we would like to address. First, the lack of gender differences between male and female participants could be seen as a weak link between the phenomena explored and the gender violence. However, in this study we refer to gender violence as a phenomenon that mainly entails not only active participation but also passive acceptance or compliance and therefore underlying both male and female's behaviors.

The lack of gender differences in terms of reactions to sexually objectified and personalized female targets is frequently reported by research on this issue (Bernard, Gervais, Allen, Campomizzi, & Klein, 2012; Heflick & Goldenberg, 2009; Heflick, Goldenberg, Cooper, & Puvia, 2011). A potential explanation relies on the fact that both women and men are exposed to similar societal-level frameworks and often endorse and share the same stereotypes about men and women (Glick & Fiske, 2001). Alternatively, men and women are supposed to similarly objectify sexualized female targets, albeit for different reasons (e.g., sexual attraction for men, and dissimilarity for women; Vaes et al., 2011; Morris, 2013). Although this issue is still debated, in this study we refer to gender violence as a phenomenon that mainly entails not only active participation, but also passive acceptance or compliance and therefore involving both men and women' behaviors.

The second consideration relates to the use of exclusively female pictures, therefore restricting the interpretation of the results to the effect of sexual objectification on women. Future studies should address the same issue by introducing also the male gender as the target of the objectification. Indeed, previous studies have found mixed evidence about the similarity of the effects of sexual objectification on the perception of a male and female individual (see Bernard et al., 2012; Schmidt & Kistemaker, 2015), leaving the question still open.

Finally, it is important to consider that the present findings are restricted to the Italian population, where the research was conducted. It is most likely that cultural factors impact on the extent to which individuals display empathic responses towards sexualized women. Specifically, given that the Nordic Europeans countries display the highest levels of gender-equality, as indicated by a reduced gender-pay gap (Gracia & Merlo, 2016; World-Economic-Forum, 2016), a diminished discrepancy of empathic feelings toward objectified and personalized women could be hypothesized. Future studies need to be done to investigate the generalizability of the present pattern of results in other countries or cultures.

In conclusion, this study represents the first attempt in examining whether social exclusion of objectified female targets elicits empathic feeling to the same extent as other social targets like personalized women. Results showed a stronger activation of the classical observed empathy for pain brain network (aINS, aMCC), extending to the mentalizing network (MFC) and the somatosensory component of pain (SII, pINS), for personalized women than for objectified women during social exclusion. At the same time, stronger subjective feelings of vicarious positive empathy (but not negative) for personalized than for objectified women were observed. Although we were able to show a differential empathic profile, both at a behavioral and neural level, toward objectified and personalized targets and a relation with the perception of physical versus mental attributes, the motivation guiding such discrepancy still remains unknown. Further studies need to investigate the reason for such diminished empathy toward objectified women and if and how this relates to gender-based violence.

Acknowledgments

We thank Luigi Gozzi for his assistance in data collection, Giovanni Novembre and Paolo Garlasco for their support in the analyses. This work is supported by PRIN (2012)-20123X2PXT grant to A.C and G.S.

REFERENCES

Abbey, A., Parkhill, M. R., BeShears, R., Clinton-Sherrod, A. M., & Zawacki, T. (2006). Cross-sectional predictors of sexual assault perpetration in a community sample of single African American and Caucasian men. *Aggressive Behavior, 32*(1), 54–67. https://doi.org/10.1002/ab.20107.

American Psychological Association T. F. o. t. S. o. G. (2007). *Report of the APA task force on the sexualization of girls*. Retrieved from http://www.apa.org/pi/women/programs/girls/report-full.pdf.

Amodio, D. M., & Frith, C. D. (2006). Meeting of minds: The medial frontal cortex and social cognition. *Nature Review Neuroscience, 7*(4), 268–277. https://doi.org/10.1038/nrn1884.

Avenanti, A., Bueti, D., Galati, G., & Aglioti, S. M. (2005). Transcranial magnetic stimulation highlights the sensorimotor side of empathy for pain. *Nature Neuroscience,* 8(7), 955–960. https://doi.org/10.1038/nn1481.

Avenanti, A., Sirigu, A., & Aglioti, S. M. (2010). Racial bias reduces empathic sensorimotor resonance with other-race pain. *Current Biology, 20*(11), 1018–1022. https://doi.org/10.1016/j.cub.2010.03.071.

Baron-Cohen, S. (2011). *Zero degrees of empathy: A new theory of human cruelty*. UK: Penguin.

Bartky, S. L. (1990). *Femininity and domination: Studies in the phenomenology of oppression*. Psychology Press.

Batson, C. D., Polycarpou, M. P., Harmon-Jones, E., & Imhoff and a, H. J. (1997). Empathy and attitudes: Can feeling for a member of a stigmatized group improve feelings toward the group? *Journal of Personality and Social Psychology, 72*(1), 105–118. https://doi.org/10.1037/0022-3514.72.1.105.

Bernard, P., Gervais, S. J., Allen, J., Campomizzi, S., & Klein, O. (2012). Integrating sexual objectification with object versus person recognition: The sexualized-body-inversion hypothesis. *Psychological Science, 23*(5), 469–471. https://doi.org/10.1177/0956797611434748.

Bernard, P., Loughnan, S., Marchal, C., Godart, A., & Klein, O. (2015). The exonerating effect of sexual objectification: Sexual objectification decreases rapist blame in a stranger rape context. *Sex Roles, 72*(11–12), 499–508. https://doi.org/10.1007/s11199-015-0482-0.

Bolling, D. Z., Pitskel, N. B., Deen, B., Crowley, M. J., McPartland, J. C., Mayes, L. C., et al. (2011). Dissociable brain mechanisms for processing social exclusion and rule violation. *Neuroimage,* 54(3), 2462–2471. https://doi.org/10.1016/j.neuroimage.2010.10.049.

Cailleau, V., Thirioux, B., Mery, B., Senon, J. L., & Jaafari, N. (2016). Impairments of empathic process in sexual offenders. *Presse Medicale,* 45(12 Pt 1), 1075–1083. https://doi.org/10.1016/j.lpm.2016.09.004.

Cikara, M., Eberhardt, J. L., & Fiske, S. T. (2011). From agents to objects: Sexist attitudes and neural responses to sexualized targets. *Journal of Cognitive Neuroscience, 23*(3), 540–551. https://doi.org/10.1162/jocn.2010.21497.

Cogoni, C., Carnaghi, A., & Silani, G. (2017). *Can we empathize with sexually objectified women? Shared representations are reduced for objects and objectified women compared to personalized women*. In preparation.

Cosmides, L., Tooby, J., & Kurzban, R. (2003). Perceptions of race. *Trends in Cognitive Sciences, 7*(4), 173–179. https://doi.org/10.1016/S1364-6613(03)00057-3.

Davis, M. H. (1980). A multidimensional approach to individual differences in empathy. *JSAS Catalog of Selected Documents in Psychology, 10*(85).

de Vignemont, F., & Singer, T. (2006). The empathic brain: how, when and why? *Trends in Cognitive Sciences, 10*(10), 435–441. https://doi.org/10.1016/j.tics.2006.08.008.

Dewall, C. N., Macdonald, G., Webster, G. D., Masten, C. L., Baumeister, R. F., Powell, C., et al. (2010). Acetaminophen reduces social pain: Behavioral and neural evidence. *Psychological Science, 21*(7), 931–937. https://doi.org/10.1177/0956797610374741.

Eisenberger, N. I. (2012). The pain of social disconnection: Examining the shared neural underpinnings of physical and social pain. *Nature Review Neuroscience, 13*(6), 421–434. https://doi.org/10.1038/nrn3231.

Eisenberger, N. I., Gable, S. L., & Lieberman, M. D. (2007a). Functional magnetic resonance imaging responses relate to differences in real-world social experience. *Emotion, 7*(4), 745–754. https://doi.org/10.1037/1528-3542.7.4.745.

Eisenberger, N. I., Lieberman, M. D., & Williams, K. D. (2003). Does rejection hurt? An FMRI study of social exclusion. *Science, 302*(5643), 290–292. https://doi.org/10.1126/science.1089134.

Eisenberger, N. I., Taylor, S. E., Gable, S. L., Hilmert, C. J., & Lieberman, M. D. (2007b). Neural pathways link social support to attenuated neuroendocrine stress responses. *Neuroimage, 35*(4), 1601–1612. https://doi.org/10.1016/j.neuroimage.2007.01.038.

European Union Agency for Fundamental Rights. (2014). *Violence against women: An EU-wide survey*.

Feldmanhall, O., Dalgleish, T., & Mobbs, D. (2013). Alexithymia decreases altruism in real social decisions. *Cortex, 49*(3), 899–904. https://doi.org/10.1016/j.cortex.2012.10.015.

Fisher, H. E., Brown, L. L., Aron, A., Strong, G., & Mashek, D. (2010). Reward, addiction, and emotion regulation systems associated with rejection in love. *Journal of Neurophysiology, 104*(1), 51–60. https://doi.org/10.1152/jn.00784.2009.

Fiske, S. T., Cuddy, A. J. C., Glick, P., & Xu, J. (2002). A model of (often mixed) stereotype content: Competence and warmth respectively follow from perceived status and competition. *Journal of Personality and Social Psychology, 82*(6), 878–902. https://doi.org/10.1037/0022-3514.82.6.878.

Forgiarini, M., Gallucci, M., & Maravita, A. (2011). Racism and the empathy for pain on our skin. *Frontiers in Psychology, 2*, 108. https://doi.org/10.3389/fpsyg.2011.00108.

Frith, C. D., & Frith, U. (2006). The neural basis of mentalizing. *Neuron,* 50(4), 531–534. https://doi.org/10.1016/j.neuron.2006.05.001.

Gaertner, S. L., & Mclaughlin, J. P. (1983). Racial stereotypes - associations and ascriptions of positive and negative characteristics. *Social Psychology Quarterly, 46*(1), 23–30. https://doi.org/10.2307/3033657.

Glick, P., & Fiske, S. T. (1996). The ambivalent sexism inventory: Differentiating hostile and benevolent sexism. *Journal of Personality and Social Psychology, 70*(3), 491–512. https://doi.org/10.1037/0022-3514.70.3.491.

Glick, P., & Fiske, S. T. (2001). An ambivalent alliance: Hostile and benevolent sexism as complementary justifications for gender inequality. *American Psychologist,* 56(2), 109–118. https://doi.org/10.1037/0003-066x.56.2.109.

Gracia, E., & Merlo, J. (2016). Intimate partner violence against women and the Nordic paradox. *Social Science & Medicine, 157*, 27–30. https://doi.org/10.1016/j.socscimed.2016.03.040.

Gray, H. M., Gray, K., & Wegner, D. M. (2007). Dimensions of mind perception. *Science, 315*(5812). https://doi.org/10.1126/science.1134475, 619–619.

Gray, K., Knobe, J., Sheskin, M., Bloom, P., & Barrett, L. F. (2011). More than a body: Mind perception and the nature of objectification. *Journal of Personality and Social Psychology,* 101(6), 1207–1220. https://doi.org/10.1037/a0025883.

Haslam, N. (2006). Dehumanization: An integrative review. *Personality and Social Psychology Review,* 10(3), 252–264. https://doi.org/10.1207/s15327957pspr1003_4.

Haslam, N., & Loughnan, S. (2014). Dehumanization and infrahumanization. *Annual Review of Psychology, 65*, 399–423. https://doi.org/10.1146/annurev-psych-010213-115045.

Haslam, N., Loughnan, S., & Holland, E. (2013). The psychology of humanness. *Nebraska Symposium on Motivation,* 60, 25–51. https://doi.org/10.1007/978-1-4614-6959-9_2.

Haslam, N., Loughnan, S., Reynolds, C., & Wilson, S. (2007). Dehumanization: A new perspective. *Social and Personality Psychology Compass,* 1(1), 409–422. https://doi.org/10.1111/j.1751-9004.2007.00030.x.

Heflick, N. A., & Goldenberg, J. L. (2009). Objectifying Sarah Palin: Evidence that objectification causes women to be perceived as less competent and less fully human. *Journal of Experimental Social Psychology,* 45(3), 598–601. https://doi.org/10.1016/j.jesp.2009.02.008.

Heflick, N. A., Goldenberg, J. L., Cooper, D. P., & Puvia, E. (2011). From women to objects: Appearance focus, target gender, and perceptions of warmth, morality and competence. *Journal of Experimental Social Psychology, 47*(3), 572–581. https://doi.org/10.1016/j.jesp.2010.12.020.

Hein, G., Silani, G., Preuschoff, K., Batson, C. D., & Singer, T. (2010). Neural responses to ingroup and outgroup members' suffering predict individual differences in costly helping. *Neuron, 68*(1), 149–160. https://doi.org/10.1016/j.neuron.2010.09.003.

Hein, G., & Singer, T. (2008). I feel how you feel but not always: The empathic brain and its modulation. *Currenr Opinion in Neurobiology, 18*(2), 153–158. https://doi.org/10.1016/j.conb.2008.07.012.

Holland, E., & Haslam, N. (2015). Cute little things. *Psychology of Women Quarterly, 40*(1), 108–119. https://doi.org/10.1177/0361684315602887.

Johnson, J. D., Simmons, C. H., Jordav, A., Maclean, L., Taddei, J., Thomas, D., et al. (2002). Rodney king and O. J. Revisited: The impact of race and defendant empathy induction on judicial decisions. *Journal of Applied Social Psychology, 32*(6), 1208–1223. https://doi.org/10.1111/j.1559-1816.2002.tb01432.x.

Kersting, A., Ohrmann, P., Pedersen, A., Kroker, K., Samberg, D., Bauer, J., et al. (2009). Neural activation underlying acute grief in women after the loss of an unborn child. *American Journal of Psychiatry, 166*(12), 1402–1410. https://doi.org/10.1176/appi.ajp.2009.08121875.

Keysers, C., Kaas, J. H., & Gazzola, V. (2010). Somatosensation in social perception. *Nature Reviews Neuroscience, 11*(6), 417–428. https://doi.org/10.1038/nrn2833.

Kiebel, S., & Holmes, A. (2003). *The general linear model*. Academic Press.

Loughnan, S., Haslam, N., Murnane, T., Vaes, J., Reynolds, C., & Suitner, C. (2010). Objectification leads to depersonalization: The denial of mind and moral concern to objectified others. *European Journal of Social Psychology, 40*(5), 709–717. https://doi.org/10.1002/ejsp.755.

Loughnan, S., Pina, A., Vasquez, E. A., & Puvia, E. (2013). Sexual objectification increases rape victim blame and decreases perceived suffering. *Psychology of Women Quarterly, 37*(4), 455–461. https://doi.org/10.1177/0361684313485718.

Majdandzic, J., Amashaufer, S., Hummer, A., Windischberger, C., & Lamm, C. (2016). The selfless mind: How prefrontal involvement in mentalizing with similar and dissimilar others shapes empathy and prosocial behavior. *Cognition, 157*, 24–38. https://doi.org/10.1016/j.cognition.2016.08.003.

Mar, R. A. (2011). The neural bases of social cognition and story comprehension. *Annual Review of Psychology, 62*, 103–134. https://doi.org/10.1146/annurev-psych-120709-145406.

Masten, C. L., Eisenberger, N. I., Pfeifer, J. H., & Dapretto, M. (2010). Witnessing peer rejection during early adolescence: Neural correlates of empathy for experiences of social exclusion. *Social Neuroscience, 5*(5–6), 496–507. https://doi.org/10.1080/17470919.2010.490673.

Masten, C. L., Morelli, S. A., & Eisenberger, N. I. (2011). An fMRI investigation of empathy for 'social pain' and subsequent prosocial behavior. *Neuroimage, 55*(1), 381–388. https://doi.org/10.1016/j.neuroimage.2010.11.060.

Masten, C. L., Telzer, E. H., Fuligni, A. J., Lieberman, M. D., & Eisenberger, N. I. (2012). Time spent with friends in adolescence relates to less neural sensitivity to later peer rejection. *Social cognitive and affective neuroscience, 7*(1), 106–114. https://doi.org/10.1093/scan/nsq098.

Mitchell, J. P., Banaji, M. R., & Macrae, C. N. (2005). General and specific contributions of the medial prefrontal cortex to knowledge about mental states. *Neuroimage, 28*(4), 757–762. https://doi.org/10.1016/j.neuroimage.2005.03.011.

Morris, K. L. (2013). *Differentiating between objectification and animalization: Associations between women, objects, and animals.* University of South Florida.

Mummendey, A., & Otten, S. (1998). Positive–negative asymmetry in social discrimination. *European Review of Social Psychology, 9*(1), 107–143. https://doi.org/10.1080/14792779843000063.

Nichols, T., Brett, M., Andersson, J., Wager, T., & Poline, J. B. (2005). Valid conjunction inference with the minimum statistic. *Neuroimage, 25*(3), 653–660. https://doi.org/10.1016/j.neuroimage.2004.12.005.

Noll, S. M., & Fredrickson, B. L. (1998). A mediational model linking self-objectification, body shame, and disordered eating. *Psychology of Women Quarterly, 22*(4), 623–636. https://doi.org/10.1111/j.1471-6402.1998.tb00181.x.

Novembre, G., Zanon, M., & Silani, G. (2015). Empathy for social exclusion involves the sensory-discriminative component of pain: A within-subject fMRI study. *Social Cognitive and Affective Neuroscience, 10*(2), 153–164. https://doi.org/10.1093/scan/nsu038.

Nussbaum, M. C. (1995). Objectification. *Philosophy & Public Affairs, 24*(4), 249–291. https://doi.org/10.1111/J.1088-4963.1995.Tb00032.X.

Penny, W., Holmes, A., & Friston, K. (2003). *Random effects analysis. Human brain function* (pp. 843–850). San Diego: Academic Press.

Poldrack, R. A., Mumford, J. A., & Nichols, T. E. (2011). *Handbook of functional MRI data analysis.* Cambridge University Press.

Pratto, F., Sidanius, J., Stallworth, L. M., & Malle, B. F. (1994). Social-dominance orientation - a personality variable predicting social and political-attitudes. *Journal of Personality and Social Psychology, 67*(4), 741–763. https://doi.org/10.1037//0022-3514.67.4.741.

Price, D. D. (2000). Psychological and neural mechanisms of the affective dimension of pain. *Science, 288*(5472), 1769–1772. https://doi.org/10.1126/science.288.5472.1769.

Rorden, C., Karnath, H. O., & Bonilha, L. (2007). Improving lesion-symptom mapping. *Journal of Cognitive Neuroscience, 19*(7), 1081–1088. https://doi.org/10.1162/jocn.2007.19.7.1081.

Schmidt, A. F., & Kistemaker, L. M. (2015). The sexualized-body-inversion hypothesis revisited: Valid indicator of sexual objectification or methodological artifact? *Cognition, 134*, 77–84. https://doi.org/10.1016/j.cognition.2014.09.003.

Singer, T., & Lamm, C. (2009). The social neuroscience of empathy. *Annals of the New York Academy of Sciences, 1156*(1), 81–96. https://doi.org/10.1111/j.1749-6632.2009.04418.x.

Singer, T., Seymour, B., O'Doherty, J. P., Stephan, K. E., Dolan, R. J., & Frith, C. D. (2006). Empathic neural responses are modulated by the perceived fairness of others. *Nature*, 439(7075), 466–469.

Vachon, D. D., Lynam, D. R., & Johnson, J. A. (2014). The (non) relation between empathy and aggression: Surprising results from a meta-analysis. *Psychological Bulletin, 140*(3), 751–773. https://doi.org/10.1037/a0035236.

Vaes, J., Paladino, P., & Puvia, E. (2011). Are sexualized women complete human beings? Why men and women dehumanize sexually objectified women. *European Journal of Social Psychology, 41*(6), 774–785. https://doi.org/10.1002/ejsp.824.

Van Beest, I., & Williams, K. D. (2006). When inclusion costs and ostracism pays, ostracism still hurts. *Journal of Personality and Social Psychology, 91*(5), 918–928. https://doi.org/10.1037/0022-3514.91.5.918.

Walby, S., Towers, J., & Francis, B. (2016). Is violent crime increasing or Decreasing? a new methodology to measure repeat attacks making visible the significance of gender and domestic relations. *British Journal of Criminology*, 56(6), 1203–1234. https://doi.org/10.1093/bjc/azv131.

Williams, A. C. d. C. (2003). Facial expression of pain, empathy, evolution, and social learning. *Behavioral and Brain Sciences, 25*(04), 475–480. https://doi.org/10.1017/s0140525x02430087.

Williams, K. D., Cheung, C. K., & Choi, W. (2000). Cyberostracism: Effects of being ignored over the internet. *Journal of Personality and Social Psychology, 79*(5), 748.

World-Economic-Forum. (2016). *The global gender gap report 2016*. http://reports.weforum.org/global-gender-gap-report-2016/.

Woo, C. W., Koban, L., Kross, E., Lindquist, M. A., Banich, M. T., Ruzic, L., et al. (2014). Separate neural representations for physical pain and social rejection. *Nature Communications,* 5, 5380. https://doi.org/10.1038/ncomms6380.

Xu, X., Zuo, X., Wang, X., & Han, S. (2009). Do you feel my pain? Racial group membership modulates empathic neural responses. *Journal of Neuroscience, 29*(26), 8525–8529. https://doi.org/10.1523/JNEUROSCI.2418-09.2009.

Zadro, L., Williams, K. D., & Richardson, R. (2004). How low can you go? Ostracism by a computer is sufficient to lower self-reported levels of belonging, control, self-esteem, and meaningful existence. *Journal of Experimental Social Psychology, 40*(4), 560–567. https://doi.org/10.1016/j.jesp.2003.11.006.