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"Would You Allow Your Wife to Dress in a Miniskirt to the Party"?: Batterers Do Not Activate Default Mode Network During Moral Decisions About Intimate Partner Violence

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Abstract
Moral convictions consist of assessments based on perceptions of morality and immorality, of right and wrong. There are people who, based on morality, commit crimes. For instance, social and moral norms based on inequality appear to play an important role in the batterer's behavior to commit violent acts. Research shows that batterers consider themselves to be moral persons, are defenders of their beliefs, and, if necessary, are self-delusional, enjoying a "feeling" of moral worth. The main aim of this work was to uncover the brain mechanisms underlying moral decision making related

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to intimate partner violence (IPV) against women. We conducted a functional magnetic resonance imaging (fMRI) study comparing moral decisions related to IPV and general violence (GV) in a sample of convicted Spanish men. The two groups of our sample were recruited from the Center for Social Insertion (CSI; Granada, Spain): batterers (BG, $n = 21$), people convicted for IPV, and other criminals (OCG, $n = 20$) convicted of violating other legal norms without violence against people. Greene's classical dilemmas were used to validate IPV and GV dilemmas. First, our results showed that IPV and GV dilemmas activate the same brain areas as those activated by Greene's dilemmas, primarily involving the default mode network (DMN), which suggests that IPV and GV dilemmas are both moral dilemmas. Second, our results showed that other criminals activated the DMN during both types of dilemmas. Nevertheless, batterers activated the DMN during the GV dilemmas but not during the IPV ones, suggesting that decisions about their female partners do not entail moral conflict. Thus, these preliminary results showed that batterers do not activate moral areas during IPV dilemmas specifically, but do so during GV dilemmas. These results suggest that intervention programs for batterers should aim to specifically modify the value system held by the abuser toward his female partner and not toward other people.

Keywords
moral norms, intimate partner violence, batterers, default mode network, moral decisions, dilemmas, fMRI

Introduction

Moral convictions involve assessments based on perceptions of morality and immorality, of right and wrong. Therefore, moral norms guide the social behavior of a cultural group, along with the acquisition of a particular set of behaviors (Moll et al., 2005). This includes moral norms about sex roles within society, including equality of personal, social, and employment opportunities, and respectful and nonabusive relationships. Nevertheless, the majority of studies regarding moral decisions have focused on relevant yet infrequent situations in which other people will be harmed as a consequence of their decision. An example of this can be seen in the seminal moral dilemma scenarios outlined by Thomson (1986a, 1968b), in which one must make a decision to avoid the death of people in a trolley crash or decide whether or not to kill one's own son. However, these types of dilemma are rather different to everyday life dilemmas (Hofmann et al., 2014). In this regard, more frequently encountered (and also relevant) situations such as respectful and nonabusive relationships with women have not yet received the attention needed.

Male moral norms regarding male–female relationships play an important role in intimate partner violence (IPV; Scarpati & Pina, 2017). IPV is a global epidemic affecting 30% of women above the age of 15 years during their lifetime (World Health Organization [WHO], 2017). In Spain, 125,936 allegations of IPV were registered in 2019. From 2003 to 2019, there were 1,033 cases in which women were killed by their partners or former partners. In 2019, there were 55 fatal victims of IPV (Ministerio de la Presidencia, relaciones con las Cortes e Igualdad, 2019). Social and moral norms based on inequality appear to play an important role in batterer behavior and could provide the basis for the motivation to commit violent acts (Devries et al., 2013). In addition, it has been found that sexist attitudes in batterers are related to a greater lack of attribution of responsibility and a greater tendency to minimize the harm caused (Guerrero-Molina et al., 2017). With respect to the lack of responsibility for aggressive behavior, they use processes of moral disassociation to justify such behavior (Bussey et al., 2015). Recently, research has shown that batterers consider themselves to be moral people, are defenders of their beliefs, and, if necessary, are self-delusional, enjoying a "feeling" of moral worth (Vecina et al., 2015). In addition, there are high levels of moral self-concept in male batterers that allow them to act in a nonprosocial manner toward their female partners (licensing effect; Vecina & Marzana, 2016). Finally, research has revealed paradoxical moral mechanisms that could make these men resistant to changing their violent behavior (Vecina, 2018). In sum, these evidences are showing that morality and IPV are closely related.

In the past decade, there has been an increasing interest in studying the cerebral mechanisms underlying moral decision making. The seminal study of moral dilemmas using functional magnetic resonance imaging (fMRI; Greene et al., 2001) found that there were differences in activation according to the type of dilemma (personal and impersonal). The areas related to moral dilemmas were the medial frontal gyrus, posterior cingulate gyrus, bilateral angular gyrus, middle frontal gyrus, and bilateral parietal lobe. Borg et al. (2006) also found that different types of moral judgment are supported by distinct brain systems, these being the orbitofrontal cortex (OFC), temporal pole, angular gyrus, and superior frontal gyrus. In a study of psychopathic individuals, Glenn et al. (2009) found reduced activity in the medial prefrontal cortex, posterior cingulate, and angular gyrus in psychopathy population. Rocha et al. (2013) also found that different cortical areas are involved depending on whether participants are faced with an impersonal dilemma or a personal dilemma. In a recent review, Eres et al. (2018) found consistent activation of the ventromedial prefrontal cortex (vmPFC), the dorsal medial prefrontal cortex (dmPFC), the temporoparietal junction (TPJ), the precuneus, the left amygdala, and the left OFC when people make moral decisions. In addition, the neuroscientific study of morality is expanding to include investigations of whether brain mechanisms differ according to the task employed (Garrigan et al., 2016), whether moral reasoning is conducted in the first or third person (Boccia et al., 2017) along with the possibility that such differences in brain activity could be useful for explaining criminal behavior (Patterson, 2018). Regarding impaired functioning, the neuromoral theory of antisocial behaviors (Raine, 2019; Raine & Yang, 2006) argues that impairment of the neural circuitry underlying morality provides a common foundation for antisocial, violent, and psychopathic behavior. According to this theory, there are brain regions implicated to both antisocial behavior and moral decision making. These areas are the fronto-polar, medial, and ventral prefrontal cortices, the anterior cingulate, the amygdala, the insula, the superior temporal gyrus, and the angular gyrus/TPJ.

To the best of our knowledge, no studies exist regarding the cerebral mechanisms involved in the moral decision making of batterers in relation to moral violations against women, whereas only a few studies have examined the brain functioning of batterers. Seminal fMRI studies have observed that male batterers show a different pattern of brain activity compared with controls (noncriminals). Lee et al. (2008, 2009) found different brain activation in batterers when watching IPV images. Specifically, Lee et al. (2008) found that batterers, in comparison with noncriminal controls, showed greater activation of the limbic system and less activation of frontal areas during the processing of threatening stimuli. Furthermore, Lee et al. (2009) found greater activation of the precuneus while observing IPV images, also when comparing batterers with noncriminals. Furthermore, brain differences have been found when comparing batterers with other criminals. In a group of batterers, Bueso-Izquierdo et al. (2016) found similar patterns of brain activity to those reported by Lee et al (2008, 2009) in emotional areas and areas of the default mode network (DMN) when they were watching IPV images. Moreover, some studies have also reported structural brain differences between batterers and other criminals (Verdejo-Román et al., 2019), although these differences are not related to the presence of brain damage (Bueso-Izquierdo et al., 2019). The results of recent and preliminary brain imaging studies suggest differences in brain functioning in batterers when they are processing images of IPV compared with that of noncriminal controls and other criminals, but it is not clear how their brains function in terms of more specific, relevant dimensions of IPV such as moral decisions.

Therefore, the main objective of this research was to uncover the brain mechanisms underlying moral convictions in a sample of batterers sentenced for IPV. To control for legal and forensic variables, our batterers were compared with other criminals convicted of crimes of equivalent severity. Participants were required to make moral decisions that are both related and nonrelated to moral norms about women, such as whether to allow their female partner the freedom to wear any type of clothing and respect for equal employment opportunities (related), or general violence (GV) against other people (nonrelated). We hypothesized that batterers, in comparison with other criminals, will show activation of different brain regions when they make moral decisions related to women compared with decisions unrelated to women. In contrast, other criminals are expected to show similar patterns of brain activation under both conditions.

Research Questions and Hypothesis Section

The research question was as follows:

Research Question 1: Do male batterers, in comparison with other criminals, activate different brain areas when making moral decisions in situations of IPV compared with situations of violence where the affected people are not women?

We hypothesized the following:

Hypothesis 1: Batterers, in comparison with other criminals, will show activation of different brain regions when they make moral decisions related to women compared with the case in which those decisions are unrelated to women. In contrast, other criminals are expected to show similar patterns of brain activation under both conditions.

Materials and Method

Participants[1]

Forty-one men convicted of crimes were recruited from the Center for Social Insertion (CSI; Centro de Inserción Social, CIS) "Matilde Cantos Fernández," in Granada (Spain). They belonged to one of two groups: (a) batterers (BG, 21 men), convicted for IPV; and (b) other criminals (OCG, 20 men), convicted of crimes other than IPV. Three participants were excluded from each group due to excessive movement during the fMRI task. Therefore, imaging data from 18 BG and 17 men of the OCG were included in the analyses.

In Spain, IPV crimes are regulated by a specific law (Law 1/2004, "Comprehensive Protection Law against Intimate Partner Violence"). This law states that a man may be convicted by a judge for several types of aggression to a woman, including insults, threats, slaps, beatings, sexual abuse, or murder. According to this law, first convictions for IPV without sexual or physical abuse are classified as a misdemeanor, which results in the perpetrator being sent to an open facility (CSI) of the Ministry of Justice for less than 2 years, but not to prison. In the CSI, batterers are required to attend IPV rehabilitation programs. Considering this, crime severity was similar in both groups. Crime severity in Spanish law is regulated by a Penal Code (Article 33). According to this article, crimes carrying sentences between 3 months and 5 years are classified as "less serious." Given that all participants were recruited from the CSI, (a) this was the first time that the participants of both groups had been convicted, (b) they were convicted for a similar sanction of less than 2 years ("less serious"), (c) they came from prison and were serving third-grade sentences. In sum, both groups were recruited from the same facility where misdemeanor offenders are incarcerated, or they were serving third-grade sentences. To control for the severity of the crimes, we compared groups in terms of type of crime. We matched psychological IPV with misdemeanor crimes such as scams or crimes of forgery, and physical IPV with felony crimes such as serious assault/robbery and violence. These comparisons revealed that the groups were similar in terms of crime severity ($p = .63$, Table 1).

All participants were right-handed males with native fluency in Spanish. The selection of participants included the following inclusion criteria: individuals aged 18 years or older; for the BG, they must have been convicted for an IPV crime; and for the OCG, they must have been convicted for a crime other than IPV. The exclusion criteria for the two

Table 1. Demographic and Type of Crime Characteristics of BG and OCG and Percentage of Affirmative Responses (Utilitarianism) During the Dilemmas in the BG and the OCG.

Variables *M* (*SD*)	BG	OCG	*p*
N	18	17	
Age	38.61 (8.93)	35.35 (8.64)	.28
Years of education	9.78 (4.08)	9.71 (2.54)	.95
K-BIT vocabulary	67.40 (6.31)	65.94 (6.07)	.51
IQ	100.46 (14.48)	93.00 (13.95)	.15
% Yes dilemmas of general violence (utilitarianism)	33.09 (28.96)	28.23 (22.27)	.56
% Yes IPV dilemmas	5.36 (9.43)	7.56 (11.27)	.54
Type of crime (% [n])			
Misdemeanor	IPV–PV = 8	SCF/DD = 9	.63
Felony	IPV–PPV = 10	GAR/VF = 8	

Note. BG = batterers; OCG = other criminals; K-BIT = K–Brief Intelligence Test; IQ = intelligence quotient; IPV = intimate partner violence; PV = psychological violence; SCF = scams or crimes of forgery; DD = dangerous driving; PPV = physical and psychological violence; GAR = grave assault/robbery; VF = violent fight.

groups included illiteracy, a history of serious antecedents of psychological and personality problems measured through the Spanish version of the Millon Multiaxial Personality Test III (Cardenal et al., 2007), head injury, neurological illness, infectious disease, history of drug abuse or dependence (including alcohol) (SCID/ Diagnostic and Stadistical Manual of Mental Disorders 4th ed.; DSM-IV; American Psychiatric Association, 1994), systemic disease or any other diseases affecting the central nervous system, and the presence of significant abnormalities in magnetic resonance imaging (MRI) or any contraindications to MRI scanning (including claustrophobia or implanted ferromagnetic objects). Participants in the OCG with a score greater than or equal to 11 on the severity scale of violence in the Conflict Tactics Scales (CTS2; Loinaz et al., 2012) were excluded. This criterion follows Cohen et al. (2003) to exclude those participants who had committed crimes of physical or psychological violence against partners.

The study was approved by the Research Ethics Committee of the University of Granada (number: 69/CEIH: 2015), Spain. The participants were invited to collaborate in the study on a voluntary and anonymous basis, and the confidentiality of personal information was guaranteed in accordance with the Spanish legislation on personal data protection (Organic Law 15/1999, December 13). All the participants signed a written informed consent document and received 25 euros for participating in the study.

Materials

An interview was conducted to collect sociodemographic information and to evaluate the risk of IPV and other variables related with their previous relationship (Echeburúa et al., 2008). The questionnaire used in the interview asked the sociodemographic variables of both the aggressor and victim, the relationship status of the couple (couple not living together, cohabitation, in the process of separating, or separated), the types of violence, the profile of the aggressor (information about the formal complaint and emotions expressed by the batterer at that time), and vulnerability factors on the part of the female victim (i.e., substance use, economic dependence. and lack of social support).

Severity of violence. The Spanish version of the CTS2 (Loinaz et al., 2012) was used to detect the existence of physical, psychological, and/or sexual violence toward a partner in a relationship. This instrument consists of 39 items with five factors (physical assault, sexual coercion, psychological aggression, physical injury, and negotiation) and two levels of severity (minor or severe). It measures the frequency and intensity of violence within the relationship, allowing to detect physical and psychological violence.

Intelligence quotient (IQ). The Brief Intelligence Test (K-BIT; Kaufman et al., 1997) measures cognitive functions through two tests: verbal (vocabulary, comprised of two tests) and nonverbal (matrix), which evaluates crystallized and fluid intelligence, obtaining a compound IQ.

fMRI task. Participants completed a moral dilemma task during an fMRI session. We used a batch of 40 moral dilemmas divided into five categories: three extracted from the Greene task (Greene et al., 2001), personal (P), impersonal (I), and control (C); and two new conditions designed for the present study, moral dilemmas of GV, and IPV. These dilemmas were based on daily life situations (Supplemental File S1). Participants have to decide whether or not to be violent toward a particular person to solve the dilemma. In the case of GV dilemmas, this was a person from their immediate environment (i.e., a sibling, a cousin, or a close friend), whereas in the case of IPV dilemmas, this person was the female partner. Each dilemma was presented in text format through a series of three screens (Supplemental Figure S1). The first two presented the scenario, whereas in the third, the question was asked and the decision was made. On the first screen, there was a general description of the situation (e.g., you are in a bar and there is a fight), whereas in the second, the two possible options were given (e.g., hitting a friend or not) along with the consequences of opting for either of the options. On the last screen, a question was presented about which option they chose from the two actions that could be performed in that scenario. The participants were allowed to read at their own pace, pressing a button to advance from the first to the second screen and from the second to the third screen. After reading the third screen, the participants responded by pressing one of the two buttons ("YES" or "NO"), with the index finger or thumb, respectively. Choosing one of the two options involved committing IPV (e.g., hitting your wife and not letting her leave your house), whereas the other option did not (e.g., allow your wife to leave the house). A new dilemma appeared every 60 s. If they answered before this time elapsed, they had to wait until the end of this time period, but if they used the whole 60 s, once they responded, the new dilemma would appear. To avoid fatigue, the task was divided into four blocks of 10 dilemmas, so that each block included two dilemmas of each type, leaving a 2-min break between blocks. The order of presentation of the types of dilemmas was counterbalanced between blocks.

The task was administered using Presentation software (Neurobehavioral System Inc., San Francisco, CA, USA). The items were presented through magnetic resonance–compatible liquid crystal display goggles (Resonance Technology, Northridge, CA, USA) equipped with various corrective lenses. Behavioral responses were recorded through a five-button box, the Evoke Response Pad System (Resonance Technology Inc.).

Acquisition and Preprocessing of Imaging Data

A 3.0 T MRI scanner with an eight-channel phased-array head coil (Intera Achieva, Philips Medical Systems, Eindhoven, the Netherlands) was used. During performance of the task, four T2*-weighted echo-planar imaging (EPI) sequences were obtained, repetition time (TR) = 2,000 ms, echo time (TE) = 35 ms, field of view (FOV) = 230 × 230 mm, 128 × 128 matrix, flip angle = 90°, 21 4-mm axial slices, 1-mm gap, 300 scans per sequence. A sagittal three-dimensional (3D) T1-weighted turbo-gradient-echo sequence (160 slices, TR = 8.3 ms, TE = 3.8 ms, flip angle = 8°, FOV = 256 × 256, 1 mm^3 voxels) was obtained in the same experimental session to check for any gross anatomical abnormalities in each participant.

Brain images were processed using the Statistical Parametric Mapping (SPM12) software (Wellcome Department of Cognitive Neurology, Institute of Neurology, Queen Square, London, UK), running under Matlab R2015b (MathWorks, Natick, MA, USA). Preprocessing steps included slice timing correction, reslicing to the first image of the time series, normalization (using affine and smoothly nonlinear transformations) to an EPI template in the Montreal Neurological Institute (MNI) space, and spatial smoothing by convolution with a 3D Gaussian kernel, full width at half maximum (FWHM) = 8 mm.

Procedure

The assessment was conducted across two independent sessions. During the first session, trained psychologists conducted the individualized interview and the neuropsychological tests at the CSI "Matilde Cantos Fernández" in Granada (Spain). The MRI session was carried out at the Centro de Diagnóstico Granada (CEDISA), and lasted approximately 1 hr.

Statistical Analyses

Behavioral analyses. Behavioral data were analyzed using the Statistical Package for the Social Sciences, version 22 (SPSS; Chicago, IL, USA). Independent-sample t tests or cross-tabulation analyses (depending on metric or nonmetric type of the variable) were conducted to compare the two groups in terms of the demographics and severity of crime variables and behavioral responses to moral dilemmas. "Yes" percentage was the behavioral dependent variable in moral dilemmas (the percentage of utilitarian responses).

Neuroimaging analyses. Task regressors at each voxel were convolved with the SPM8 canonical hemodynamic response function (using a 128-s high-pass filter). To measure the brain activity related to the processing of the moral dilemmas, the brain response was modeled as a condition of interest from the presentation of the second screen of each dilemma, where the consequences of making each decision were presented, up to the moment at which the participant gave their response to the question. The time during which the person read the first screen of the dilemma was used as baseline, which eliminates the effect of reading.

To validate the new dilemmas of GV and IPV, Greene's personal and impersonal dilemmas were used as the control condition. For this, following Greene et al. (2008), we defined a "Personal Dilemmas> Impersonal Dilemmas" contrast. The results obtained on this contrast were used as a reference to study the activation produced by the new dilemmas.

To analyze the new dilemmas, the contrasts "Dilemmas of General Violence> Impersonal Dilemmas" and "Dilemmas of Intimate Partner Violence> Impersonal Dilemmas" were defined. To explore the results of these contrasts in the whole sample, we exclusively evaluated the brain regions obtained from the personal–impersonal contrast. Significant results in these analyses would show that the new dilemmas evoked the same brain regions than the Greene's classical moral dilemmas. Once the new GV and IPV dilemmas had been validated, we examined whether both types of dilemmas evoked different patterns of brain activation in each group. To this end, the contrasts "Dilemmas of Intimate Partner Violence> Dilemmas of General Violence" and "Dilemmas of General Violence> Dilemmas of Intimate Partner Violence" were defined. Within-group *t* tests were conducted to this end. Finally, the eigenvalues extracted from the clusters where significant differences were found in the dilemmas of IPV and dilemmas of GV contrasts were used to study the Group × Type of dilemma interaction.

Statistical threshold criteria. Significance on the *t* tests and cross-tabulation analyses for the demographic, severity of crime, and moral dilemma response variables was established at a threshold of $p < .05$. For the imaging analyses, results were corrected for multiple comparisons using a combination of voxel intensity and cluster extent thresholds. The spatial extent threshold was determined by 1,000 Monte Carlo simulations using AlphaSim, as implemented in the SPM REST toolbox (Song et al., 2011; Ward, 2013). The input parameters included were similar for each analysis, but the brain masks included were different, resulting in different cluster extent thresholds. In the whole-brain analysis of the personal dilemmas–impersonal dilemmas, the parameters were a brain mask of 174,773 voxels, an individual voxel threshold probability of .005, and a cluster connection radius of 5 mm, considering the actual smoothness of data following model estimation. A minimum cluster extent (KE) of 475 voxels was estimated corresponding to a corrected for multiple comparisons $p < .05$. For the validation of the new dilemmas, we used a brain mask including only the significant results of the previous analysis, resulting in a brain mask of 5,531 voxels. A minimum cluster extent of 29 voxels was estimated.

When comparing IPV versus GV dilemmas, we used a whole-brain approach, and the parameters, therefore, were a brain mask of 174,773 voxels, an individual voxel threshold probability of .001, and a cluster connection radius of 5 mm, considering the actual smoothness of data following model estimation. A minimum cluster extent (KE) of 256 voxels was estimated corresponding to a corrected $p < .05$.

Results

Demographics, Crime Characteristics, and Behavioral Responses to Dilemmas

Table 1 displays the descriptives for sociodemographic, severity of crime, and response to dilemmas variables. The groups did not significantly differ in age, education level, IQ, severity of crime, or response to dilemmas.

Validation of the Moral Dilemmas of GV and IPV

To confirm that the new dilemmas on GV and IPV were actual dilemmas, we checked whether they activated the same brain areas as Greene's dilemmas, which have been widely used in a range of samples.

Table 2 and Supplemental Figure S2 display the significant differences between Greene's personal and impersonal dilemmas observed in our whole sample. Activations were larger for the personal than for the impersonal dilemmas in a set of DMN brain areas, previously shown to be involved in moral decision making (Greene et al., 2008), including the precuneus, the medial frontal cortex, the anterior and posterior cingulate cortices, and the left angular gyrus extending to the temporal lobe, and embracing the left TPJ. Importantly, we do not observed differences between BG and OCG groups in these dilemmas.

Next, we examined whether the GV dilemmas activated the same brain areas as Greene's dilemmas in our whole sample, using impersonal dilemmas as a control condition, and being the inclusive mask the one derived from the previous analysis. The results showed that our GV dilemmas activate the same brain areas as Greene's personal dilemmas,

Table 2. Brain Areas Showing Significant Higher Activation in the Personal Than in the Impersonal Greene's Dilemmas Using the Whole Sample of Criminals.

Brain Region	H	BA	*X*	*Y*	*Z*	*k*	Peak *t* Value
Precuneus	R/L	7/31	0	−60	28	1,420	5.29
Angular gyrus	L	39/40	−54	−62	32	2,324	5.24
Medial frontal gyrus	R/L	9/10	−4	50	−12	1,183	4.45
Temporoparietal junction	L		−48	−54	18	2,324	4.03
Posterior cingulate cortex	R/L	24/31	−14	−14	46	604	3.99
Anterior cingulate cortex	R/L	24	−2	28	18	1,183	3.22

Note. H = hemisphere; BA = Brodmann Area; *X*, *Y*, *Z* = MNI peak coordinates; *k* = cluster size in voxels; MNI = Montreal Neurological Institute.

Table 3. Brain Areas Activated When Comparing Dilemmas of General Violence With Impersonal Dilemmas in the Whole Sample ($n = 35$).

Brain Region	H	BA	*X*	*Y*	*Z*	*K*	Peak *t* Value
Precuneus	R/L	7/31	−6	−52	28	1,302	6.02
Medial frontal gyrus	R/L	9/10	4	54	20	980	5.67
Angular gyrus	L	39/40	−56	−64	30	1,906	5.52
Posterior cingulate cortex	R/L	24/31	−14	−20	44	439	5.12
Temporoparietal junction	L		−48	−54	18	1,906	3.80

Note. H = hemisphere; BA = Brodmann Area; *X*, *Y*, *Z* = MNI peak coordinates; *k* = cluster size in voxels; MNI = Montreal Neurological Institute.

excepting the Anterior Cingulate Cortex (ACC) (see Table 3 and Supplemental Figure S3), which suggest that, as expected, they are moral decisions.

Finally, we tested whether the IPV dilemmas activated the same brain areas as Greene's, using impersonal dilemmas as a control condition. The results showed that the IPV dilemmas activate similar brain areas to those activated by Greene's personal dilemmas (see Table 4 and Supplemental Figure S4), indicating that they are moral decisions.

The GV and the IPV dilemmas activated brain areas similar to the personal dilemmas used by Greene et al. (2001) and overlap considerably with the areas of the DMN, indicating that these new two types of dilemmas are real moral dilemmas.

Table 4. Brain Areas Activated When Comparing Intimate Partner Violence With the Impersonal Dilemmas in the Whole Sample.

Brain Region	H	BA	*X*	*Y*	*Z*	*k*	Peak *t* Value
Medial frontal gyrus	R/L	9/10	4	46	−10	1,020	6.60
Posterior cingulate cortex	R/L		−8	−18	46	426	5.73
Temporoparietal junction	L		−42	−52	6	898	5.43
Angular gyrus	L	40	−58	−44	26	161	4.10
Anterior cingulate cortex	R/L	24	2	30	18	60	4.08
Precuneus	R/L		12	−52	30	346	3.99

Note. H = hemisphere; BA = Brodmann Area; *X*, *Y*, *Z* = MNI peak coordinates; *k* = cluster size in voxels; MNI = Montreal Neurological Institute.

Table 5. Brain Areas With Greater Activation When Processing Dilemmas of General Violence Than Intimate Partner Violence in Batterers.

Brain Region	H	BA	*X*	*Y*	*Z*	*k*	Peak *t* Value
PCC/precuneus	R/L	23/31	−4	−52	20	1,633	5.54
Medial frontal gyrus	R/L	9	10	42	50	617	4.89
Angular gyrus	R	39	50	−66	32	573	4.80
Angular gyrus	L	39	−48	−68	32	565	4.71

Note. H = hemisphere; BA = Brodmann Area; *X*, *Y*, *Z* = MNI peak coordinates; *k* = cluster size in voxels; PCC = posterior cingulate cortex; MNI = Montreal Neurological Institute.

Comparison Between the GV and IPV Dilemmas in Batterers and Other Criminals

Next, we examined whether there were differences within each group between the patterns of brain activation evoked by the GV dilemmas and the IPV dilemmas. We observed that BG showed greater activation of the DMN regions during the GV than during the IPV dilemmas. These regions were medial prefrontal cortex, precuneus, posterior cingulate cortex (PCC), and bilaterally in the angular gyrus (see Table 5 and Supplemental Figure S5).

In the batterers group, no regions showed significant greater activation during the IPV dilemmas than during the GV dilemmas. In the other criminals group, no significant differences were found between the GV and the IPV dilemmas.

To test the interaction between the type of dilemma (GV and IPV) and group (batterers and other criminals), 2×2 factorial analyses of variance (ANOVAs) were conducted on the data of the regions that had shown significant results in the previous analysis: medial prefrontal cortex, precuneus/PCC, and both angular gyri.

The results showed a significant interaction in the PCC/precuneus ($p = .004$) and medial frontal gyrus ($p = .018$), and marginally significant one for the angular gyrus ($p = .066$ and $p = .067$, for the right and left hemispheres, respectively; Figure 1). These interactions are a consequence of the deactivation of these DMN regions in BG when faced with IPV dilemmas compared with those of GV, along with the lack of a difference between both dilemmas in the OCG group (see Figure 1).

Discussion

The main aim of this seminal and exploratory study was to uncover the brain mechanisms involved in the moral decision making of batterers when faced with dilemmas involving situations of violence against a female partner in comparison with the case in which the decisions are concerned with violent situations in general. In batterers, no DMN regions were activated when making moral decisions involving their female partner, but activation is observed when faced with situations of GV. This difference is specific to our batterers sample, because for the participants who had been convicted of other crimes, the DMN is activated both when the moral decisions involve his female partner and when the decision involves a situation of GV. In addition, decisions about breaking women's moral values such as refusing to allow a certain way of dressing or decisions involving employment equality are real moral dilemmas, as they activate the same brain areas as those observed when faced with the decision to be or not to be violent toward (or harm) another person.

The results obtained with both Greene's dilemmas and those of GV are in accord with the findings of other studies indicating that the DMN is activated when people make moral decisions (Sevinc & Spreng, 2014). These studies have shown that the DMN is indispensable for the understanding of others and is involved in social understanding, internal thinking, autobiographical memories, self-referential processing, episodic and semantic memory, deduction of mental state from others, self-judgments, and prospective thinking (Reniers et al., 2012).

This pattern of activation of the DMN has also been found in batterers when they make moral decisions about harm or GV but not when

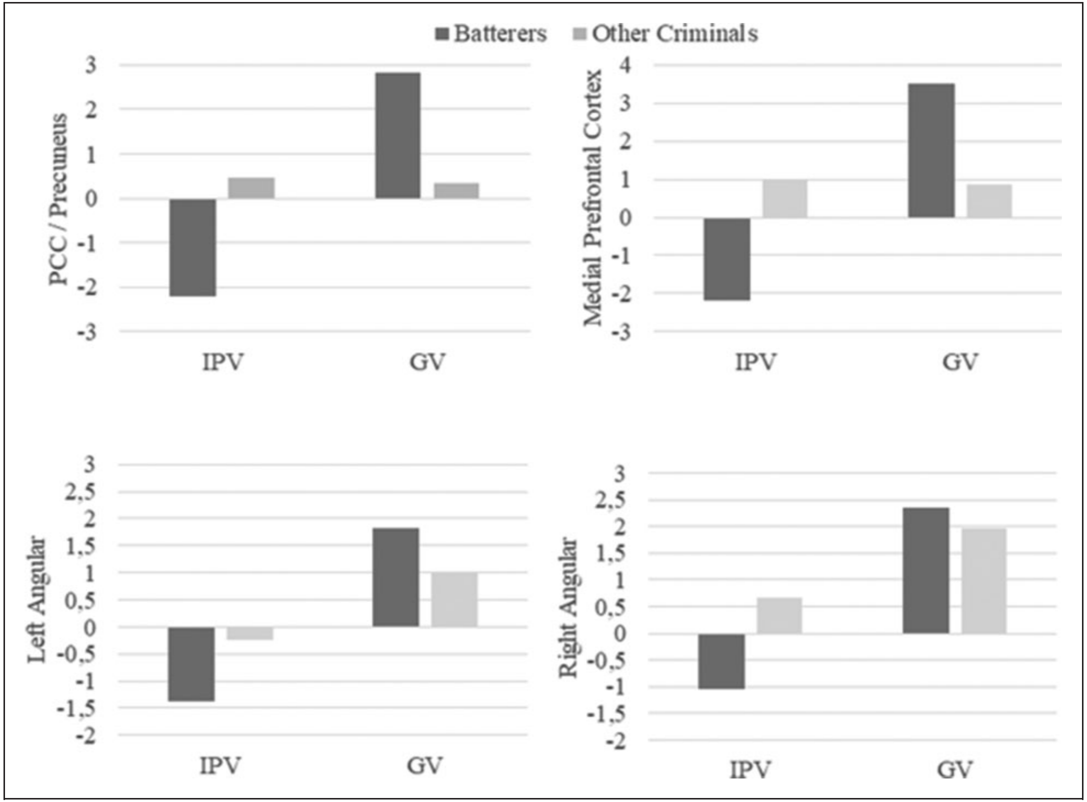

Figure 1. Values of activation of the brain regions that show greater activation when processing GV dilemmas compared with IPV dilemmas in BG for both groups.

Note. GV = general violence; IPV = intimate partner violence; BG = batterers.

decisions involve whether to allow the female partner to engage in certain behaviors such as her choice of clothes, or employment. When faced with these moral decisions, batterers show the opposite pattern of brain activity, that is, there is deactivation of the DMN. The altered functioning of these areas matches with two areas proposed in the neuromoral theory of antisocial behaviors (Raine, 2019; Raine & Yang, 2006): the medial prefrontal cortex and the angular gyrus. According to Raine (2019), the neural dysfunction in some regions of morality network could cause to moral dysfunction and antisocial behavior, and could predict later offending. For this reason, this altered circuit might help to understand batterer's behavior.

Deactivations of the DMN have been widely reported when the task demands attention to external stimuli. This would imply that for batterers, although deciding whether to harm another person is a moral dilemma, the decision of whether or not to harm their female partner is not. In addition, the deactivation of the DMN has been found in cognitively demanding or attractive tasks, in tasks directed toward objectives and in novel tasks (Raichle, 2015). Therefore, one might suppose that for batterers, the decisions about their female partner could be regarded as tasks that are cognitively demanding and goal driven. However, the deactivation of the DMN in batterers could be explained by the cognitive social theory of Bandura (Bandura, 2016). Moral disengagement has been studied in a multitude of populations that commit immoral acts, such as harassment in prisons, bullying, war and terrorism, as well as in dating relationships (Rubio-Garay et al., 2016). These latter authors have found that in dating relationships, anger, hostility, and aggression are mediated by moral detachment. Thus, in batterers, a moral disengagement would be set in motion, a cognitive process that allows moral principles to not be applied to themselves in a particular context to avoid moral conflict, allowing them to commit acts of violence against their partners. In doing so, they are exempt from blame by spreading responsibility, minimizing or denying the harmful effects of their actions, and dehumanizing those who mistreat and blame them (Bandura, 2016). Thus, the self-concept is protected and the behavior is irrelevant and justifiable (moral justification; Echeburúa & Amor, 2016). Nevertheless, this is the first study addressing the moral brain functioning in batterers and more studies are needed to replicate our results.

The observation of a specific pattern of brain functioning in batterers has also been found in other studies. Bueso-Izquierdo et al. (2016) found that batterers, compared with other criminals, showed activation of the medial prefrontal cortex, the PCC, and the left angular gyrus when they saw images of IPV, but not of GV. Verdejo-Román et al. (2019) have also found lower volume in the areas related to emotional processing compared with other delinquents. These results, together with those presented here, point to the possibility that violent crimes against women should be considered as a type of offense that is distinct from other crimes against people (Moffitt et al., 2000).

Our results also provide evidence regarding the specificity of moral values. Most studies on moral decisions have been carried out using dilemmas about whether or not to harm another person. In this regard, our study has replicated the results of previous works (Harrison et al., 2008). However, our results point to a differential functioning of the same brain structures (the DMN network) depending on the person who is going to be harmed. As shown above, in batterers, the DMN is activated when the decision involves whether or not to harm an unknown person, and is deactivated when the decision is whether or not to harm his own female partner. A possible explanation could be that in the case of the batterers, decisions about his female partner do not present a moral conflict because, from the batterer's point of view, he is not harming her but also helping her (Morrison et al., 2018). Thus, from this perspective, when a batterer forbids his partner from wearing a miniskirt to attend a party, this does not represent a moral conflict regarding the freedom of the woman, but is instead seen as the best way to help her avoid problems with men. Therefore, in such decisions, the DMN would not be activated because it is not a moral conflict.

It is also worth noting the differences in the percentage of utilitarian responses between the GV and IPV dilemmas in the two groups. The percentage of utilitarian responses to GV dilemmas is similar to those found in our previous study (Carmona et al., 2014). However, in the case of the IPV dilemmas, the percentages are very low, that is, they do not exceed 7%. These judgments depend on the strength of the negative emotional response and the moral norms in relation to women. A lower percentage of utilitarian responses indicates that it is worse for batterers to attack their female partner than other people because of the greater emotional bond shared with her. However, we did not find statistically significant differences in the activity in brain areas related to emotions, thus raising the possibility that the behavioral differences could be due to the presence of social desirability that exists of Western societies in the face of sexist beliefs (Gracia et al., 2015).

The results of this study have several implications. First, we have found that male batterers exhibit a different pattern of brain activity depending on whether they are making decisions about other people or about their female partner. This suggests that IPV should not be considered in the same way as other instances of violent crime against people because the two types of violence are underpinned by different value systems (WHO, 2013). According to our results, the batterer does have a moral conflict when he harms another person, but not when he harms his partner. This should be taken into account in intervention programs for batterers where the intention is to reeducate or modify this value system of an abuser. Intervention programs should aim to specifically modify the value system held by the abuser toward his female partner and not toward other people. Second, research on moral dilemmas should consider the batterers' interpretation of the moral norm. It is clear that not harming another human being is a moral norm, but when the harm is interpreted as an aid to this human, it does not involve any conflict or moral violation.

Finally, the results of this preliminary study should be considered in the light of certain limitations. First, given the complexity of the population studied, it was difficult to obtain a larger sample size. Despite the fact that this study has enough statistical power, this could affect the representativeness of the evaluated population, and thus the generalizability of the results. However, the sample size is equal to or greater than those used in previous studies with batterers and neuroimaging. However, our sample was composed of participants who met the strict inclusion criteria regarding the history of drug use or brain damage, which considerably reduces the type of offenders who have been evaluated. However, with these exclusion criteria, we are confident that the differences found in this study are due to the type of crime and not to other variables such as the use of drugs, the presence of psychopathologies, or illiteracy. In addition, because this is a preliminary study, we presented representative scenarios related to IPV such as whether to allow their female partner the freedom to wear any type of clothing or to visit friends, with severe consequences for the victims (e.g., hitting or choking her). Because this is not representative of all possible abuse scenarios (e.g., harassment or psychological violence), future studies should study brain functioning during these moral dilemmas. A further limitation is the absence of a noncriminal control group. The previous literature shows that there are significant differences in brain activity between noncriminals and male batterers while processing IPV images, and future investigations should, therefore, include this group to explore differences in brain activation during the processing of moral dilemmas. Thus, our aim in this particular study was to establish whether there are differences in the pattern of brain activity according to the type of crime committed. Finally, future studies should include larger samples and should take in account diverse races, cultures, and languages to explore whether the differences found in our sample are also present in other batterers. However, given that IPV is a complex problem and male batterers are characterized as a heterogeneous group (Dixon & Browne, 2003), we did not include any exclusion criteria based on age, ethnicity, socioeconomic status, or cultural level to restrict the sample to one that is as representative as possible of the batterers population. It is, therefore, difficult to make global generalizations, given the wide range of diversity in male batterers.

In summary, our results demonstrate that batterers show a pattern of activation that is typical of the DMN when making decisions about GV, but, in stark contrast, the opposite pattern of deactivation when making decisions about their female partner. Future studies should investigate why the DMN is deactivated when the decision is about his partner, that is, if the deactivation implies, for example, an activation of autobiographical memory. Moreover, future studies could use IPV moral dilemmas with images, to analyze whether the format of the task determines whether or not they are considered dilemmas. Previous studies have found that images support deontological judgments, because they trigger automatic emotional responses (Amit & Greene, 2012).

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Note

1. First, we calculated sample size according to formal power analysis (https://designingexperiments.com/shiny-r-web-apps/ and fmripower.org). Based in prior neuroimaging data that found an effect size of 0.9 (Bueso-Izquierdo et al., 2016), an expected power of 0.8 and an assumed alpha level of .5, the sample size should be of a minimum of 16 per group.

Supplemental Material

Supplemental material for this article is available online.

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