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Research paper

Do affective episodes modulate moral judgment in individuals with bipolar disorder? [☆]Belén Gago ^{a,b}, Manuel Perea ^a, Pilar Sierra ^{a,c}, Lorenzo Livianos ^{a,c}, Antonio Cañada-Martínez ^d, Ana García-Blanco ^{a,d,*}^a University of Valencia, Valencia, Spain^b "Institut Pere Mata" University Hospital, Reus, Spain^c "La Fe" University and Polytechnic Hospital, Avda. Fernando Abril Martorell, 106, 46026 Valencia, Spain^d "La Fe" Health Research Institute, Valencia, Spain

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ABSTRACT

Background: Bipolar disorder (BD) patients experience altered emotional states and deficits in social adaptation that may also be involved in deontological moral judgments in which participants have to choose whether to sacrifice one person in order to save the lives of a greater number.**Methods:** In the present study we compared the utilitarian responses of BD patients in their different states (euthymia, mania, depression) and healthy controls to moral dilemmas with low (impersonal dilemma) and high (personal dilemma) emotional saliency.**Results:** Our findings revealed an increased tendency to utilitarian judgments in the three groups of BD patients in impersonal dilemmas relative to healthy individuals. In addition, utilitarian responses were increased during manic and depressive episodes in personal moral dilemmas relative to control group. Furthermore, we found no differences in social adaptation between utilitarian and deontological BD responders, though the depressive BD had a lower adaptation than the euthymic individuals.**Limitations:** The recording of response times, the exhaustive control of medication effect, or the inclusion of a non-moral condition in the battery of moral dilemmas would provide a better characterization of moral judgment in BD.**Conclusions:** For impersonal dilemmas, BD patients exhibited more utilitarian reasoning, which is also affected by emotional engagement for personal dilemmas during acute episodes of mania and depression. Social adaptation is not associated to utilitarian reasoning, but is rather influenced by mood state.

1. Introduction

Bipolar disorder (BD) is a chronic and severe psychiatric disorder characterized by recurrent episodes of depression, mania or hypomania, and euthymia. These mood fluctuations have been associated with shifts in social adaptation (Mansell et al., 2007). Specifically, social impairment in BD has been associated to deficits in social cognition (Cusi et al., 2012; Lee et al., 2013; Samamé et al., 2012), facial emotional recognition (Mercer and Becerra, 2013), emotional processing (García-Blanco et al., 2013a), theory of mind (Kerr et al., 2003), and emotion dysregulation (Corbalán et al., 2015). In the present study, we focus on a relatively neglected issue: whether deontological moral judgments are disturbed in the different episodes of BD (see Kim et al.,

2014, for an exception). To that end, we examined whether BD patients in manic, depressive and euthymic episodes show an impaired moral reasoning relative to healthy controls. Additionally, as moral reasoning is an essential socio-cognitive skill to appropriate social functioning (see Vera-Estay et al., 2016), we also examined whether these alterations in moral judgment also entail lower social adaptation when the mood episode is controlled.

The study of human morality includes overlying cognitive (moral judgment), emotional (moral emotions experience), and behavioral (moral decision) abilities (Moll and de Oliveira-Souza, 2007). Greene (2001) proposed a dual-process theory of moral judgment in which both automatic emotional senses (emotion) and deliberative rational processing (cognition) interact to produce moral choices

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(behavior). The crucial aim of moral dilemmas is to explore how differences in emotional engagement affect individuals' moral judgments and, subsequently, behavioral choices (Greene, 2007). In this sense, in low emotionally charged scenarios (known as “impersonal dilemmas”), individuals tend to choose utilitarian judgments (approving harmful actions when they serve a greater good), which are supported by controlled cognitive processes (Paxton et al., 2013). However, in high emotionally salient scenarios (known as “personal dilemmas”), respondents deliver more frequently deontological judgments (prohibiting harmful actions despite its utilitarian value), which are supported by automatic emotional responses (Greene, 2009).

In Thomsons' version of the trolley dilemma, two scenarios are contrasted based on emotional salience (Thomson, 1976): one is impersonal (“trolley dilemma”) and the other is personal (“footbridge dilemma”). In the trolley dilemma, a trolley is approaching to five people in a sidetrack. Participants are asked to decide whether to flip a switch to redirect the trolley onto a man and away from the five people (utilitarian response), or whether to allow the trolley to hit the five people (deontological response). In the footbridge dilemma, the participant has the choice between pushing with his own hands a large man onto the tracks in order to avoid the trolley from killing the five persons. Utilitarian responses are more common in the impersonal than in the personal dilemma, where most individuals feel strong emotional aversion to the utilitarian decision (e.g., see Skulmowski et al., 2014). Therefore, the key difference between the two scenarios relies on the more emotional salience of the thought of pushing someone to his death in the footbridge dilemma, compared to the thought of hitting a switch in the trolley dilemma (Greene, 2001).

Before describing the current experiment, we review previous studies that have tested the hypothesis that people's mood can influence moral decisions, especially in emotionally salient scenarios. A number of these studies have focused on healthy participants under mood induction procedures, that is, individuals under normal and extrinsically induced emotions (Pastötter et al., 2013; Strohminger et al., 2011; Valdesolo and DeSteno, 2006). Valdesolo and DeSteno (2006) applied the footbridge and the trolley dilemmas under the induction of positive mood in healthy individuals. They found that heightened positivity increased the number of utilitarian responses in the personal dilemma, but not in the impersonal dilemma, respect to the control group (see Strohminger et al., 2011, for similar findings after mirth and elevation positive mood-induction). In the experiment conducted by Pastötter et al. (2013), participants received positive or negative mood induction and they had to indicate the reason for making the moral decision. Both groups showed higher utilitarian responses in the personal dilemma, but this apparent similar pattern was due to different reasons. Whereas individuals after positive mood-induction were more focused on saving five people from death, individuals after negative mood-induction were more focused on not allowing five people to die.

The study of moral dilemmas in BD allows to explore if the alteration in moral judgments is due to the mood disturbances (i.e., a state: depressive and manic patients, but not euthymic, would exhibit more utilitarian judgments related to healthy controls; Epa et al., 2014; Kerr et al., 2003), or if it is an inherent feature of this affective disorder (i.e., a trait: all BD patients, regardless the episode, exhibit more utilitarian judgments related to healthy controls; Cusi et al., 2010, 2012; Derntl et al., 2012; Hibar et al., 2018; Mercer and Becerra, 2013; Samamé et al., 2012). In addition, it enables us to determine if altered mood state, positive or negative, defines the impairment of moral judgments in BD. In fact, utilitarian outcomes during affective episodes in BD could be explained by the mood-congruency hypothesis posited by cognitive models (Beck, 1976), which indicates that information processing is biased when patients show affective symptoms but not in euthymic states. That is, manic BD patients (biased to positive information) would be focused on feelings of grandiosity saving five people from death, whereas depressed BD patients (biased to negative information) would be focused on feelings of guilt for allowing five

people to die (e.g., García-Blanco et al., 2013b, 2015).

To the best of our knowledge, only one published study has applied moral dilemmas in BD patients. Kim et al. (2014) applied a battery of 60 moral dilemmas, analogous to the trolley and the footbridge scenarios, to 27 manic BD patients, 26 euthymic BD patients, and 42 healthy controls in a sample of South Korean individuals. For personal dilemmas, they found that manic patients exhibited more utilitarian choices (35%) than euthymic patients (22%) and healthy participants (20%). However, for impersonal dilemmas they failed to obtain significant differences between groups (the utilitarian rate was 57% for manic patients, 46% for euthymic patients, and 55% for healthy participants). The authors asserted that manic patients' responses only differed for personal moral dilemmas, which are more emotionally provocative than impersonal moral dilemmas.

In our study, we fill the gaps in knowledge by means of (1) including BD patients in their different episodes (euthymia, mania, and depression), by (2) controlling the severity of affective symptoms in order to exclude mixed states as well as the absence of affective symptoms in euthymic patients and healthy participants, and by (3) focusing thoroughly in the personal and impersonal versions of the trolley dilemma, which has been considered a paradigmatic scenario to shed light on moral judgment (Greene, 2001). First, due to the deficits in moral reasoning among the BD illness course (Epa et al., 2014; Samamé, 2013), we expected that the three groups of BD patients would show increased utilitarian judgments related to healthy controls for impersonal dilemmas. That is, healthy participants would have higher levels of moral thinking and would reject utilitarian choices, even in impersonal dilemmas. Secondly, we hypothesized that both manic and depressed BD patients would show increased utilitarian responses in personal dilemmas relative to healthy participants (Donges et al., 2005; Fujino et al., 2014; Kim et al., 2014; Pletti et al., 2016), whereas no differences would be exhibited in the comparison between euthymic BD patients and healthy controls. In this sense, both mania and depression appear to influence mostly in moral behavior when emotional salience is more intense, due to the increased effect of emotional engagement during acute episodes in BD (García-Blanco et al., 2015). Finally, we also examined whether these alterations in moral judgment could explain social adaptation in BD patients, when the mood episode is controlled. That is, BD patients with utilitarian responses would show lower social adaptation than BD patients with deontological responses, regardless of their episode (Vera-Estay et al., 2016).

2. Method

2.1. Participants

The participants were 89 BD patients from the Psychiatry Department (49 from in-patient wards and 40 from the outpatient Bipolar Disorder Unit) at the University and Polytechnic Hospital La Fe (Valencia, Spain) and 32 healthy individuals recruited through advertising in the community. Patients fulfilled the DSM-5 criteria (APA, 2013) for BD and were included in the manic ($n = 30$), depressed ($n = 28$), or euthymic ($n = 31$) group at the time of assessment. The ethics committee at the Health Research Institute La Fe authorized this study. Demographic and clinical details are presented in Table 1.

Exclusion criteria for the patients were as follows: neurological history or major medical disorders likely to affect cognition; use of non-psychotropic medication that could affect cognition (e.g., treatment with corticosteroids); and other psychiatric diagnoses based on DSM-5 criteria (American Psychiatric Association [APA], 2013). No healthy control showed any type of psychiatric history. A total of two participants were excluded from the original sample (91 patients, 32 healthy controls) on the basis of these criteria.

All patients were referred by psychiatrists in the department. DSM-5 diagnoses were established by clinical interview and case note review, and were confirmed by the responsible psychiatrist. An experienced

Table 1

Demographic and clinical data from control group, depressed, euthymic and manic patients. Data shown are mean (standard deviations) and median (1st, 3rd quartiles) for continuous variables, and relative frequencies (%) for categorical variables.

	Control (n = 32) Mean (SD) / n (%) Median (1st, 3rd Q.)	Euthymia (n = 31) Mean (SD) / n (%) Median (1st, 3rd Q.)	Mania (n = 30) Mean (SD) / n (%) Median (1st, 3rd Q.)	Depression (n = 28) Mean (SD) / n (%) Median (1st, 3rd Q.)	p value
%Female	50	41.94	30	64.29	0.063
Age	36.41 (12.64) 31 (28, 39)	44.68 (10.97) 42 (37, 55)	43.67 (15.11) 40.5 (31, 53.75)	47.93 (8.08) 49 (43.75, 53)	0.002
# Of episodes	–	7.3 (5.33) 6 (5, 8)	5.3 (4.09) 4.5 (2, 8)	6.62 (5.4) 5 (2, 9.25)	0.330
Age of onset	–	26.3 (9.61) 24 (18.5, 31)	26.19 (5.63) 26 (22, 29)	34 (13.25) 33.5 (23.25, 43.75)	0.047
Education					<0.001
Primary (%)	6.25	12.9	40	35.71	
Secondary (%)	28.12	35.48	40	42.86	
University (%)	65.62	51.61	20	21.43	
% BD type I	–	70.97	85.19	46.43	<0.001
SASS ^a	46.16 (4.36) 46 (43.75, 49)	39.58 (6.42) 39 (34, 44)	32.48 (11.33) 35 (26, 40)	30.48 (7.32) 31 (26, 34)	<0.001
YMRS ^b	0 (0) 0 (0, 0)	0.65 (1.47) 0 (0, 1)	26.3 (7.98) 26 (21, 32)	0.43 (1.45) 0 (0, 0)	<0.001
BDI ^c	0.34 (0.97) 0 (0, 0)	7.06 (4.44) 7 (3.5, 10)	3.83 (5.46) 3 (0, 5)	27.18 (11.86) 28.5 (19.25, 35.5)	<0.001
BAI ^d	1 (1.88) 0 (0, 0.5)	10.68 (10.55) 7 (3, 15)	8.31 (5.76) 7 (4, 10)	18.3 (8.9) 17 (11, 24)	<0.001
Medication					
Lithium (%)	–	74.19	60	48.15	0.124
Antipsychotic (%)	–	51.61	96	62.96	<0.001
Antidepressive (%)	–	22.58	0	77.78	<0.001
Antiepileptic (%)	–	51.61	28	48.15	0.172
Anxiolytic (%)	–	51.61	84	81.48	0.010
Impersonal dilemma					
Utilitarian response (%)	62.5	96.77	93.33	82.14	<0.001
Personal dilemma					
Utilitarian response (%)	18.75	41.94	70	67.86	<0.001

^a Social Adaptation Self-evaluation Scale.

^b Young Manic Rating Scale.

^c Beck Depression Inventory.

^d Beck Anxiety Inventory.

psychiatrist diagnosed the episode in which the patient was at the time of the assessment. A clinical psychologist—together with the scores in the tests—corroborated this diagnosis. Other relevant data were recorded for analysis, namely: age of illness onset, number of episodes, psychotic symptoms, current affective symptoms, substance use, patients and family's psychiatric background, and medication. The Beck Depression Inventory-II (BDI-II; Beck et al., 1996) and Young Mania Rating Scale (YMRS; Young et al., 1978) were used to exclude mixed features in manic and depressed episodes, and to assure the absence of affective symptoms in euthymic patients and healthy participants (BDI-II scores <9, except in depressed group >18; YMRS scores <6, except in the manic group >20). If any inconsistency was noticed between the clinical diagnosis and the assessment by tests, the patient was excluded.

Additionally, every participant filled out the Beck Anxiety Inventory (BAI; Beck et al., 1988) to measure anxiety, which has been linked to a general inhibitory effect on utilitarian responses (Perkins et al., 2013). We classified patients in each group according to the cutoff of 16 (BAI scores >16 indicate moderate and severe anxiety symptoms). Among bipolar patients, 55.6% of depressed patients, 22.6% of euthymic patients and 17.2% of manic patients exhibited significant levels of anxiety. Finally, the Social Adaptation Self-Evaluation Scale (SASS; Bosc et al., 1997) was included to measure social adaptation. Three participants were excluded based on these criteria, resulting in a final sample of 121 participants.

2.2. Procedure

Participants were tested individually in a quiet room. After signing an informed consent form, all participants responded to a demographic

and clinical interview, and to clinical scales. Afterwards, two moral scenarios were presented to participants in counterbalanced order: the standard trolley dilemma and the footbridge dilemma (Greene, 2001). Participants were asked to choose whether to harm one person to save five people in both scenarios. The text of the two dilemmas is presented in the Appendix.

2.3. Data analysis

We present all the descriptive variables in Table 1, in which the continuous variables were summarized using mean (standard deviation) and median (1st, 3rd quartiles), whereas the categorical variables were summarized using absolute and relative frequencies (%). Additionally, we have added the descriptive analysis dividing the data into utilitarian responses (yes/no) for each dilemma. See Table S1 for impersonal dilemma and Table S2 for personal dilemma in supplementary material.

To analyze the effect of group and the type of dilemma on utilitarian judgments, we adjusted a Bayesian logistic regression model on the dichotomous response (1 [yes; utilitarian response], 0 [no]), the dilemma type as a two-level factor: personal, impersonal—this was the reference condition, and group as a four-level factor: bipolar disorder patients (depression, mania, and euthymia) vs. controls—this was the reference group. The interaction between group and dilemma was also included in the model. Due to previous research have found that sex (Friesdorf et al., 2015), educational level (Côté et al., 2013), and age (Gasser et al., 2013), these factors were treated as covariates in the model (note that prior research has described the variation of moral judgment under the influence of dimensions such as gender, religion,

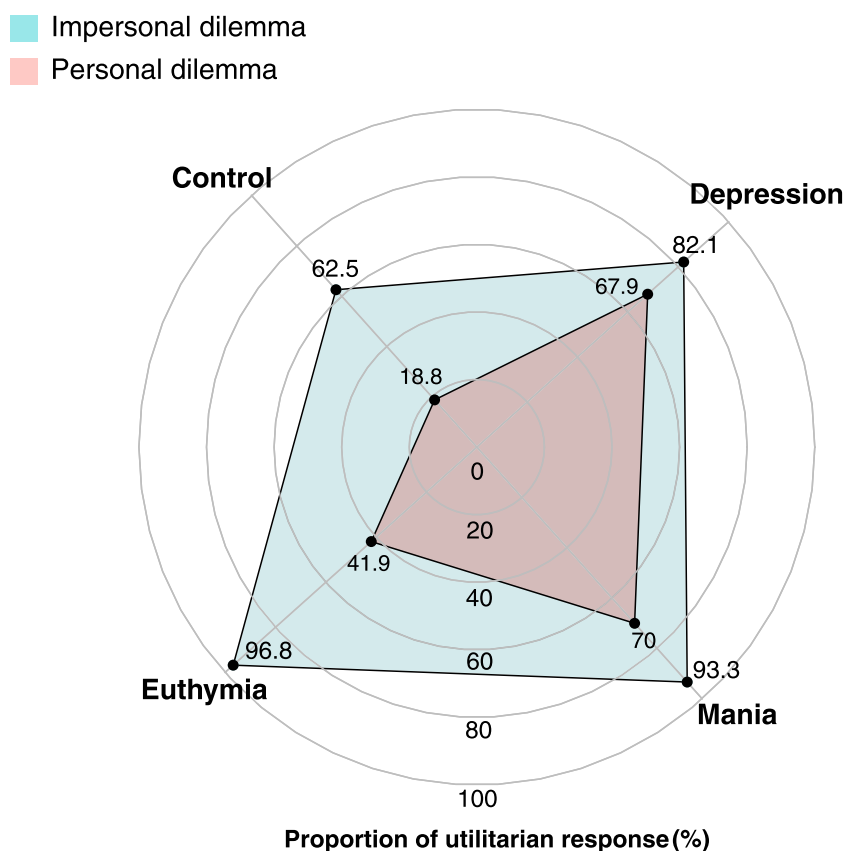


Fig. 1. Relative frequency of utilitarian responses in personal and impersonal dilemmas.

social class, or, among others). In addition, we examined the association between SASS with the utilitarian responses in BD, with the euthymic group as reference. To that end, we created an ordinal Bayesian regression model including the interaction between group and utilitarian response in personal dilemma. All statistical analyses were performed using R (version 3.5).

3. Results

The differences between groups in the choice of a positive response for impersonal (trolley) and personal (footbridge) moral dilemmas are shown in Fig. 1.

3.1. Utilitarian judgements

The results of the Bayesian logistic regression model are presented in Table 2. The proportion of utilitarian responses rate of the control group was higher for impersonal than personal dilemma (62% and 19%, respectively, OR = 0.0001, CI 95% [0.00, 0.02]). For impersonal dilemma, the groups of BD showed higher proportion of utilitarian responses than the control group (the utilitarian rate was 97% in euthymia, OR = 361.85, CI 95% [5.82, 37,610.58]; 93% in mania, OR = 164.16, CI 95% [2.31, 24,395.80]; and 82% in depression, OR = 8.65, CI 95% [2.31, 619.23]). For personal dilemma, the euthymic BD group showed a decrease in the utilitarian responses (41%, OR = 0.01, CI 95% [0.00, 0.85]). However, the proportion of utilitarian responses was maintained in both the manic group (70%, OR = 2.66, CI 95% [0.04, 190.82]) and the depressive group (68%, OR = 64.02, CI 95% [1.72, 3824.81]).

As for the covariates, whereas age and sex did not have an effect in the model, results showed a decrease of utilitarian responses with higher educational levels (the utilitarian rate was 61.36% in primary education level and 85.71% in secondary education level, OR = 0.01,

CI 95% [0.00, 0.85]).

3.2. SASS scores

The ordinal Bayesian regression model on the association between SASS with the utilitarian responses in BD, with the euthymic group as reference, only showed that the depressive BD had a lower SASS than the euthymic individuals, OR = 0.01, CI 95% [0.00, 0.85] (see Table 3).

4. Discussion

The present study was designed to examine whether there were differences in the choice of utilitarian responses in moral dilemmas for the patients among the three BD episodes (manic, depressive, euthymic) compared to healthy controls. For the impersonal dilemma, the three BD groups exhibited more utilitarian responses than healthy controls. However, for the personal dilemma, both depressed and manic BD patients exhibited increased utilitarian judgments compared to healthy controls. Taken together, these data extend the findings of Kim et al. (2014), who compared hypomanic/euthymic bipolar individuals and healthy controls but did not include a group of bipolar depression and did not control for mixed features. Furthermore, in case of BD patients, we found no significant association between utilitarian responses and social adaptation, neither in impersonal nor in personal dilemmas when the mood episode was controlled. Therefore, the two key new findings in our study are: (1) there is an increased utilitarian judgment in the three groups of BD patients for impersonal dilemmas, which suggests difficulties in moral judgments as an inherent feature in BD; and (2) there is a relevant effect of the emotional engagement in personal dilemmas, where manic and depressed patients favored the utilitarian outcome more frequently than the control group.

Firstly, more utilitarian judgment than deontological responses in the three groups of BD patients for impersonal dilemmas points to an

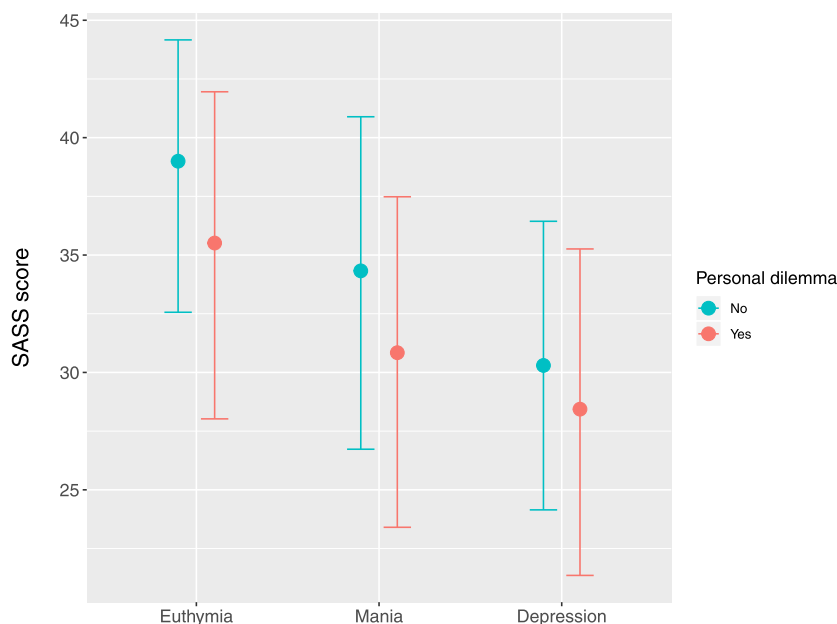


Fig. 2. Social adaptation according to utilitarian responses in BD patients for personal dilemma.

abnormal moral reasoning in BD. Previous research has posited deficits in social cognition among the BD illness course, such as the deficits in theory of mind (Samamé et al., 2012), emotional processing (Samamé, 2013), reduced perspective taking and emotion recognition (Cusi et al., 2012), and increased personal distress from observing another's negative experience (Cusi et al., 2010; Derntl et al., 2012). Therefore, our results suggest that the impairment of moral thinking in BD would be part of the deficits in social cognition during the illness course, even in non-emotional salient scenarios.

Secondly, for personal dilemmas, unlike euthymic patients, both depressed and manic BD patients selected utilitarian choices more often than healthy controls. That is, those patients who were under pathological and intrinsic emotions exhibited additional deficits in moral judgments for emotionally salient scenarios. This finding would demonstrate a phenomenon of cognition-emotion interaction in moral judgment during acute episodes in BD. More specifically, bipolar mania is characterized by grandiosity and decision-making with little premeditation (American Psychiatric Association [APA], 2013), which would favor the pursuit of the greater good in moral decisions in spite of the approval of harmful actions. Manic episodes also usually cause behavioral disinhibition and impulsivity (Kernberg and Yeomans, 2013; Strakowski et al., 2009), which has also been positively correlated with utilitarian preferences in personal dilemmas (Duke and Bègue, 2015;

Paxton et al., 2013). As regards to depression, it has been described a reduced awareness of others' emotions (Donges et al., 2005; Fujino et al., 2014), as well as an increased awareness of the sense of guilt elicited by moral decisions (Pletti et al., 2016). Therefore, in personal dilemmas, depressed patients would be more focused on minimizing their own feelings of guilt for allowing five people to die, rather than on the large man's emotions

Beyond mood-congruent processing, both depressed and manic BD patients would be more utilitarian in their moral judgments due to several potential reasons. The negative emotions produced by the increased emotional salience in the footbridge dilemma would be more difficult to regulate during manic and depressive episodes (Greene, 2001; Hummer et al., 2013). Furthermore, both manic and depressive mood has been related to additional difficulties in social cognition (see Samamé, 2013, for a review), and to poor inhibition of behavioral responses to emotionally-charged stimuli (García-Blanco et al., 2013a, 2017). Thus, the difficulties in emotional processing and regulation during depressive and manic episodes influence mostly in moral behavior when emotional salience is more intense, favoring utilitarian judgments.

Interestingly, we found that only a higher level of education was significantly associated to lower utilitarian judgments for personal dilemmas, whereas no other covariates exhibited significant influence in

Table 2

Bayesian logistic regression model for impersonal and personal dilemmas. The control group was treated as the reference group and impersonal dilemma was treated as the reference dilemma. Age, sex, and educational level – primary education as reference – were treated as covariates.

	Estimate	Std. Error	exp(Estimate)	Lower 95%	Upper 95%
(Intercept)	4.685	3.249	108.284	0.26	96,233.804
Personal dilemma	-7.18	1.974	0.001	0	0.021
Euthymia	5.891	2.289	361.854	5.816	37,610.577
Mania	5.101	2.397	164.164	2.314	24,395.802
Depression	2.157	2.136	8.649	0.135	619.23
Sex: Female	-1.714	1.459	0.18	0.008	2.768
Age	0.058	0.065	1.059	0.945	1.222
Secondary education	-4.49	1.965	0.011	0	0.371
University education	-2.355	1.858	0.095	0.002	3.011
Personal dilemma: euthymia	-4.436	2.335	0.012	0	0.854
Personal dilemma: mania	0.977	2.163	2.655	0.036	190.816
Personal dilemma: depression	4.159	1.99	64.022	1.719	3824.811
sd(Intercept) id	6.22	1.746	-	3.407	10.153
WAIC	144.974	13.531			

Table 3

Ordinal Bayesian regression model for impersonal and personal dilemmas: association between SASS with the utilitarian responses in BD, with the euthymic group as reference. Interaction between group and utilitarian response in personal dilemma has been included.

	Estimate	Std. error	exp(Estimate)	Lower 95%	Upper 95%
Mania	−1.239	0.816	0.29	0.059	1.388
Depression	−2.236	0.823	0.107	0.021	0.517
Personal dilemma: utilitarian responders	−0.918	0.67	0.399	0.109	1.457
Impersonal dilemma: utilitarian responders	0.412	0.786	1.51	0.326	7.13
Mania: personal dilemma utilitarian responders	0.051	1.048	1.053	0.142	8.199
Depression: personal dilemma utilitarian responders	0.461	1.018	1.585	0.218	12.308
WAIC	661.035	23.444			

moral decisions for personal and impersonal dilemmas. These findings are congruent with the theoretical models that support that the development of moral reasoning is associated to the cognitive construction of social reality (Rest et al., 2000). In this sense, those participants with higher educational level would be more able to make a rational judgment based on abstract principles, and consequently, to favor deontological moral decisions.

The present findings may appear to be inconsistent with those found by Kim et al. (2014), as their manic and euthymic BD patients did not show differences in moral judgment compared to healthy participants in impersonal dilemmas—they only found that manic BD patients exhibited differences for personal dilemmas. They found lower rates of utilitarian responses in both personal and impersonal scenarios compared to those found in our study, especially in BD patients. These apparent divergences may be due to several factors. First, the pathological nature and the severity of affective episodes could shape utilitarian responses. In this sense, the manic BD patients sample selected in the current study exhibited a higher severity of manic symptoms (YMRS mean score = 26.3) than in the Kim et al. (2014) study (YMRS mean score = 17.7), which are more consistent with hypomanic states. This difference in the level of affective manic symptoms between the two samples could justify divergences in the use of medication and may explain higher rates of utilitarian choices in our study. Second, the emotional valence of affective states could have a differential influence on moral behavior. The study conducted by Kim et al. (2014) did not include a bipolar depressed group for comparison and, furthermore, the scores in the depression scale in the manic BD sample cannot ensure the exclusion of patients in a depressive or manic episode with mixed features. Third, Kim et al. (2014) applied a heterogeneous battery of moral dilemmas that varied in the level of emotional conflict from the original trolley dilemma used in our study. This would entail differential results, given that emotional engagement is a relevant determinant of moral outcomes. Finally, the cross-cultural differences between the participants who answer the moral dilemmas could constitute a modulating effect on utilitarian responses. In case of Kim et al. (2014), moral dilemmas in BD were applied to a South Korean sample. Prior research has demonstrated clear differences between Asian and Western individuals in the rating of intent and responsibility in moral judgments: Asian participants emphasized the role of normative pressures, whereas Western participants focused on the actor's idiosyncratic goals (Plaks et al., 2016). Therefore, Asian individuals may elicit more deontological responses than Western participants.

Finally, we explored the association between social adaptation with moral judgment, taking into account the interaction between BD episode and the utilitarian response. We did not find any differences in social adaptation between utilitarian and deontological BD responders. However, in case of personal dilemmas, those depressed BD patients who chose utilitarian response showed lower social adaptation compared to euthymic BD patients. In contrast, and according to Beck's cognitive model in BD (e.g., Beck, 1976), this phenomenon would not be exhibited in manic patients because of the positive schemata that related unrealistic self-perception during manic states (note that social adaptation was assessed by a self-evaluation scale). To sum up, our

study found that, when controlling for patients group, the mood episode would determine the patient's social adaptation rather than the utilitarian responses. To the best of our knowledge, this is the first experiment that explores the association between utilitarian moral judgment and social adaptation across the different episodes of BD.

Despite the contributions of the present study to this field of research, we acknowledge that it has several limitations. First, all BD patients in our study were medicated. Previous literature showed that enhancing serotonin blockade might influence personal dilemmas toward deontological judgments (Crockett et al., 2010; Siegel and Crockett, 2013), pointing that the use of antidepressants in patients with BD would increase deontological responses. Nonetheless, as depressive BD patients tend to choose more utilitarian responses than euthymic patients in the personal dilemma, the use of antidepressants would not explain our findings. Second, response times for moral dilemmas were not registered. Due to the longer response latencies in manic patients reported by prior studies (Kim et al., 2014), these data could have contributed to the characterization of moral processing in BD. Third, a longitudinal design would better test the dual state-trait hypothesis in moral judgment, minimizing the effect of the inter-individual confounding variable. Finally, the inclusion of a more extensive battery of moral dilemmas in our study or the incorporation of a non-moral condition may provide a greater generalization of empirical results in terms of external validity.¹

In conclusion, the present study adds three main findings to previous studies on moral judgment in BD. Firstly, BD patients in their different episodes (manic, depressed, and euthymic), showed an impaired moral judgment in terms of utilitarian responses in impersonal scenarios when comparing to healthy controls. Secondly, we found that moral judgment is affected during manic and depressive episodes in personal moral dilemmas relative to healthy controls, pointing to a relevant interaction between emotion and cognition in moral reasoning. Finally, social adaptation is affected by mood episode rather than utilitarianism. From a clinical perspective, these results open new treatment options in psychosocial therapy. In particular, future research should examine whether training moral judgment during depressive and manic episodes can reduce the interference of affective symptoms in the social sphere.

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¹ Footnote 1: Note that in the Kim et al. (2014) study, the mean and standard deviation scores in the BDI-II were 9.2 and 12.4, respectively. These values may be taken to suggest that some patients in the manic BD group were in a mixed episode—the cut-off point to assert the presence of depressive symptoms in the BDI-II is 9.

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Supplementary materials

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Appendix

The standard trolley dilemma and the footbridge dilemma were presented to participants as follows:

- (a) Trolley dilemma: *A runaway trolley is coming down a railway track. The trolley is approaching to five persons in a sidetrack who will not be able to leave in time before the trolley will hit them. If the trolley will continue it will certainly overrun the five persons and will kill all of them. You are standing beside a switch of a railway track. The only way for you to save the five persons is to throw the switch. This will cause the trolley to go to another track where it will overrun and kill one person, while the five persons on the first track will survive. Would you decide whether to flip a switch to redirect a trolley onto the man or whether to allow the trolley to hit the five people?*
- (b) Footbridge dilemma: *In this scenario, the trolley is approaching to five persons in the railway track. This time you are in a bridge above the track, and a man is beside you. The only way for you to save the five persons is to push the man off the bridge so that his body would stop the trolley from hitting five people further down the tracks. Would you decide whether to push the man off the bridge or whether to allow the trolley to hit the five people?*

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