USING MORAL DILEMMAS TO CHARACTERIZE SOCIAL DECISION-MAKING

Martina Carmona-Perera, Raquel Vilar-Lopez, Miguel Perez-Garcia, Antonio Verdejo-Garcia

Abstract

Objective: Moral dilemmas are used in neuroscience research to characterize brain systems involved in utilitarian vs. deontological behavior. However, few studies have explored whether behavioral responses to these dilemmas can be used as a 'performance measure' of social decision-making skills, and whether these skills are replicable across cultures. the aims of this study were (i) to examine whether a Spanish version of the Greene's moral dilemmas questionnaire was able to dissociate distinctive 'choice patterns' and 'difficulty ratings' as a function of the type of social scenario, (ii) to determine the cultural equivalence of 'choice patterns' with respect to existing US samples, and (iii) to explore whether the moral dilemmas induce substantial changes in respondents' mood (in accordance with the somatic-maker model).

Method: To achieve these aims, we developed and tested a Spanish version of the Greene's questionnaire in 154 undergraduate students. In addition to the 'choice' measure (taking/not taking the utilitarian action), this version incorporated two novel performance measures: 'difficulty to make the choice' and 'congruent responses to non-moral dilemmas'. We examined these measures' performance profile as a function of type of dilemma and their equivalence with US results. We also assessed Panas-indexed mood states before and after exposure to the dilemmas.

Results: The results showed that both 'choice' and 'difficulty' measures discriminate responses to different types of moral scenarios.

Conclusions: In sum, our study has verified that choice patterns in the Spanish population are similar to the US, hence supporting the usefulness of moral dilemmas' derived performance measures. In addition this research provide information about the bi-directional relationship between emotion and moral judgments.

Key words: moral judgments, moral dilemmas, emotion, cross-cultural

Declaration of interest: none

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Introduction

Over the last decades human morality has become the object of neuroscientific research. This new approach, called moral neuroscience, has its origins in the study of changes in moral behavior of patients with brain dysfunction, and its main objective is to discover the cognitive capacities and neuronal mechanisms underlying moral behavior. From this perspective morality is defined as a consensus of habits and behaviors aiming to guide social decision-making (Moll et al. 2005). In neuroscience research, moral judgment is challenged using moral dilemmas, which are usually divided into three groups: non-moral, moral-impersonal, and moral-personal (Greene et al. 2001, Koenigs et al. 2007). Personal dilemmas are those where the subject must decide if directly provoke a physical damage to a certain person or group in order to save the highest possible number of people, which implies a great emotional conflict (Greene et al. 2001), and they can be divided into low and high conflict ones. Responses to high conflict personal dilemmas obtain a low consensus between people, as well as fewer affirmative responses, and longer reaction times compared to the other dilemmas (Greene et al. 2004). Affirmative responses to personal dilemmas are considered "utilitarian" answers because those responses imply to perform an emotionally aversive action in favor of communitarian wellbeing (e.g. suffocating a baby in order to save a group of people) (Greene et al. 2004). Utilitarian responses are thought to involve cognitive brain networks including the dorsolateral prefrontal cortex and the anterior cingulate cortex, whereas non-utilitarian (or deontological)

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responses involve affective processing brain pathways including the ventro-medial prefrontal cortex (Greene et al. 2001, Greene et al. 2004, Koenigs et al. 2007). Although multiple neuroimaging and brain lesion studies have used these dilemmas to engage (or describe the dysfunction) of the brain systems involved in moral judgment (Moll et al. 2002, Luo and Blair 2006, Young and Koenigs 2007) few studies have explored whether the behavioral responses to these dilemmas can be used as a 'performance measure' of social decision-making, or whether the resulting choice patterns can reliably discriminate between different social scenarios regardless of cultural background.

Up to date, two explanatory approaches to human moral behavior have been proposed: Kohlberg's verbal-rational theory and Haidt's social-intuitive theory. The verbal-rational theory (Kohlberg 1958) claims that the moral development of a person is divided in six levels that are independent of emotion. From this point of view, moral judgments are conscious, voluntary, and rational, and moral behavior is a capacity that varies as a function of personal experiences, education, and culture. On the other hand, the social-intuitive theory (Haidt 2001) claims that moral judgment is automatic, unconscious, intuitive, and very linked to emotion. Moral judgment is not determined by forethought or explicit reasons, but by a quick relatively automatic 'approval' or 'disapproval' of an action, such that any rational justification of these decisions takes place *a posteriori* (Greene and Haidt 2002). Furthermore, the theory assumes that moral judgments are universal, irrespective of culture, experience, and education (Haidt 2001). Several neuroscientific studies have recently obtained results coherent with the social-intuitive hypothesis: most neuroimaging studies have found that the fronto-limbic emotional networks are involved in moral judgments (Greene 2007, Heerkeren et al. 2005, Moll et al. 2003, Moll et al 2005), psychophysiological evidence has detected anticipatory electrodermal responses that precede endorsement vs. a moral violation (Moretto et al. 2011), and lesion studies have shown that patients with ventromedial prefrontal cortex damage usually make utilitarian decisions (Koenigs et al. 2007). These results indicate that the behavioral measures derived from moral dilemmas' instruments can be useful to characterize clinical populations characterized by dysfunctions in these emotional networks, one of the main challenges of neuropsychological assessment. However, these behavioral measures (or performance measures) should first demonstrate ability to induce consistent response patterns across cultures, and sensitivity to capture the emotional aspects involved in social decision-making.

The aims of this study were (i) to examine whether a Spanish version of the Greene's moral dilemmas questionnaire was able to dissociate distinctive 'choice patterns' and 'difficulty ratings' as a function of the type of social scenario, (ii) to determine the cultural equivalence of 'choice patterns' with respect to existing US samples, and (iii) to explore whether the moral dilemmas induce substantial changes in respondents' emotions. To achieve these aims, we developed and tested a Spanish version of the Greene's questionnaire in 154 undergraduate students. In addition to the 'choice' measure (taking/not taking the utilitarian action), this version incorporated two novel performance measures: 'difficulty to make the choice' and 'congruent responses to non-moral dilemmas'. We examined these measures' performance profile as a function of type of dilemma and their equivalence with US results. We also assessed PANAS-indexed mood states before and after exposure to the dilemmas.

Methods

Participants

One hundred and fifty four undergraduate students from the University of Granada volunteered to participate in the present study. Their education level ranges from 15 to 22 years, with a mean of 16 years and 8 months. As for gender, 120 of the subjects were female and 29 were male. Mean age of the subjects is 21.51, ranging from 18 to 54. Substance use was controlled, given its potential incidence in the results. However, no subject was excluded, as nobody fulfilled the criteria of abuse/dependence. The experiment was approved by the Ethical Committee of the University of Granada, and all the students gave their informed consent to participate on the experiment.

Instruments

In this research we used the following instruments belonging to a more extensive evaluation protocol:

Interview for Research on Addictive Behavior (Verdejo-García et al. 2005): is a table covering the most significant data about possible drug use (drug type, frequency, quantity used per episode, abstinence period, etc.). Its duration is five minutes.

Positive and Negative Affection Schedule (PANAS) in its Spanish version (Sandin et al. 1999): consists of a 20-item self-report questionnaire, covering information about the emotional state of the subject. It was administered before and after the moral dilemmas questionnaire in order to determine whether or not there is any kind of emotional change as a consequence of moral dilemmas.

Battery of moral dilemmas by Greene, adapted to the Spanish population: For the purposes of adaptation, the original questionnaire was translated into Spanish and then back-translated into English by a translator. After comparing the back-translation with the original English version, we did not observe significant differences between them and considered both questionnaires as equivalent.

In the analyses of the psychometric properties of the adaptation of the battery to the Spanish population, Cronbach's alpha was 0.705, and Spearman Brown coefficient was 0.377 for the proportion of 'yes'.

The Spanish adaptation has the same structure as the original questionnaire (Greene et al. 2001), so it is composed of 60 hypothetical scenarios, classified into three categories: non-moral dilemmas (n=20), moral-personal dilemmas (n=22), and moral-impersonal dilemmas (n=18). Participants answer 'yes' or 'no' to an action proposed by the dilemma. In addition to the dependent variable of "affirmative answers", in the Spanish version we included two new dependent variables: difficulty to make each moral judgment and congruent answers to non-moral dilemmas. We consider that both variables can add information that is not included in the original version of the instrument, which would be another contribution of this research. As for reliability in the difficulty index, Cronbach's alpha was 0.705 and Spearman Brown coefficient was 0.377

Procedure

The subjects were recruited from several schools of the University of Granada. In a typical session, the

subjects were informed about the study and accepted to participate voluntarily.

The administration order of the battery was counterbalanced, obtaining 12 different rotations. The unifactorial ANOVA showed that all twelve sequences counterbalanced were not different either in the 'yes' proportion or mean difficulty.

The task was administered in paper-and- pencil format with no time limits. The evaluation was performed in groups of 20 people, and duration time was two hours.

Measures

Both in this study and in the analyses of the original questionnaires, the dependent variable is the proportion of affirmative answers (AA). However, we have introduced two new variables: difficulty and congruent answers to non-moral dilemmas, as we consider that both variables may add relevant information. Thus, the dependent variables used in the statistical analyses were the following:

- Affirmative answer (AA): is the proportion of 'yes' answers given by the subjects to the dilemmas. A 'yes' answer means that the subject accepts to perform the action proposed in the dilemma.
- Difficulty (DIF): is the mean of the difficulty index, considering all dilemmas. Difficulty index evaluates the difficulty to produce each of the judgments the subject performs. It ranges from 1 (very low difficulty) to 10 (extreme difficulty).
- Congruent Answers (CA) are the proportion of congruent answers to non-moral dilemmas. Congruent answers include both 'yes' and 'no' "rational answers". For instance, answering 'yes' to the plant transportation dilemma (make two trips instead of ruining the expensive leather of the back seats) in Greene's battery and 'no' in the investment offer (no invest $1000 in a non reliable mutual fund) are both considered as congruent answers.

Statistical analyses

The statistical analysis of Greene's instrument started analyzing the descriptive statistics in order to explore the data and obtain the mean proportion of affirmative answers and difficulty for each item. In order to explore the differences in answer choice for the three categories of dilemmas we performed a repeated measures ANOVA, taking AA and CA as dependent variables, and the type of moral dilemmas as a factor. The same analysis was used to determine the differences in difficulty to answer according to the type of dilemma. In this case, the dependent variable was DIF. Then, we performed a two-way repeated measures ANOVA to determine the differences in the dependent variables AA and DIF between difficult and easy moral-personal dilemmas. In addition, we analyzed difficulty in moral-personal dilemmas according to the function of affirmative response (utilitiarian judgment) or negative (non-utilitarian judgment) of the subject by means of a descriptive exploration. Finally, we analyzed the data of the PANAS questionnaire through a repeated measures ANOVA for positive items and another one for negative items, the dependent variable being total score, and the independent variable being the administration prior (PRE) and post (POST) to the battery of moral dilemmas.

Results

Preliminary analyses

In the first place we performed a descriptive analysis of the dependent variables (i.e. AA and DIF) according to the different types of dilemma (non-moral, moral-impersonal, and moral-personal), as well as the two sub-classes of moral-personal dilemmas (low-conflict and high-conflict). The descriptive analysis shows a high variability in the proportion of affirmative answers and mean difficulty in items belonging to the same class, except for mean difficulty in non moral dilemmas, which is very low in all items (figures 1 and 2).

As for the distinction between high and low conflict personal dilemmas, we observed a lower proportion of affirmative answers and a greater response consensus in low conflict dilemmas as opposed to high conflict moral dilemmas, where responses are more variable and the proportion of affirmative answers is higher (Figures 1 and 2). In addition, difficulty variable corresponds with the classification of low and high conflict dilemmas, since high conflict personal moral dilemmas scored higher in difficulty (M = 6.6; SD = 1.80), as opposed to low conflict personal moral dilemmas, where most dilemmas scored very low in difficulty (M = 2.9; SD = 1.40).

Differences between moral personal and impersonal dilemmas and non-moral dilemmas

We performed a repeated measures ANOVA, considering the types of moral dilemmas as a factor

Figure 1. *Proportion of affirmative answers (AA) according to the different types of dilemma*

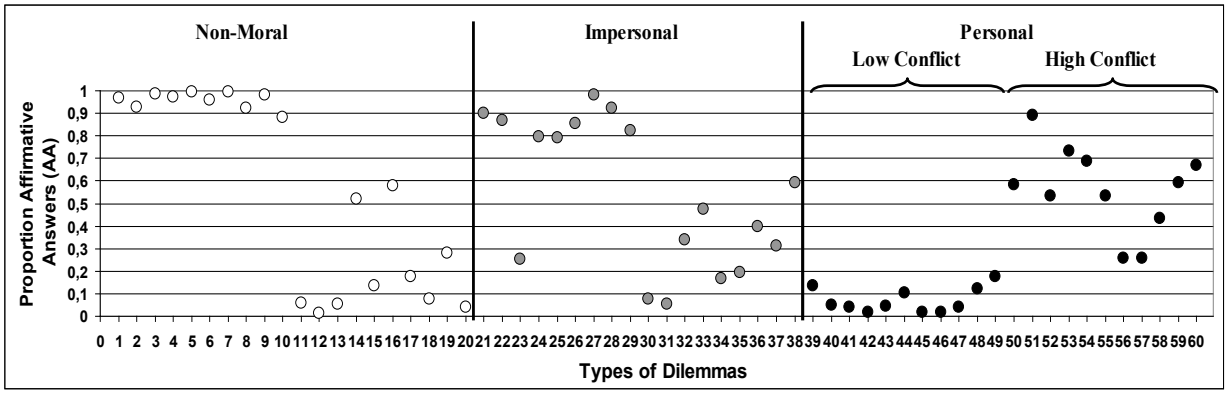
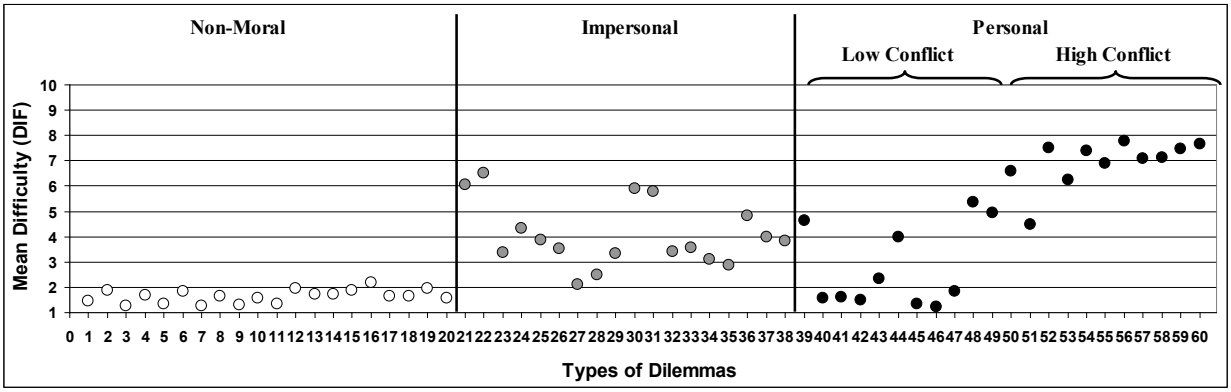


Figure 2. *Mean difficulty (DIF) according to the different types of dilemma*



and AA, DIF, and CA as dependent variables. The results showed significant differences between non-moral, moral personal and moral impersonal dilemmas according to the affirmative answers given by the subjects (F = 165.358, df= 2,228, p < 0.000). Non-moral dilemmas were those with the highest proportion of affirmative answers, followed by moral impersonal, and finally moral personal dilemmas. As for the mean difficulty for the subject to give an answer, the results also showed significant differences (F= 370.837, df= 2,228, p < 0.000), personal dilemmas being the most difficult. On the other hand, we observed that differences between the proportion of congruent answers in non-moral dilemmas and the proportion of affirmative answers in moral personal and impersonal dilemmas were also significant (F= 682.318, df= 2,228, p< 0.000), with a highest proportion of congruent answers in non-moral dilemmas (see **table 1**).

In order to analyze the differences between high-conflict and low-conflict moral personal dilemmas, we performed a two-way repeated measures ANOVA, taking AA and DIF as dependent variables. The results showed significant differences between high and low conflict personal dilemmas in terms of AA (F= 548.023, df= 2,282, p < 0.000), with a higher proportion of affirmative answers in high conflict dilemmas compared to low conflict dilemmas. This applied also in variable DIF (F= 606.041, df= 2,228, p < 0.000), where high-conflict dilemmas scored higher (M = 6.6; SD = 1.80). (See **table 1**).

We explored if the variable difficulty to answer was equivalent to the response time variable used by Greene and Koenigs (Greene et al. 2001, Greene et al. 2004, Koenigs et al. 2007); i.e., the longer response time, the higher difficulty. We further analyzed the differences in difficulty for moral personal items, according to whether answers were affirmative or negative. For that purpose, we performed a descriptive data analysis, which showed that in some moral personal dilemmas difficulty was high irrespective of whether the answer was affirmative or negative. Mean difficulty in personal dilemmas 52 to 60 was over 6 irrespective of the answer.

Table 1. *Repeated ANOVAs for the non-moral, moral impersonal, and moral personal dilemmas on the different dependent variables of the study*

Independent Variable	Dependent Variable	Types of dilemma	Mean (Sd)	*F*	*p*	Pairwise comparison (significant)
Non-moral, impersonal and personal dilemmas	% of affirmative answers (AA)	Non-moral	57.14 (6.89)	165.358	0.000	Non-moral>impersonal
		Moral impersonal	49.21(12.22)			Impersonal>personal
		Moral personal	34.31(15.39)			
	Mean difficulty (DIF)	Non-moral	1.58 (0.69)	370.837	0.000	Non-moral<impersonal
		Moral impersonal	3.87 (1.63)			Impersonal<personal
		Moral personal	5.07 (1.40)			
	% Congruent answers (CA)	Non-moral	83.90 (8.18)	682.318	0.000	Non-moral>impersonal
		Moral impersonal	49.21 (12.22)			Impersonal>personal
		Moral personal	34.31 (15.39)			
High conflict and low conflict dilemmas	% of AA	High-conflict	50.47(21.71)	548.023	0.000	Low-conflict>High-conflict
		Low-conflict	5.82 (12.38)			
	Mean difficulty (DIF)	High-conflict	6.62 (1.80)	606.041	0.000	Low-conflict<High-conflict
		Low-conflict	2.92 (1.40)			

However, in items 40 to 47 difficulty was near or under 4 in both answer types (see **figure 2**). On the other hand, the results show that when the subject accepted giving an emotionally aversive answer, the dilemma was considered more difficult. Nevertheless, impossibility to perform a direct analysis due to the small number of affirmative answers did not allow determining whether difficulty of moral personal items significantly differ according to the answer.

When comparing our results with Greene's battery as modified by Koenigs et al (2007), we observed that both questionnaires behave in a very similar way. The data obtained through the repeated measures ANOVA show significant differences between the three types of dilemmas: non-moral, impersonal and personal (see **table 1**). Also, the percentage of affirmative answers for each type of dilemmas was very similar for the Spanish and American populations; 60% for the American population and 61% on the Spanish population for the non-moral dilemmas, 52% for the Americans and 67% for the Spanish on the moral impersonal dilemmas, and 22% for the American sample vs. 32% for the Spanish on the moral personal dilemmas.

When comparing our results with those of Koenigs (Koenigs et al. 2007) item by item, we observed a very similar response pattern to personal dilemmas, the proportion of affirmative answers being very low in easy or low-conflict dilemmas, and higher in difficult or high-conflict dilemmas (**Figure 3**).

We performed two repeated measures ANOVAs, with the dependent variable being the scores for positive and negative states in the PANAS, and factor being the administration of PANAS prior to (PRE) and after (POST) the moral dilemma questionnaires. The results of the analyses showed significant differences between PRE and POST administration, leading to a decrease in positive affective state (F= 40.996, df= 1,147, $p < 0.000$), and an increase in negative emotions (F= 57.664, df= 1,147, $p < 0.000$) as a consequence of moral judgments. Total score of positive items in the initial PANAS (M = 24.46; SD = 6.78) was five points higher than in the final administration (M = 20.65; SD = 6.81). However, we observed a reverse pattern in the results of negative items, since the summation of scores of all negative items in the PRE administration of PANAS was significantly lower (M = 13.66; SD = 6.23) than the scores obtained in the POST administration (M = 19.04; SD = 8.78).

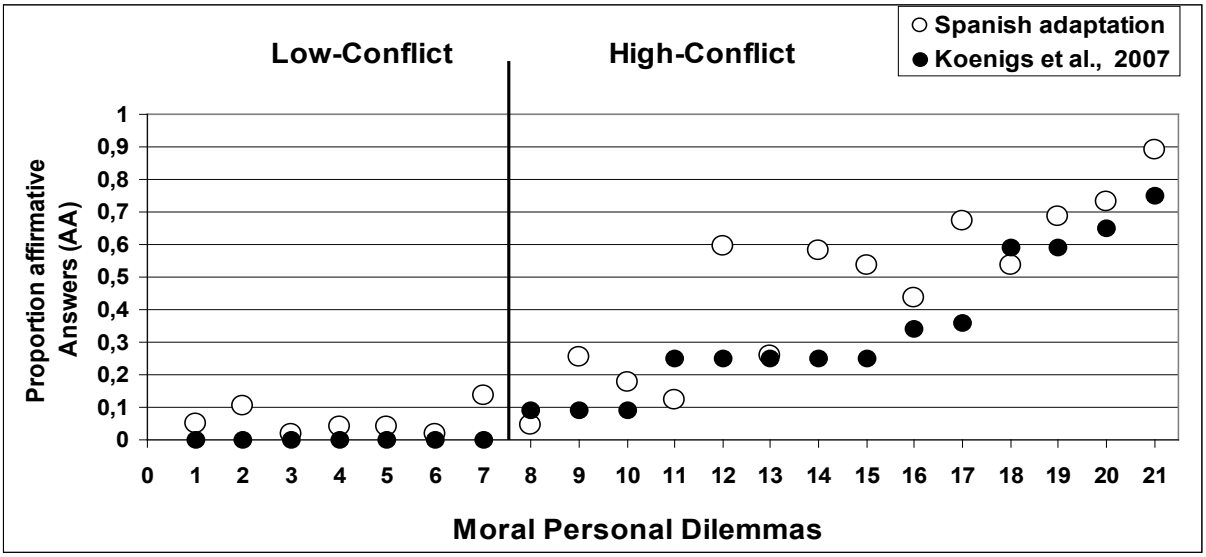
Discussion

The aims of this study were (i) to examine whether a Spanish version of the Greene's moral dilemmas questionnaire was able to dissociate distinctive 'choice patterns' and 'difficulty ratings' as a function of the type of social scenario, (ii) to determine the cultural equivalence of 'choice patterns' with respect to existing US samples, and (iii) to explore whether the moral dilemmas induce substantial changes in respondents' emotions. Results showed (i) that behavioral indices had adequate psychometric properties and were able to discriminate between moral, moral-impersonal, and moral-personal dilemmas based on proportion of affirmative answers (AA), difficulty (DIF), and congruent answers (CA); (ii) that the scores obtained by our student sample were remarkably similar to those obtained in the original US sample, and that (iii) moral dilemmas were able to significantly modify the emotional state of the subjects, by increasing their negative emotions and decreasing their positive ones.

In our study we found that the Spanish version of Greene's battery of moral judgments performs similarly to the original questionnaire, differentiating the types of dilemma or the main effects proposed by its author according to the answers given by the subjects, as well as the degree of difficulty to answer claimed. It is noteworthy that our results also replicate those of Koenigs in his adaptation of Greene's battery (Koenigs et al. 2007). In both instruments, high emotional conflict dilemmas have a lower frequency of affirmative or utilitarian answers. In other words, individuals tend to reject to perform an action that would infringe a moral norm and would be emotionally aversive, e.g. suffocating their child to save themselves or a group of citizens. In addition, difficulty in these situations is higher, as compared with other types of dilemmas.

Based on Greene's hypothesis, the results of this study were predictable. Nevertheless, the similitude between the results of the original instrument in the US and to the results obtained with the Spanish population is noteworthy, given the enormous cultural differences

Figure 3. *Proportion of affirmative answers (AA) in moral personal dilemmas. Comparison of the results of the adaptation of Greene's questionnaire to 50 dilemmas (Koenigs et al. 2007) with its Spanish version*



between both countries (i.e., more individualistic vs. more communitarian, Green et al. 2005). Our data suggest the existence of a cross-cultural phenomenon in moral judgments, in line with the social-intuitive theory (Haidt 2001), which claims that moral judgments are universal, irrespective of cultural or educational phenomena. In our study this rule applies, as we observed that Spanish subjects (as Greene highlighted with Americans) consider actively causing damage as more inadmissible, even when the damage would originate a better outcome (personal moral dilemmas); however, they tend to accept damage caused by omission or indirectly caused (impersonal moral dilemmas).

As for the difficulty variable, our data show its capacity to distinguish between the different types of dilemma, indicating that the higher the emotional charge, the higher the difficulty to answer. When comparing the difficulty variable (measured in a ten-point Likert scale) with Koenigs' emotional importance variable (rated in a seven-point scale), we observe that they both allow differentiating between non-moral, impersonal, and personal dilemmas. However, this emotional importance scale does not distinguish between low and high conflict dilemmas, unlike the difficulty scale, which finds significant differences. On the other hand, we could hypothesize that the difficulty variable is equivalent to the reaction time used by Greene (Greene et al. 2001, Greene et al. 2004). This reaction time variable allows distinguishing utilitarian and non-utilitarian judgments in moral personal dilemmas, since subjects that answer that they would perform the action proposed take longer to give an answer than those who reject it, which according to Greene means that the moral conflict is higher.

In our case, we did not perform a direct comparison between affirmative and negative answers, except in personal moral dilemmas, given the small number of affirmative answers. However, in a descriptive exploration we found that difficulty is higher when the answer is affirmative (utilitarian) than when it is negative, but not for personal dilemmas in which difficulty is high in both affirmative and negative answers. For instance, in the dilemma proposing suffocating one's own child to save oneself and a group of citizens, the subjects that answered affirmatively considered the dilemma much more difficult than those who gave a negative answer. In this sense, the difficulty variable would be the equivalent to the time reaction variable. However, difficulty would provide additional information not included in reaction time. As shown in **figure 2**, difficulty to answer to moral personal judgments is very variable, as the subjects had no difficulty to make a decision in some judgments, whereas they found it really difficult in other judgments. Therefore, we could state that in said cases, difficulty to make a decision does not correspond with RT and provides extra information allowing comparison of judgments within the same condition. Also, this new variable gives us subjective information and is substantially easier to administer. Nevertheless, further research is needed to study equivalence between both variables.

As for the 'congruent answer' variable in non-moral dilemmas, gives a more direct comparison with moral judgments, as proportion of congruent answers (close to 1 in normal population) allows observing more clearly the differences between proportion of affirmative answers of impersonal and personal moral judgments.

Based on the analysis of the results obtained in the PANAS questionnaire, we consider that moral judgments can modify the emotional state of the subject, after observing significant differences showing an increase in negative affective state and a decrease in positive emotions, as a consequence of moral judgments. These data are consistent and complementary to those of Valdesolo (Valdesolo and Destefano 2006), showing how the affective state can modify moral judgment. Therefore, our results provide information about the bi-directional relationship between emotion and moral judgments, the latter having also the capacity to alter the emotional state.

Our results may be limited by some variables that have not been considered. For instance, the study was performed on a sample composed of university students with a high educational level and mostly women, which could be influencing variables. Therefore, this would limit generalization to different ages, education levels, and samples with different genre proportions. Nevertheless, our results are very similar to those of the original questionnaires.

In sum, our study has verified that moral judgments of the Spanish population are similar to those of other cultures, specifically the US. Also, our study points to the utility of the difficulty and congruence variables as new measures to considered in moral judgments. Finally, this research has registered some evidence showing the key link between emotion and moral judgments, as those modify the emotional state of the individuals. The first one refers to the capacity of moral judgments to modify the emotional state of the subject by means of the pre- and post- administration of the PANAS questionnaire. Secondly, the results of the Spanish version of Greene's battery show that it is a valid instrument to differentiate moral personal from moral impersonal dilemmas, based on their emotional content.

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