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Differences on Utilitarian and Moral Decision Between Male and Female[1]

César A. Acevedo-Triana[2], Juan Francisco Muñoz Olano[3]
Universidad Pedagógica y Tecnológica de Colombia

Pablo Reyes[4]
Pontificia Universidad Javeriana, Bogotá

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Abstract

Objective. Moral judgments are based on decisions that take into account the representation of norms and law, values, functionality and situations themselves. Morality has been studied with "hypothetic moral dilemmas", in order to identify the type of outcome and the process behind moral reasoning. But judgments by themselves are not enough to establish differences in the type of resolution or the relationship with other cognitive processes. The present paper aimed to compare performance in tasks of utility maximization, cognitive control, and moral judgments, taking into account sex and other sociodemographic variables. **Method.** Seventy-three university students participated (50 women, 20 men and 3 with unreported gender, the average age was 19.53 years (*SD* = 1.68 years). The Iowa Gambling Task (IGT) was used to identify behaviors of utility maximization. In addition, we used the switch costs and the web application of moral machine tasks. **Results.** A difference between variables of the IGT, but no differences in the switch costs task were found. **Conclusion.** Regarding moral judgment, males gave more value to respect norms than females. Some variables of the IGT task support outcomes related to differences between sexes. Results are congruent with differences shown in existing literature.

Keywords. Morality, judgments, decisions, utilitarianism, deontological.

Diferencias en las decisiones utilitarias y morales entre hombres y mujeres

Resumen

Objetivo. Los juicios morales se basan en decisiones que toman en cuenta la representación de las normas y la ley, los valores, la funcionalidad y la situación en sí. La moral se ha estudiado con "dilemas morales hipotéticos" para identificar el tipo de resultado y el proceso detrás del razonamiento moral. No obstante, los juicios en sí mismos no son suficientes para establecer diferencias en el tipo de resolución o la relación

[1] Research paper framed on research topic about Psychological Process of authors at Universidad Pedagógica y Tecnológica de Colombia, Tunja, Colombia.

[2] Magister in Neuroscience. Email: cesar.acevedo02@uptc.edu.co

[3] Magister in Clinical Psychology. Email: juan.munoz04@uptc.edu.co

[4] Magister in Neuroscience. PhD student in Engineering. Email: pabloreyesg@gmail.com

con otros procesos cognitivos. Por lo anterior, el presente estudio buscó comparar el desempeño en tareas de maximización de la utilidad, control cognitivo y juicios morales, teniendo en cuenta el sexo y otras variables sociodemográficas. **Método.** Participaron 73 estudiantes universitarios (50 mujeres, 20 hombres y 3 con sexo no reportado, la edad promedio fue 19.53 años (*DE* = 1.68 años). El Iowa Gambling Task (IGT) se utilizó para identificar comportamientos de maximización de la utilidad. Además, el estudio empleó la prueba de cambios de tarea y la aplicación web Máquina Moral. **Resultados.** Se encontró una diferencia entre las variables de IGT, sin observar diferencias en la prueba de cambios de tarea. **Conclusión.** En cuanto al juicio moral, los hombres dieron más valor al cumplimiento de normas que las mujeres. Algunas variables de la tarea IGT apoyan las diferencias entre los sexos. Los resultados son congruentes con las diferencias mostradas por la literatura.

Palabras clave. Moral, juicio, decisiones, utilitarismo, deontológico.

Diferencias nas decisões utilitárias e morais entre homens e mulheres

Resumo

Escopo. Os juízos morais estão baseados em decisões que levam em conta a representação das normas e a lei, os valores, a funcionalidade e a situação concreta. A moral tem se estudado com "dilemas morais hipotéticos" para identificar o tipo de resultado e o processo detrás do razoamento moral. Mas os juízos em si não são suficientes para estabelecer diferencias no tipo de resolução ou a relação com outros processos cognitivos. Por tanto, o escopo de este estudo foi comparar o desempenho em tarefas de maximização da utilidade, controle cognitivo e juízos morais, levando em conta o sexo e outras variáveis sócio demográficas. **Metodologia**. Participaram 73 estudantes universitários (50 mulheres, 20 homens e 3 com sexo não reportado, a idade de média foi de19.3 anos, (*DE* = 1.68 anos). O Iowa Gambling Task (IGT) foi utilizado para identificar comportamentos de maximização da utilidade. Além, o estudo empregou a prova de mudança de tarefa e a aplicação web Máquina Moral. **Resultados**. Foi achada uma diferencia entre as variáveis de IGT, mas não há diferencias na prova de mudança de tarefa. Em quanto ao juízo moral, os homens deram mais valor ao cumprimento de normas que as mulheres. Algumas variáveis da tarefa IGT apoiam as diferencias entre os sexos. **Conclusão**. Os resultados são congruentes com as diferencias mostradas na literatura.

Palavras-chave. Moral, juízos, decisões, utilitarismo, deontológico.

Introduction

Studies about morality initially emerge in philosophy and it has been a field of multiple researchers with methods characteristic of the study of philosophy. There is an intersection with moral psychology and cognitive morality regarding decision making, but psychological perspective is closer to empirical research with humans in evaluation of hypothetical situations and outcomes. In this text, morality is assumed from an evolutionary perspective and more closely related to what is referred to as moral intuition (for more extended comprehension see Álvarez-Díaz, 2015 and Churchland, 2012). Additionally, this view is framed by a theoretical model of five groups of universal moral intuitions proposed by Haidt, 2007. These moral intuitions are harm, fairness, ingroup, authority, purity.

From a psychological view, morality can be seen from different perspectives. First, as a higher order mental process that has the aim of overcoming incorrect maladaptive behavior (Paxton, Ungar, & Greene, 2012), making to use of empathy to others, more than simple impulse control (Miller & Cohen, 2001). Second, as a non-transgression of socially accepted norms; failure to comply could lead to intense feelings of shame and guilt, and could also lead to discrimination (Fontenelle, De Oliveira-Souza, & Moll, 2015; Harris & Corriveau, 2011; Fusaro & Harris, 2008; Harris, 2000) and

third, as a step forward from the pure utilitarian stance proposed by the philosopher John Stuart Mill (1806-1873), who highlighted the usefulness of human decisions for the pragmatic acquisition of a greater good (Patil, Cogoni, Zangrando, Chittaro, & Silani, 2014; Ryan, 2000), towards an intuitive and deontological position, described by Immanuel Kant (1724-1804) who sought the achievement of a greater good to the pragmatic or utilitarian, centered on the respect of universal rights, human obligations and personal duties (Kant, 1990).

Following an evolutionary perspective (Churchland, 2012; de Waal, 2005; 2008; Haidt, 2007) it is clear that there are neuroanatomic, endocrine, genetic and epigenetic neural circuits related with social emotions, which in turn are based on behaviors such as moral decisions, which together with cultural patterns allow the performance of individuals in situations of uncertainty (Bernhard et al., 2016; Pascual, Rodrigues, & Gallardo-Pujol, 2013; Hoffman, 1994). In previous decades, economic, experimental and mathematical explanations of behavior, assumed that an individual only thinks about his own behavior, concerned exclusively with the result of his interactions, without taking into account the complexities given in social relationships where it is possible to negotiate, exercise coercion, weigh benefits, distribute opportunities and voluntarily share with others (Gintins, Bowles, Boyd, & Fehr, 2005).

The distinct nature of the evolution of utilitarian and deontological (e.g., moral) decisions has been confirmed in neuroscientific studies. According to Greene (2009), human moral judgment can be explained by the theory of dual processing of moral judgment, where two interdependent neuronal systems are active, but anatomically separated. Following that theory, the moral judgement is the outcome of a quick distinction of whether a situation requires a strategy of a rational decision of a utilitarian type, or a strategy of a moral decision of the non-utilitarian or deontological type. This is consistent with the distinction made by Kahneman (2003) where he describes the process of making decisions in two systems. First, there is an intuitive system an affective assessment, non-awareness, with value and risk; and second, a deliberate system rational, with utilitarian hope, probabilities of winning and avoiding the risk.

On other hand, from the neuroanatomic point of view, this decision making process requires different abilities of cognitive control (executive functions, operative memory and attentional cost) widely associated with the functioning of dorsal structures in the prefrontal cortex (Miller & Cohen, 2001; Smith & Kosslyn, 2008). These brain areas are closely related with rational, utilitarian decision-making. Bechara et al. (1995) have shown the effects of brain damage on the prefrontal ventromedial structures, leaving the patients making poor decisions and with low-value adaptation in rational, utilitarian decisions, such as the Iowa Gambling Task (Bechara, Damasio, Damasio, & Anderson, 1994). Thus, moral judgments can be assessed from utilitarian decisions and morals from deontological views. Although they are different in nature, both can have links with emotional and affective dimensions (Bonnefon, Shariff, & Rahwan, 2016).

The origin of utilitarian and deontological rationalities found in genetic and cultural co-evolution could explain the existing differences between the actions and the moral feelings of women-female and men-male. Currently, studies have shown that there is a difference in the assessment of individuals according to their sex (Efferson & Glenn, 2018), and this can be explained by evolutionary pressure of species, relating this performance to the activation level of reward circuitry brain structures, both in humans and in others primates (Soutschek et al., 2017; Wilson et al., 2013).

Considering Hamilton's Rule on altruist selection, cooperative behaviors and morals would be selected in groups when their costs are inferior to their benefits. In addition, the closeness of kinship in interactions is important for cost worth, as is exemplified in the following coefficient of the relationship between cost and altruistic benefit by kinship:

$$pb > c$$

Where p is the degree of kinship, b is the benefit obtained and c is the cost given in the altruistic interaction (Reeve & Keller, 1999). Thus, early experiences of parental recognition seem to end up creating differences in moral behavior between sexes, while children learn to expect different altruistic behaviors from their mothers

and their fathers, and therefore, between women and men (Silk, 2005). These conditions of group selection of altruistic behaviors by sex are evolving in humans and primates that share a similar social structure. It should be noted that among mammals, social behaviors of various kinds are presented (Churchland, 2012).

Research in primates (macaques, chimpanzees, bonobos and vervet monkeys) has found a matrilineal line of altruistic obedience and cooperation directed to females, whereas young females cannot use utilitarian strategies against their own mothers (Chapais, 1992). This difference in the social response and functionality within the species (generation of a link between mother-child, for example) allows individuals to make different judgments or behave differently depending on their gender-based parenting. Thus, theories about sexual differences have been raised in the utilitarian and deontological moral decision-making.

Some studies have shown the existence of these differences, for example, findings on a criterion measuring higher altruistic exchange when female-female relationships occur (Solnick, 2001); also, a major frequency of acceptance of altruistic exchanges on the part of females (Eckel & Grossman, 2001). In an ultimatum game in which an offer should divide an amount of cash equitably between himself and others, women tend to offer more equitable distributions than men (Güth, Schmidt, & Sutter, 2007). Finally, it has been found that females tend to return more cash than males in experimental situations (Croson & Buchan, 1999). These results seem to suggest that altruistic behavior of males is more sensitive to contextual factors than for female behavior, possibly due to females feeling more aversion to unfair exchanges (deontologists), while men, base their decisions more on efficiency (utilitarians) if there are no influences given by social norms, altruistic incentives or punishments for selfish behavior (Christov-Moore et al., 2014).

However, studies that focus on sexual differences have used different methodologies, and in addition to not having consistently found neurophysiological and neuroanatomical differences, neither did they find genetic differences, which were the differences referred in experiments and correlational studies (Fine, 2011). As proposed by Christov-Moore et al. (2014) some studies have been show non-consistent with respect to how much men and women cooperate and are altruistic among themselves. The experimental methodologies can be seen as an explanation for this difference between men and women because they combine face to face interaction, in some cases, and strategic interaction with unknown persons in others. Thus, the conditions in the experimental interactions are different and can be related to variability. In addition, other studies have shown cognitive bias based in Likert-type scales, something that seems to confuse the severity of an aversive consequence or a risk of a choice, with the probability estimated of a positive or negative consequence to choice (Harris, Jenkins, & Glaser, 2006).

As mentioned before, the present study asked about the possible differences between utilitarian and deontological decision-making related to sex, with the aim to support a discussion about the existence of evolutionary and psychological reasons that characterize moral and altruistic human behavior. Thus, the interest of the investigation is the interaction in the performance between a utilitarian task (Iowa Gambling Task), a control cognitive task (switching task), and a deontological decisions task (moral machine task).

Method

Participants

Seventy-three healthy college students (50 female, 20 male; 3 genders unknown, M_{age} = 19.53 years, SD_{age} = 1.68 years) were enrolled in the study. Inclusion criteria taken into account were student health, absence of neurological or psychiatric disorders, and voluntary participation. Subjects were from two institutions (public and private) (see table 1). Their participation was anonymous, voluntary and without pay. None of the participants had previous knowledge of the tasks in the study. Recruitment was conducted using a snowball type sampling method. All procedures complied with national and international ethical guidelines for psychological research (American Psychological Association, 2002; Congreso de la República de Colombia , 2006) and were in accordance to the ethical requirements of the latest version of the Helsinki Declaration. All participants signed a written informed consent prior to participation in the study explaining the aim of research, scope,

benefit, duration, researchers responsible of observations and contact information. In addition, before finalizing the data collection, the participant explicitly sent us their data knowing that it would be processed for current research.

Instruments

Utilitarian decisions with the Iowa Gambling Task (IGT).

The IGT was administered in order to assess decision-making under ambiguous conditions. In the current study, we used the IGT understanding utilitarian as the maximization of choice (Hernández, Denburg, & Tranel, 2009; Kornreich et al., 2013). A computer version of the Iowa Gambling Task (IGT) was employed (Bechara et al., 1994). Briefly, the task consisted of 100 trials and in each of these the PD patients could choose one card out of four possible decks (decks A, B, C or D). With each choice, the patient could add or subtract money from an initial amount ($2000) (Gansler, Jerram, Vannorsdall, & Schretlen, 2011). The program of winning or losing was distributed in advantageous decks (C and D decks) associated with smaller wins ($50 per trial) and smaller losses. On the other hand, decks A and B were disadvantageous, characterized by larger wins ($100 per trial) and larger losses (Gescheidt et al., 2012). It was possible to assess the number of choices from the deck. The total score of IGT consists in subtracting the disadvantageous decks from the advantageous ones (CD – AB). But, in addition, some studies suggest analyzing in five blocks of 20 trials each one (trial 1-20 [Block A]; 21-40 [Block B]; 41-60 [Block C]; 61- 80 [Block D] and 81 – 100 [Block E]) (Gansler et al., 2011).

Attentional cost using Switch Costs Task.

The switch cost task was implemented to assess how participants could quickly change between two types of task, each one demanding attention and previous training. Some studies suggest that switching between tasks may reflect the control processes that are engaged when participants needed to attend to two or more instructions (Wylie & Allport, 2000; Rogers & Monsell, 1995). We used the Switch Task similarly to previous studies (Cooper, Garrett, Rennie, & Karayanidis, 2015). Briefly, participants carry out two trials of task A, that consist in matching a letter stimulus with a keyboard, followed by two trials of task B where the participant is trained to find the location and response with a different keyboard; and then back to task A. Hence, a task switch occurs every two trials. The difficulty to switch between tasks is expressed as immediate slow down following a task switch.

All stimuli were presented on a black background and using the task programmed in the website PsyToolkit. Task cues were letters (consonants or vowels) and numbers (for example the combination G 1) and the participant should respond with keys “b” and “n” depending on the location of stimulus. Thus, if the location of the stimulus appeared at top of the screen the correct answer was typing a letter. In addition, at the top of the screen consonants could appear (G, K, M or R) which should be responded with the “b” key, or vowels may appear (A, E, I or U) which should be responded with the “n” key. On the contrary, if the location of the stimulus appeared at the bottom of the screen the correct answer was typing a number. In addition, if the number that appeared was odd (3, 5, 7 or 9) the correct answer was the “b” key and if the number that appeared was even (2, 4, 6 or 8) the correct answer was the “n” key.

Trials were staggered by a 500 milliseconds intertrial interval (ITI) and the task consisted of three blocks. The first: training the relationship location; the second block: training the relationship with cue; and third block: mixed to assess switching task. Each trial started with a task cue and finished when the participant gave an answer. After each response, the participant received a feedback (correct or error).

Deontological moral decisions using Moral Machine Task.

The moral machine is a website application that was designed to analyze the moral performance of participants through hypothetical situations with autonomous vehicles and pedestrians (Bonnefon et al., 2016; Kim et al., 2018). Although the current approach used a website application, this procedure followed the recommendations on moral dilemmas by including the participant in a situation with a finite number of answer options (Christensen & Gomila, 2012), but specifically focused on features of pedestrians preferred by participants.

Briefly, the moral machine consisted of a situation (out of a total of 13) where the participant had two possibilities and must choose one of them, each one having a different ethical outcome. In each scenario or situation, a pedestrian was randomly chosen, pedestrian types ranged from kids or babies to older people, including animals and under different conditions (healthy, overweight, doctors or thieves among others). Likewise, the scenario could vary if the pedestrian follows a rule or not (crossing the street at a red light or during a green traffic light). At the end of thirteen scenarios, the participants saw their general outcomes, which reported the following data, preference by "save more lives", "protect pedestrian", "respect the law" and "do not intervene". Moreover, the preferences across sex (male and female), species (animals or people), age (babies or elder), health (fitness or overweight) and social value (thief or doctor) were measured.

Procedure

The subjects were invited to participate in the study, and all tasks were performed individually on a computer. Initially, a sociodemographic survey was made and after the switch cost task, IGT and moral machine were performed. The time allotted for the application was approximately 30 min.

Data Analysis

Descriptive results are presented as mean (*M*) or median (*Mdn*) ± standard deviation (*SD*) or standard error (*SE*). For each statistical test a *p*-value (two-tailed) < 0.05 was considered significant, except where otherwise stated. Student *t* test and mixed ANOVAs with repeated measures were performed to assess performance across different tasks. The effect size was calculated with *d* Cohen by *t*-test and eta square (η^2) by ANOVA. Spearman correlations were conducted to explore potential associations.

Results

Detailed results of the sociodemographic variables grouped by sex are presented in table 1. For initial analysis, data was taken by combination and then, compared by specific variables such as sex, religious belief and test performance of utilitarian and deontological decision-making.

Table 1
Sociodemographic variables

	Total	Male	Female	Not indicated
Frequency	73	20	50	3
Age *M(SD)*	19.53 (1.68)	20.05 (1.82)	19.28 (1.61)	20.33 (1.15)
Program				
Legal and social sciences	68	18	47	3
Health	2	1	1	-
Basic sciences	1	1	-	-
Other	2	-	2	-
Place of residence				
Boyacá	46	12	34	-
Bogotá	27	8	16	3

Utilitarian decisions with the Iowa Gambling Task

Initially, a separation by sex was carried out to evaluate the decision making in the IGT test. By calculating a student *t*-test, a significant difference was found between men and women in the total net score (t (25.39) = 2.34; $p < 0.05$; $d = 0.68$) showing a large effect size between groups. Likewise, there was a higher score for men ($M = 29.68$; $SEM = 9.74$) than for women ($M = 4.68$; $SEM = 4.31$), suggesting a typical risky profile in men.

In the males performance, cards with the highest profit were chosen more often, even when the

probability of losing large amounts of hypothetical money was greater. This result contrasts with the comparison of response time between different options (total response time, response time for secure options and response time for risky options); that is, although there were no significant differences between total response times and response times of safe cards (cards C and D), men demonstrated a tendency to take risky options (M = 1295.28 milliseconds; SD = 540.26), compared with women (M = 1117.88 milliseconds; SD = 528.1), indicating a certain absence of impulsive decision-making in women.

Regarding tests trials, the amount of hypothetical money obtained was greater for men (M = 2960.52 pesos; SD = 901.32) than for women (M = 2094.79 pesos; SD = 775.77), with a large effect size between both sexes (t (65) = 3.93; $p < 0.001$; d = 1.02). It is worth noting that no male or female participant lost the initial monetary amount in test trials ($ 2000), indicating that both men and women chose good strategies for picking cards. However, cards chosen by men were more effective in gaining money than cards chosen by women.

When analyzing the IGT scores in trials (Gescheidt et al., 2012)dementia, executive dysfunction according to the Tower of London test and the Stroop test, or pathological gambling, participants were found to make random choices at the beginning of the tasks (block A). A finding similar to the responses of participants in other studies (Gescheidt et al., 2013; Kobayakawa, Tsuruya, & Kawamura, 2010; León, Martínez, Cruz, & Hernández, 2011). This in as much as the scores obtained were close to zero in differences between decks of cards (CD - AB), suggesting that choices made by participants followed random patterns, in an effort to find an optimal strategy.

Also, an analysis of variance was performed through an ANOVA of repeated measures with blocks of choices (1 to 5) as a within-subject factor. Sex was analyzed as a factor between subjects given a frequency of choice. However, the differences between choices that were illustrated by gender were not significant, nor did they have an effect on participants' total scores ($F_{(4, 268)} = 0.14$; $p = 0.966$), So, no interaction between decks sex was found ($F_{(8, 260)} = 0.51$; $p = 0.852$).

Likewise, no difference was found between participants' scores of choice (total and by series) and their religious beliefs (atheist or believer). Finally, the IGT test was used to characterize participants' choice in two possible outcomes: first, the risky decision (with frequent choice of cards with greater profit but also with greater loss (decks A and B); and second, the cautious decision, typical of the participants who frequently presented choices of cards with lower loss, but also with lower profit (cards C and D) (figure 1).

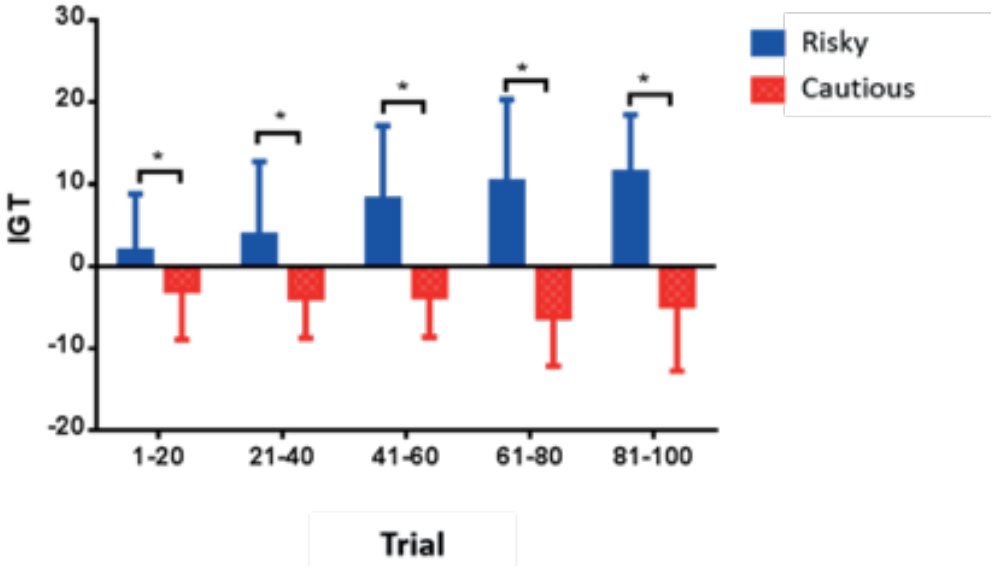

Figure 1. IGT scores during the performance of five (5) blocks. * $p < 0.05$

When performing an analysis of variance by mixed ANOVA, between-subject performance was taken as the total score (> 1 = "cautious" or < 1 = "risky") and as a within-subject factor, each of the blocks of cards to choose from in the trials was considered, finding a significant difference in terms of the classification factor ($F(2, 67) = 39.65$; $p < 0.001$; $\eta^2 = 1.18$).

On the other hand, no difference was observed in the comparison between the different test blocks ($F(4, 268) = 1.21$; $p = 0.303$), although a difference in the interaction between blocks classification was found, with a small effect size ($F(8, 268) = 8.42$; $p < 0.001$; $\eta^2 = 0.25$). These facts support the idea of differential performance among the subjects of each group. Thus, differences were found between net scores for each block, supporting the differences attributable to "risky" and "cautious" profiles of decisions.

As for other variables, there were no significant differences between the total response times of participants, nor between the response times to the risky decks (A and B) and the cautious ones (C and D). However, there was a significant statistical difference between the election profiles of the participants ($t(64) = 6.84$; $p < 0.001$; $d = 1.71$) the performance of the "cautious" profiles presenting a greater profit ($M = 2901.4$; $SD = 851.51$) compared to the 'risky' profiles ($M = 1603.1$; $SD = 671.89$) who ended up losing money below the initial $2000.

Attentional cost using Switch Costs Task

Descriptive results of the attentional change task are presented in table 2. Men and women's scores from the attentional change task were compared, and only differences were found in the Mixed block Switch Error Rate task ($U = 327$, $Z = -2.29$, $p = 0.022$). Among the other variables, there were no differences.

When comparing subjects who were classified as risky or cautious, there were only differences in performance with the Mixed block repeat speed task ($U = 389$, $Z = -1.98$, $p = 0.047$) (table 2). Following the comparison between atheist and believers, no differences were found in any of the variables of this attentional task ($p > 0.05$). When trying to correlate the scores of this test and the IGT scores, no significant relationships were found between the scores of both tests.

Table 2
Results of Switch Cost Task

	Total		Cautious		Risky			
	M (*n* = 66)	*S*D	*M* (*n* = 34)	*SD*	*M* (*n* = 32)	*SD*	*U* (Z)	*p*
Pure blocks speed	838.16	170.61	801.04	117.42	834.20	127.63	478 (-0.847)	0.39
Pure block error rate	5.30	6.98	3.88	3.78	5.16	5.09	436 (-1.39)	0.16
Mixed block switch speed	1608.04	324.79	1582.58	277.25	1625.50	319.85	482 (-0.795)	0.42
Mixed block repeat speed	1153.91	338.83	1067.38	242.75	1201.08	298.74	389 (-1.98)	0.04*
Mixed block repeat error rate	5	8.57	3.97	6.93	6.56	10.42	507 (-0.522)	0.60
Mixed block switch error rate	11.02	11.08	8.97	9.59	13.59	12.65	423 (-1.57)	0.11

Deontological moral decisions using Moral Machine Task

The scores of moral decisions were analyzed according to previous division. This is because one of the objectives of the study was to evaluate moral decision-making, so the nine variables reported by the Moral Machine website were analyzed.

Thus, a scale was created with values between -7 (*does not matter*) to 7 (*it matters a lot*) to locate the responses of the subjects in the variables "save more lives", "protect passengers", "respect the law" and "do not intervene." Similarly, the preference was reported according to the subjects' choice between the variables of "preference by gender" (male or female), "preference by species" (human or animal), "preference for age" (elderly or baby), "preference for being fit" (large people or people in shape) and "preference for social value" (lower value and greater social value) (table 3).

Table 3
Results of Moral Machine

	Save more lives (*n* = 72)		Protect passengers (*n* = 72)		Respect the law (*n* = 72)		Do not intervene (*n* = 72)	
Mdn	7		-1		2		0.5	
Type of behavior	Cautious	Risky	Cautious	Risky	Cautious	Risky	Cautious	Risky
Mdn (*SD*)	7 (2.64)	7 (3.45)	-1 (3.65)	-1.25 (3.02)	3 (3.04)	1.25 (3.35)	0.5 (2.01)	0.5 (2.53)
Sex	Male	Female	Male	Female	Male	Female	Male	Female
Mdn (*SD*)	7 (2.75)	7 (3.18)	-1.25 (3.98)	-1 (3.18)	3.5 (2.49)	2 (3.41)	0.5 (1.91)	0.5 (2.31)

Choice	Preference for gender		Preference for Species		Preference for Age		Preference for Fitness		Preference for Social Value	
Mdn	2		-7		-3		0		-7	
Type of behavior	Cautious	Risky	Cautious	Risky	Cautious	Risky	Cautious	Risky	Cautious	Risky
Mdn (*SD*)	3.5 (3.59)	1.5 (4.32)	-7 (5.46)	-7 (4.97)	-7 (4.59)	-2 (4.13)	0 (5.01)	0 (5.63)	-7 (4.98)	-2 (5.87)
Sex	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
Mdn (*SD*)	1.75 (3.72)	2.75 (4.37)	-7 (6.09)	-7 (4.92)	-2.25 (5.09)	-5.25 (4.13)	-7 (5.31)	0 (5.18)	-7 (5.39)	-7 (5.63)

Note. Although the measurement of these variables was done with the scale from -7 to 7, the extreme values of the variables were: preference for gender (-7 = male; 7 = female), preference for the species (-7 = humans; 7 = animals), preference for age (-7 = babies; 7 = elder), preference for being fit (-7 = fitness; 7 = heavy people) and preference for social value (-7 = greater social value; 7 = lower social value).

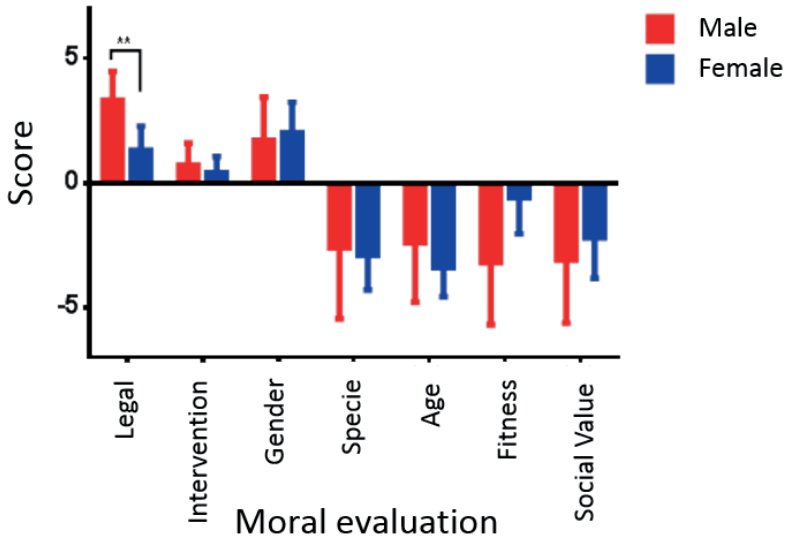

Figure 2. Performance in moral decisions between male and female. ** $p < 0.05$

When grouping the IGT scores and comparing the groups (cautious and risky) in the morality tests using the Mann-Whitney *U* test, no differences were found between the individuals in any of the variables of moral behaviors ($p < 0.05$s). Nor were differences found in the comparison for the same test between people calling themselves "atheists" and those self-styled "believers". However, when the comparison was made by sex, a difference was found between men and women for the variable of "importance for respecting the law" ($U = 332.5$, $Z = -2.09$, $p = 0.036$), presenting a median of greater importance for men ($Mdn = 3.5$, $SD = 2.49$) compared to women ($Mdn = 2$, $SD = 3.41$) (figure 2). Thus, the homogeneity of the scores in the case of men could show a trait of social desirability dependent on sex (figure 3).

Figure 3. Correlation between age and Mistakes.

Discussion

The main goal of the study was to compare the performance in tasks with a utilitarian component, considering cognitive and deontological control according to sex, as a way to establish possible differences around decision-making at different levels. Results showed differences between the utilitarian choices of men and women in a similar way to those found in studies in which men tend to present more predilection for risky alternatives (Hillier & Morrongiello, 1998). On other hand, other studies have found that men and women have ambiguous choice contexts and high risk (Derevensky & Gupta, 2006), presenting in turn a greater confidence in situations of potential risk (Pulford & Colman, 1997). Likewise, results are in line with those reported in meta-analysis done by Charness & Gneezy (2012), showing that men have lower risk aversion than women.

Furthermore, results showed less attention to risky options in the Iowa test completed by women, something consistent with other studies: given a greater risk aversion in the behavior of choice (Byrnes, Miller, & Schafer, 1999), as well as a greater aversion to ambiguous decisions (Schubert, Gysler, Brown, & Brachinger, 2000).

Also, greater female sensitivity to pressures for money has been documented (Paserman, 2007); in addition, Loewenstein, Weber, Hsee, & Welch (2001) indicate the possibility that risky utilitarian decisions may generate different responses between both sexes. Similarly, it has been found that women take risks more seriously than men, since men tend to seek risks in their decisions in greater proportion; it is easier to persuade them to make decisions with high ambiguity. Harris et al. (2006) found important differences in the utilitarian decision making given between men and women, with respect to behaviors such as betting, engaging in high-risk behaviors and estimating in different ways the probability of negative consequences with respect to interacting with other people, engaging in risky acts, expecting negative consequences and enjoying these experiences.

While in the present study men presented better choice strategies, even in situations of risk, both women and men showed optimal gains in the Iowa test. However, no differences were found between men and women with respect to preferences for blocks of choice in the test. Be that as it may, there is a tendency for men to be more willing to learn the unpredictable pattern of losses generated by the IGT test.

With respect to the attentional cost tests, only differences by sex were found in the execution of the sub-tests that presented uncertainty conditions to change attentional expenditure and cognitive control, such as the sub-test Mixed block switch error rate and the Mixed block repeated speed subtest (Cooper et al., 2015). These results confirm those who found differences between the sexes with respect to the preference for tasks involving choices under ambiguous conditions, although in the study the relationships between performance in the Iowa task and the attentional cost tests were inconclusive. Thus, results of the present study do not present differences in cognitive control attributable to sex,

as has been the case raised by Miller & Halpern (2014), about how inconclusive studies have been about cognitive differences in attention and memory, attributable to sex and hormonal influence.

With respect to evidence of moral decisions, only differences by sex were found with respect to the "importance of respecting the law" condition, that being a moral norm that was observed to be of greater relevance for men. Deontological decisions for the most part, did not allow verification of expected differences, according to which men could have presented less moral inclination toward altruistic and cooperative behaviors, in comparison to women. Moral imperatives on life, respect for others, and respect for the other sex did not show any difference between the sex of participants. Reasons for a greater male preference for the law could be explained by a greater predisposition on the part of men to give value to moral and altruistic behaviors as long as they are prescribed by a social norm or other additional factors (Christov-Moore et al., 2014). This is what Elster (1989) considered as the tendency given in a social context to give permission for social norms to prevail over self-interest, changing the judgment and evaluation given on how much an individual loses by breaking the rule.

A dual theory about moral judgment remains relevant, even though in the present study not all the differences and distinctions considered initially were shown. A difference between sexes was presented in utilitarian decisions. As the dual model of the Moral Judgment of Greene (2009) proposes a quick distinction on a dilemmatic situation, part of the cerebral cortex quickly proposes a utilitarian solution that can be optimal, with the appropriate affective and emotional attitudes, something demonstrated in the present study to a greater extent in men. According to Greene (2009), this distinction would be mediated initially by the activity of the anterior cingulate cortex. And to activate the utilitarian decision, the dorsolateral prefrontal cerebral cortex and the inferior parietal lobe would be involved. The neuroanatomy of utilitarian decisions is supported in several studies (Anderson, Bechara, Damasio, Tranel, & Damasio, 1999; Breiter, Aharon, Kahneman, Dale, & Shizgal, 2001; Grattan & Eslinger, 1992; Heekeren et al., 2005; Kim & Shadlen, 1999; Salzman, Britten, & Newsome, 1990).

In turn, the activation of deontological moral reasoning would involve, to a greater extent, the functioning of the medial prefrontal cerebral cortex, the posterior cingulate cortex, and the temporo-parietal cerebral intersection, findings that are also supported by a variety of neurophysiological studies (Beer, Heerey, Keltner, Scabini, & Knight, 2003; Blair, 1995; Greene, 2009; Greene, Nystrom, Engell, Darley, & Cohen, 2004; Greene, Sommerville, Nystrom, Darley, & Cohen, 2001; Kedia, Berthoz, Wessa, Hilton, & Martinot, 2008; Peng, Jiao, Cui, Chen, & Li, 2017; Robertson et al., 2007; Schaich-Borg, Hynes, Van Horn, Grafton, & Sinnott-Armstrong, 2006; Schaich-Borg, Lieberman, & Kiehl, 2008; Yang, Raine, Narr, Lencz, & Toga, 2006; Young, Cushman, Hauser, & Saxe, 2007; Young & Saxe, 2008).

Thus, the utilitarian reasoning would be similar to the system of deliberate thinking proposed by Kahneman (2012), as the one who decides based on estimated and weighted probabilities, hoping to obtain a marginal individual gain in the decision. Deontological moral reasoning would consist of the intuitive system of thought also proposed by Kahneman, which seems to make possible the social and affective heuristics that enable altruistic and cooperative behaviors automatically, while inhibiting deliberate decisions for such a case. This deontological moral reasoning could be what Kitcher (2010) called psychological altruism, given in adopting psychological attitudes centered not on the subjective personal perception, but on the perceptions, interests and actions of the other.

In future research, the robust measurement of deontological moral behaviors will be considered according to methodologies evincing the current social norms for the participants, as well as possible experiments of interaction between the decisions of such participants. This, in as much as the test of moral decisions used here, could be only tangentially linked to the deontological judgments of the participants. A potential limitation of the current study was not having a comparison with moral dilemmas traditionally used in moral decisions (Christensen & Gomila, 2012). However, it is noteworthy that the studies in moral judgments that have been carried out in recent years make use of technology, like virtual reality and hypothetical situations, taking into account additional variables to the known intentions of participants (Caruana,

Spirou, & Brock, 2017; Kim et al., 2018; Patil, Calò, Fornasier, Cushman, & Silani, 2017; Patil et al., 2016; Sütfeld, Gast, König, & Pipa, 2017).

These modifications may not necessarily separate the process fundamental to the moral decisions made based on situational dilemmas, as previously proposed, but it is important to standardize the methods used to favor the validations of outcomes. This suggests that research in the field of morality should use these types of tools to explore the moral judgment of individuals with instruments of high ecological validity, in order to overcome some of the biases found in moral judgment measurement (Bocian & Wojciszke, 2014). Recently, some studies have come out showing the functionality of the moral machine as a instrument to assess preferences by people through moral situations (Awad et al., 2018; Maxmen, 2018).

In conclusion, in this study a difference was found regarding the assessment of norms by men and women through a situation of moral judgments. However, no difference was found in tasks of utility and executive control related with moral reasons, nor was a difference found in terms of variables such as religious beliefs. Results are consistent with a wide range of studies that evaluate the performance of the subjects taking into account sex, considering a combination between functionalist, anatomical and evolutionary points of view of moral psychology.

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