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The Neural Mechanisms of Utility and Ethic in the Management Moral Decision Making

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Abstract

The study aimed at investigating the neural mechanism of business moral decision-making. 15 participants were presented with a set of 96 dilemmas in business situation. Participants were required to decide between option 1 (more utilitarian decision for self benefit) and 2 (ethical decision for fairness or institution). ERPs were recorded to a slide displaying the letter 1 and 2 when subjects were deciding between options. The selection rate was calculated after the experiment as the behavior data. The business moral dilemmas prompted more ethical option. A larger P260 component was elicited in the left frontal lobe area when participants were deciding to act ethically. On the other hand, decisions on utilitarian aroused weaker emotional experience, as supported by the shorter LPC and smaller P260 amplitude.

Keywords

Management, Moral Decision Making, Event-Related Potentials, Nerve

1. Introduction

Business moral dilemma involves a conflict in choosing between to undesirable options. The empirical researches were seldom and the studies of its neuroscience mechanism were even less. In the business situation, managers always encounter the dilemma of money and the ethic. How do they make the choices between utility and ethic? What is the potential psychological mechanism? Is the managerial dilemma different from the traditional moral dilemma and what factors need to be taken into consideration during the decision making process.

The emergence of psychology boosted the moral reasoning researches. Jean Piaget suggested that the moral sense development of children contains three stages [1]. Kohlberg constructed the cognitive development theory of moral judgment through researches of moral dilemmas. His theory indicated that the cores of moral decision

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making include abstract reasoning capability and higher cognitive processing.

Moral decision making was a rational thinking processing. Fishbein and Ajzen (1975) suggested that individuals will analyze the available information rationally in order to make a decision that consistent with the moral standards. However, not all moral decisions can be controlled rationally. Many scholars try to use the normal moral decision making models and theories to explain the management moral decision making. Such as the Theory of Planned Behavior from Ajzen (1991) and the Moral Integration Model from Dubinsky and Loken (1989). But all the models were hypothesized that people can think rationally.

Haidt (2001) published an article "The emotional dog and its rational tail: A social intuition is approach to moral judgment" in the Psychology Review [2]. The paper demonstrated that people making moral decision frequently and doubtless without naming a reason. This ethical judgment did not need precise deduction and reasoning. Haidt suggested that moral decision is driven by intuition processing based on emotion. He used the Social Intuitionist Model (SIM) to describe moral decision-making as an unconscious, fast and automatic process. Greene (2001) has suggested a dual process theory. This dual process theory has been supported by functional magnetic resonance imaging (fMRI) data of people's moral decision-making when they encountered the trolley dilemma and footbridge dilemma [3]-[5]. The fMRI data indicated that people spend more time on utilitarian decision making in the dilemma. There is activation of the dorsolateral prefrontal cortex (DLPFC) which are responsible for cognitive processing and decision making. The non-utilitarian decision making required greater amount of time and psychological resources. Higher brain region, such as the ventromedial prefrontal cortex (VMPFC) [6]-[13], gyrus temporalis superior, amygdale, and limbic system were activated during the non-utilitarian decision-making [14] [15]. But the validity of the above result was challenged by McGuirea who found out that the item discrimination of moral dilemma materials was not outstanding. At the same time, the time resolution of fMRI limits its application in researching the temporal dynamics of moral decision making [14]. For the sake of tackling this problem, Sarlo (2012) modified the previous materials and paradigm of fMRI and used the ERPs technology to analyze the ethical decision making process [16]. The empirical research of management moral decision making was not enough, and the experiment based on the neuroscience technology even less. Since the neuroscience technology can demonstrate the brain mechanism of moral decision making more directly and precisely. It also can be applied to the further management moral decision making process research. After redesigning and assessing the business moral dilemma materials, this experiment investigated the neural mechanism of business moral decision making by presenting participants the binary business moral dilemmas.

2. Methods

2.1. Subjects

Seventeen informed and consenting healthy subjects (8 males, 9 females) were recruited at Management School of Jinan University. Participants were aged 22 - 27, (M = 24.5, SD = 1.24). All right-handed, had normal or corrected-to normal vision, and had no history of CNS disease and similar experience of ERPs experiment. They were paid 50 RMB for their participation.

2.2. Material

We developed 96 experimental dilemmas based on previous business moral decision making studies [11]. The managerial moral dilemma materials were classified into ethical decision and utilitarian decision according to the subjects' reaction. For example" You are the sale manager of the TDT company. You and your college are competing for a project by masterminding a business activity. One day you saw your college's proposal in the desk and there were no one else in the office. Will you plagiarize the file and adapt your own plan? There are two options: 1 represents YES and 2 represents NO. If subject selected option 1, means he made the ethical decision. If he selected option 2, means he made the utilitarian decision. All the materials were standardized and the letters were limited in 69 ± 4 characters, represented.

2.3. Procedure

Each participant was seated comfortably at a distance of 80 cm from a computer monitor in a sound-attenuating chamber. Participant adjust the horizontal angle to 1.5˚ and vertical angle to 1.5˚. The experiment begins with a

warm tip: "Welcome participating in managerial moral decision making experiment. During the experiment you may encounter some business dilemmas. Please make your choice". Experiment was divided into exercises and formal experimental section. The trail was presented to the subject randomly. Every 30 trails the participator can have a rest.

Each trial begins with a fixation cross showing for 2000 ms, followed by a blank screen for 600 - 800 ms. Then the managerial moral dilemma will be presented in the screen. Subjects can read on their own pace and press any button to skip to the screen representing the binary decision. Subjects were instructed to press one button using their right index finger. Button 1 represents YES, and button 2 represents NO. After the decision making, the next trail will begin. The experiment process was controlled by the program edited through E-prime 2.0. All EEG data was recorded by computer automatically, experiment program as depicted in **Figure 1**.

2.4. Data Recording and Analysis

EEG data were recorded by a Neuroscan 64-channel device (SynAmps2, Neuroscan, El Paso, TX, USA) with both left and right mastoids as reference and a bandpass filtered at 0.05 - 100 Hz. Four additional bipolar electrodes were used to record electro-oculograms (EOGs). The HEOG was recorded by placing two electrodes at the outer canthi of both eyes, and the VEOG was recorded by placing two electrodes in the superior and inferior areas of both eyes. EEG and EOG were continuously recorded at a sampling rate of 500 Hz. Electrode impedances were kept below 5 KΩ. Offline analysis the data and calibrate the ocular artifact. The low wave bandpass filtered at 20 Hz and exclude the amplitude EEG data more than ± 80 μV.

The experiment was divided according to the present of stimulus. Time course from 200ms pre-stimulus to 600 ms post-stimulus were analyzed.

The valence effect was analyzed by a repeated-measures ANOVA with decision (ethical, utilitarian), visual regions (left frontal lobe, right frontal lobe, left parietal lobe, and right parietal lobe).

Since little components were discovered in several moral decision making studies. As Greene and Haidt (2001) indicated that the moral decision making will activated several brain regions. Mean amplitudes at 12 midline and medial-lateral electrodes were averaged for four regions: left frontal lobe (F1, F3, F5), right frontal lobe (F2, F4, F6, left parietal lobe (C1, C3, C5), and right parietal lobe (C2, C4, C6). The decision making will activate the P3, N4 components. The P3 is positively correlated to the use of degree of psychological resource to some extent. The subject thought in more cognitively, the more positive on going wave would be elicited. In addition, The P260 is related to the negative emotion processing. All statistics was analyzed through PASW19.0 (IBM).

3. Result and Analysis

3.1. Behavioral Findings

Two participants were excluded from the behavioral analysis as they made mote than 80 ethical choices out of 96 moral dilemmas. There are 34 ± 2.4 utilitarian decisions and 67 ± 3.2 ethical decisions on average. Post hoc contrasts confirmed that subjects tend to make ethical decision compared to utilitarian decision ($F(1,79) = 5.42$, $P < 0.05$) under the business moral dilemma.

3.2. ERPs Findings

- P260

The analysis of ERPs mean amplitudes demonstrates a positive component 260 ms post-stimulias shown in **Figure 2**. The frontal lobe and parietal lobe region showed more positive going wave. Post hoc contrasts the P260 mean amplitudes of these regions under ethical decision-making and utilitarian decision making. The mean

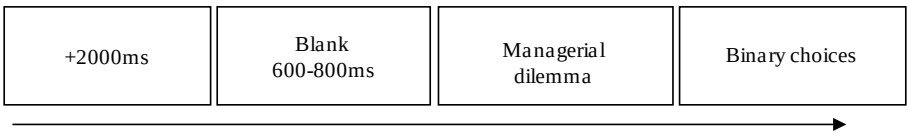

Figure 1. Management moral decision-making experiment program.

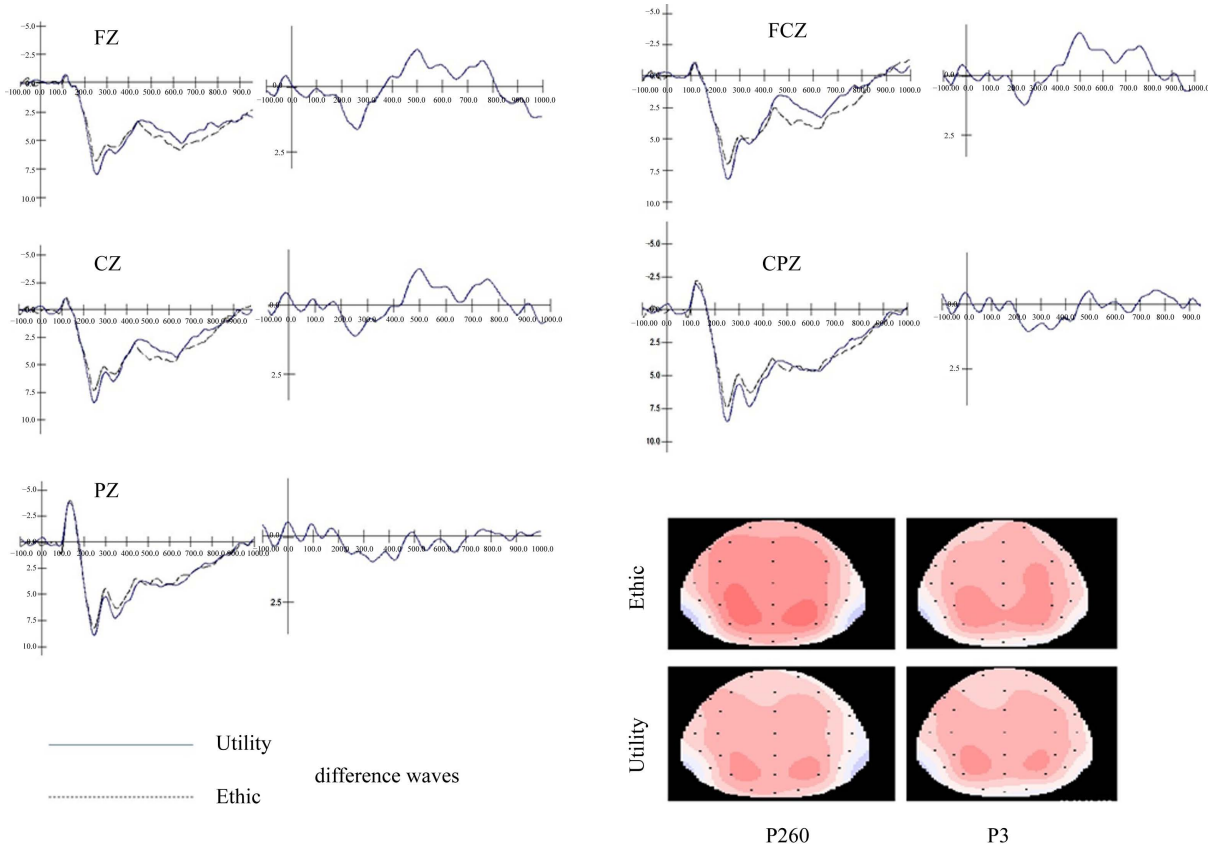

Figure 2. Grand average ERPs and EEG mapping at Fz, Cz, Pz, FCz, CPz for Utility and Ethic.

amplitudes of left frontal lobe (F1, F3, F5), right frontal lobe (F2, F4, F6, left parietal lobe (C1, C3, C5), and right parietal lobe (C2, C4, C6) were compared through repeated-measures ANOVA. The analysis suggested that the main effect of decision types is significant ($F(1,14) = 155.87$, $P < 0.000$), but this effect was not confirmed for brain regions ($F(3,42) = 41.153$, $P = 0.053$). In addition, there was an interaction between decision type and brain regions. The amplitude of P260 inutilitarian decision making (25.29 ± 0.59 μV) and ethical decision making (31.749 ± 0.56 μV) show obvious difference by the simple effect analysis. The P260 mean amplitudes of the four brain region in utilitarian decision making are less than that of ethical decision making ($F(1,14) = 11.53$, $P = 0.004$; $F(1,14) = 69.06$, $P = 0.000$; $F(1,14) = 75.10$, $P = 0.000$).

Post hoc contrasts confirmed that the latency of P260 in utilitarian decision making ((259.70 ± 1.56 ms) is shorter than that of ethical decision making (278.93 ± 2.32 ms) through the repeated-measures ANOVA ($F(1,14) = 46.130$, $P < 0.000$).

- The analysis of LPC

Figure 2 shows that between 100 - 1000 ms of brain waves. In the time windows between 300 - 350 ms the main effect of decision type ($F(1,15) = 0.99$, $P = 0.340$) was not significant. On the contrary, the main effect of electrode was significant ($F(1,14) = 42.77$, $P < 0.000$). So as the interaction effect between decision type and electrode ($F(3,42) = 143.667$, $P < 0.000$). Post hoc simple effect analysis confirmed that mean amplitude in left frontal lobe show significant difference between utilitarian decision making and ethical decision making.

In the time windows between 350 - 400 ms the main effect of decision type ($F(1,14) = 1.141$, $P = 0.306$) was not significant. However, the main effect of electrode was significant ($F(1,14) = 28.179$, $P < 0.000$). So as the interaction effect between decision type and electrode ($F(3,42) = 155.056$, $P < 0.000$). Post hoc simple effect analysis confirmed that mean amplitude in left frontal lobe show significant difference between utilitarian decision making and ethical decision making.

In the time windows between 400 - 600 ms the main effect of decision type was not significant ($F(1,14) = 1.789$, $P = 0.206$) through repeated-measures ANOVA. On the contrary, the main effect of electrode was signif-

icant ($F(1,14) = 148.929$, $P < 0.000$). So as the interaction effect between decision type and electrode ($F(3,42) = 166.657$, $P < 0.000$). Post hoc simple effect analysis confirmed that mean amplitude in left frontal lobe and right parietal lobe show significant difference between utilitarian decision making and ethical decision making.

4. Discussion

The social intuition model (SIM) describes the moral decision making as a fast, unconscious, automatically and serial processing. Decision making firstly activates the intuition processing system, followed by the cognition processing system. People prefer ethical option when the emotion is activated as the intuition is the majority factor in the serial processing. On the contrary, the utilitarian decision which requires both intuition processing and the cognition processing need more psychological sources. Thus it is much more complicated and time consuming [2]. However, the analysis of ERPs data disapproved the above conclusions. When people make ethical decision, the VMPFC and ACC are activated, eliciting greater P260 amplitude. The time course of ethical decision making is longer than that of making utilitarian decision. In addition, less activated brain region and amplitude were recorded in the utilitarian decision making. Thus, the moral decision making is not belong to the serial processing. In another word, the SIM can not explain the neural mechanism of moral decision making.

The dual process theory postulates that moral judgments are controlled by two competing processing systems: a slow, rational processing system based on cognition, favoring utilitarian judgments, and a fast, automatic intuition processing system based on emotion, driving non-utilitarian judgments. The utilitarian decision making requires greater amounts of attentional resources and reaction time [2]. However, the latency of P260 elicited by utilitarian decision making is shorter compared to the ethical decision making.

These findings may contributed by: a) The disadvantage of low time resolution limits the fMRI to analyze the time course of moral decision making precisely. b) Compared to managerial moral dilemma, the extreme moral dilemma presented by Greene will arouse stronger emotion which restraint the cognitive processing in moral decision making. c) The “moral struggle” caused by strong negative emotion that influence the P260 amplitude may be the reason why the latency is delayed.

The analysis of LPC yielded further relevant information on difference between ethical decision making and utilitarian decision making. Frontal lobe is the brain region responsible for higher cognition processing [17]. Left frontal lobe is activated in a large scale and elicits a greater amplitude P260 component, indicating that the negative emotion improve the ethical decision making.

This study provided new insights into the neural mechanism of business moral decision making through the analysis of ERPs technology. The time course of neuro activation was recorded in response to a set of well-designed business dilemma. As expected, participants tended to make ethical decision through the behavior analysis. Accordingly, in line with what has been previous reported (Sarlo, 2012), moral decision making is influenced by emotion which is fit for the dual processing theory. The brain processing mechanism of ethical decision making is more complicate, evolving stronger emotional experiences compared to utilitarian decision making. Eliciting participants’ emotion can super them to do the ethical emotion.

Some limitations of this study are worth mentioning. First, the competitive relation between intuition system and cognition system is lack of relevant evidence. The further study in emotional cognitive-emotional processes, involving emotion elicitation, attentional requirement, and working memory load might be the inspiration. In addition, the participants consisted of university students from business school may influence the ecological validity. At last there still several variables of business moral decision making need further research.

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