

# Abnormal social interactive behavior in major depressive disorder

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## Background:

Main depressive disorder (MDD) is characterized by a determined and overwhelming feeling of sadness. Emotional process, including emotional reaction and feeling states, are a significant factor with a major impact on decision making. Previous studies have found that the abnormal feeling state in patients with MDD may bias their decision-making behaviors, as evidenced from altered sensitivity to reward and punishment, reduced experiences of regret, and poor decision performance. In spite of these significant findings in MDD, all these studies have investigated people in non-social interaction contexts, in which actions only have consequences for the self-interests of the participants. However, many real-life decision harms involve social exchanges with other individuals and a firm division of economic outcomes among them. The power of the depressive state on real-life economic decisions has rarely been studied in a social interaction context. Considering that MDD affects up to 20% of the worldwide population, the manipulation of the depressive state on social-economic decisions is an important research question. Ecologically valid social decision-making paradigms such as the ultimatum game (UG) may help identify suboptimal choices associated with MDD and, thus, may provide a potential bridge for translation research in MDD. The UG is a normally used paradigm to study the process of decision-making in a social interaction context. In the UG, a proposer suggests a way to divide a fixed sum of money. The responder has to accept or reject the proposal.

## Methods:

**Ethics statement** This study was approved by both the Institutional Review Board of the Institute of Psychology, Chinese Academy of Sciences, and the Medical Research Ethics Committee of the Second Xiangya Hospital. All participants gave written informed consent.

## Procedures:

Previous studies have shown that patients with MDD have impaired cognitive function, although the conclusions are inconsistent. The Digit Symbol and Information subtests of the Wechsler Adult Intelligence Scale-Chinese Revision (WAIS-RC) were used. The Digit Symbol subtest requires that subjects write down symbols that correspond with figures one to nine in 90 seconds, which reflects a person's memory and speed of processing. The Information subtest requires participants to answer some common questions, which reflects a person's range of general information. A like cognitive estimation was performed in a previous study. The participants first received instructions explaining the rules of the game, and each participant was required to complete a series of test questions after reading the instructions to verify their comprehension. In the formal experiment, the participants acted as responders in a series of trials of the UG, during which they might play with a computer or with a person. Each trial had 5 phases. The participants were informed that proposals from real persons had been submitted by previous participants and that in each trial their partners would be different (a one-shot game). They were also told that the proposals from the computer were randomly

generated. In reality, the entire offer was pre-set by the experimenter. In addition, they were told that we would also submit their proposals after the experiment and that their proposals might be adopted in future plays of the game. In reality, the participants' proposals were not used beyond their function as a cover story. Moreover, to avoid uncontrolled associations, the human proposers were represented by alphanumeric codes, not by their pictures or by real names.

## Conclusions:

In summary, our findings provide further evidence supporting the role of emotion in decision making. More importantly, our findings show that depressed patients show altered decision-making behavior in social interaction contexts. Our findings also designate an authority of clinical symptoms on everyday decision making in MDD patients, an issue that has been neglected but is obviously important to their lives. Future studies should additionally examine the possible mechanisms, such as perception of fairness and the neurobiological basis, behind patients' impaired social decision making. While it remains to be seen whether these abnormal decision characteristics can be validated in large independent studies, the preliminary findings reported here suggest the possibility that abnormality in the social decision making procedure could be a potential marker for MDD diagnosis and prognosis.