# Money Talks: Neural Substrate of Modulation of Fairness by Monetary Incentives

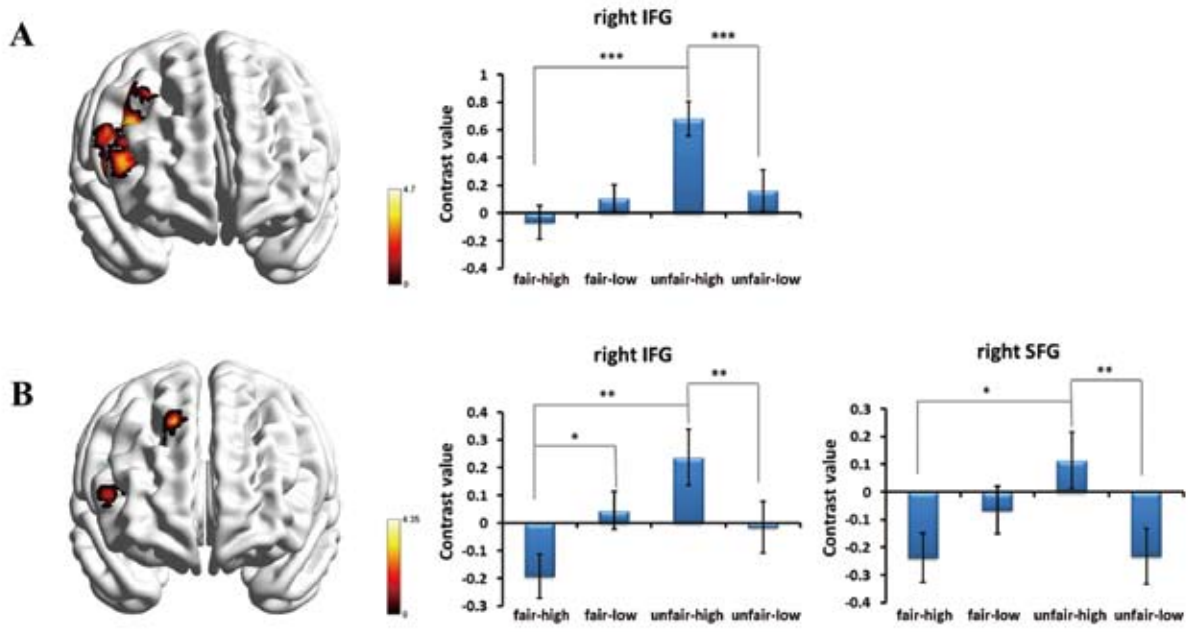
A unique feature of human beings is their compliance with social norms, even though this normative decision often means curbing self-interest. However, money talks sometimes. In other words, once in a while people prefer to pursue wealth at the cost of moral goodness. How human beings make a normative decision when facing a large monetary temptation within a social interaction context is an interesting question.

Using the ultimatum game (UG) previous behavioral studies showed deviations from the fairness-related normative decision as a result of high monetary incentives. At high stakes, responders tend to reduce the threshold below which they reject proposals. However, the neural substrate underlying this deviation from the fairness-related normative choice when facing a high monetary temptation in the UG is still to be determined.

Prof. LI Shu, Dr. ZHOU Yuan and their coworkers from the Institute of Psychology, Chinese Academy of Sciences have conducted an fMRI study using a revised UG paradigm in which fairness and a proposed monetary amount were orthogonally varied. Researchers collected both behavioral and fMRI data of 28 healthy subjects. During the scanning, the participants acted as responders in a series of rounds of the UG, during which they might play with a computer or with a person.

At the behavioral level, they found that the magnitude of the stake size significantly modulated the rejection rates. Specifically, the rejection rates for unfair proposals with a high stake size were significantly lower than those for unfair proposals with a low stake size, a finding that was

Fig. 1. Prefrontal cortices influenced by the interaction between fairness and stake size and simple effects of the interaction effects in (A) all the proposal conditions and (B) the human proposal condition. Abbreviations: IFG: inferior frontal gyrus; SFG: superior frontal gyrus. *p<0.05, **p<0.01, ***p<0.001.



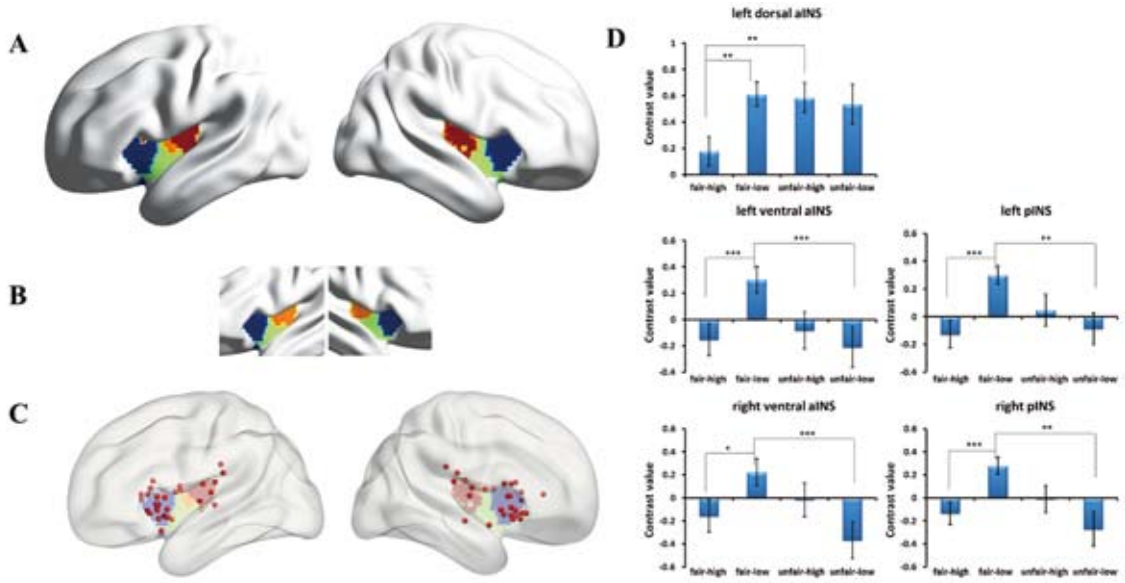



Fig. 2. Insular subregions influenced by the interaction of fairness and stake size for all the proposals. (A) Insular subregions intersected by Kelly's template. (B) Kelly's insular subregions template (k = 3 solutions). (C) Locations of the reported insular clusters on Kelly's template. (D) Simple effects of the modulation of fairness by stake size in insular subregions. Abbreviations: aINS: anterior insula; pINS: posterior insula. *p<0.05, **p<0.01, ***p<0.001.

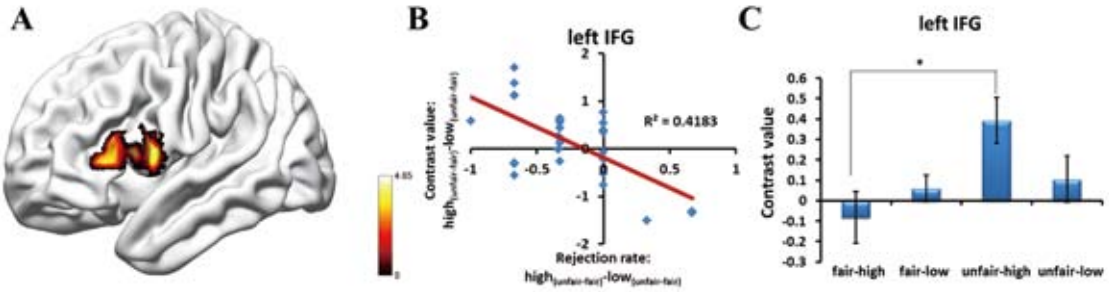



Fig. 3. (A) Left IFG (B) Significant negative correlation was found in the left IFG between the bold signal of the [$high_{(unfair-fair)}$ − $low_{(unfair-fair)}$] contrast and the rejection rate of the [$high_{(unfair-fair)}$ − $low_{(unfair-fair)}$] proposals. (C) Significant interaction effect of fairness*stake size was found in the left IFG for participants who deviated from the fairness norm. *p<0.05.a

consistent with previous reports.

At the neural level, they found evidence for a significant modulation by the proposed amount on fairness in the right lateral prefrontal cortex (PFC) and the bilateral insular cortices (Fig. 1). Additionally, the insular subregions showed dissociable modulation patterns (Fig. 2). These modulation effects were only observed in the human condition, not in the computer condition, indicating that the modulation effect of fairness by monetary incentives only exists in social interaction situations. Furthermore, inter-individual differences in the modulation effects in the left inferior frontal gyrus (IFG) accounted for inter-individual differences in the behavioral modulation effect as measured by the rejection rate (Fig. 3), supporting the concept that the PFC plays a critical role in making fairness-related normative decisions in a social interaction condition.

Taking into consideration all of the above results, they have provided neural evidence for the modulation of fairness by the size of a monetary incentive and also for inter-individual differences in the deviation from fairness-related normative choices. By manipulating monetary incentives to alter the fairness-related normative decision, they have provided deeper insight into the neural substrates of the normal normative decision.

Their article, entitled 'Money talks: Neural substrate of modulation of fairness by monetary incentives', was published in *Frontiers in Behavioral Neuroscience*. The research was supported by the National Basic Research Program of China, the National Natural Science Foundation of China and Beijing Nova Program.