Behavioral Monotonicity and Value Encoding in a Bayesian Game – Observations from an fMRI Experiment

Ming-Hung Weng*, Jen-Tang Cheng#, and Yi-Reng Hsu#

Abstract
We hope to better understand how decision makers interact in a static Bayesian (poker) game by investigating with a functional magnetic resonance imaging (fMRI) experiment where pairs of participants simultaneously and repeatedly wager between high or low-stake bets against each other without knowing their opponent’s card. With pairs of cards sampled (without replacement) from a deck of four or seven cards, the winner of each trial is either the sole high-stake better or the one whose card is of higher number if the same bets are placed. Observations suggest that participants behave in a way generally monotonic in their states by placing high-stake bets with a higher probability when having cards with higher number though Bayesian Nash Equilibrium (BNE) predicts more complicate strategies. Nevertheless, more risk-seeking tendency as suggested by BNE is still displayed for choices in extreme low states when cards are drawn from a deck of seven cards.
On the neural level, a much broader network is recruited when participants place high than low-stake bets. While higher BOLD activities in striatum are associated with higher number of cards only when high-stake bets are placed, higher activities in anterior cingulate cortex (ACC) are also associated with higher expected values for low-stake bets. Moreover, activities in vmPFC, an important area known for value encoding, are also correlated with the expected values of participants’ choices.

Keyword: Bayesian Nash equilibrium, monotonicity, fMRI experiment, neuroeconomics
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*: Corresponding author. Department of Economics, National Cheng-Kung University, Taiwan. Email: mhweng@mail.ncku.edu.tw. The research project was sponsored by Ministry of Science and Technology of Taiwan (MOST-105-2420-H-006-003-MY2).
#: Department of Economics, National Cheng-Kung University, Taiwan