Neural correlates of undiscovered dishonesty: An fMRI and ERP study

Delin Sun[1,2,†], Chetwyn C.H. Chan[3,†], Yang Hu[4], Zhaoxin Wang[4]
Tatia M.C. Lee[1,2,5]

[1] Laboratory of Neuropsychology, The University of Hong Kong, Hong Kong
[2] Laboratory of Cognitive Affective Neuroscience, The University of Hong Kong, Hong Kong
[3] Applied Cognitive Neuroscience Laboratory, Department of Rehabilitation Sciences, The Hong Kong Polytechnic University, Hong Kong
[4] Key Laboratory of Brain Functional Genomics, Institute of Cognitive Neuroscience, East China Normal University, Shanghai, China
[5] The State Key Laboratory of Brain and Cognitive Sciences, The University of Hong Kong, Hong Kong, China

[†] Both authors contributed equally to this work

Correspondence to:
Tatia M.C. Lee, Ph.D.
Rm 656, Laboratory of Neuropsychology
The University of Hong Kong
Pokfulam Road, Hong Kong
Tel: (852) 3917-8394; Fax: (852) 2819-0978
Email: tmclee@hku.hk

Zhaoxin Wang, Ph.D.
Key Laboratory of Brain Functional Genomics (MOE & STCSM)
Institute of Cognitive Neuroscience
School of Psychology and Cognitive Science
East China Normal University
Shanghai, China
Tel: (86) 021-6223-3293; Fax: (86) 021-6223-3352
Email: zxwang@nbic.ecnu.edu.cn

Abstract

Objectives: Previous neuroimaging studies on dishonesty focused on the process of cognitive manipulation. Here we investigated the neural responses during outcome presentation, especially when the dishonest persons get the information that they have successfully avoided detection. **Methods:** Twenty-six Chinese volunteers were recruited. They were asked to interact with anonymous counterparts in an economic game. They could appropriate the property belonging to another by utilizing another's ignorance of the truth. That is, they could behave consistently (making honest choices) or inconsistently (making dishonest choices) with the counterparts' proposals on how to divide some profits. The counterparts had 50% chance to detect whether the participants' choices were dishonest. Successful dishonest choices (not being detected) brought large reward, honest choices (regardless of being detected or not) medium reward, and failed dishonest choices (being caught) no reward. Combining both functional magnetic resonance imaging (fMRI, 3-Tesla Siemens Trio MR scanner) and event-related potential (ERP, 64-channels cap by Brain Products) methods, participants' neural responses during outcome presentation were recorded in different sessions. **Results:** We found that, when not being detected, dishonest (versus honest) outcomes elicited stronger fMRI activations in brain regions related to reward processing (i.e., the nucleus accumbens [NAcc]) as well as arousal (i.e., the posterior cingulate cortex [PCC]) (Fig. 1). Moreover, dishonest (versus honest) outcomes evoked larger late posterior positivity (LPP), an ERP component, at central-parietal scalp sites in two time windows, (i.e., [260, 430] ms and [470, 710] ms) (Fig. 2). **Conclusion:** These results suggested that, compared with that of honest response, the outcome of successful dishonest choice is evaluated as more rewarding and elicit higher arousal within two short intervals after the outcome presentation. These findings advanced our knowledge on the neural processing of dishonest actions, and may be utilized to detect dishonesty in real life, especially when the dishonest persons know that they have successfully escaped from detection and punishment.

Keywords: dishonesty; outcome; reward; arousal; fMRI; ERP

Figure 1. Outcome of dishonest (versus honest) choice elicited stronger fMRI activations (p <
0.001, cluster size > 100 voxels) at posterior cingulate cortex (PCC) and structures
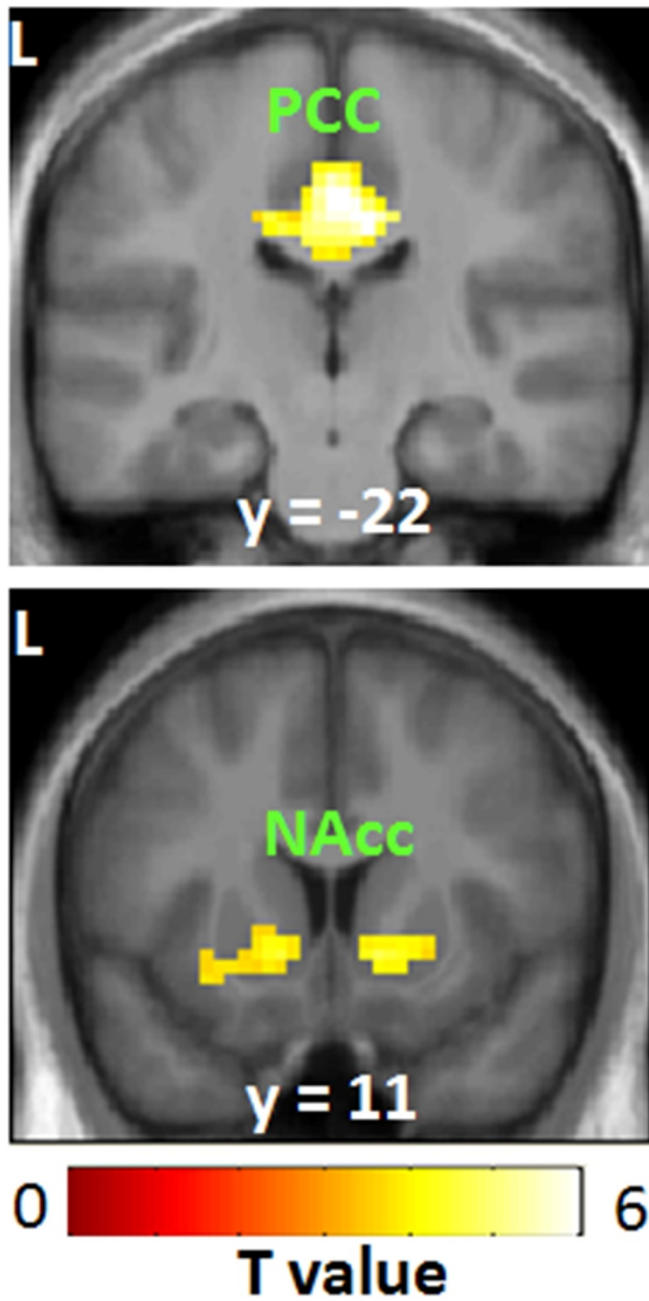encompassing nucleus accumbens (NAcc).

Figure 2. Outcome of dishonest (versus honest) choice elicited more positive amplitudes at central-parietal sites (represented by the CPz channel) within two time intervals (i.e. [260, 430] ms and [470, 710] ms). The source reconstruction results ($p < 0.05$, cluster > 60 voxels) were also shown.