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On the role of emotions and social ties in public good games : behavioral and neuroeconomic studies

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Summary

This thesis presents four essays regarding the role of emotions and their influence on decision making as well as the dynamic development of attachment between interacting parties. More precisely, the first three chapters are interested in how social ties are created and evolve in anonymous laboratory interactions. This investigation is done at the theoretical, behavioral and neural levels such that it offers a quite complete view of how social ties are formed and how they guide decisions in repeated social interactions. The fourth and final chapter explores the use of verbal feedback as a tool to increase cooperation and the underlying role played by emotions in this environment.

Social ties are affective bonds that emerge between interacting agents, making them care about the fate of each other and thus influencing their future actions. These bonds can only arise through the occurrence of a social interaction and are influenced by the feelings triggered by the interaction. As a consequence, social ties can be positive or negative depending on experienced emotions and the satisfaction derived from the counterpart's behavior. The "need to belong" (Baumeister and Leary, 1995) has been shown to play a preponderant role in human life and appears as one of the principal motivations underlying our social behavior. Economically relevant situations as diverse as team work, neighborhood life, oligopolies or customer-seller relationships are all susceptible to the development of bonds between the parties involved.

Chapter 2 starts by extending the theoretical analysis of social ties developed by van Dijk and van Winden (1997). We expand the model by including a probabilistic choice mechanism and, more importantly, by allowing agents to plan ahead. The main goal of this chapter is to confront this behavioral model of choice to data gathered in the laboratory. To that purpose, we will use data from different public good experiments that have different characteristics in terms of game structure and number of parties involved. Our empirical objectives are twofold in this chapter. We first estimate the social tie model both at the group and individual level and show that it has explanatory power over the data and that social ties are indeed developed. These results suggest that history is an essential part of the determinants of preferences, that some reciprocity takes place and that about half of the

subjects are indeed forward-looking. Second, we generate individual predictions in order to track dynamic changes from round to round in contribution decisions. The performance of the model appears surprisingly good as it is able to track very complex dynamic patterns of contributions. This is true both for games played in pairs and in groups of four players, where the decision-making processes are much more complex.

Following this behavioral approach and in order to combine different sources of evidence, Chapters 3 and 4 investigate the neural mechanisms underlying behavior in these experiments. In Chapter 3, we examine how individual differences in trait empathy and interpersonal ties modulate neural responses to imposed monetary sharing. First, we find that sharing prompted activation of neural systems associated with reward (striatum) and empathy (anterior insular cortex and anterior cingulate cortex) only after the occurrence of an economic interaction, but not before. We thus extend previous results (Singer et al. 2004; 2006) and show that empathic neural responses occur after some contact between parties, notwithstanding the limited emotional intensity that an anonymous economic interaction can elicit. Second, sharing also provokes activations in areas associated with altruism and social significance (posterior superior temporal sulcus, pSTS) that are correlated with interaction success as well as post-experiment liking ratings of the interaction counterpart. Finally, we show that only tie-related activation predicts prosocial behavior during subsequent interaction while empathy-related activation fails, suggesting the pSTS as a neural substrate for keeping track of social relevance.

In Chapter 4, we use a model-based fMRI approach to examine the neural correlates of the theoretical model presented in Chapter 2 and try to confirm the role of the pSTS suggested in Chapter 3. We find that at the moment of choice, activity in the bilateral pSTS and temporo-parietal junction (TPJ) correlates with the dynamic estimate of the social tie, supporting the role of these regions in social tie formation. In addition, activity of the medial prefrontal cortex (mPFC; associated with higher cognitive functions like goal planning and long-term decision making) correlates with the contribution decision in the public good game. Moreover, we gather support for the idea that feelings are involved in the tie formation mechanism: when feedback was provided, the cooperativeness of the other's action is encoded in regions previously implicated in reward-based emotions and especially in affective reactions in social settings (striatum, anterior insula, ACC, pSTS and TPJ). Finally, we found functional connectivity between the pSTS and the mPFC, suggesting that the representation of social ties is integrated in the decision process.

Finally, Chapter 5 investigates the potential use of verbal communication as a feedback tool to sustain cooperation in public good games. Because of its high emotional load and low cost compared to monetary punishment, we saw verbal feedback as a potentially successful mechanism in order to raise prosocial behavior, as suggested by previous results in different games (Xiao and Houser, 2005;2009; Ellingsen and Johannesson, 2008). We find verbal feedback to be of limited effectiveness compared to monetary punishment. It appears able to maintain a higher level of cooperation (compared to the absence of both communication and punishment) for a time but not to maintain it on the long run. Interestingly, guilt provocation appears to be fostering cooperation but this effect disappears on the long run. On the other hand, generating angry reactions was harmful to cooperation. The decay in cooperation after some periods of play is explained by the loss of effectiveness of messages in provoking guilt at that time whereas angry reactions are more and more present.

This thesis combines several methodologies to investigate the determinants of behaviors in repeated public good games. We showed that dynamic social preferences modeled as developing affective ties between parties were performing well in predicting contribution behavior in public good games. Moreover, using an ambitious model-based fMRI approach, we were able to track the neural substrates of the parameters of our theoretical model and to find consistent neural correlates of social ties between different tasks, pointing at a network that is involved in the decision making in such public good environments. This thesis also sheds new lights on the impact of verbal feedback on cooperative behavior and on its underlying emotional processes.