

# Neural processing of iterated prisoner's dilemma outcomes indicates next-round choice and speed to reciprocate cooperation

Cervantes Constantino, F.

Garat, S.

Nicolaisen-Sobesky, E.

Paz, V.

Martínez-Montes, E.

Kessel, D.

Cabana, Á.

Gradin, V.B.

## Abstract

The iterated prisoner's dilemma (iPD) game is a well-established model for testing how people cooperate, and the neural processes that unfold after its distinct outcomes have been partly described. Recent theoretical models suggest evolution favors intuitive cooperation, which raises questions on the behavioral but also neural timelines involved. We studied the outcome/feedback stage of iPD rounds with electroencephalography (EEG) methods. Results showed that neural signals associated with this stage also relate to future choice, in an outcome-dependent manner: (i) after zero-gain "sucker's payoffs" (unreciprocated cooperation), a participant's decision thereafter relates to changes to the feedback-related negativity (FRN); (ii) after one-sided non-cooperation (participant wins at co-player's expense), by the P3; (iii) after mutual cooperation, by late frontal delta-band modulations. Critically, faster reciprocation behavior towards a co-player's choice to cooperate was predicted, on a single-trial basis, by players' P3 and frontal delta modulations at the immediately preceding trial. Delta-band signaling is discussed in relation to homeostatic regulation processing in the literature. The findings relate the early outcome/feedback stage to subsequent decisional processes in the iPD, providing a first neural account of the brief timelines implied in heuristic modes of cooperation.

## Author keywords

Delta

FRN

P3

prisoner's dilemma

Social heuristics