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## A Cortical Network Model of Cognitive and Emotional Influences in Human Decision Making

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#### **Abstract**

Decision making (DM)<sup>2</sup> is a complex process that appears to involve several brain structures. In particular, amygdala, orbitofrontal cortex (OFC) and lateral prefrontal cortex (LPFC) seem to be essential in human decision making, where both emotional and cognitive aspects are taken into account. In this paper, we present a computational network model representing the neural information processing of DM, from perception to behavior. We model the population dynamics of the three neural structures (amygdala, OFC and LPFC), as well as their interaction. In our model, the neurodynamic activity of amygdala and OFC represents the neural correlates of secondary emotion, while the activity of certain neural populations in OFC alone, represent the outcome expectancy of different options. The cognitive/rational aspect of DM is associated with LPFC. Our model is intended to give insights on the emotional and cognitive processes involved in DM under various internal and external contexts. Different options for actions are represented by the oscillatory activity of cell assemblies, which may change due to experience and learning. Knowledge and experience of the outcome of our decisions and actions can eventually result in changes in our neural structures, attitudes and behaviors. Simulation results may have implications for how we make decisions for our individual actions, as well as for societal choices, where we take examples from transport and its impact on CO<sub>2</sub> emissions and climate change.

Keywords: Decision making, emotion-cognition, neural network model, amygdala, OFC, LPFC

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<sup>&</sup>lt;sup>2</sup> Decision making is abbreviated as DM throughout the text

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