Modeling reciprocal belief coordination in social interaction based on free energy minimization

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We present a hierarchical Bayesian model based on principles of active inference to investigate the interplay of core processes within the social brain, during communicative interaction between multiple agents. Building on recent work on the sensorimotor processes in action and perception the model is extended to contribute a functional account of reciprocal belief coordination on the basis of communicative intentionality and free-energy minimization.

To investigate the possible interplay within the social brain during interaction of social agents, we developed an integrated Bayesian model, called *Hierarchical Predictive Belief Update* (*HPBU*), that grounds continuous sensorimotor perception and action in principles of Predictive Processing and active inference (A. Clark, 2013; Friston, Daunizeau, Kilner, & Kiebel, 2010; Kilner, Friston, & Frith, 2007).
Mentalizing gets involved in inferring intentionality from interaction partner's behavior, thereby influences the strength of perception-action coupling (Teufel, Fletcher, & Davis, 2010). Also, the attribution of intentionality was found to activate mentalizing to influence sensory processing to become “social perception”, an altered understanding of each other’s actions (Wykowska, Wiese, Prosser, & Müller, 2014).
In previous work, we looked at the prediction-based processes underlying self-other distinction and sense of agency and how they interact with higher-level cognitive processes like mentalizing during non-verbal social interaction. We proposed and tested a functional model of sense of agency, embedded in HPBU, with which self-other distinction has been successfully simulated to arise during action and perception (Kahl & Kopp, 2018).

We present an extension of the HPBU hierarchy to achieve a bootstrapped mentalizing capability, informed by motor beliefs and self-other distinction of actions produced and perceived during interaction with other agents.
The model was evaluated in a simulation of three agents (each equipped with the model) interacting in a non-verbal communication game.
Results show that the extended hierarchy is able to infer and produce sequences used for belief coordination with the other interacting agents and the model’s belief dynamics show its capability to foster belief coordination and create common ground between all three agents.

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