Modelling the social coordination of behavior with public symbols

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In the recent decade, there has been an upsurge in models of language evolution. These models are based on the idea that multi-agent dynamics coupled with certain simple capabilities can lead to basic linguistic behavior. The general organization of these models, however, betrays an idea common to the cognitivist paradigm, namely that the linguistic symbols used by humans are labels for inner representations. The experiments in which these models are tested consist of two separate stages, which are (1) generating labels for sensory data and (2) using these labels for communication. The models also reflect this division, and consequently contain separate modules (1) for creating representations and (2) for creating and transmitting vocalizations that correspond to these representations. An alternative to this division between perception/categorization and symbolic representation is using situated representations. The main idea behind situated representations is that the symbols human beings use in communication serve not only to carry meaning, but also to coordinate their embodied interaction. Inherent in this view is the social shaping of embodied activity through linguistic symbols. Traditionally, human cognition is divided into contrasting classes of high- and low-level processes, which then share inner representations among them in the mediation of thinking and action. Situated representations implicate that the relationship between high- and low-level processes, traditionally posited to be linear, rather is a dialectic one, where the social being of the agent affects, but is at the same time formed by, its embodied activity.

In order to model situated representations with multiple agents, the microworlds methodology used in the early days of artificial intelligence is ideal. In such a setup, it is possible to study in a task environment the necessary components of symbolic intelligence, namely social situatedness and ecological relevance. In the case of the model presented here, a robotic approach was chosen in order not to abstract away from the sensory-motor aspects of intelligence. Our approach to categorization is called “categorization without categories”, which refers to avoiding internal representations which do not have a linguistic function. In order to implement it, we have used an exemplar-based mechanism which relied on a simple similarity measure and the storing of whole sets of sensory data.

The principle idea of our experimental setup is providing the robot with an environment with a number of choices. In the first part of the experiment, the agents learn picking one of the choices, using solely the possibilities of the environment as cues. The second part starts with teaching one of the agents making a certain choice. Afterwards, a language game is played in which this agent instructs the other one. By developing a mechanism to instruct and to be guided by instructions, one agent can profit from the learning experience of the other and can directly choose the best out of a number of possible behavioural alternatives without having to go through the same learning experience again.