

Social models of semantics learning

Acquisition and Evolution of Quantifier Meaning

Description for the General Audience

In everyday language communication we often try to coordinate the meaning of expressions we use. Consider for example the following dialogue:

- Many people accept this solution.
- Many? Not more than one third.
- Is it few?
- OK, perhaps many, but not most of them.

The traditional approaches to semantics have been dominated by the view according to which semantics is well defined and stable. Acquisition of a given language amounts to the acquisition of its syntax and predefined meanings of expressions of this language. This traditional approach has been recognized as insufficient in face of the attempts at designing robots and artificial systems communicating with humans in natural language. It turned out that in many contexts different people interpret the same expressions in different ways.

Contemporary attempts aimed at constructing realistic artificial systems for communication drives the paradigm change. It is impossible to implement our semantic intuitions in robots directly. Moreover, the semantics cannot be fixed and hard-coded, as an intelligent robot needs to adapt to external circumstances (for example it could enter a society with different categorizations). Additionally, severe discrepancies in semantic interpretations may occur even between members of the same society. An adequate methodology is that of distributed language evolution models, tested within agent-based modelling and robotic experiments.

The starting point of the research proposed in this project is the observation that some sentences (such as *Most villagers and most townsmen hate each other*) have computationally difficult semantics. Perhaps for this reason, language users give various non-equivalent interpretations of such expressions. An interesting question is then how people communicate if they use expressions with many different interpretations. Of course, this leads to the general question of how the semantics evolves through everyday communication.

The goal of the project is to propose and investigate mathematical models of meaning coordination in natural language, with a special focus on quantifier expressions. We consider a multi-agent system, in which agents exchange information about a situation by means of quantifiers. The meaning of quantifier is what they coordinate. It seems that important parameters of the system are: authorities of agents, structure of the population and communication channels, and parameters of the the environment in which agents live. The project is aimed at investigating the properties of the proposed models, such as convergence, influence of authorities, population structure and various universal properties of quantifiers, such as monotonicity or computational complexity. The models shall be analysed mathematically and by means of computer simulations. Selected predictions of the models will be tested empirically through social games with human subjects and online gaming experiments.