Simulating the Emergence of Grammatical Agreement in Multi-Agent Language Games

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Why do natural languages use complex grammatical concepts? We believe that many of these concepts emerged in order to guide linguistic processing and to reduce processing effort.

In this work we investigate the concept of grammatical agreement. Grammatical agreement has become an essential part that guides linguistic processing. We hypothesize that agreement emerged in natural languages in order to facilitate the recognition of phrasal constituents, and hence, reduce processing effort. In order to support our hypothesis we develop an experiment consisting of artificial agents playing so-called language games. We show that the agents are able to bootstrap a simple agreement system which enables them to recognize phrasal constituents with much less effort.
The most important concepts discussed here are ***language games and their results***, ***constituent marketing strategy*** *and various* ***feature selection methods.***
The ***language game*** *model was first* ***proposed by Steels*** *to study the dynamics of language interaction between agents. Agents here could be humans or robots. The results of the language games are, if agents are allowed to invent and learn agreement markers, the processing effort decreases over time otherwise it stays high.*
In the constituent marking strategy*, the speaker attaches markers to linguistic units. Units that belong together are marked by the same marker. Each marker represents a semantic feature, such as gender, number, determination, etc. The agent identifies discriminating grammatical features of the phrases that correspond to its perception. It then associates the markers with the selected features and attaches each marker to all members of the matching phrase.*
Sometimes we don't have unique discriminating feature so we compare the following ***feature selection methods:***
Single feature selection (both agents select same feature), random feature selection (randomly select) and emergent feature selection method (preference of feature selected in past).

In this paper semantic agreement features were more focussed, we could even apply same and could record the results for syntactic ones. For the sake simplicity few assumptions were taken for the implementation of language games.
First, use of one-one feature form mapping which forced to select only one feature but this could be extended. Marker string can be mapped to feature matrix i.e. .each marker can be marked with different features. This extension will lead us to a new discussion on emergence of feature matrices can we can discuss on how design island are built.
Second, the agents always invent immediately as soon as they experience cognitive effort in terms of indistinguishable referents. We can introduce a threshold for invention agents only invent a marker for a certain feature if they face cognitive effort very often without disposing of a marker for that feature.

In future we can investigate the complexity of agreement systems further by extending our experiments and verifying the results on a larger population with more and more features.
Also we have only used two agents with same perception of scene and same, we could use two agents with different perception of scene, we will see result is that communicative success is not guaranteed.
Following lines were taken from the paper itself :

- *"a new discussion on emergence of feature matrices can we can discuss on how design island are built."*
- *"agents only invent a marker for a certain feature if they face cognitive effort very often without disposing of a marker for that feature."*
- *"we will see that communicative success is not guaranteed."*