

In this paper, I describe computational experiments carried out on populations of simulated agents who develop their own communication systems based on inferring the reference of unfamiliar words from their presentation in multiple contexts. Communication is based on meaning inference in order to avoid the problems found in many computational models of language acquisition and development, which are characterised by the signal redundancy paradox: meanings are explicitly and accurately transferred between agents during communication, and therefore the signals which accompany them are redundant; yet if the signals are removed from the model, it is difficult to claim that the system represents a model of communication at all.

One of the most interesting puzzles of language acquisition, however, is how children learn the meanings of words so effortlessly, overcoming Quine (1960)'s problem of the indeterminacy of meaning with apparent ease. In order to explain this feat, many psycholinguistic biases have been proposed, such as the assumption of mutual exclusivity (Markman, 1989). Under this assumption, a child will ensure that a newly-encountered word does not refer to the same things as a word which already exists in their lexicon.

Computational models have recently been used to explore a world where agents create their own individual meanings following interactions with an external environment, and use context-driven disambiguation of the possible meanings to which a word refers (Smith, 2003). These experiments have shown that communicative success is very highly dependent on the level of conceptual structure which is shared by the agents. I build on these results here, by describing experiments in which the psycholinguistically plausible assumption of mutual exclusivity is incorporated into the existing model of successful communication.

On a semantic level, the introduction of mutual exclusivity into the hearer's interpretation process leads to the creation of new meanings in order to disambiguate the reference of unfamiliar words. Over time, this leads to the hearer developing relatively fewer meanings than in the experiments without mutual exclusivity, and different agents construct different conceptual structures. Despite this lack of shared meanings, however, the concepts created by the hearer are significantly more relevant and therefore more useful for communication than those in previous experiments. This results in relatively higher communicative success, as the assumption of mutual exclusivity allows the agents to overcome the differences in their conceptual structure.

References

- Markman, E. M. (1989). *Categorization and naming in children: problems of induction*. Cambridge, MA: MIT Press.
- Quine, W. v. O. (1960). *Word and object*. Cambridge, MA: MIT Press.
- Smith, A. D. M. (2003). Intelligent meaning creation in a clumpy world helps communication. *Artificial Life*, 9(2), 175–190.