Signalling signalhood: A study into the emergence of communicative intentions

Thom Scott-Phillips
thom.scottphillips@gmail.com
Language Evolution and Computation Research Unit,
University of Edinburgh

In recent years the emergence of communication systems in populations of interacting agents has been approached in a number of different ways, in particular computational modelling, evolutionary robotics, experimental psychology and game theory. Much of this work falls under the general domain of the evolution of language, and as such a crucial question for this line of research is the creation of symbols: arbitrary meaning-form mappings that are shared across a population. The present work reports on an experiment I have conducted that sheds light on this question.

The crucial novelty in this work is that the speaker's communicative intention is not built into the investigative set-up. That is, unlike most previous work, I address the question of how receivers even know that signals are signals. This is not, as my work shows, a trivial task. Yet the fulfilment of communicative intentions (or their analogue in artificial agents) has, with one exception, been assured by the set-up of previous investigations. This is typically achieved by pre-defining one or more of the following: the roles of signaller and receiver; the signal and meaning spaces; or the communication channel. There is one exception to this trend (Quinn, 2001) but even here the communication system that emerged was iconic and also a discovery of natural selection, rather than the creation of specific agents. Yet linguistic signals are arbitrary and are created or learnt individually. How, then, do humans (and, indeed, how did pre-linguistic humans) create and acquire symbols in real time? More specifically, how do they signal and recognise signalhood?

I have designed an interactive two-player computer game that can be used to investigate this question. The set-up of the game ensures that success can only be achieved through the creation of symbols in an unfamiliar medium. Crucially, participants must not only create new symbols but also signal that the symbols are indeed symbolic. In other words, communicative intentions must be signalled in some way that is independent of meaning.

My results show that the task is not at all straightforward: many participants fail to develop any communicative system at all. Moreover, the symbols that are created invariably involve the use of idiosyncratic movement, even though there are solutions that would be quicker and easier to use. This suggests that the need for both players to identify what exactly is a signal appears to work against the emergence of the most efficient systems.

These results are interesting in a wider context for several reasons. First, they show that the identification of another's communicative intention in an unfamiliar medium is not trivial. This should not come as a surprise, as it appears to be non-trivial even for as powerful an algorithm as natural selection: only a minority of observed natural signalling systems utilise symbolism; in most cases signals are either iconic or indexical. Moreover, arguably only one species – humans – has evolved the ability to *create* and *learn* new symbols. The identification of the psychological prerequisites for such a task is therefore an important question for those interested in the evolution of language.

Quinn, M. (2001). Evolving communication without dedicated communication channels. In J. Kelemen & P. Sosík (Eds.), *Advances in artificial life: ECAL6*. Berlin: Springer.