

# Language as Autopoiesis : Experimental Approach to Agency in Linguistic Communication

Keisuke Suzuki<sup>1</sup>, Ryoko Uno<sup>2</sup>, and Takashi Ikegami<sup>3</sup>

<sup>1</sup>Laboratory for Adaptive Intelligence, RIKEN, Brain Science Institute

<sup>2</sup>Institute of Symbiotic Science and Technology, Tokyo University of Agriculture and Technology

<sup>3</sup>The Graduate School of Arts and Sciences, The University of Tokyo  
ksk@brain.riken.jp, ryokouno@cc.tuat.ac.jp, ikeg@sacral.c.u-tokyo.ac.jp

## Extended Abstract

One of the challenges of artificial life is to implement agency in the creature. This paper is going to argue for the concept of agency existing in linguistic communication. It is usual and normal to see that agency exists outside of language: it is the user of the language who is equipped with agency, and language is not ostensibly related to it. On the other hand, since the invention of the Turing test, it has been an unsolvable question whether agency is a physical property, or something that is attributed from the outside. Here, it is argued that agency emerges in linguistic communication itself. For developing this idea, we have designed a new communication game between two human subjects in order to see how "agency" is organized in each communication pattern (which is intended to be a proto-language).

Some researchers, most notably Galantucci (2005), already reported evolution of artificial language in human communication necessary to tell some information to others. Here, our focus is not on language as informative tools, but on language itself as goal of communication, in which it has own agency.

We asked 20 subjects (10 pairs) to communicate using an artificial language, where the expressions are the spatial pattern of the triplet in a 3-by-3 bit square. The subjects are allowed to rewrite the pattern alternatively. Here are some examples from our data. (2) is in response to (1):

@ \* @  
\* @ \* (1)  
@ \* @

###  
#@ \* (2)  
# \* @

Each trial consisted of 16 exchanges of pattern messages between two subjects. Then, the subjects were asked to report their intentions behind the sent messages, and their interpretations of the received messages. The pattern of symbol arrays was analyzed mathematically, and the reports linguistically. We especially focused on how topics shifted during the communication.

Our analysis shows that when the Hamming distance between the patterns of symbol arrays was small, the agents tended to report the messages using metaphorical expressions and not in a literal descriptive manner. The report in (3) explains the intention of (1) to use metaphorical expressions, while that in (4) describes the pattern in (2) literally.

(3) Cherry blossoms are beautiful.

(4) Break the circle by movement from top left to bottom right.

It should be noted that in this experiment, the subjects are forced to exchange messages, so the language pattern should be sufficiently attractive to keep the communication going. Once an attractive pattern emerges, the pattern may inherit the characteristic of being attractive, irrespective of the subjects' intentions. The pattern dynamics are, therefore, operationally

closed in the same sense that Luhmann (1986) defined a social system as being autopoietic. This perspective is also found in a simulation model for demonstrating the Luhmann's concept by Dittrich et al. (2003).

We found that when the Hamming distance between successive patterns gets smaller, human subjects tend to use metaphorical expressions in order to overcome the monotonous development of the pattern exchanges. Thus, the emerging pattern dynamics inversely subdued the subjects, which proves that the communication is indeed structurally coupling system.

### References

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