**Communication Orchestration with a Cognitive Architecture**

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**Introduction:** The field of Neurotechnology involves the integration of brain science and computational technologies. In one of its facets, computational techniques are used to help in the diagnose and treatment of brain diseases [1]. A completely different facet uses brain science findings in order to foster the development of computational algorithms to simulate cognitive functions, as e.g. language. These algorithms are particularly useful within the field of cognitive architectures and can be used to control virtual or physical robots to assist or replace humans in several activities [2]. In this work we present a neuroscience inspired cognitive architecture that orchestrates virtual robots communication in order to create a semantic infrastructure to nominate environment objects. This infrastructure evolves gradually, without relying on pre-established rules.

**Materials and Methods:** We developed a cognitive architecture which was used to orchestrate and to simulate dialogs among robots from communities of different sizes (10, 50, and 100 virtual robots). In order to validate the system performance, the notion of language games was employed. A language game is a mechanism proposed by the philosopher Ludwig Wittgenstein to explain how words obtain meaning during established activities between a speaker and a listener [3]. This mechanism is a way of verifying if the robots are reaching linguistic consensus about the names of 4 objects. In the proposed language game, the players are virtual robots and a mediator who grants them the permission to dialog. Several dialogs may be established in parallel. Nevertheless, the mediator allows two robots to dialog only if none of them is already talking. In our experiment, the mediator maintains a list of playing robots and their current state. If a robot A (speaker) wants to talk to robot B (listener), the mediator checks if robot B is available. If not, robot A cannot talk to robot B at the moment, and it can try another one. In the case both robots are available to talk, the mediator sends a positive feedback and the dialog is started. During the dialog, the speaker robot picks up an object, creates a name for it and utters it to the listener robot. If the name is already known by the listener, it indicates the corresponding object according to its own dictionary of names. Otherwise, the listener answers that it does not know that name. The game is only successful if the listener indicates the object which the speaker has picked up. When the dialog is finished, the mediator updates the status of the robots. Then, the robots are once more available to start another dialog. The robots in the community have different names to reference the same object. Hence, each name receives a score, which increases when there is a communicative success and decreases when the opposite occurs. The names with highest score are always chosen to reference an object. On the hand, those with low scores are removed from the dictionary. The communicative convergence will always occur when the robot population has only one word to appoint each object and all robots use the same word for it. However, each population, according its size, will need a different number of played games (in total) to converge.

**Discussion and Results:** The results indicate that the proposed cognitive architecture was especially interesting since many dialogs were established in parallel, apart from the size of the community. Moreover, the robots learned from their failing dialogs and their internal dictionaries converge towards a common language. Furthermore, the architecture does not depend on predefined linguistic terms and semantic rules, differently from traditional architectures in literature [4].

**Conclusion:** Our cognitive architecture is able to adequately simulate some aspects of language use among artificial agents. Since it does not depend on external synchronizing mechanisms and the linguistic consensus emerges evolutionarily, its performance is biologically plausible.

**References:** [1] Ayers J et al.. Neurotechnology for biomimetic robots. MIT press, 2002; [2] Langley P, Laird J. Cognitive Sys Res 10(2):141–160, 2009; [3] Steels L. The Talking Heads experiment: Origins of words and meanings. Berlin: Language Science Press, 2015; [4] Roy D, Reiter E. Artif Intell, Elsevier 167(1): 1–12, 2005.