Two Bots, One Brain: Component Sharing in Cognitive Robotic Architectures

Bradley Oosterveld Luca Brusatin Matthias Scheutz
Human-Robot Interaction Lab
Tufts University, Medford, MA
{first}.{last}@tufts.edu

ABSTRACT

Humans communicate knowledge and coordinate actions through natural language exchanges, effectively externalizing their thoughts as they cannot directly access each others' minds. This, however, is not a limitation for artificial agents like robots which can easily access its each others' minds directly. Specifically, with the right provisions, cognitive robotic architectures can enable robots to directly access each others' control systems and the knowledge contained therein. They can even enable robots to share components of their architecture analogous to the human case of craniopagus twins that have direct brain connections. In the robotic case, however, the robot bodies do not have to be physically connected; rather, their "brains" can communicate through wireless connections.

In this video, we demonstrate the utility of being able to share components in our cognitive robotic DIARC architecture [1] which is implemented in the ADE middleware [2]. Shared natural language processing and dialogue management systems, for example, allow physically distributed robots to understand conversations at remote locations, and local robots to speak on behalf of others that are remotely located. Sharing internal perceptual and long-term memories allows robots to report what other robots in their cohort see, know, do, and intend. Shared perceptual systems also allow robots to learn about environments in which they are not located, and report on them to humans.

We believe that the underlying technology of *architectural component sharing* can be very useful in any application domain where multiple artificial agents like robots have to cooperate on a common task and coordinate their activities, especially in mixed initiative teaming contexts where groups of robots work together with multiple humans. In addition, this notion of shared components, and ultimately architectures, raises interesting philosophical questions about the identity of those agents: who is who? Is the identity of such agents only constituted by the agents' different bodies? And what if those agents were instead virtual?

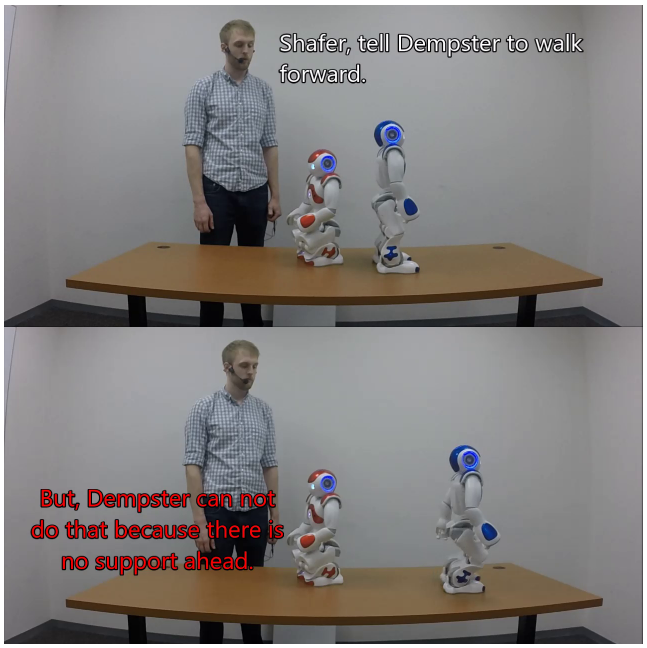

Figure 1: *Dempster (blue) is given the goal to walk forward via Shafer (red). Dempster begins to carry out the goal, but fails when the edge of the table is detected. This goal failure is then reported from Shafer's perspective.*

1. REFERENCES

[1] R. C. E. K. T. W. Matthias Scheutz, Gordon Briggs and R. Veale. Novel mechanisms for natural human-robot interactions in the diarc architecture. In *Proceedings of AAAI Workshop on Intelligent Robotic Systems*, 2013.

[2] M. Scheutz. ADE - steps towards a distributed development and runtime environment for complex robotic agent architectures. *Applied Artificial Intelligence*, 20(4-5), 2006.

HRI '17 Companion March 06-09, 2017, Vienna, Austria

ACM ISBN 978-1-4503-4885-0/17/03.
DOI: http://dx.doi.org/10.1145/3029798.3036652