

Interaction Based Knowledge Acquisition and Exchange Using Grounded Symbols – Transferring Affordance Based Learning to Virtual Agents

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Abstract— The presented work introduces the basis for a new generation of virtual agents that are able to assist their users in finding, retrieving and processing data. Since higher level cognitive processes, however, still remain the domain of humans, these virtual agents can be seen, in a metaphorical sense as “dogs” being able to provide their skills to humans after a training/learning process guided by the user. The aim of our research is to combine the power of both sides, computers and humans, to realize virtual agents that provide capable assistance to their users with a certain degree of autonomous and flexible behaviour but still being guided by humans. In our approach, we do not attempt to mimic human cognition. Rather, we enable the agents to learn via self-experience, from positive and negative feedback by the user, and from communication with other agents of their kind using grounded and agreed upon symbols. The design of the agents is inspired by insights from embodied cognition - in particular from affordance-based robotics - that are transferred to a virtual context.

I. EXTENDED ABSTRACT

The goal is to develop virtual agents able to provide assistance capabilities, whose behaviour is biologically inspired and who gain knowledge - clearly different from human knowledge, but grounded in the theory of human use of affordances. This kind of knowledge first of all forms the basis for robust and flexible action selection within a single agent, but is then the base for information exchange between agents, as well as for communication between the agents and their users. The first step was to transfer the bottom-up driven affordance-based learning approach of increasing complexity as described in [1] from the physical robotics environment, it initially has been designed for, to the virtual context. To enable the virtual agents to sense their environment (at early learning stages a reduced set of resources, e.g. closed domain databases, handpicked RSS feeds and websites, as well as a reduced and simplified instruction-driven user input), they are equipped with sensor channels geared towards the particular

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environment. User feedback and instructions are part of their environment and also perceived via their sensor layer. Software tools realize the actions through which the agents interact with their environment. The outcomes of the tools acting on the environment are again treated as input to the sensor channels. In a way this is similar to a robot’s perception of the consequences of an action application. During the affordance based learning process, the agents are exploring their environment and are building a knowledge repository (the *Affordance Representation Repository* as described in [2]) consisting of a set of input situations (I), a set of tools (T) and a set of interaction outcomes (O) (see Fig. 1). To increase the capabilities of single agents they are enabled to exchange their knowledge with other agents of different users. Due to the differences in their experience bases and their internal representations a negotiation process takes place,

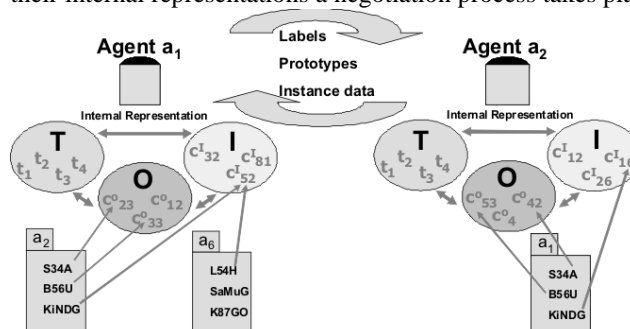


Fig. 1. Two agents are exchanging prototypes and instance data as a prerequisite for agreeing on common labels for concepts and strategies.

establishing common labels for their individual knowledge of input and outcome situations, allowing them to exchange tool application strategies. The scope of the ongoing research incorporates the transfer from biologically inspired aspects to the virtual context, the development of a robust and flexible affordance based knowledge about the agents’ own interaction possibilities within their environment, as well as the establishment of common concepts and labels allowing the exchange of strategies to improve their assistance capabilities.

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