# Teaching a Humanoid Robot with Natural Language

One day, humanoid robots could assist us in our daily life by performing daily tasks in our homes or workshops. However, it is impossible to equip a robot with all skills and capabilities it needs to handle all situations it will encounter in its lifetime. It is therefore important that the robot is able to learn new skills from its users. Its users will not be robotic experts, so teaching a robot new things should be easy. One way is Programming by Demonstration, where a human performs an action or task and the robot tries to replicate it. Another way is to tell the robot what it needs to do via language. As humans, we often use both at the same time – we show what to do and explain it simultaneously. Ideally, we could teach a robot new things just like a master craftsperson teaches their apprentice.
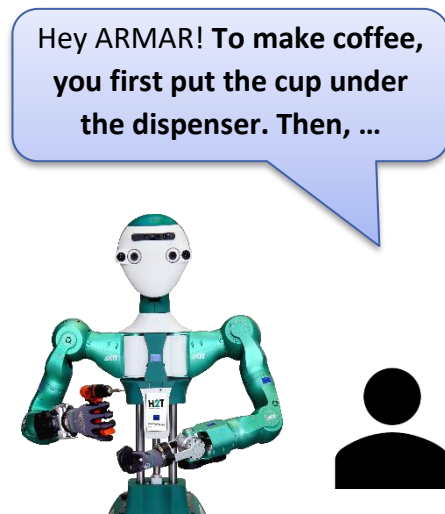
In this work, you will investigate how a humanoid robot can be taught new skills via natural language. To this end, you will integrate *ProNat*, a system for programming in natural language (Weigelt et al.), on the humanoid robot ARMAR-6. This will involve preparing an ontology-based API with some basic skills such as navigating through a room and grasping or handing over an object. Using this system as basis, a human teacher should be able to compose simple behaviours based on existing. Finally, these basic skills should be combined to form more complex skills, such as setting a table.

Relevant research questions include:

- How must skills be represented to provide an API for programming in natural language?
- How can skills in form of ArmarX statecharts be generated from natural language instructions?
- How can more skills be composed to build more complex skills with natural language?

This work will use the humanoid robot ARMAR-6 and work with ontologies as well as *ProNat*:

- ArmarX (C++, Python): armarx.humanoids.kit.edu
- *ProNat*, an instance of *PARSE* (Java): code.ipd.kit.edu/weigelt/parse
- Web Ontology Language (OWL)

Contact: Rainer Kartmann (rainer.kartmann@kit.edu)