OpenDial: A Toolkit for Developing Spoken Dialogue Systems with Probabilistic Rules

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Dialogue modelling

- Hybrid, logical/probabilistic approach to dialogue modelling based on *probabilistic rules*

- The rules are structured as *if...then...else* constructions mapping logical conditions to probabilistic effects

- They can be used to express both conditional probability distributions and utility functions

- Each rule may contain unknown parameters (probabilities or utilities) to estimate from interaction data via supervised or reinforcement learning

- The formalism provides a (logic-based) *abstraction layer* on top of classical probabilistic models

- **Benefits**: reduced size of parameter space, integration of expert knowledge into the domain models

Architecture
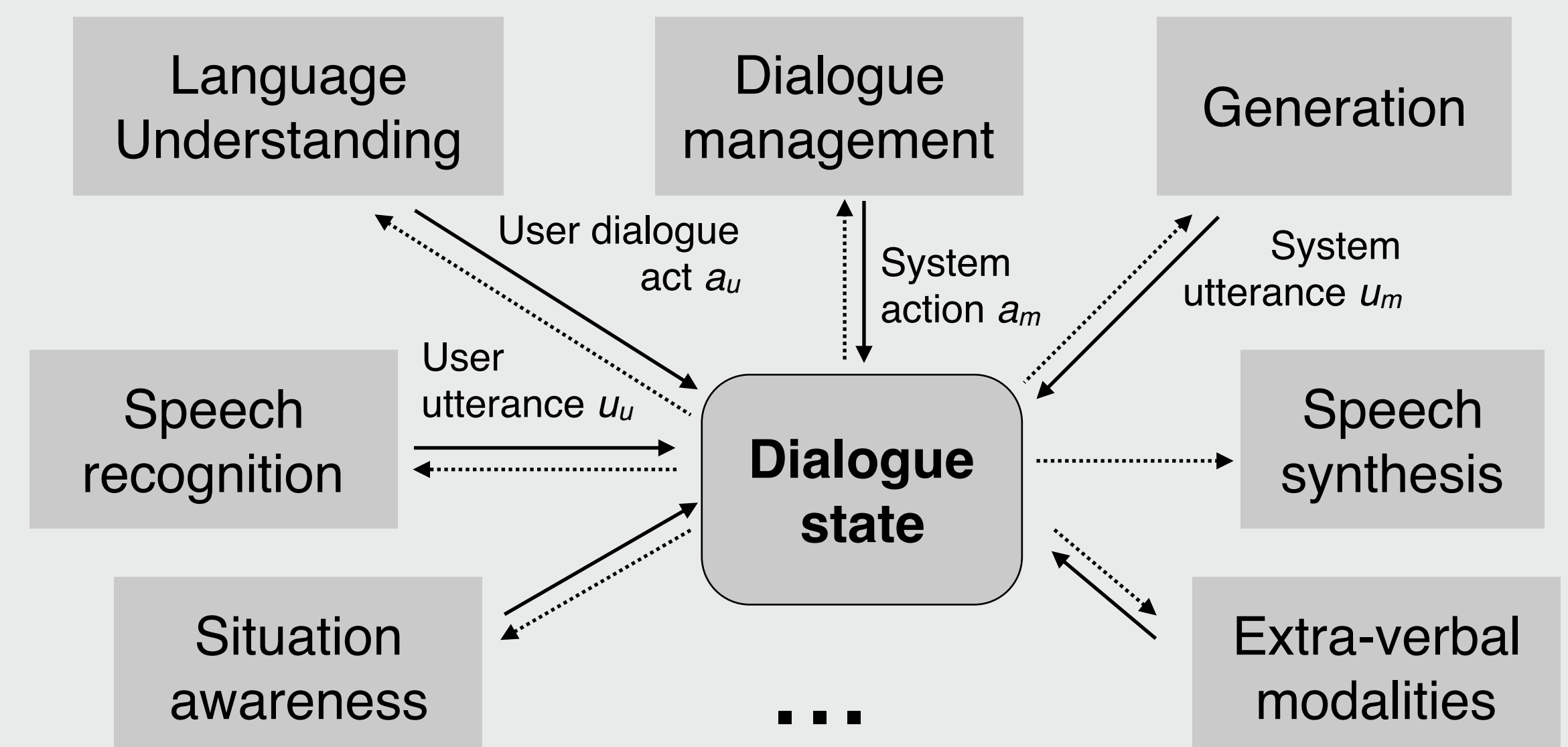
- Blackboard design centered on the dialogue state (represented as a *Bayesian Network*)

- Dialogue domain (encoded in XML format) =
  1. initial dialogue state
  2. list of domain models (collections of rules)
 3. settings for the external modules

Implementation

- Developed in Java, MIT open-source license

- Algorithms for exact & approximate inference, parameter estimation and forward planning

- User interface to easily develop, evaluate and monitor spoken dialogue systems

- Plugins for external components (CMU Sphinx, Mary TTS, MaltParser, Nuance Speech API, etc.)
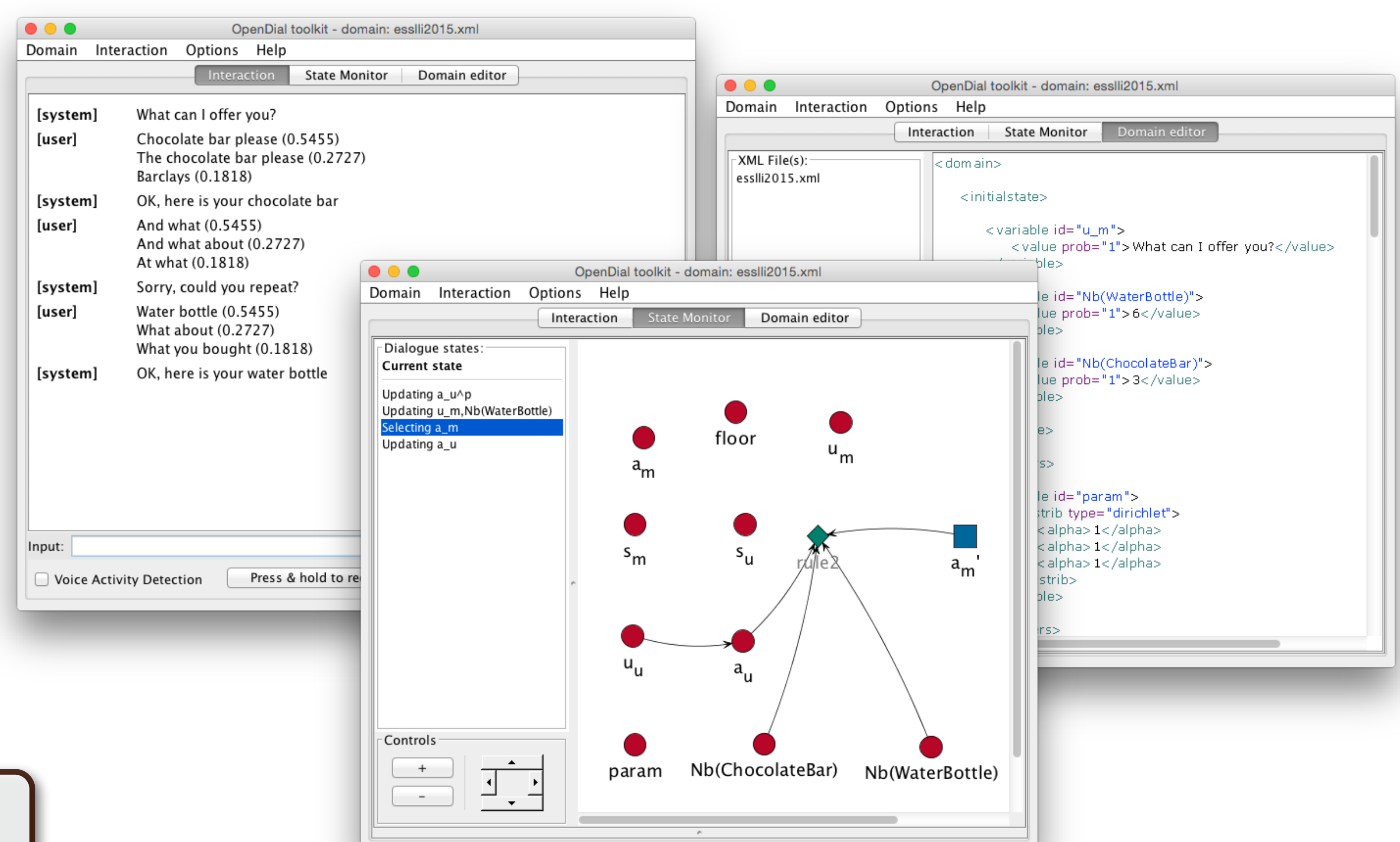
Application domains

- Experiments in human-robot interaction with unknown parameters learned from Wizard-of-Oz data (Kennington et al, 2014, Lison 2015)

- Dialogue manager for a multimodal, in-car driver assistant (Kennington et al, 2014), a cooking coach (Wolf et al, 2015) and a multimedia system for cultural exhibits (Sorgente et al, 2016)

- Current work on integrating OpenDial for intelligent tutoring systems and web-based chatbots

- Teaching platform for courses on spoken dialogue systems at several universities in Europe & the U.S.
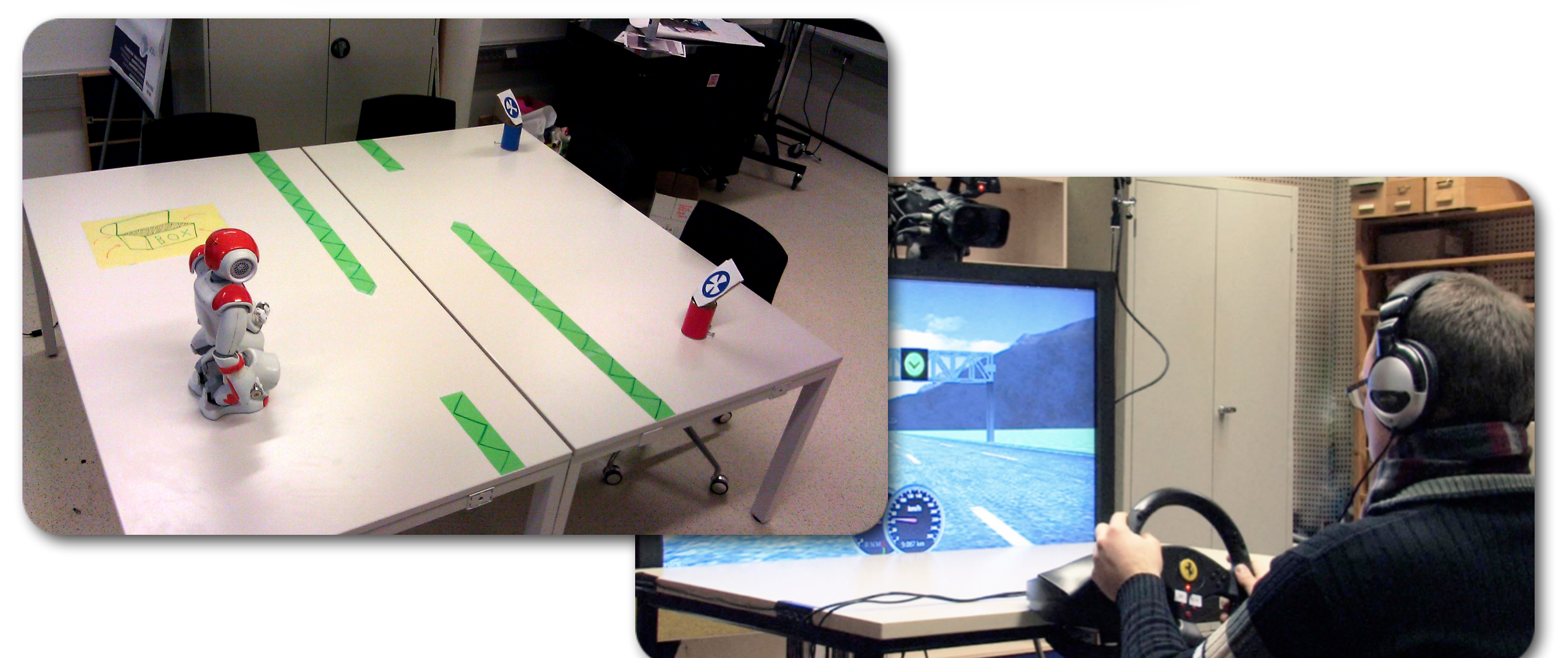
For details, check the toolkit website at
http://opendial-toolkit.net
[release packages, user docs, step-by-step examples]