

# Adaptive Mind Agent

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## 1 Introduction

We present the Adaptive Mind Agent, an intelligent virtual agent that is able to actively participate in a real-time, dynamic environment. The agent is equipped with a collection of processing tools that form the basis of its perception from and action on the environment consisting of web documents, URLs, RRS feeds, domain-specific knowledgebases, other accessible virtual agents and the user. How these predispositions are finally shaped into unique agent behaviour depends on the agent's abilities to learn through actual interactions, in particular the abilities: (i) to memorize and evaluate episodes comprising the actions the agent had performed on its environment in the past depending on its perceptions of the user requests and its interpretation of the user's feedback reinforcing or inhibiting a certain action; (ii) to dynamically develop user-driven interest and preference profiles through memorizing and evaluating the user clicks on selected web pages.

The agents reside in a JAVA-/OSGi-based platform realizing a component-based development and execution model that allows for modular composition of different kinds of agents from a set of building blocks [1]. The source code of the platform including the Adaptive Mind implementation is available under gpl from <http://rascalli.sourceforge.net/>. The running system, an Adaptive Mind Agent in the popular music domain, is accessible via <http://www2.ofai.at:8180/rascalli> where one creates the own agent, shapes and monitors its interests and preferences, and via a 3D interactive ECA client for windows downloadable from <http://www.ofai.at/rascalli/demonstrators/ECA.html>.

## 2 Adaptive Mind

At the core of the Adaptive Mind stand the components for episode-based action selection and for user-driven agent profiling. The former is wrapped by action selection rules, and a dialogue and interaction model. The latter influences what is in the agent's focus. All together this determines which agent actions are triggered by a certain user utterance. In the following, we briefly address the two components.

**Episode-Based Learning of Action Selection:** To model the action capabilities of the agent, we have adapted an action-based model for learning affordances in robots [2] leading to tool-specific application spaces containing all the episodes experienced with the individual actuator tools including the agent's perception of the input and outcome situations. The appropriate new action to be selected and executed by the agent is determined based on the similarity of only a small number of features in the input situation (utterance and question class, utterance interest and focus), and on the evaluation of positive and negative user feedback on the outcome of the agent's action. This allows rapid prototyping and eases integration with new tools. The following methods are applied in the given order: 1. recent positive feedback given the same input situation; 2. majority positive feedback given the same input situation; 3. positive feedback given a similar input situation (vector space based similarity calculation); 4. random selection with exclusion of the action with the recent negative feedback received from the user applied to the same input situation.

**Learning of User Interests and Preferences:** By navigating through a music browser from within the agent application, the user provides the agent with a growing episode base of user actions (e.g. view, listen to, rate positive, rate negative) on items (e.g. artist, song) at certain times. This information is stored and aggregated into the agent's interest profile using standard machine learning approaches and an adaptation strategy supporting neglect, where the agent's preference profile is split into a short-time preference profile refined by the user actions within a session, and a long-term profile based on the short-term profiles. For details see [3], the section on "Agent Modelling Server". As far as we are aware of, we have for the first time combined the mind implementation of virtual information processing and communication agents with personalization technology usually employed in e- and m-commerce, and at the same time we have introduced a cognitive notion of memory into personalization technology.

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