An Architecture for Action, Emotion, and Social Behavior

Joseph Bates, A. Bryan Loyall and W. Scott Reilly
School of Computer Science, Carnegie Mellon University
Pittsburgh, PA 15213, USA

Abstract. The Oz project at Carnegie Mellon is studying the construction of artistically effective simulated worlds. Such worlds typically include several agents, which must exhibit broad behavior. To meet this need, we are developing an agent architecture, called Tok, that presently supports reactivity, goals, emotions, and social behavior. Here we briefly introduce the requirements of our application, summarize the Tok architecture, and describe a particular social agent we have constructed.

1 The Oz Project and Broad Agents

The Oz project at Carnegie Mellon University is developing technology for artistically interesting simulated worlds [3]. We want to let human users participate in dramatically effective worlds that include moderately competent, emotional agents. We work with artists in the CMU Drama and English Departments, to help focus our technology on genuine artistic needs.

An Oz world has four primary components. There is a simulated physical environment, a set of automated agents which help populate the world, a user interface to allow one or more people to participate in the world [14], and a planner concerned with the long term structure of the user's experience [2].

One of the keys to an artistically engaging experience is for the user to be able to "suspend disbelief". That is, the user must be able to imagine that the world portrayed is real, without being jarred out of this belief by the world's behavior. The automated agents, in particular, must not be blatantly unreal. We believe that a way to create such agents is to give them a broad set of tightly integrated capabilities, even if some of the capabilities are somewhat shallow. Thus, part of our effort is aimed at producing agents with a broad set of capabilities, including goal-directed reactive behavior, emotional state and behavior, social knowledge and behavior, and some natural language abilities. For our purpose, each of these capacities can be as limited as is necessary to allow us to build broad, integrated agents [4].

Oz worlds can be simpler than the real world, but they must retain sufficient complexity to serve as interesting artistic vehicles. The complexity level seems to be somewhat higher, but not exceptionally higher, than typical AI micro-worlds. Despite these simplifications, we find that our agents must deal with imprecise and erroneous perceptions, with the need to respond rapidly, and with a general inability to fully model the agent-rich world they inhabit. Thus, we suspect that
some of our experience with broad agents in Oz may transfer to the domain of social, real-world robots [5].

Building broad agents is a little studied area. Much work has been done on building reactive systems [1, 6, 7, 10, 11, 23], natural language systems (which we do not discuss here), and even emotion systems [9, 19, 21]. There has been growing interest in integrating action and learning (see [16]) and some very interesting work on broader integration [24, 20]. However, we are aware of no other efforts to integrate the particularly wide range of capabilities needed in the Oz domain. Here we present our efforts, focusing on the structure of a particular agent designed to exhibit goal-directed reactive behavior, emotion, and some social behavior.

![Tok Architecture](image)

Fig. 1. Tok Architecture

2 Tok and Lyotard

Through analysis of our task domain, we have concluded that the primary capabilities we want in our initial Oz agents are perception, reactivity, goal-directed behavior, emotion, social behavior, natural language analysis, and natural language generation. Our agent architecture, Tok, assigns these tasks to several communicating components. Perception, while partially task specific, is also in part handled by a pair of systems called the Sensory Routines and the Integrated