SecondLife® as an Evaluation Platform for Multiagent Systems Featuring Social Interactions

(Demo Paper)

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ABSTRACT

In this paper we propose to use SecondLife®as an evaluation environment for multiagent systems that model social group dynamics and social interactions. To this end we developed a control interface for NPCs in SecondLife®that allows for running supervised or unsupervised long-term evaluations. Thus, this platform offers the possibility to move evaluation studies from the laboratory into a "natural" setting for the participants. First tests show the potential for this kind of evaluation.

Categories and Subject Descriptors

I.2.1 [**Artificial Intelligence**]: Applications and Expert Systems; I.2.11 [**Artificial Intelligence**]: Distributed Artificial Intelligence; I.6.7 [**Simulation and Modeling**]: Simulation Support Systems

General Terms

Experimentation, Human factors

Keywords

SecondLife, evaluation, multiagent system

1. INTRODUCTION

SecondLife®(SL) represents the first massive 3D multiplayer platform that is not primarily concerned with gaming but aims at establishing a general virtual meeting place. Thus, every conceivable type of interaction is in principle possible, be it buying or selling virtual or real goods, or be it playing out as a real DJ in a virtual club. Central feature of SL is the use of virtual agents as interaction devices which can either represent a real user (avatar) or can be non-player characters (bots). Consequently, SL represents a multiagent system where users in the form of avatars and autonomous virtual agents can engage in social interactions. This offers for the first time the opportunity to evaluate multiagent system techniques in unconstrained tests with an unlimited number of participants. Evaluation studies are no longer confined to laboratory settings, but can be done in the field i.e. in the "natural" environment of the users. To exploit this possibility, we created a control architecture for autonomous agents in SL and exemplified the general use of this architecture with a simulation toolbox for social group dynamics, which constitutes our first test case for multiagent evaluation approaches in SL.

The control architecture had to integrate the following components:

- Low-level behavior control: For animating an agent, sending and receiving speech events, and for navigating through the environment, SL provides an open source client which was modified to handle the special needs of coordinated verbal and nonverbal behavior.

- High-level behavior control: To abstract from the tedious work of controlling every parameter for the agent in SL, an abstract control module was realized (BotControl). The BotControl represents the interface between SL and the third-party application. It provides the necessary control methods for agents in SL which can be incorporated in arbitrary applications handling the low-level behavior routines of the agents as well as the event handling for SL events occuring in social interactions like spatial behavior.

To test a multiagent social simulation in SL we relied on previous work on the social group dynamics of agents ([5]). Two additional components create this simulation:

- Behavior toolbox: The toolbox handles the agents' behavior according to a set of theories from the social sciences. Each theory can be plugged or unplugged to test its applicability in the specific scenario and select the optimal model. The toolbox has already proven successful in simulating appropriate communicative behavior.

- Chatterbot functionality (AIML): To realize believable linguistic behavior, chatterbot functionality was integrated into our system. To this end, a widely used AIML based chatterbot program was extended to deal with interaction categories from the behavior toolbox as a pattern structuring mechanism.

Cite as: SecondLife as an Evaluation Platform for Multiagent Systems Featuring Social Interactions (Demo Paper), Matthias Rehm and Peter Rosina, *Proc. of 7th Int. Conf. on Autonomous Agents and Multiagent Systems (AAMAS 2008)*, Padgham, Parkes, Müller and Parsons(eds.),May,12-16.,2008,Estoril,Portugal,pp.1663-1664.

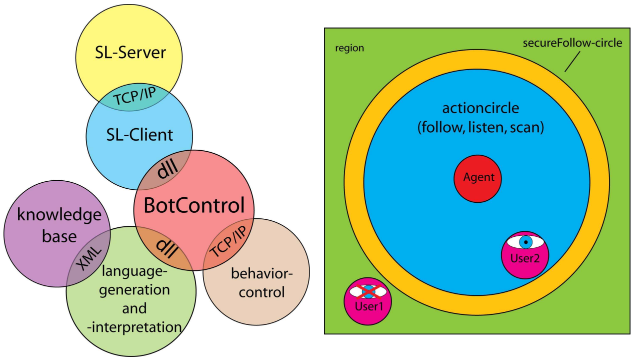

Figure 1: Left: Overview of components. Right: Proxemics behavior for agent.

A first pilot study was run to exemplify the potential of SecondLife® as an evaluation platform and is summarized below (Section 3).

2. CONTROLLING AN AGENT

Figure 1 (left) gives an overview of the different components, which were integrated into our system.

2.1 Low-level behavior control (SL-Client)

The communication with the SL-server is realized by a modified version of an open source library called *libsecondlife*. This modification was necessary to allow for more functionality in controlling the character on the one hand, and on the other hand in providing more information about the environment. The resulting SL-client serves as an interface, which handles events between the higher level control component and the SL-server.

2.2 High-Level behavior control (BotControl)

BotControl represent the high-level behavior control that allows for more abstract specification of agent behavior. It serves as the control center for an agent allowing to monitor its interactions, to set interaction parameters, to connect control components, and to manually override the behavior components in order to control the agent by the user. An example of an interaction parameter is the spatial behavior of the agent. Following Hall's ideas on proxemics [2], we define different spatial areas that trigger different behavior routines in the agent (see Figure 1 right). To this end, a scan radius can be defined that provides a threshold above which an agent does not react to other agents. Moreover, it is possible to define an area which triggers a follow event if the agent is currently in an interaction with a user.

2.3 Integrating AIML

Interaction in SecondLife® consists mainly of chat events between users. Consequently, it was necessary to endow our system with chat capabilities. As a means to this end we rely on a well-established AI technique, i.e. the Artificial Intelligence Markup Language (AIML), which was developed for the chatterbot A.L.I.C.E (e.g. [6]).

2.4 Integrating Behavior Models for Agents

To allow for testing different behavior models for multiagent interactions, BotControl provides an interface to transmit data about the agent's perceptions to a given control module. To exemplify this feature a previously developed behavior toolbox was integrated [5]. It allows for either rapidly prototyping different models of social group dynamics like Congruity Theory [4] or Social Impact [3] in a given multiagent application or for using it as the central behavior control component. From the available theories, Interaction Process Analysis (IPA) [1] was chosen as a test case. IPA generates an interaction category for the agent at each turn. This category then has to be mapped to an appropriate observable behavior of the agent. In SecondLife®, the primary interaction modality is verbal, thus, AIML was augmented by IPA-based interaction categories. In principle, the agent could also react by pre-defined animations that accompany its utterances. But as this is rarely seen in the user, it was thus not taken into account for the pilot study.

3. PRELIMINARY RESULTS

A pilot study was run to show the feasibility of the approach and to test if users are interested at all in interacting with the agent. Two test runs were carried out in different areas of SecondLife®, both sparsely crowded to prevent the agent from annoying the users by continously trying to interact with them. Test runs lasted for around 15 hours a day for seven days. The agent interacted with 39 users in this time, the average time for the interactions was 6 minutes 34 seconds. It is unclear how many users discovered that they were talking to an agent. 17 of the 39 users explicitely marked this fact. One-third of those continued their interaction and made some positive remarks and requested more information about the project. Another third finished the interaction shortly after the discovery (under two minutes) and the last third became hostile against the agent. It is unclear if the other 22 users did not discover that they were talking to an agent or if they did not care. A closer analysis of the log files for the verbal interactions might give some insights concerning this question. The pilot also showed some technical limitations. To sum up, the main goals of this approach have been reached. It was possible to attract many users to interact with the agent showing the potential of running unsupervised large scale evaluation studies in SecondLife®.

4. ACKNOWLEDGMENTS

The work described in this paper is partly funded by the German Research Foundation (DFG) under research grant RE 2619/2-1 (CUBE-G).

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