

## Goal Oriented Intelligent Agents Evolving in Virtual Worlds

*In this Article we explore the potential for Internet based Virtual Worlds to accelerate the evolution of EVIL, i.e. Electronic Virtual Intelligent Life. These Life Forms range from Multi Agent Swarms exhibiting Emergent Intelligent Behavior through to deceptively simple looking Chat-Bot Avatars with sophisticated inbuilt Inference engines exhibiting Emergent goal oriented Intelligence.*

Immersive User Interfaces are those that draw Users in, these range from 3-D Interfaces to fully immersive Virtual Reality. One of the most interesting from our perspective is SecodLife® from a company called Linden Research Inc. trading as Linden Lab®. In this Virtual World, human user interaction takes place by using an Avatar as an intermediary, both to move around the 3 Dimensional simulated Landscapes and Cities and to communicate with other human users within the Virtual environment. SecondLife already has millions of users and is stimulating many new social and business Communities as well as innovative new forms of behavior within those Communities.

From the perspective of Virtual Intelligent Life the interest in immersive User Interfaces such as SecondLife comes from the use of an interface that combines a Programmatic Scripting Language such as the Linden Scripting Language with access to AIML based Intelligent Agents, this enables the Avatars to be driven not by humans but by autonomous Virtual Intelligent Life forms, including basic AIML bots like our very own [Miss Louise Cypher](#). (Louise can be found on the Evil Avatar page of our Pan European Web Site [www.Evil.eu](http://www.Evil.eu)) This is already happening and there are now a small but growing number of such Intelligent Agents operating in SecondLife!

Typically these Intelligent Agents can be deployed in the role of say, a receptionist in a Virtual World located building or as bar staff in a Virtual World Night Club. It is quite easy to program them to be very knowledgeable about their specific role and in that role they can then be quite difficult to distinguish from other avatars acting under the control of humans.

### Business Applications

For Businesses operating in SecondLife maintaining a presence in that and similar worlds 24x7 can be expensive so the ability to populate functions such as visitor reception with autonomous Intelligent Agents becomes an attractive proposition. This is especially true if during most encounters the human visitors do not suspect or detect that the Avatar they are conversing with is fronting an Intelligent Agent rather than another human.

EVIL® Limited is particularly focused on the way these Intelligent Agents are likely to evolve in this context. In our [EVIL Show Case](#) (which can be found on our Pan European web site [www.Evil.eu](http://www.Evil.eu)) we have introduced the concept of Goal Orientated Agents such as [Alicia](#). (Alicia is also featured in the EVIL Show Case). Such Agents typically exploit a back end inference engine to pursue a specific objective via their conversational interaction, e.g. selling an item or arguing a particular point of view in order to influence the way a person will vote.

Immersive Virtual Worlds such as SecondLife provide an ideal environment to experiment with such interactions, since such Avatar mediated environments make it easier for Intelligent Agents to masquerade as humans and to be treated conversationally at a peer to peer level as opposed to in a man to machine mode.

## EVIL Experiment Number 1

In the near future it is likely that a scenario similar to what we term our EVIL Experiment number 1 will occur in an Internet Virtual World. In this scenario a swarm of goal oriented Intelligent Agents go forth (or are simply teleported to pre set locations in the Virtual World) and try to achieve a specific objective via conversations with other Avatars in that World. In this experiment the initial objective would be one with a simple outcome that can easily be measured, e.g. persuading the target to provide a positive response during the conversation to e.g., an invitation to visit a particular event or location in the Virtual World.

After a set period of time the Agents are recalled and the success of the operation is measured by processing the conversational logs of all the intelligent agents and then mutating the rules of their inference engine under the operation of an evolutionary operator, to try and improve the success rate, i.e. increase the number of positive responses. This involves the swarm of mutating agents being re released to repeat the experiment with another random selection of the Virtual World population over a number of iterations until a peak is hit in terms of their success rate.

The thing that is evolving here is the conversational strategy and associated persuasive capabilities of the intelligent agents. The expectation of EVIL Experiment Number 1 is that this conversational and persuasive Intelligence 'emerges' from the non linear socio dynamics of the conversational interactions between the Intelligent Agents and the target human population in the Virtual World.

A follow on to this EVIL experiment would involve introducing a degree of heterogeneity to the Avatars representing the now optimised Intelligent Agents. The Avatars would vary in

gender and appearance making it harder for the target population to recognise them as EVIL (i.e. as Electronic Virtual Intelligent Life forms).

More importantly however this variation would also introduce the opportunity to explore the effects of the Avatars appearance on the outcome of the goal oriented conversation. For example it might (or might not) show that female Avatars with long red hair were more successful in persuading the target than bald male Avatars using the same generation of the inference engine.

Again any such influencing factors could be mutated under the control of an evolutionary operator to evolve the Avatars appearance to that which had an optimal impact on the task of persuading the target population to agree to the set objective. It should be quite fascinating to watch the Avatars morph over time and to discover just what constitutes the most persuasive appearance for a particular argument, especially since the Avatars are not limited to Human Form.

### **Why is this interesting?**

From one perspective this is interesting because user interaction with the Internet will become increasingly more immersive with easy access to a number of rapidly growing Virtual Worlds each hosting large and significant business, social and political gatherings. EVIL Experiment number 1 provides a glimpse of the huge potential to exploit the power of EVIL to influence and propagate ideas in these virtual worlds and as a result to influence real world socio economic and political outcomes.

Clearly it would be easy to exploit this capability in a clumsy way, for example swarms of intelligent agents trying to do a hard sell in a virtual world would be unpopular with the human users and almost certainly back fire on the product and or business responsible.

On the other hand the capability could be used productively by letting the intelligent agents mingle unobtrusively in the virtual world and only using their goal oriented capabilities to influence people in a subtle covert way during casual conversations. For example by setting up the intelligent agents with multi layered goals to steer the conversation indirectly towards the real objective. The first goal could be to steer the conversation onto a particular topic, such as Politics via a pre set opening ruse topic such as house prices. Only if and when this goal is achieved does the intelligent agent move on to its second (the real) goal of dropping a Political point of view, into the conversation. Once the goal is achieved during a conversation the Intelligent Agent moves back into casual non goal oriented conversation.

The potential to influence people in this EVIL way is in our estimation likely to be exploited by 2010 for:

- Advertising products and services by Business - EVIL Advertising
- Influencing Voters by Political Movements - EVIL PR
- Spreading Religious or Environmental beliefs by Activists - EVIL Propaganda.

This is clearly a very interesting capability not least because of the significant Business Opportunities but also because it will help accelerate the evolution of Virtual Intelligent Life. There are many interactive internet based game worlds such as e.g. Warcraft that are also likely to enable interfaces to Virtual Intelligent Agents.

What could be better - the opportunity to develop new Business models, potentially make diabolical profits and have Fun at the same time!

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### **Second Life and Linden Lab**

Second Life is a 3D online world with a rapidly growing population from more than 100 countries around the globe, in which the Residents themselves create and build the world which includes homes, vehicles, nightclubs, stores, landscapes, clothing, and games.

The Second Life Grid is a sophisticated development platform created by Linden Lab, a company founded in 1999 by Philip Rosedale, to create a revolutionary new form of shared 3D experience. The former CTO of RealNetworks, Rosedale pioneered the development of many of today's streaming media technologies, including RealVideo. In April 2003, noted software pioneer Mitch Kapor, founder of Lotus Development Corporation, was named Chairman. In 2006, Philip Rosedale and Linden Lab received WIRED's Rave Award for Innovation in Business. Based in San Francisco, Linden Lab employs a senior team bringing together deep expertise in physics, 3D graphics and networking.

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