PERADA Interaction Report

University of Central Florida and Cardiff University

SOCIALNETS

Background: This visit resulted from a proposal submitted by Dr. Brian Goldiez of the University of Central Florida's Institute for Simulation and Training (IST) to PERADA requesting a visit and interactions with the SOCIALNETS Project via Dr. Roger Whitaker. As a synopsis, the work Goldiez is currently pursuing involves using high performance computing in an interactive environment (e.g., massively multiplayer on-line games), data needed to maintain persistent virtual environments where users can come and go, and the use of agents (software and robotic) as a member of and an enabler for collaboration between members of a team. The proposal suggests that SOCIALNETS may benefit from interactions with Dr. Goldiez by studying and developing experiments which explore how combinations users and agents interact through use of various virtual environments using a variety of interaction schemes. The SOCIALNETS project offers insights for Dr. Goldiez research in how various parameters and aspects of different social schemas can be utilized in creating computer and network based environments that are built upon social structures and interactions. This has potential benefit in developing approaches to connect various virtual environments with the real world and as well as to understand how to create better interfaces between humans and agent based systems.

Details: The meetings between Drs. Goldiez and Whitaker occurred on 18 and 19 August, 2008 when Dr. Goldiez visited Cardiff University. Both Goldiez and Whitaker presented overviews of their relevant work and Goldiez was introduced to a Post Doctoral Researcher working on the SOCIALNETS project and other faculty from the Computer Science Department at Cardiff University. Additionally Dr. Whitaker provided Dr. Goldiez with papers written by members of the SOCIALNETS team with particular pointers to the work of Dr. Robin Dunbar as key underpinning to the development of a SOCIALNETS architecture for devices and networks.

A wide range discussion ensued that are summarized, below.

1. Physical scientists tend to be reductionist oriented and interested in extracting the salient features of a system. Social scientists tend to take a holistic approach to studying system behavior. Both approaches discard some details and retain others, but the details kept could be very different between groups. Strategies must be developed to bridge these groups. SOCIALNETS builds from a basis of Dunbar's Number which originates from the social sciences. The challenge is to build a bridge between social and computational sciences. Goldiez group builds virtual, mixed, and augmented reality environments where experimentation occurs principally in the area of using these environments to create better approaches to training and learning. The characteristics of these environments are based on novel uses of available technology, the creation of software to glue the technology, and resulting assessments of utility with potential users (which could be the SOCIALNETS team). Goldiez presented an example specifically oriented to high performance computing and games. This is clearly an area of mutual collaboration.
2. There are both published (formal) and informal sets of interactions in any organization or society. The informal set of interactions has to operate within the confines of the

published organization. Change in the published organization are most often disseminated to the members of the organization, but the informal interactions are often subject to individual attributes such as trust and mutual benefit, which are often hard to discern and therefore hard to instantiate in a system of hardware and software. These informal interactions can also be situationally dependent. Nonetheless, informal interactions provide effective approaches to interaction.

At this point it is not clear to Goldiez the extent to which the informal set of interactions are situationally and personality dependent (e.g., consider interactions within a military unit as contrasted with underlying interactions within a university). In any event it seems reasonable to assume that underlying interactions can be abstracted to some common basis that could be used in programs such as SOCIALNETS. What is not clear is how individual differences in the formal and resulting underlying interactions may impact a specific instantiation or set of interactions of the SOCIALNETS paradigm. In other words, there may be classes of SOCIALNETS that lend themselves to implementation with specific sets of hardware and software.

3. Goldiez group is researching approaches and technique for overlaying what seems to be parallelizable software applications onto high performance computing. This work consists of massively multiplayer on-line games; a research effort sponsored by the US National Science Foundation in crowd modeling; and a military program that models battlefield behavior of individuals and units (known as OneSAF). While these programs all appear to be parallelizable because they concern modeling the behaviors and interactions among many individual entities, they currently reside on one or very few processors, thereby limiting the number of participants, robustness of the interactions, and runtime performance. Goldiez efforts are sponsored by the U.S. Army who is interested in creating an environment for training to perform a task(s) or to identify team deficiencies and augment those deficiencies with intelligent and cooperative agents. Teams can be a mixture of humans and agents (software and robotic).

<u>Possible Synergies Between SOCIALNETS and UCF Simulation Activities:</u>

1. Goldiez is creating a controlled laboratory setting in a virtual environment that can be remotely accessed. This laboratory could be made available to the SOCIALNETS to experiment with various mixtures of human agent interactions to study and validate theories in migrating formal and informal social structures to computational networks and devices, exploring issues related to trust, mutual payment/reward structures, etc. A possible example case would be to implement the Prisoners Dilemma problem in the virtual environment and develop a set of experiments with different mixes of users and agents. Another possibility would be to create an environment involving teams conducting search and rescue tasks with various simulations of humans, agents, and networks (with the ability to vary the robustness of the agent and network).
2. Goldiez team could benefit from output and interactions with the SOCIALNETS team by investigating how social structures can be used as a paradigm for distributing functions in a multi-user virtual environment. There are several possibilities in this regard.
    a. Currently distribution of games or virtual environments across multiple processors tends to be spatially based. In the case of games, rooms or spatial extents are

often designed that impose physical (and software) limits on the number of avatars that can be in a physical area. Alternatively, some environments impose hard limits on the number of players in a world. These limitations are somewhat artificial based on computational performance. Perhaps SOCIALNETS can provide more reasonable groupings for interactions.

b. As an extension to a, above, it is understood that Dunbar's (and Milgram's) work includes levels of social structure, the impact of trust and cooperation on these levels, and the linkage between individuals in social networks. Perhaps these structures can be used to build large mixed virtual and real environments where various social interaction schemas can be used to build hierarchical links between virtual environment users/teams where more distant linkages utilize slower or less reliable networks and conveyance of data than local groups/teams. Dynamic reallocation of these resources would clearly be desirable along with consideration and utilization of agents as team members and as facilitators of information conveyance. The impact of software, network, and device characteristics, reliability, and interaction paradigms can affect the human/system performance.

c. The military might be a good test case to study because their social structures are well defined and personnel are trained to operate within the social structure.

3. Additional interactions are planned between IST and PERADA. These include;

   a. Goldiez intent to review the year 1 deliverables from SOCIALNETS and map those results onto UCF research in human-robot collaboration/teams as well as training and education employing large scale interactions using game engines on high performance computing platforms. Follow up meetings will be scheduled as required.

   b. Exploring organizing a visit and exchange meeting or conference by PERADA projects at the University of Central Florida in the next year.