Corporate Training in Virtual Worlds

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ABSTRACT

This paper presents virtual training worlds that are relatively low-cost distributed collaborative learning environments suitable for corporate training. A virtual training world allows a facilitator, experts and trainees communicating and acting in the virtual environment for practicing skills during collaborative problem solving. Using these environments is beneficial to both trainees and corporations. Two system prototypes – the sales training and the leadership training virtual worlds – are described. The leadership training course design is discussed in details.

Keywords: Virtual Reality, Virtual Words, Corporate Training, Leadership Training.

1. INTRODUCTION

Corporate learning and training is one of the major concerns for large companies with high rate of work force turnaround and rotation. For example, sales forces and call center operators training requires substantial budget. The most complex training is a group training that focuses on development of communication, management and leadership skills during a collaborative problem solving. For this type of training face-to-face business simulation games are used [1]. Training for these jobs is an expensive proposition that often involves getting experts and trainees together in a common place to "mock-up" staged scenarios and exercises around interaction skills. Computer-based and Web-based training have been dramatically decreasing the costs of delivering information to personnel in a globally consistent manner around the world at point of need. However, most of currently used technology-based corporate training software cannot support synchronous interactions among distributed trainees.

Virtual reality (VR) is considered as a perspective tool for learning [2]. Currently there are several directions in developing VR tools and equipment. First, it is the distributed virtual reality systems that use sophisticated immersive projection equipment and advanced input/output device (tactile gloves, touch screens, location sensors, etc.) [3]. These systems are used for collaboration on projects, such as architectural or product design and scientific data exploration. Several industrial applications have been developed, such as General Motors' VisualEyes system that allows designers to collaborate for inspecting and reviewing 3D CAD models of the products [4] and Motorola's drop test visualization systems, which use simulation to observe the effects of a device damage and collaborative discussion for identifying weaknesses in the product design [5]. These systems could be used for training, but high expenses for maintenance and high initial cost of equipment and supporting software limits their usage.

The second direction is to use a less expensive set of equipment for individual immersion into a virtual world. The set includes a head-mounted stereoscopic display with tracking sensors, surround sound speakers or a headphone, input devices with position tracking for navigating the world (for example, 3Ball device), and, sometimes, a wear vest that allows the user to feel physical force such as punches, kicks, or vibration. These hardware and software allows creating immersive multi-sensorial 3D learning environments using the visual, auditory and haptic senses. A number of experimental learning environments have been created. For example, the ScienceSpace project includes three VR learning environments for learning science for high school students [6]. However, the maintenance, hardware, and software developing cost are still prohibitively high for using this kind of VR systems for everyday corporate training.

The third direction is using current achievements in display technology, networking and computer multimedia to create immersive VR systems. Most of these systems focus on cognitive involvement of the users in opposite to physical involvement. Two origins of this approach are the collaborative textually based virtual environments, such as MUDs/MOOs [7,8], and realistic graphically intensive video games, such as flight simulators. A virtual world in these environments is represented as a 3D landscape (indoor and/or outdoor) and users (players) are represented by their graphical avatars. The users can collaborate or compete with each other to achieve their goals. Advances

in computer technology, networking, and advent of the WWW allow creating Web based distributed games and learning environments that are available from any Internet-enabled computer. Some online games such as EverQuest [9] and the SIMS [10] attracted thousands of players. These types of environments are becoming the most cost effective form of corporate training and learning. We will call them virtual training worlds.

2. VIRTUAL TRAINING WORLDS

A virtual training world is a distributed VR learning environment that allows trainees to collaborate for solving problems. There are three categories of users: facilitators (trainers), problem domain specialists (experts) and students (trainees). The facilitator's role is to present the problem, analyze students' solutions and change the situation to demonstrate the advantages and drawbacks of students' decisions. The experts' roles are to provide expertise in the problem domain and evaluate students' knowledge. Sometimes one person can play the facilitator's and the expert's roles at the same time. In other cases a computer program can serve as a source of domain knowledge. Each student plays a role of particular character (for example, a hunter or a mechanic) that has a specific set of skills and physical abilities. Users can be located in the same room or remotely. Each user has his/her computer that displays the current state of the world with the other users represented by avatars and the user's character internal state such as how tired the character is (level of energy), level of health, etc. The users interact using text messages and voice. The system collects text and voice messages for the follow-up discussion.

Depending on a training scenario one student can play the principal role and the others assist him/her to achieve the goal. One example is training a salesperson for selling complex pharmaceutical products. In the pharmaceutical industry, companies spend millions dollars to fly in their salesmen, and then also bring in retired doctors, nurses, and other support personnel to simulate a typical selling environment. A scenario for training pharmaceutical sales force personnel would include a virtual hospital world, which would allow the salesperson to emulate navigating the front desk, talking with the receptionists, dropping off samples, having discussions with doctors, and several other points. Figure 1 presents a screenshot from a prototype of the sales training environment, which shows a reception desk with the receptionist's avatar at the top and an avatar conferencing tool at the bottom.

This kind of scenario can be used for business training in the other industries:

- For selling complex goods (selling cars, broker dealers, investment management, etc.).
- Call center operators training for complicated call situations.

Figure 1. Screenshots of Virtual Sales Training World.

- Financial manager training for decision making in investment/risk management and analysis in combination with standard simulation.
- Training for lawyers in courtroom scenarios.

Another training scenario may assume that students' roles are equally important. For example, training of management or leadership skills can use a scenario of a military mission or an exploration expedition with a group of people, when the formal leader is absent (get killed or wounded at the beginning of the scenario).

Using a virtual world environment for training can dramatically decrease the cost and improve the availability of training that requires significant person-to-person interaction. The virtual world can simulate a business environment visually, while using live remote people to deliver the lessons. The virtual world does this by representing real life interactions through avatar character visualization coupled with telephone driven voice conversations. This simulates the level of quality of interaction of the face-to-face training environment without having to bring people to the same location. Additionally, training can be spread out throughout a long period of time. Instead of a focused week of training, employees could take training at regularly scheduled times with the trainers being paid by the amount of time they log into the system to support the virtual sessions. This shifts

training from a "once and done" mentality to an ongoing channel for continuous skills development. For example, if a sales person wants to try a new strategy or technique on a customer, they can practice in advance in the virtual world before attempting the task in the real world.

The overall costs of building and running a virtual training world are much smaller than real world training environments. Additionally, since the virtual training world does not attempt to model behavior, but just acts as a channel for human interaction, the cost of modeling or automation is much lower than costs that are typically associated with high end training platforms such as business simulation.

3. LEADERSHIP TRAINING COURSE OVERVIEW

Our experience with immersive virtual games such as EverQuest [9] gave us two observations important for the selection of subject matter for training: (1) authenticity - users seem to be willing to suspend disbelief and relate to virtual reality as if it were authentic reality; (2) socialization – users develop and maintain complex and dynamic social relationships with other users. These observations suggest that goal-oriented virtual social environments are especially suited for leadership training. Leadership training is a key component of management development in the corporate world and includes development of the following skills:

- Communication
- Situational awareness and flexibility
- Intelligent risk taking
- Envisioning the future
- Planning
- Team organization
- Process management
- Crisis management
- Conflict resolution
- Team motivation

Our goal was to create a virtual environment, which enabled users to develop and exercise these skills through interaction with other users. To achieve this goal, we selected a course scenario based on the story of legendary Sir Ernest Shackleton's trip to Antarctica in 1915-1916. The course places trainees on board of a virtual ship and assigns each individual certain roles/tasks (medic, carpenter, cook, etc.) A natural group tension emerges through the trainee's interactions, which results in the surfacing of leaders, followers, and aggravators. The system maintains the coherence of the world, but the course facilitator plays the role of "god" controlling the pace of the simulation by introducing various stress factors (i.e. virtual leak in hull, limited food supply) that force the team members to react to and resolve the matter based on their skills and leadership capabilities.

Interactions inside of the virtual training world are structured by groupings of events into discrete sessions or course modules. The activities of the team inside of each
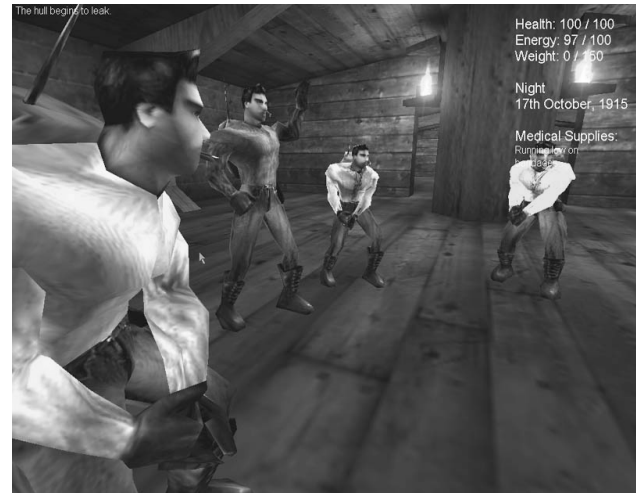

Figure 2. A screenshot of the leadership training world

module are guided through the following five phases:

1. Introduction
2. Planning
3. Plan execution
4. Complication
5. Debriefing.

In the introduction stage, participants are briefed on the situation. During planning, they work together to come up with an approach for best handling their circumstances. Plan execution focuses on how well the team works together to implement their plan as well as measuring the success of the tactics themselves. A complication phase tests the flexibility of the plan, as well as the responsiveness of the team to changing situations. Finally, a debrief phase allows the team to reflect on their accomplishments and development points, and prepare for the next module.

An illustrative module shows the five phases in action. During the introduction phase of this particular module, it is announced to the members of the expedition that their leader Sir Ernest Shakleton is dead, their ship is trapped and that they have to decide what to do – do nothing, hoping that the ship will be freed, abandon ship and try to reach land, etc. Participants are told to form small groups (2-3 people) and propose a course of action. Each small group presents its plan to the entire expedition that tries to reach a consensus on what to do. While they debate and discuss what to do, regular tasks have to be accomplished – food prepared, ship maintained, etc. Different participants have access to different sources of information according to the role they play: The navigator can find out their geographic coordinates, the meteorologist can provide a weather forecast, etc. This design feature obviates the need for prior specialized knowledge while ensuring dependencies between participants.

After a period of debates and discussion, a plan emerges and various roles for its execution are assigned. As the team starts executing the plan, the facilitator then introduces a complication testing the plan's assumptions.

In our example, the facilitator may send a strong wind that will start cracking the ship requiring immediate evacuation. This experience should enable the course participants develop and exercise their leadership skills and observe the skills of others. Each module is followed by a debriefing session with the facilitator, in which the trainees reflect on their performance and the facilitator helps them to understand their strengths and weaknesses and to improve their skills.

4. LEADERSHIP TRAINING COURSE DESIGN

The functional design of the virtual leadership world was quite complex. As previously stated, interactions inside of the virtual training world are structured by groupings of events into discrete sessions or course modules. Since this world was designed to test and augment leadership skills in participants, a series of events needed to be constructed to best exercise those skills in a wide variety of situations. Different types of events and emergencies needed to be designed to engage the participants in situations that were of both major and minor concern to both the team and/or specific participants due to the impact on their role. Design of the course also included an examination of the duration of the event on the leadership style of the team. All of the modules needed to be linked together in a cohesive story to allow suspension of disbelief of the participants. Therefore, events were ordered in a manner that repeated certain skill lessons in various times through different scenarios. As previously stated, the final design incorporated scenarios to test the following skills:

- Communication
- Situational awareness and flexibility
- Intelligent risk taking
- Envisioning the future
- Planning
- Team organization
- Process management
- Crisis management
- Conflict resolution
- Team motivation

The actual course was grouped into of eight 1-1.5 hour sessions or modules. Each module included a flexible complication phase resulting in variations of the final course based on the facilitator who is in charge of its final implementation. The course modules were as follows:

1. Steering Module
2. Evacuation Module
3. Blizzard Module
4. Fracture
5. Leopard Seal Attack
6. Food Shortage
7. Penguin Migration
8. Open Sea Voyage

These modules in turn provided the team with scenarios to understand the situation, and resolve various circumstances they were faced with. The crisis for each scenario was different in terms of who it targeted on the team, the severity of its impact, the speed at which it hit the team, and its duration. One of the modules was set up to provide a windfall to the team and gauge reactions and interactions to a positive event. Also, one of the modules focused specifically on team coordination.

5. DETAILED MODULE DESCRIPTIONS

The details of each module are listed here to give some insight into how the virtual leadership world combines skills and scenarios to provide training support. Each module title is given, along with its main crisis type, and a detailed description.

1. Steering Module (Familiarization and Ice-Breaking Exercise). It is an abstracted role-assignment scenario that allows the users to become familiar with the system controls without being in a stressful situation. The facilitator can increase the stress of the situation by controlling the number of dangerous ice floes nearby, how bad the weather is and so on.

2. Evacuation Module (First Crisis). The ship is crushed slowly by the pressure from the ice floes. The module is initiated when the team is split apart. The team has to make quick decisions as to how much energy they devote to saving the food versus saving the ship. They will also have to be monitoring their own energy levels, as well as plan ahead because they will have to forego sleep that night. Figure 2 shows a screenshot of this module, specifically depicting a time when the team starts saving the food by moving it out of the sinking ship.

3. Blizzard Module (Aggravated crisis scenario). The Blizzard Module is designed to occur mid-way through the Evacuation Module, and forces the team to monitor even more tasks concurrently. The main concern of the Blizzard Module is the construction of shelters while continuing to repair the ship as well as deciding whether to remove supplies.

4. Fracture (Sudden Major Crisis). As the weather begins to warm, the team has to endure a new problem – being constantly wet. The ice floe is much more difficult to traverse, and ice floes are thinning. This crisis could also occur when the ice floes are thick and solid. In either case, a sudden fracture opens on an ice floe perhaps directly under the camp. A few warnings, such as increasing pressure, should be given. The team must decide how to form an emergency plan, and what the roles of each individual in such an event should be. The team should also decide how to prevent the loss of as many supplies as possible.

5. Leopard Seal Attack (Sudden minor crisis). Leopard seals are the only natural animals in the Antarctic Circle that would attack a human without provoking it. Leopard seals can travel on the ice floes as fast as a running man. The appearance of a leopard seal requires quick decision making to prevent serious injuries.

6. Food Shortage (Prolonged crisis management). The

facilitator will decide how a large portion of available food stocks are lost – either through contamination or lost because of cracked ice floes. The team will have to decide how to manage the remaining meager supplies, how to quickly boost food supplies, and whether to take more drastic actions such as killing the sled dogs.

7. Penguin Migration (Sudden boon). A thick fog obscures the area around the camp, and the loud, bewildering sounds of large crowds of penguins surprise the team. Hundreds of penguins are migrating and passing through the team's camps. The fog eventually begins to clear, and the team sees penguins all around them. Maybe have this event take place at the end of the Food Shortage scenario. Alternatively, perhaps only allow 3-4 penguins to wander into the camp, and see whether any users realizes that other penguins may be nearby and tries to look for them.

8. Open Sea Voyage (Split-team management). Two lifeboats are left with the team, but each can only seat half the number of participants. The team must decide how to split the participants, keeping in mind the skill sets of each individual. The participants will have to coordinate themselves within each lifeboat as well as with the other lifeboat, while performing very arduous and complex tasks as they try to navigate to Elephant Island.

6. DETAILED SKILL DESCRIPTIONS

The skills addressed by the virtual leadership world are listed here. The questions below serve as criteria for evaluating trainees' performance by the instructor.

Communication.
General: Does the user express his ideas clearly? Does the user listen to others and respond appropriately?
Evacuation Module / Fracture: Can the user effectively communicate plans and actions under stress or in the event of a sudden crisis?
To make the communication take on more of a strategic challenge, the facilitator can alter the communication channel in different ways. For example, limiting the length on each typed message or allowing the chat panel displaying only three recent messages with no scroll bar capability.

Flexibility.
General: How willing is the user to hear the ideas of another person? Is the user willing to try solutions that Shackleton did not try?
Blizzard Module / Food Shortage: When unexpected events occur, how easily does the user adapt to the new crisis? Does the user have alternate plans ready for such situations?
The facilitator can test alter the salience of warning cues, or a mole in the group could bring up a particular danger ahead of time – ice floe fracture.

Situational Incentive.
Various subtle events will be introduced meant to be taken advantage of. For example, the sudden appearance of sea gulls signifies proximity to ocean. Or the appearance of several penguins may signify the proximity of a much larger herd. These cues will be used to test a user's awareness and ability to take advantage of an opportunity.

Intelligent Risk Taking.
Evacuation Module: Does the user try to gather as much information as possible before making a decision? Does the user consider as many alternatives as possible? Is the action taken overly risky?
Open Sea Voyage: How does the user split the team onto the two lifeboats? What actions does the user take to minimize risk?

Project Planning and Budgeting
General: How well does the user manage the limited supplies available? How well does the user manage his own training schedule?
Evacuation Module: Does the user set goals knowing that not all supplies can be removed from the ship? Does the user plan meals before they are needed?
Food Shortage: When food is in short supply, does the user take appropriate actions to ensure long-term survival? To complement the short-term or sudden events, the overall goal of the module requires long-term planning or decision making that will be revisited as the team's situation changes. For example, the leader may decide and persuade the team early on that heading to the edge of the pack ice to launch their lifeboats may be their best chance for survival. When the difficulty of moving lifeboats on the ice floes become apparent, and the team becomes uncooperative, the leader may need to change his goal or perhaps persuade his team to continue on.
Users will also have to plan how to spend their training points as individuals, and how much time they spend on training skills they have.

Team Organization
General: How well does the user handle discipline?
Steering: Does the user take time to understand the roles as well as the strengths and weaknesses of each individual? How optimized are the assigned roles?
Open Sea Voyage: Is the user able to delegate power appropriately so that someone else can be in charge of the second lifeboat?

Process Management
Evacuation Module / Penguin Migration: How well does the user optimize the process flow? Does the user identify and resolve inefficiencies?

Crisis Management
Evacuation Module / Fracture: When the shipped is trapped in the ice floe, does the user create an emergency or evacuation plan for what to do if the ship begins to be crushed by the pressure? Does the user plan for how to regroup quickly in case of an emergency? How well does the user respond to the emergency?

Conflict Resolution
General: When team members come up with conflicting solutions, how does the user decide the final course of action without offending either individual? When disagreements arise, how does the user defuse tension?

Envisioning the Future.
Fracture: When the team is finally stranded on the ice floe, how does the user choose among the alternatives possible? Is he able to set a direction for this team now that their ship has been crushed?
Open Sea Voyage: How does the user envision a future to motivate his team to expose themselves to the open seas?

Sharing the Vision.
General: How does the user persuade others to share his vision? How does he deal with antagonists or people who do not believe in his vision? Does he empower the team to believe in the goal?

Leading a Team
General: Does the user create an atmosphere that establishes cooperation, trust and cohesion within the team? Is he able to get his team to trust him?
Blizzard Module: Does the user build and sustain morale during a crisis?

Motivating a Team.
General: Does the user pay attention to each individual's needs and motivations? Is the user able to give members of his team a sense of belonging and recognition? Does the user reward success appropriately – verbally or otherwise?

7. SUMMARY

A virtual training world is a relatively low-cost distributed learning environment that uses virtual reality techniques to immerse learners in a realistic environment to practice skills or collaborate with the other learners to solve problems. The learners can communicate with each other in real-time. The facilitator can control the session by aggravating or releasing the situation based on trainees' performance.

The prototypes of two virtual training worlds have been developed at the Accenture Technology Labs. The sales training world allows a trainee to practice sales skills when he/she sells a complex pharmaceutical product. The leadership training world allows a distributed team to collaborate for solving problems. The design of the leadership training course using the virtual training world has been discussed in detail.

Virtual training worlds are very different than previous computer-based learning approaches. Previous attempts at computer based training typically rely on computer interactions with individual students via multiple choice question or text entry interaction with artificial intelligence engines. Most of the currently used technology-based corporate training software cannot support synchronous interactions among distributed trainees. Current software solutions on the market also cannot capture the nuances and group dynamics of live human interaction. By leveraging the power and subtleties that live human-to-human interaction brings to the learning experience, interactions in virtual training worlds can be much richer, deeper and more realistic than with

existing computer-based techniques. In addition, using virtual training worlds for corporate training has such advantages as decreasing training cost by lowering trainees' travel and lodging expenses, providing a wide range of flexibility for training schedules, and improving the motivation of trainees.

REFERENCES

[1] Swain, J.J., Power Tools for Visualization and Decision-Making,, *ORMS Today*, INFORMS, February, 2001. http://www.lionhrtpub.com/orms/surveys/Simulation/Simulation.html

[2] *Visions 2020: Transforming Education and Training Though Advanced Technologies*. U.S. Department of Commerce, Report of Technology Administration, September 17, 2002 http://www.ta.doc.gov/reports.htm

[3] Pantelidis V.S., The RAVE, CAVE, and Collaborative Virtual Environments, Report by CIITR, July 31, 2000, http://www.soe.ecu.edu/vr/rave/RAVEtext.htm

[4] Smith, R., Pawlicki, R. R., Leigh, J., Brown, D. A., Collaborative VisualEyes, in *Proc. IPT 2000: Immersive Projection Technology Workshop*, Ames IA, June 19-20, 2000.

[5] Wong H., Liu. X., Quah S., Leigh J., Motorola drop test visualization Web site: http://www.evl.uic.edu/cavern/users/moto.html

[6] Dede, C., Salzman, M., Loftin, B., & Ash, K., Using virtual reality technology to convey abstract scientific concepts. In M. J. Jacobson & R. B. Kozma (Eds.), *Learning the Sciences of the 21st Century: Research, Design, and Implementing Advanced Technology Learning Environments*. Hillsdale, NJ: Lawrence Erlbaum, 2000.

[7] Bruckman, A., Programming For Fun: MUDs As A Context For Collaborative Learning. *Proc. National Educational Computing Conference*, Boston, MA, June 1994.

[8] University of Virginia, IATH's Web page: *MOOs, MUDs and Other Virtual Hangouts* http://www.iath.virginia.edu/iath/treport/mud.html

[9] EverQuest's Web site: http://everquest.station.sony.com/

[10] The SIMS' Web site: http://thesims.ea.com/