

Transpositions in Configurable Virtual Story-Worlds, James J. Sosnoski, Kevin Q. Harvey, Jordan Stalker, and Colleen Monahan.

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Transpositions in Configurable Virtual Story-Worlds

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EXECUTIVE SUMMARY

A. **BACKGROUND:** The Center for the Advancement of Distance Education (CADE) is a self-supporting unit within the School of Public Health at the University of Illinois at Chicago. The Center's services range from online continuing education and professional training to multimedia web-casting and research data management, analysis and presentation.

B. **TECHNOLOGY USED:** In public health emergency response training, an isolation and quarantine situation is one of the most challenging. Second Life has the capability and potential to address many of the training and planning challenges associated with such a sensitive topic. It enables public health emergency responders to test and refine existing plans and procedures in a safe, controllable, immersive and repeatable environment.

C. **THE CASE:** a quarantine scenario designed for emergency training. We designed "The Canyon Crossroads" as a key transit point between two quarantine areas and two uninfected areas. We placed a state border to divide the crossroads leaving quarantine zones in each jurisdiction. The local hospital was located in one of the quarantine zones and it is an official holding and treatment location for infected victims. The Exercise involves transmitting persons in and out of the areas.

D. **CHALLENGES:** There are three challenges we are currently addressing: (1) how to increase the levels of engagement in the training process, (2) how to construct a virtual world that fosters collaboration, and (3) how to measure the levels of engagement in collaborating.

A. BACKGROUND

1. The Center for the Advancement of Distance Education

The Center for the Advancement of Distance Education (CADE) is a self-supporting unit within the School of Public Health at the University of Illinois at Chicago. CADE partners or contracts with university, government, non-profit and for-profit organizations to provide innovative technological solutions to meet a variety of educational, training, research and administrative needs. These collaborations include the creation of interactive online training modules, the design and development of web sites,

simulations, games and virtual worlds, mobile phone applications, multimedia production and webcasting, course registration and learning management system construction, web-based programming and database connectivity, and online data gathering and analysis.

CADE is actively involved in advancing online opportunities in the areas of public health, medicine, oral health, pharmacy and nursing. The Center's experience ranges from online continuing education and professional training to multimedia webcasting and research data management, analysis and presentation. By expanding into new and emerging technological fields, CADE has managed to sustain continued growth in terms of personnel, annual revenue, client base and number of simultaneous projects.

2. Management Structure

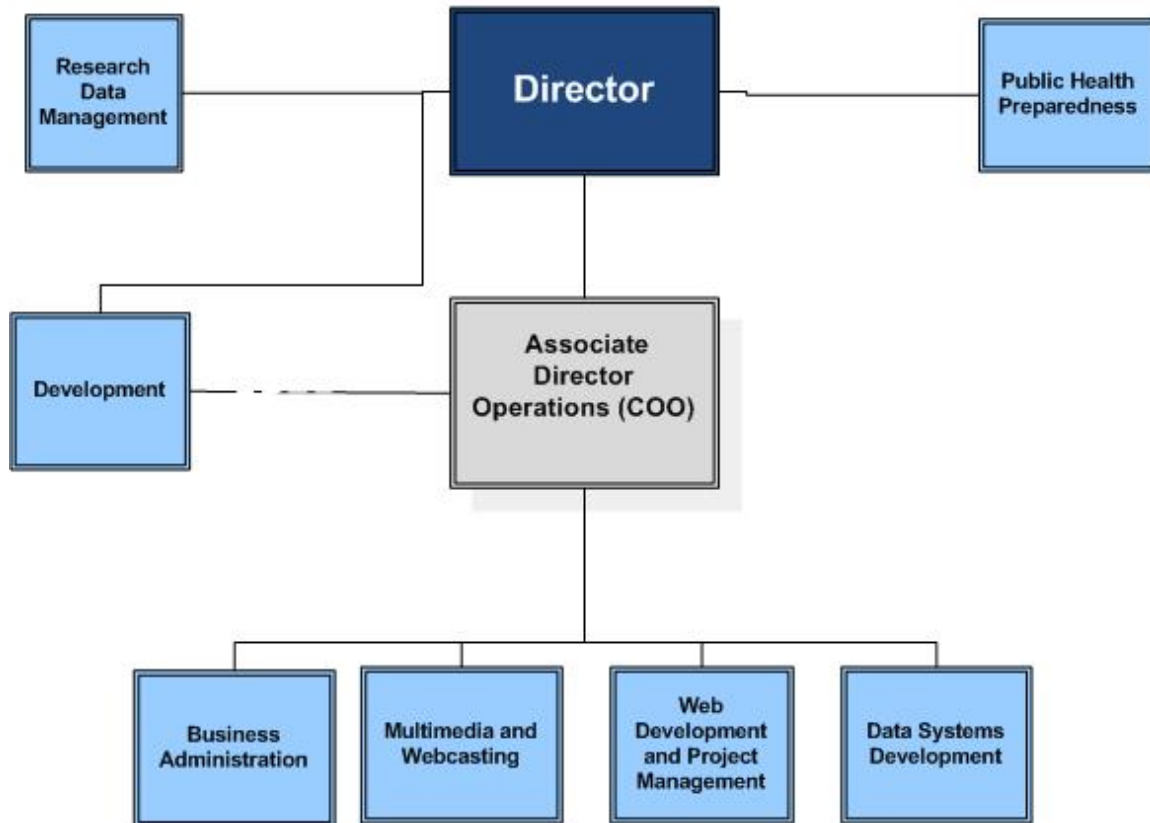
Dr. Colleen Monahan, CADE's Director and Founder, has 20 years experience successfully managing a self-supporting unit. From 1986 to 1997, Dr. Monahan founded and ran a self-funded Research and Development (R&D) unit within the UIC Division of Specialized Care for Children (DSCC). This unit focused on the development of proposals/projects that focused on children with special needs and their families. Eventually the topics of interest broadened to include more public health populations and, in 1997, Dr. Monahan transferred the unit and staff to the School of Public Health under its present name (CADE). CADE has a successful 10 year track record with revenues of over 22 million to date.

CADE employs over 25 personnel - all full-time staff have college degrees; all higher-level staff have advanced degrees. Given the technical nature of CADE's activities, most of the staff have been recruited from their respective specialist fields: the Multimedia and Webcasting staff come from professional audio-video industries; the Web Design and Development group come from the graphic design, instructional design, programming, usability and project management professions; the Research Data Management staff have epidemiology, statistics and programming backgrounds; the Network and Server Administration team have computer engineering, IT, and MIS expertise.

CADE mobilizes and integrates expertise across its production groups: Web Design and Project Management; Multimedia and Webcasting; Research Data Management; Data Systems Programming and Public Health Preparedness. This integration capacity permits the Center to deliver services that incorporate features drawing from a wide variety of specialized activities, which address the client's specific and specialized needs. CADE's projects blend programming, webcasting, web design, instructional design, data analysis, and learning/knowledge management system creation and development in ways few other organizations can.

CADE develops distance-learning solutions, to facilitate and improve training, communication, and collaboration among professionals, students, and members of the public. It provides expertise across the full spectrum of development processes to support successful online learning and research data initiatives. This flexibility and breadth ensures the right combination of system features and services are designed and delivered to meet clients specific needs.

CADE Organization



3. Type of business

PRODUCTS AND SERVICES

CADE services include:

- Support for online educational programs (e.g., skill building for faculty and staff, course development and remote communication strategies);
- Development of training/information/entertaining CD-ROMs and DVDs;
- Development of serious games and simulations, including virtual worlds;
- Development of facilitated virtual tabletop exercises using virtual worlds;
- Studio and Location Recording (e.g. HD video, Digital DVCAM or MiniDV in single or multi-camera productions, DAT and hard disk audio recording);
- Support for internet-based meetings (broadcasting/webcasting);
- Development of Internet-based applications to support business and educational

- systems. (e.g., online Course Evaluation Questionnaires, registration systems, online inventories, etc.);
- Assistance in writing grant proposals to include use of innovative online technologies;
 - Development of informational web sites; and
 - Research data management support for research projects.

B: SETTING THE STAGE

1. Use of Second Life technology

Any activity that involves the emergency response field, from didactic training to drills and exercises, creates a significant cost structure for those involved. Often, local health departments, especially those that function with shrinking budgets and human resources, cannot fully implement processes that would create cost savings after a high initial cost.

In public health emergency response, an Isolation and Quarantine situation is one of the most challenging to rehearse and mitigate. Each state has the capability to exercise Isolation and Quarantine orders and every Pandemic Plan includes Isolation and Quarantine mitigation options, the issues surrounding these operations repeatedly trigger disagreements in strategy and ethics. It is also difficult, if not impossible, to exercise some of the possible scenarios, such as the quarantine of a school or a section of a community, in any realistic or meaningful way.

There are two major concerns at issue when dealing with Isolation and Quarantine scenarios:

- First is the ethical dilemma of protecting the public without violating their rights of privacy or liberty.
- Second, and probably most provocative, is the issue of enforcement, which can lead all the way to considerations of lethal force.

Second Life has the capability and potential to address many of the training and planning challenges associated with such a sensitive topic. It enables public health emergency responders to test and refine existing plans and procedures, or to assist in developing plans, if they do not yet exist; all in a safe, controllable, immersive and repeatable environment.

There are two major benefits:

- The first is that, with the exception of the costs to acquire parcels of *Second Life* islands and employ builders, there is almost no expense to run the scenario, whether it is a medical supplies dispensation, a quarantine or mass fatality management.
- Second, there are no real, permanent consequences to the scenarios. If the users of the *Second Life* training course fail to effectively contain a major disease outbreak, such as pandemic influenza, they can, at CADE's discretion, retry the scenario until they

get it right. This is of course unlike an offline disaster where the effects are permanent.

Second Life allows for organizations to create unique tutorial islands for their users. CADE has established one such environment that it calls Preparedness Island. The environment is a cluster of islands owned and maintained by CADE (the permission to build on these islands – to place objects in the environment – has been granted by Linden Labs, the creator of the *Second Life* platform.). The islands include an airport terminal, a shopping mall, a high school gymnasium, businesses and a hospital.

CADE uses *Second Life* to implement a set of best practices for training. In an effort to appeal to the widest number of clients, CADE provides access to *Second Life* in several formats. All of these combine to make for an enriching experience that increases efficiency and utility of the trainees.

Using *Second Life* enables the clients to immerse themselves in the Virtual Learning Environment (VLE) and interact with the environment and create an experience much closer to the real emergency situation for which they are planning. Hypothetical situations discussed in flow charts and PowerPoint presentations typically fail to capture the audience's attention in a way that fosters memorization.

The scenarios that utilize Auto-Bot Interaction (see Table 1 below) afford the opportunity to witness consequences, virtual though they are, of incorrect or inefficient response.

2. Advancement of Virtual Learning Environments

It does not seem totally out of line to place VLEs and Collaborative Learning Environments (CLEs) in the same lineage of educational technologies such as instructional television channels or open learning systems. Those technologies gained notoriety in the 1960s and especially took off in least-developed countries where large segments of the population had access to radio or television signals but not classroom-based education (for a more detailed description of open learning systems, see Hawkrige, 1977).

One of the major drawbacks to large-scale open learning systems, as with any technology, is a very high startup cost. The client base, students from impoverished nations, makes for a difficult time recuperating those initial capital expenditures. *Second Life* provides a means for nearly free initial setup and a very low maintenance fee. With only very few exceptions, the costs associated with maintaining a presence in *Second Life* will never reach the same level as those of a material, physical model and training program. For example, if a vaccine is distributed in the offline world, the moment the vaccine is distributed and ingested by a patient that product no longer exists and more must be manufactured and brought to the distribution site. In-world, however, programmers can embed an island with the instructions to regenerate objects instantaneously or on a time release. Instantaneous regeneration allows the users of the scenario to try a different method of distribution and the benefit of a time-released object

is of course that it better simulates what would happen in the field during an actual emergency while a response team waits for supplies to be replenished.

3. Teaching Practices

The CADE staff has used *Second Life* to design and demonstrate several types of emergency preparedness scenarios. Prior to engaging in the work related to the current grant under review that involves medication dispensation, mass fatality management and quarantining procedures, CADE developed, in consultation with the University of Illinois Hospitals, a functional scale model of the University of Illinois Hospital in Chicago, Illinois. The purpose of that scenario was to train the employees of the hospital what must be done in the case of a total facility evacuation.

In all three case studies, CADE developed a comprehensive training manual for the participants. The manuals combine an introduction to the *Second Life* VLE and included a series of learning objectives for the users. There were also several sets of exercise and evaluative questions in addition to set-by-step instructions that described how to proceed with the scenario.

Table 1. CADE's training techniques for collaborative learning environments.

<i>Training Type</i>	<i>Description</i>
Groupthink	Large groups of trainees share a guided, simultaneous virtual world experience
Breakout Groups with "Designated Drivers"	Small groups assigned unique tasks guided by group leaders with virtual world experience
Benchmark Training	Expert CADE staff set benchmarks for training to identify understanding and knowledge gaps of the users
Command Team Training	Groups are assigned to respond and manage a disaster as first responders or materials dispensation
Incident Command System Reinforcement	Participants gain knowledge of the National Incident Management System through division of labor
Intelligent Environment	Uses in-world triggers to progress through the scenario
Auto-Bot Interaction	Involves interaction with pre-programmed objects, including Non-player Character (NPC) avatars, that enhances learning and training
Automatic Data Set Generation	Allows automated collection of data from scenario

4. Teaching Philosophy

CADE established its Readiness Training Group in 2005 with the vision that it could use new technologies like *Second Life* to deliver greater service and results to its immediate clients, which would in turn produce information about disaster situations that would facilitate recovery, response and prevention efforts for the affected populations. The user-generated content focus of *Second Life* enables CADE's team of programmers and designers to implement nearly limitless concepts for its clients. Given enough time to physically design objects for and write programming scripts for scenarios, CADE uses *Second Life*'s open platform technology to enhance training in and analysis of situations like those described in this chapter.

Like open learning systems of previous decades, VLEs enable CADE to service urban and rural communities and provide them with essential emergency preparedness training. The exercises meet the federally mandated standards set by the Centers for Disease Control and the Department of Homeland Security. This compliance with institutionalized standards and formalization enables the CADE staff to act and attract with a certain degree of reputation and stature that most non-university or non-governmental bodies – in other words, independent private sector entrepreneurs such as those who have long existed in *Second Life* – cannot have.

Trainee Protocols:

- There are no right or wrong answers.
- Respond based on your own knowledge and training using CDC's, DHS's, CDPH's, or your community's current plan and capabilities; use only current assets.
- Make decisions based on the circumstances presented.
- Assume the cooperation and support of other exercise players/responders and other agencies.

5. Teachers and Students

The CADE staff fills the role of the teacher in many of the scenarios with which it deals. Ideally they train a small core of individual clients to become adept enough so that the client can become self-sustaining to manage the project in the event of any continual or long-term processes.

“Teaching” in or about virtual environments is a bit of a misnomer. The term “facilitator” might be better. This is especially true in the early adopter stage. We firmly believe that, although relatively new in development, educational technology tools like *Second Life* will be the classrooms of the future. Most of the courses taught that make heavy use of *Second Life* are appearing in the catalogs at universities for the first time. Some of the instructors, even if they are adjunct lecturers who have careers building and utilizing *Second Life* or similar products, are sometimes only minimally more savvy than the students they intend to teach.

It is also difficult to standardize instructional elements in *Second Life*. The novelty of *Second Life* lies in the user's ability to change his or her appearance and to shape the environment. This can also pose a problem when it comes time to devise a syllabus that includes visits to different locations and islands. If an instructor assigns students to investigate a company's *Second Life* presence, the island has the potential to change in the interval between the instructor's visit to the island and a student's visit. The difference from a textbook is clear: the textbook does not change. Even revised translations or expanded editions must be treated as new texts. *Second Life* is decidedly more adaptive and responsive to the desires of the users and programmers who take it upon themselves to change the "text."

The *CADE* project is no exception to the scenario just described. An investigator's experience is dependent on the time when they encounter the island. A person familiar with the island as the hospital was being built will take away significantly different types of information than those of a person who visits it now. Both users would also have different experiences if they visited the island by themselves than visiting it as part of the pre-arranged training put on by the City of Chicago and CADE. We are still learning how to manage such differences.

C. CASE DESCRIPTION

[Note: the technologies involved are discussed in section B.]

1. *The Isolation and Quarantine Exercise: Management and Organizational Concerns:*

In *Pandemic Plans*, the most extreme instances of quarantine (*cordon sanitaire*) are repeatedly regarded as improbable. However, lethal viruses or toxic agents suddenly increases the likelihood of quarantine not only for individuals but for communities. And setting up quarantine in a bio-event is still applicable for setting up cordons for other disasters like fire or flood.

Although with infectious diseases the question for communities is which side of the quarantine line you fall on. Are you keeping something out of your community or keeping it in? And due to the divisive nature of quarantine, can it ever work voluntarily?

These issues become even more complex when they occur at the borders of tribal reservation lands, especially if the quarantine direction creates a reservation versus state dynamic as in our case. Practicing collaboration between state and tribal representatives is critical to sort out the issues in such cases.

Tribal communities not only have special jurisdictional and legal concerns regarding quarantine, but they also have a history of tragic experience. We make an effort in this exercise to explore various scenario complications and balance the tribal needs with the state plans.

In this exercise, we begin with a sample response and allow trainees to change it according to the recommendations of their group.

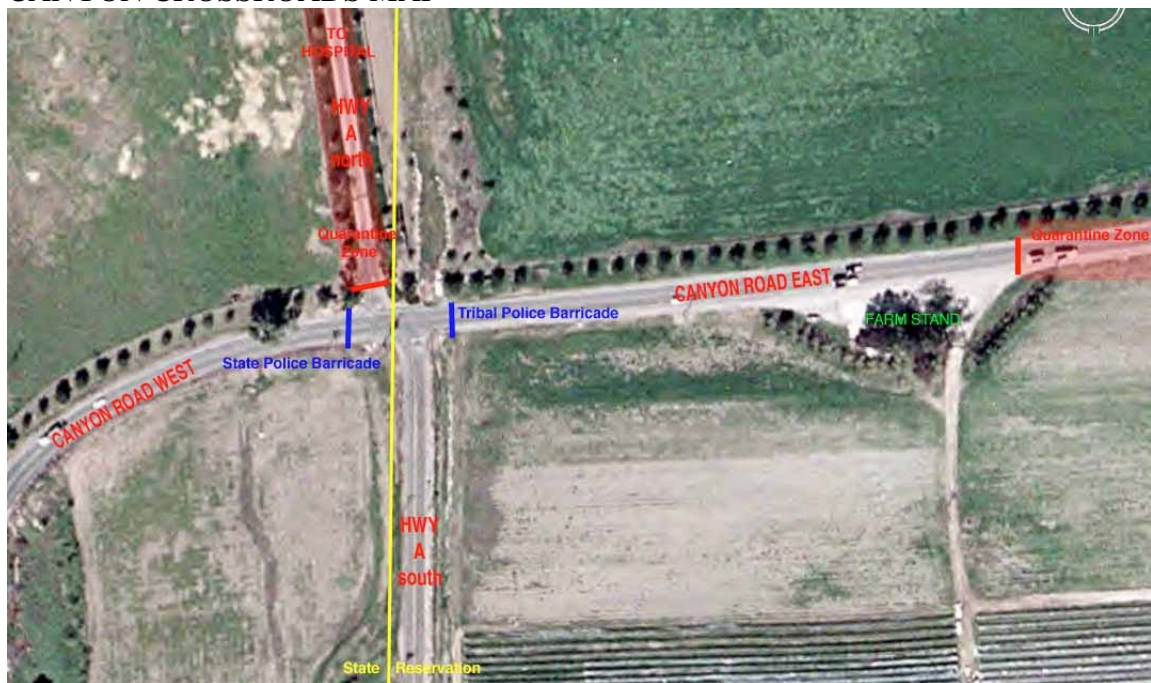
2. *description of the project*

QUARANTINE SCENARIO:

In this scenario, the Canyon Crossroads is a key transit point between two quarantine areas and two uninfected areas. However, the state border divides the crossroads leaving quarantine zones in each jurisdiction. The local hospital is in one of the quarantine zones north on Hwy A and it has become an official holding and treatment location for infected victims.

And just to make things a bit more complicated, a fruit stand is located on Canyon Road East, not far from the intersection. It is a mainstay supplier of food for local populations. The Health Department has carefully tested and inspected its employees for signs of infection and cleared them.

CANYON CROSSROADS MAP



How should quarantine be set up?

EXERCISE:

- Establish the decision making criteria used by the Local Health Officer to determine

how to support the officers in charge of the quarantine. And what steps are appropriate to protect the local population.

- Identify the authorities, roles and responsibilities of health officers and partner agencies in the event of an encounter requiring I&Q of one or more individuals trying to leave the quarantine area.
- List or demonstrate appropriate steps to limit the spread, including infection control measures, and use of appropriate personal protective equipment by officers or others enforcing the quarantine.
- Describe procedures and decision trees for accomplishing intervention and restraint, both voluntary and involuntary, for a single infectious case up to a large group.
- Describe procedures for staffing a dedicated facility for I&Q of persons who have broken quarantine.
- Define roles and responsibilities for your agency, local health care partners, and local response agencies during an outbreak event requiring isolation and/or quarantine. Pay careful attention to potential jurisdictional issues.
- Describe how communications and coordination will occur between your agency, local and state entities during such an event.
- What are the enforcement rules? Define the Rules of Engagement for this hazard.
- Will you employ the Good Faith Rule: An individual's cooperation with voluntary isolation or quarantine will be assumed in good faith unless there is evidence to the contrary.

LEARNING OBJECTIVES

Exercising emergency organizations and emergency plans provides information needed for:

- Determining capabilities and limitations
- Improving plans and procedures
- Identifying any shortfalls in response resources
- Evaluating the effectiveness of training
- Allowing responders to get to know one another and practice their skills, both individually and interactively.

These Exercises are broadly intended to:

- Validate plans and policies
- Promote team-building
- Achieve consensus

- Provide exposure to the decision-making process during an emergency
- Provide pre-event training and practice for operations or exercises
- Provide an opportunity to practice skills and improve individual performance under varying degrees of stress.

Participants in this exercise will be able to (generally):

- Perform sound overall tactical evaluation of the event.
- Confront complex ethical and practical planning issues
- Test the knowledge and skills of plan implementers.
- Assess and balance the tension created in protecting the public, rights of privacy and rights of liberty
- Recognize legal authority to impose isolation and quarantine on the public
- Recognize legal authority across tribal and state jurisdictions and the limits of that authority
- Address issues surrounding enforcement
- Understand border and access issues in various outbreak scenarios
- Determine new areas for improvement regarding emergency coordination with state and local authorities

More specifically, participants in this exercise will improve their skills and abilities to:

- Recognize reasoning behind ISO/QUARANTINE design and improve the ability to adapt that design to meet new challenges, i.e. wind direction, contamination, public evacuation, etc.
- Perform safety assessments of physical response logistics
- Review and revise the security of the affected area
- Analyze potential issues arising from restrictions and rerouting of traffic on site public roadways
- Provide technical analysis and assistance in support of response organizations
- Recognize, categorize and properly classify the emergency event(s)
- Test participants knowledge of protective action decisions and offsite recommendations based on pre-approved default criteria
- Identify specific issues relating to provisions for proper emergency medical care for ill/infected victims, transportation for ill/infected victims, and local hospital support for multiple victims
- Evaluate if the space and layout of emergency response facilities are adequate to support assigned staff functions and activities
- Develop new ISO/QUARANTINE Response recommendations
- Update and refine existing emergency management plans from lessons learned during the ISO/QUARANTINE virtual world exercise

During this exercise, the following assumptions apply:

- That the scenario is plausible, and events occur as they are presented.
- That participants will concentrate on the local response, assuming that federal and state responders have their own plans, procedures, and protocols in place and operating.

Some mathematical models of quarantine for flu show that there must be a nearly perfect degree of limitation of travel to be effective. Other analyses suggest that these measures do not have to be absolute to be effective. Modeling exercises suggest that partial quarantine can be effective in slowing the rate of disease spread, especially when combined with vaccination.

3. Related Issues: Commuters Play Large Role In Flu Spread

- The potential for the avian influenza strain H5N1 to spread into the human population and kill tens of millions of people has motivated researchers to study how influenza spreads. Some researchers at the US National Institutes of Health found through mathematical modeling that long commuter trips play a large role in spreading influenza.
- Researchers at the National Institutes of Health (NIH) conclude that the regional spread of annual influenza epidemics throughout the United States is more closely connected with rates of movement of people to and from work than with geographical distance or air travels. They also found that epidemics spread faster between more populous locations.

D. CURRENT CHALLENGES FACING THE ORGANIZATION

1. The challenges

There are three challenges we are currently addressing: (1) how to increase the levels of engagement in the training process, (2) how to construct a virtual world that fosters collaboration, and (3) how to measure the levels of engagement in collaborating.

These challenges stem from CADE's most recent project—"Preparedness and Emergency Response Using Simulated Environments" (PERUSE)—which has recently been funded by the Centers for Disease Control and Prevention (COTPER/CDC) of the United States Department of Health and Human Services (HHS). The overall goal of this project is to determine whether the use of a Collaborative Virtual Environment (CVE) improves individual and system performance in public health preparedness and response planning. Though we believe that the use of Virtual Environments such as Second Life show great promise as a low cost ways to address some of the challenges we face, very little research has been done in their usefulness for training. . This project looks at the issues surrounding the use of Second Life to support a collaborative disaster response planning process.

The Aims of the Project are:

1. To discover whether a Collaborative Virtual Environment (CVE) has the capabilities to improve administrative and operational collaboration and cooperation in emergency response planning.

2. To discover whether a CVE has the capabilities to increase awareness of the need to plan for vulnerable populations.
3. To discover whether increasing realism in the training exercise increase the effectiveness of planning.
4. To discover whether an agency, after introducing a tool like the CVE, will continue to use it.

Each of these aims depends upon the degree of engagement the trainees have in performing in the Collaborative Virtual Environment specific to their mission. By “engagement” we mean, the act of participating in the activities of a group, particularly when sharing a collective aim. Collaboration and cooperation are attitudes that engender dispositions to act in concert with others. Awareness of needs depends upon attentiveness to the conditions that call for them. The effectiveness of a group depends upon a commitment to shared concerns. The continued use of a tool depends upon the extent to which persons are committed to a purpose. Dispositions, awareness, commitment, and continuous practice all involve emotion (an integral aspect of motivation). Increasing the level of engagement in training exercises is a critical component of the project’s aims.

2. Problems that the organization faces

Empirical evidence shows that the current public health system is severely lacking in the knowledge, skills, abilities that are required for an effective response. The *Nationwide Plan Review* (U.S. Department of Homeland Security 2006), the most comprehensive assessment of catastrophic planning yet undertaken in this country, found that the majority of the nation’s current emergency operations plans and planning processes cannot be characterized as fully adequate, feasible, or acceptable to manage catastrophic events as defined in the *National Response Plan* (U.S. Department of Homeland Security 2004). They also found that planning processes are outmoded, current tools and guidance are rudimentary, and planning expertise is insufficient for catastrophic incidents. Further, states and urban areas are not conducting adequate collaborative planning, as a part of “steady state” preparedness. The response to Hurricane Katrina uncovered major structural flaws in our current system for national preparedness. Most experts agree that a more collaborative approach is the best solution to effective disaster response (Waugh and Streib 2006). So, the challenge is not only how do we engage persons to commit to a common purpose, but more specifically how do we motivate persons to collaborate with each other. It is one thing to share a common goal, but quite another to be disposed to work with others. In the light of these general circumstances, we are focusing on the three specific problems mentioned earlier: *increasing engagement by using story based models of virtual worlds* and *finding ways to measure the results*.

a) Increasing the level of engagement

Although virtual worlds that simulate real life experiences engage their visitors through several senses and although experiences in virtual worlds are recalled more readily than those encountered in conventional learning contexts, nonetheless, virtual worlds do not

invariably induce significant *felt*-experiences. Since users do not necessarily identify with their avatars, learning in virtual worlds is often experienced as an exercise that mimics real life situations and thus is a less “serious” event. On the other hand, when users identify with their avatars to the point that they experience feelings as if they were actually in the situation, learning is intensified and the gap between the virtual world and the real world is bridged to varying degrees. In such instances, a transposition occurs during which participants in virtual worlds experience what they expect their avatars to feel in such circumstances.

Consider the differences among the most common types of virtual worlds with respect to participant reactions to them. A selective list of different types of simulated worlds would include:

1. Cinema-graphic Worlds (e.g., 3D films shown to audiences who react to their effects)
2. Computer Assisted Worlds (e.g., computer-aided design (CAD) programs on computers creating 3D artifacts and scenes)
3. Video Game Worlds (e.g., shooter games that provide interactivity with figures in the world)
4. Immersive VR Worlds (e.g., CAVES—Immersive VR with an environment back-projected on several walls creating the sense of being inside the environment.)
5. Projected VR Worlds (e.g., GeoWall technology—Computer assisted projections of 3D environments onto a screen.)
6. Habitable VR Worlds (e.g., Second Life)ⁱ

Each of these worlds was designed with specific goals in mind and for distinct audiences. Aspects of four of these virtual worlds are pertinent to our project because they intensify virtual experiences and have “as-if real” effects. However, different degrees of participant involvement depend on the medium and the type of virtual world. Each medium engages our senses in different ways. *Absorption* is a term suitable for readers of fiction because they become absorbed in the virtual world their imagination creates in response to the narrative. Movie audiences seem *entranced* by the audio/visual spectacles in front of them because films put their audience members in a trancelike state where they are controlled by the images and sounds they experience. Of course, the size of the screen and the deployment of sound alter an audience’s experience. Seeing the same film in a fully equipped theatre is not the same experience as seeing it on TV. Visitors to VR CAVES are typically *immersed* in an environment with which they interact. Second Life scenarios can attain the highest degree of interactivity in a virtual world where participants can be *transposed* and behave with considerable agency and creativity as if they were their avatars (Sosnoski, 2006, 40).

Depending upon the effectiveness of the narrative presentation, any of the media mentioned can “*transport*” its audience albeit to varying degrees. The phenomenon of “psychological transportation,” is defined “as a state in which a reader becomes absorbed in the narrative world, leaving the real world, at least momentarily, behind” (Green/Brock 2002 317). Media can induce their participants to “*transpose*” themselves only on the

condition that audiences identify with the desires or conflicts of a figure in a narrative. Relating these two phenomena to virtual worlds, it is critical to our project that transportation together with transposition—the highest degree of interactivity possible in an avatar-based environment.

b) Why a gaming model of a virtual world should be replaced by a story world model.

Based on their propensity to produce specific types of interactivity, we can classify virtual worlds along the following lines:

1. Absorbed (attentive observation)
 - a. Subjects enter a SIMULATED WORLD which is a replica of real life—e.g., early versions of emergency situations such as Cease-Fire which replicated Chicago neighborhoods where gang activity is common.
 - b. Feelings are typically projected onto figures in the world as concepts of what they might be.
2. Entranced (via immersion & interaction via partial agency).
 - a. Subjects enter a GAME WORLD—e.g., “The Disaster Game.”
 - b. Feelings are typically internalized and added to one’s autobiographical memory.
3. Transported (via immersion & interaction but without “agency”)
 - a. Subjects enter a STORYWORLD—e.g., a film (ref: Christopher Stapleton and Charles Hughes’s experiential entertainment trailers.)
 - b. Feelings are typically internalized and assimilated to previous ones in similar situations)
4. Transposed (transported agency and creative involvement)
 - a. Subjects enter a CONFIGURATION (Configurable World) —e.g., “The Thing Growing,” an immersive VR scenario designed to evoke anger.
 - b. Feelings are typically accommodated—revising previous felt experiences stored in memory.

The typical differences in affordances (Gibson, 1977; Norman 1988)ⁱⁱ among these four virtual worlds would be:

1. SIMULATED WORLDS allow visitors to passively experience the environment
2. GAME WORLDS add *interactivity*, allowing participants to alter the environment and to make choices about navigating it.ⁱⁱⁱ
3. STORYWORLDS add a *plot* with twists and turns that requires resolution (problem solving)
4. CONFIGURABLE WORLDS add *creativity* and a greater *propensity for transportation & transposing*

There is no doubt that virtual worlds are changing the way we think about learning, collaboration, and networking at intra- and inter-organizational levels, and in fact, how we think about learning environments themselves (Dickey, 2005). A review of two

distance learning projects using a virtual environment, concluded that a *virtual world* had significant potential for “facilitating collaborations, community and experiential learning” and that it allowed learners to become “situated and embodied” within the learning environment (Dickey, 2005).

It is clear that, due to the realistic nature of virtual environments, learners experience situations that are impossible or difficult to experience in the real world for reasons of safety, cost, time, etc. (Corti, 2006; Squire & Jenkins, 2003). In educational applications, studies have shown that an immersive learning experience creates a profound sense of motivation and concentration conducive to mastering complex, abstract material. (Swartout & van Lent, 2003). Shaffer, et. al (2005) argue that acting in virtual worlds makes it possible to develop situated understandings, effective social practices, powerful identities, shared values, and ways of thinking of important communities of practice.

Although Second Life does not render the level of fidelity found in high-end virtual reality systems such as military flight or medical patient simulators (nor the cost associated with these!), there is evidence that it has enough verisimilitude to provide for an immersive experience. Research by Herrington, Reeves and Oliver (2007) has indicated that the ‘cognitive realism’ of the task is of greater importance than its realistic simulation. They have found that it is the task itself that is the key element of immersion and engagement and that the technologies can be used as cognitive tools in constructivist learning to solve complex problems. But Shaffer, et al (2005) and Squire et al (2005) assert that there needs to be more research into the use of CVEs in education.

New training approaches are needed that not only enhance preparedness skills, but create a culture of readiness. Barnett et al (2005) explain that “this may require innovative training and organizational development methods to enhance preparedness skills, and create a culture of organizational readiness among public health workers through a process of “syntonic” organizational change. In the syntonic model, organizational change is a nonthreatening, natural growth process that is more likely to be embraced by employees than resisted; key factors in syntonic change include anticipatory guidance and experiential learning. In addition to teaching competency-based factual information, preparedness curricula must also foster appropriate attitudinal “buy-in” from public health employees about their new professional readiness duties. The use of CVEs is consistent with the syntonic model of organizational change, as these can incorporate experiential learning to have an impact on knowledge and attitudes in a nonthreatening way. (2005). Competition is, in a number of respects, “threatening.” Cooperation, by contrast, is nonthreatening.

In this context, it may be time to let go of the influence that video gaming has had upon the creation of virtual worlds and move toward a more “collaborative” type of situation. Games, after all are either won or lost, hence they induce competition more than collaboration.^{iv} Storyworlds, on the other hand, provide roles for participants and those roles can be collaborative rather than competitive.

A team of programmers and educational researchers from the Electronic Visualization Lab at UIC developed N.I.C.E: Narrative-based Immersive Constructionists-Collaborative Environments.

NICE is a project that applies virtual reality to the creation of a family of educational environments for young users. Our approach is based on constructionism, where real and synthetic users, motivated by an underlying narrative, build persisting virtual worlds through collaboration. This approach is grounded on well established paradigms in contemporary learning and integrates ideas from such diverse fields as virtual reality, human-computer interaction, CSCW, storytelling, and artificial intelligence.^v

We have a backlog of experience at UIC in construction Configurable Story Worlds as collaborative environments. Consequently, we recommend a combination of the third and fourth types of virtual world mentioned above—a configurable story-world which Second Life technology makes possible. But, how can we determine the degree of engagement in a configurable story world designed as a collaborative environment.

c) **How do you measure engagement?**

While virtual simulation environments provide a means to construct “artificial worlds” in which individuals can have experiences in a realistic interactive setting, the degree of control and observability that is feasible in these environments depends upon what is being measured. *While it is difficult to estimate engagement, nonetheless it can be measured with respect to the language used by participants to describe their virtual experiences.* Discourse Analysis provides a variety of tools for identifying emotional engagement. For this reason, we have chosen interview and ethnographic modes of assessment to track the degree of participant engagement.

Measures that will be collected include team performance evaluations, as indicated by such factors as the number of tasks successfully completed.^{vi} It is also possible to measure process variables that provide insight into decision strategies and team coordination, such as the speed with which different tasks are processed (including time to complete the exercise), the existence of uneven task loading across team members, the transfer of information among team members, and the transfer of resources among team members. Communication measures can also be collected. Text based communication measures and audio recordings will be collected and scored by project staff either in real time or from recordings. This data, collectively, provides an account of participant engagement.

In addition, measures will be collected from individuals participating in each planning group and from observers of each planning group.

Observer-Based Team Process Measures are obtained from trained observers who observe team performance and processes during a scenario run. The ratings they provide will pertain to individual members of the team, to subcomponents of the

team, or to the team as a whole.

Participant-Based Knowledge and Perception Measures focus on individual respondents, other team members (individually or collectively), the team as a whole, and on factors associated with the scenario itself. These include subjective workload, mutual awareness measures, and team members' assessments of team processes and performance, as well as evaluation of the scenario. Participant-based measures will be obtained at the end of each scenario.

The particular measures that are collected in any given situation will depend upon the factors incorporated into the scenario and the goals of the training context in which the measures are collected. The purpose of the measures used in these efforts will be to assess how teams structure and how the use of the CVE affects the team's processes, and how those processes contributed to outcomes. See Table 2.

Table 2. Types of Data

Construct/Measure	Level (focus) of observation	Source of Data	Description	When
Demographics	Individual	Q, O	Demographics questionnaire.	Initial
Technology Acceptance	Individual	Q	Use the Technology Acceptance Model	Initial and Final
Individual Performance	Individual	Q	Behaviorally anchored ratings of quality of aspects of and individual performance, including number of tasks successfully completed	After each scenario run
Team Performance	team	Q, O	Behaviorally anchored ratings of quality of aspects of and overall team performance, including number of tasks successfully completed.	After each scenario run
Team Processes/ Dynamics / Performance	Individual, team	Q	Enumeration of unobservable individual and team factors underlying team processes.	During scenario
Team work	team	Q, O	Behaviorally anchored ratings of quality of six dimensions of teamwork processes: communication, monitoring, feedback, back-up, coordination, and team orientation	During scenario and After each scenario run
Communication Measures	Individual	O	Records of type, sender and recipient, and frequency of communications	During scenario
Mutual Mental model congruence	Individual, team	Q	Assessment of the congruence of models team members hold of one another	Initial and Final
Organizational awareness	Individual	Q	Assessment of the accuracy or congruence of team members'	Initial and Final

			situational and mutual mental models	
Evaluation of the scenario	Individual, team	Q	Ratings of aspects of scenario including level of difficulty, complexity, uncertainty, ambiguity for self, others, and/or team as a whole	After each scenario run
Attitude about the goal	Individual	Q	Assessment	Initial and After each scenario run
Emergency Plan Development	Individual	Q	Assessment of the contribution of the scenario to emergency plan development.	Final
Emergency Plan Modification	Individual	Q	Assessment of the contribution of the scenario to emergency plan modification.	Final
Emergency Plan Evaluation	Individual	Q	Assessment of how the scenario contributed to emergency plan evaluation.	Final
Cross-agency collaboration	Individual	Q	Assessment of frequency, types and novel communication across agencies attributed to intervention	Annual
Networking	Individual	Q	Number and type of new relationships formed due to intervention	Annual

Q=Questionnaire/Survey; O=Observation

3. The current status of the aforementioned challenges and problems

From a cognitive point of view, our aim is to generate an “experience transfer”—a transfer of virtual experiences in SL to real life (RL) experiences through the conduit of an avatar. The virtual experiences are thus remembered in RL situations and provide strategies for coping with them. Drawing upon recent developments in Cognitive Psychology and Neuroscience, we believe that virtual experiences that result in “deep” learning (significant changes in perspectives) depend upon the process of transposition wherein persons assume the identities of their avatars and experience a virtual environment as if they were their avatars. In this process, transposed virtual experiences are *felt experiences* and *generate emotions related to engagement*. Unless some degree of transposition takes place, persons entering virtual worlds only observe their avatars behaviors, remaining detached from them.

Stories provide optimal conditions for transpositions because they predispose their audiences to feel the desires and the conflicts upon which they are structured (Green, 2002). For example, in the N.I.C.E. project participating children desire to grow plants. Conflicts ensue when they must share the sun and rain with other participants. They have to learn to work and share by allowing their avatars to cooperate with other avatars. Thus

their avatars are the conduits of desires and conflicts. Configurable storyworlds, in our view, are more conducive to virtual deep learning experiences than other virtual worlds.

What does it mean to say that a virtual world is “configurable?” Earlier we noted that configurable worlds (type 4 VW) add creativity and a greater propensity for transportation & transposing to a storyworld (type 3 VW). Every virtual world depends upon a visitor’s imagination. The graphical dimensions of virtual worlds guide visitors’ imagination but invariably they continue to be aware that the virtual environment is not the real world and do not take it seriously (no “felt” consequences in the experience). Nonetheless, visitors go through a process of mental modeling in “filling in” the construction of the virtual world in their imaginations according to the way in which the simulation provokes images that can be mapped to past experiences. Visitors in large part “flesh out” the graphical representation of an environment with details from their past experiences of similar objects and events.

A configuration is a term for this “construction” but it is a particular way of doing it. As with other virtual worlds, visitors perceive “figures”^{vii} in a representative situation located in a recognizable environment. In such perceptions, visitors can assume the perspective of one of the figures in virtual worlds—usually that of the avatar with whom they identify as a “self-figure.”^{viii} Other figures are already in the scenario or enter it. It is not, however, an automatic occurrence that visitors assume the perspective of their avatars. Frequently visitors to virtual worlds maintain their RL perspective as “observers” of their avatars. They assume the perspective of their avatars only when they identify with them (“configure them”—perceive the situation as-if they were their avatars). Its condition is a “turning point” event, which is usually the realization that a particular action can solve a problem they encounter (see examples below).

Considering that many virtual worlds are seen only from the detached perspective of a person outside looking in (a perspective that most persons who are new to SL initially experience), we need to consider what happens when visitors “transpose” their perspectives with that of their avatar’s. Borrowing from Cognitive Science, we can say that a transposition occurs when visitors are no longer aware that they are not their avatars and merge their perspective with their avatar’s. Part of this phenomenon is the effect of transportation. Configuring occurs at the moment of transposing perspectives once transportation has occurred. Some examples of this phenomenon drawn from the experiences in SL that students have reported. [Note: this data was collected from a course on SL but is relevant to the phenomena of being in a story world and thus is applicable to designing emergency training as a story world rather than a game.]

1. John does not care that his avatar is not as attractive as some of the other avatars in SL. Then at some point in time while exploring an SL environment, John feels that other avatars disregard his avatar and do not pay attention to “*him*”. As a result, John redresses his avatar and hopes for a more positive reaction to *his* embodiment.
2. Mary has been visiting various SL environments but finding them uninteresting on the whole because for the most part no other avatars are

there. Suddenly a very attractive male avatar approaches her and asks if she would like to join him at a party. She realizes that “*she*” wants to do this.

3. Joan is a white woman whose avatar is also white. She meets another white avatar who tells her that in RL she is an African American. Joan is surprised to learn that many African Americans have white avatars to avoid the racial prejudice which exists in their virtual world. Joan decides to convert the skin of her avatar to resemble an African American. At a concert in SL to which she has frequently gone, she now experiences racial slurs, hatred, and malice. “*She*” is furious.

Each case begins with a virtual experience detached from the avatar representing the person at the computer terminal. Then some “turning point” event occurs and the person begins to experience the world through his or her avatar’s perspective. This change in perspective can be a “deep learning” experience as it is in the fourth story. The story world is the critical factor because what makes a story a story is that an initial situation, as the result of some pivotal turning point (event), is resolved by inverting the initial situation. In Joan’s case, her experience of SL is positive, she redresses herself as a black avatar, her next experiences are negative.

Configurable worlds are story worlds in which transpositions induce dispositions. In educational scenarios they can dispose learners to solve the problem that the virtual world presents. Changing perspective is the cognitive turning point. In a virtual world, this happens only when the world is configured and persons assume the perspectives of their avatars.

Creating a configurable virtual world depends upon creating a storyworld in which persons manipulating their avatars encounter a situation in which desires and conflicts are experienced and emotions are generated in them as if they were their avatars. The emotional component intensifies the virtual experience and deepens the learning.

Though we are persuaded that configurable story worlds are a model for training in CVEs, we are at the preliminary stages of shifting from a gaming model, designing a story world for training, and learning how to assess the process of configuring.

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SUPPORT MATERIAL

A. BENCHMARKS OF VW TRAINING

We adapted Glynn and Duit’s (1995) five conditions for learning meaningfully. Their schematic fits the parameters of “concept transfers” in Cognitive Psychology. We revised their “conditions” drawing upon recent developments in other Cognitive Sciences, principally from the research of Langacker, Lakoff, and Johnson in Linguistics, of Fauconnier and Turner in Cognition, and of Kosslyn and Koenig in “the New Cognitive Neuroscience.” In addition, our adaptation was done with Don Norman’s guidelines for VR design in mind. Whereas Glynn and Duit’s benchmarks were consonant with experience transfers, we added the complementary notions about “experience transfers” in accordance what has been called “the embodied mind” model of cognition. The revised benchmarks are listed showing the concept transfer (CT) and the experience transfer (ET):

1. existing memories are activated by the present situation (assimilation)
 - a. CT—source of motivation is the problem encountered
 - b. ET—[added value] recognition of disparities between past and present experiences.
2. existing experiences are mapped to ongoing experiences
 - a. CT—logical process of matching
 - b. ET— [added value] “Cognitive blending,”¹ a refinement of the activity of mapping.
3. intrinsic motivation is developed
 - a. CT—feelings are activated
 - b. ET— [added value] dispositions are generated
4. new knowledge is constructed
 - a. CT—accommodation (a conceptual change)
 - b. ET— [added value] creative agency in constructing a mental model of experience
5. new knowledge is applied, evaluated, and revised Change in world views
 - a. CT—change in conceptual framework
 - b. ET— [added value] change in belief system
6. new experience is retained in memory
 - a. CT—concept retained in memory
 ET— [added value] concepts, images, and feelings retained in memory

B. DEFINING ISOLATON AND QUARANTINE

The CDC differentiates between Quarantine and Isolation. Isolation is the separation of a person or group of persons from other people to prevent the spread of infection. Quarantine is the restriction of activities or limitation of freedom of movement of those presumed exposed to a communicable disease in such a manner as to prevent effective contact with those not so exposed.

ISOLATION

Isolation means separation, during the period of communicability, of a person infected with a communicable disease, in a place and under conditions so as to prevent direct or indirect transmission of an infectious agent to others. It may mean extremely limited contact with an ill person who is diagnosed with or suspected of having a communicable disease. The isolation can occur in a hospital setting in a negative airflow room (prevents potentially contaminated air from going back into the hospital) for very infectious airborne diseases. Isolation usually requires health care providers and visitors to use clothing protectors, masks or respirators, goggles and gloves as a means of protecting the visitors but also to protect the patient from exposure to new diseases that their weakened immune system may not be able to overcome.

QUARANTINE

Quarantine means restrictions, during or immediately prior to a period of communicability, of activities or travel of an otherwise healthy person who likely has been exposed to a communicable disease. The restrictions are intended to prevent disease transmission during the period of communicability in the event the person is infected. This period is commonly known as the "incubation" period of a disease. This means they have been exposed to an individual with a communicable disease and may be developing the disease as well. Some diseases are not communicable until symptoms appear; other diseases may be communicable for hours or days before the person shows any signs of the disease. Quarantine can be accomplished by a variety of means including having the person stay in their own home and avoid contact with others (including family members) to having the person or group of persons stay in a designated facility, to restricting travel out of an impacted area.

SANITARY BARRIER

In extreme circumstances, public health officials may consider the use of widespread or community-wide quarantine, which is the most stringent and restrictive containment measure. Strictly speaking, "widespread community quarantine" is a misnomer, since "quarantine" refers to separation of exposed persons only and (unlike snow days) usually allows provision of services and support to affected persons. Like snow days, widespread community quarantine involves asking everyone to stay home. It differs from snow days in two respects: 1) It may involve a legally enforceable action, and 2) it restricts travel into or out of an area circumscribed by a real or virtual "sanitary barrier" or "cordon sanitaire" except to authorized persons, such as public health or healthcare workers.

NIH Report (*Interregional spread of influenza through United States described by virus type, size of population and commuting rates and distance*, The John E. Fogarty

International Center for Advanced Study in the Health Sciences (FIC) - Wednesday, April 19, 2006) From Randall Parker Article (http://www.futurepundit.com/archives/cat_pandemic_isolation.html)

C. PRIMARY HYPOTHESES TO BE EVALUATED INCLUDE THE FOLLOWING:

Use of a CVE for emergency response planning will improve collaboration in emergency response planning. Based on a study by Dickey (2005), who showed virtual worlds have a significant potential for “facilitating collaborations, community and experiential learning” we predict that we will improve emergency response planning.

Use of a Collaborative Virtual Environment (CVE) will increase awareness of the need to plan for vulnerable populations. Based on Shaffer, et al, (2005), who argued that acting in virtual worlds makes it possible to develop situated understandings, effective social practices, powerful identities, shared values, and ways of thinking of important communities of practice, we predict that the use of CVEs will increase awareness of the need to plan for vulnerable populations.

Once trained on the use of the CVE, the participants’ will continue to use the modality on their own. Based on Barnett et al (2005), who argue that the use of CVEs is consistent with a model of organizational change in that incorporates experiential learning that has an impact on knowledge and attitudes in a nonthreatening way and is more likely to be embraced by employees than resisted, we predict that once trained on the use of the CVE, the participants’ will continue to use the modality on their own.

Increasing the realism in the training exercise, through the use of CVE, will increase the effectiveness of the planning. Based on Corti, 2006 and Squire & Jenkins, 2003, who claim that, due to the realistic nature of virtual environments, learners experience situations that are impossible or difficult to experience in the real world for reasons of safety, cost, time, etc., we predict that increased realism in the training exercise, through the use of the CVE, will increase the effectiveness of the planning.

ENDNOTES

ⁱ By a “habitable” world we mean one in which the visitor to it is represented by an avatar who “lives” inworld. The other types of virtual worlds keep visitors outside of the world as observers of it.

ⁱⁱ Psychologist James J. Gibson originally introduced the term in his 1977 article *The Theory of Affordances* and explored it more fully in his book *The Ecological Approach to Visual Perception* in 1979. In 1988, Donald Norman appropriated the term *affordances* in the context of human-machine interaction to refer to just those action possibilities which are readily perceivable by an actor. Through his book *The Design of Everyday Things*, this interpretation was popularized within the fields of HCI and interaction design.

ⁱⁱⁱ Guidelines for the use of gaming simulation (#2 above) in bioterrorism and emergency readiness were summarized by the ASPH/CDC Simulation-Based and Interactive Training Collaboration Group (chaired by Dr. Monahan) in January of 2007. The CDC commissioned this collaboration group of CPHP network participants to “review CPHP methods and identify measured benefits and successes related to such methods (simulation-based and interactive training) employed for preparedness training and education” (Association of Schools of Public Health, 2007). The group concluded that the learner using gaming

simulation could be sensitized to roles and problems encountered during an emergency. “On the merits of these advantages, games and simulations should be an integral part of preparedness training in public health” (Ibid). Given limited training budgets, personnel resources and time constraints, the challenge is to provide guidance to health departments on how to approach an all-hazards training approach that not only addresses core readiness issues but is flexible, adaptive and effective.

^{iv} Some cooperative scenarios are marketed as “video *games*.” For the purposes of this essay, we are not categorizing them as “games.”

^v For more information on NICE, go to <http://www.evl.uic.edu/core.php?mod=4&type=1&indi=371>

^{vi} It is very likely that there will be some modifications to the original measures.

^{vii} Etymologically the word configuration suggests “figures with (*con*) other figures,” that is, a recognizable situation.

^{viii} This parallels the cinematic technique of having the perspective of the camera seeing the scene from behind it as if the camera were one’s own eyes.