Chapter 54: Virtual Harlem as a Collaborative Learning Environment: A Project of the University of Illinois at Chicago's Electronic Visualization Lab

JIM SOSNOSKI, STEVE JONES, BRYAN CARTER,
KEN MCALLISTER, RYAN MOELLER, AND RONEN MIR

[AQ1]

Although numerous virtual reality (VR) applications devoted to educational purposes have been developed at University of Illinois at Chicago's (UICs) Electronic Visualization Laboratory, we focus on the Virtual Harlem project because it is designed as a collaborative learning environment (CLN)—a VR application that structured as a networked collaboration with the goal of building a model of the subject being studied (see "the Virtual Harlem Project" below for a more detailed description).

Virtual Harlem is a learning environment (Sosnoski & Carter, 2001). Visitors can enter Virtual Harlem and navigate through it as a way of learning about the historical context, the events, the everyday life of persons who were living in Harlem at the time.

J. Weiss et al. (eds.), The International Handbook of Virtual Learning Environments, 1259–1290.

Unlike a conventional classroom in which the subject matter being studied is available to students mostly in textbooks, on blackboards, or in slides projected on the wall, Virtual Harlem is a locale that has to be experienced. Students enter a cityscape that can be experienced, albeit virtually, as if they were tourists visiting Harlem, NY via a time machine. To visit Virtual Harlem is to undergo a virtual experience.

Virtual Harlem is also an historical replica of Harlem, NY. during the Harlem Renaissance in the 1920s and 1930s. Scholars of the Harlem Renaissance direct their students in research that contributes to the model. Their research informs the work of students in computer science at the University of Illinois at Chicago's (UIC) Electronic Visualization Lab (EVL). Many of these students are in the Fine Arts program at UIC and they contribute their skills by creating digital replicas of the buildings, people, automobiles, and other aspects of the scenario.

Virtual Harlem is also a networked project and has been seen at VR sites from New York, to France, to Sweden, to Japan, and to Arizona. Classes in the Harlem Renaissance at various universities, for example, at the Sorbonne in Paris, France are part of the network that use Virtual Harlem to give their students a more holistic experience than books can provide.

The Virtual Harlem project at UIC has been influenced by two important VR educational applications developed at UICs EVL, namely, the NICE project and the Round Earth project. We describe these projects and indicate how they have influenced the Virtual Harlem project in the next section. Then we delineate the pedagogical rationales underlying the project. Next we describe the Virtual Harlem project as a CLN, after which we comment on two of its outcomes, and conclude with comments from our perspective on the significance of the Virtual Harlem project.

1. THE RESOURCES OF THE UNIVERSITY OF ILLINOIS AT CHICAGO'S ELECTRONIC VISUALIZATION LABORATORY

The Electronic Visualization Laboratory (EVL) at the UIC is a graduate research laboratory specializing in VR and real-time interactive computer graphics directed by Tom Defanti and Dan Sandin. Instruction at EVL is a collaborative effort of faculty in UICs College of Engineering, the School of Art and Design, and the College of Liberal Arts and Sciences.

An important focus of EVLs research has been the development of VR systems and their application to both science and art. Current research focuses upon developing the software to support collaborative, virtual environments, and the networking over which these applications are shared. Research is also ongoing to utilize video, audio, and database technologies to provide seamless, collaborative, virtual environments for design, interactive art, and data visualization.

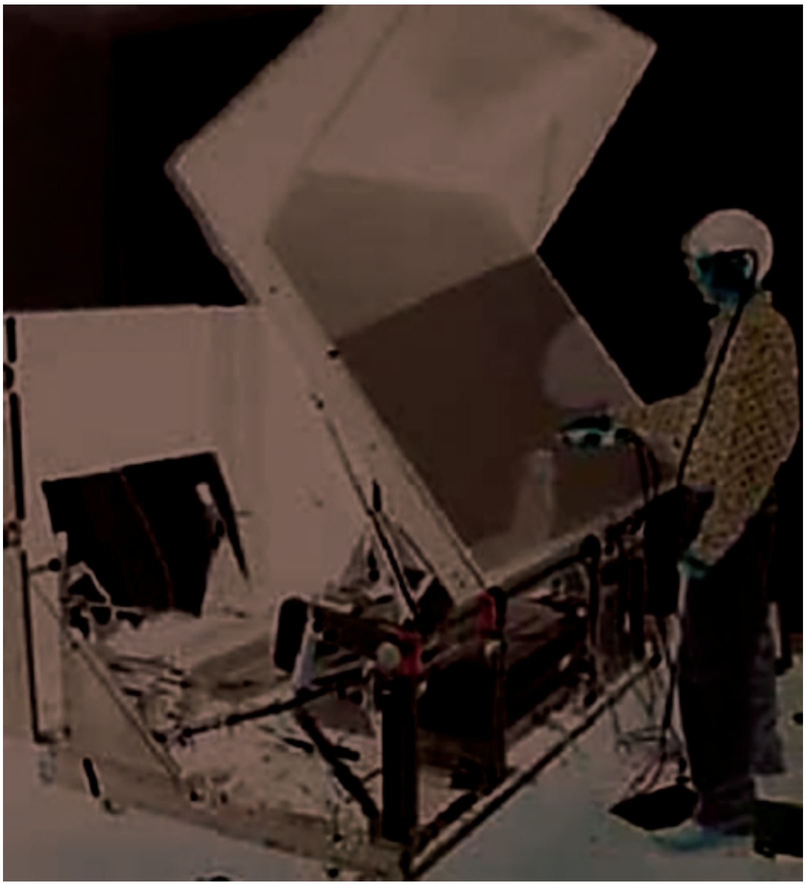


Figure 1.

[AQ2]

EVL seeks to provide an infrastructure for educators to collect, maintain, develop, distribute and evaluate virtual environment (VE) tools and techniques used to create learning environments. VE tools and techniques include computer-based models, simulations, data libraries, programming libraries, and user interfaces. The libraries and user interfaces encompass visual, auditory, tactile, and motion-based information displays.

After building first and second-generation immersive VR devices (the CAVE—Computer Automated Virtual Environment—in 1991 and the ImmersaDesk in 1995 Figure 1) to support tele-immersion applications, EVL is now conducting research in "third-generation" VR devices to construct variable resolution and desktop/office-sized displays. The Access Grid Augmented Virtual Environment (AGAVE), GeoWall (Figure 2), and Paris are the most recent VR devices developed at EVL.

Over the past decade, EVL has developed VR applications for collaborative exploration of scientific and engineering data over national and global

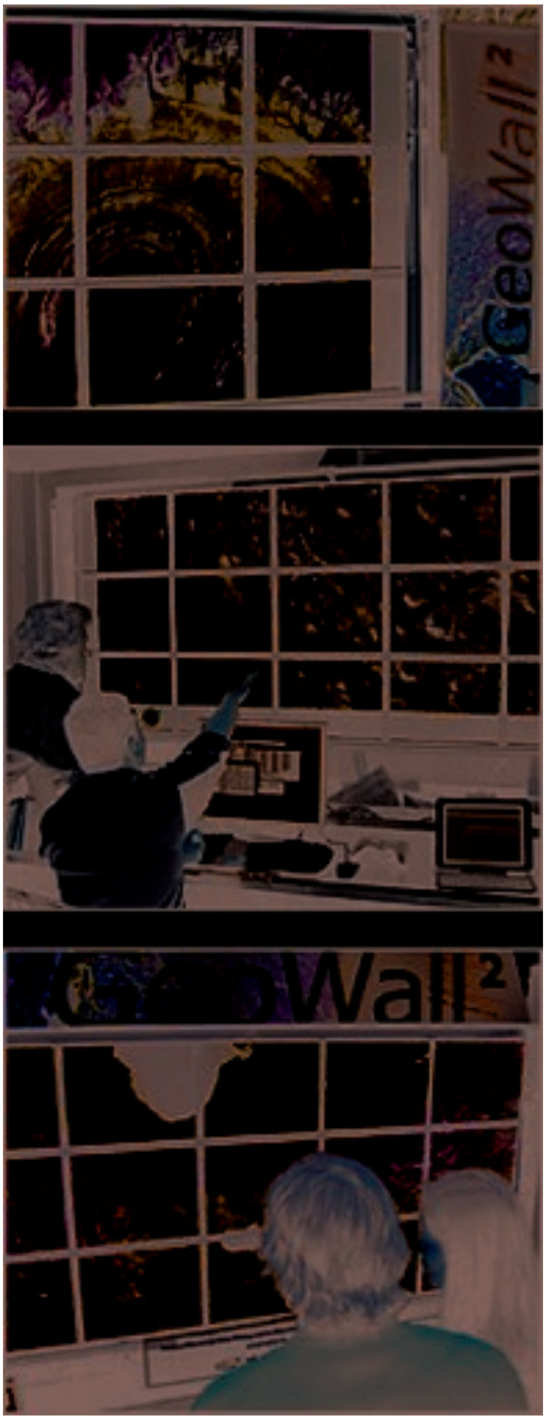


Figure 2.

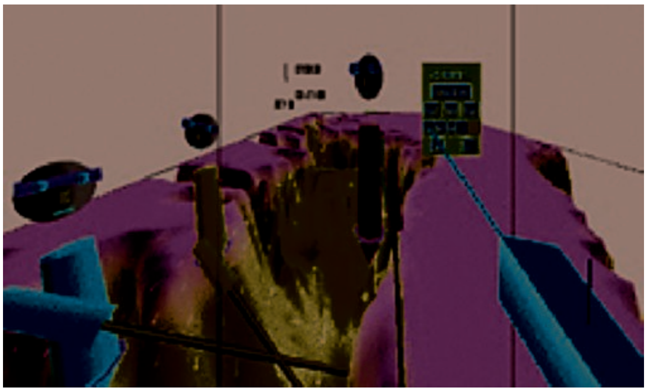
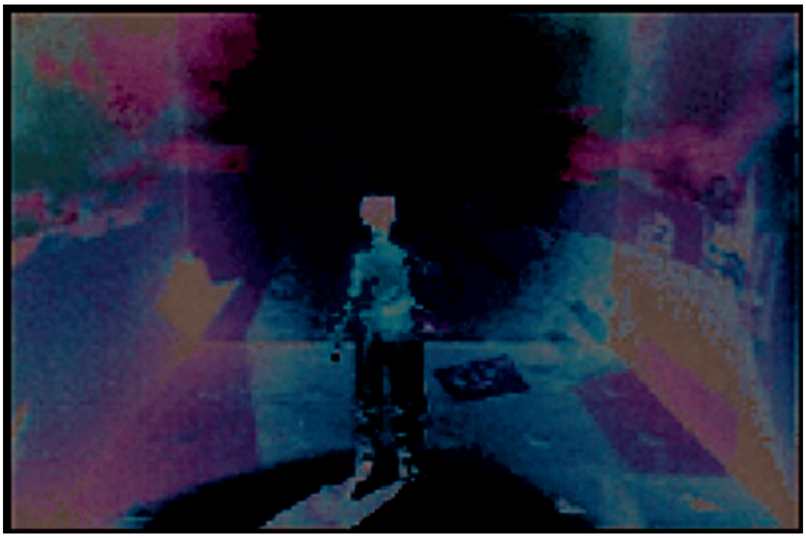


Figure 2. Continued **[AQ2]**

high-speed networks referred to as "tele-immersion" (Defanti et al., 1999; Johnson, 200; Lascara et al., 1999; Leigh et al., 1999;). Tele-immersion is defined as collaborative VR over networks, an extension of the "human/computer interaction" paradigm to "human/computer/human collaboration", with the computer providing real-time data in shared, collaborative environments, to enable computational science and engineering researchers to interact with each other (the "tele-conferencing" paradigm) as well as their computational models, over distance. Current tele-immersion research focuses on providing easy access to integrated heterogeneous distributed computing environments, whether with supercomputers, remote instrumentation, networks, or mass storage devices using advanced real-time 3D immersive interfaces. **[AQ3]**

CAVERN, the CAVE Research Network, is an alliance of industrial and research institutions equipped with CAVE-based VR hardware and high-performance computing resources, interconnected by high-speed networks, to support collaboration in design, education, engineering, computational steering, and scientific visualization.



CAVERNsoft is the collaborative software backbone for CAVERN. CAVERNsoft uses distributed data stores to manage the wide range of data volumes (from a few bytes to several terabytes) that are typically needed for sustaining collaborative virtual environments. Multiple networking interfaces support customizable, latency, data consistency, and scalability that are needed to support a broad spectrum of networking requirements. These diverse database and networking requirements are characteristics typically not exhibited by previous desktop multimedia systems but are common in real-time immersive VR applications.

Many of the applications developed at EVL are educational. In the next section, we focus on one of them, the Virtual Harlem project because it is a good example of a collaborative learning network utilizing CAVE technology. We first delineate the pedagogical assumptions underlying the Virtual Harlem project. Next we briefly speak about the educational projects at EVL that preceded and influenced the design of Virtual Harlem. Then we speak briefly about the migration of such projects to different technological settings such as small science museums and gaming engines converted to educational purposes. After describing the Virtual Harlem project, we include a brief interview with Tom Defanti and Dan Sandin, the Co-Directors of EVL, on future directions in VR developments. We conclude with a reflection on what has been accomplished and what work needs to be done on projects like Virtual Harlem.

2. EARLY EXPERIMENTS AT EVL AND THEIR IMPACT ON THE VIRTUAL HARLEM PROJECT

In 1996, NICE was the first collaborative VR learning environment created at the EVL. The team that built NICE was: Andy Johnson, Maria Roussou, Tom Moher, Jason Leigh, and Christina Vasilakis (N-team). The NICE project was a collaborative environment in the form of a virtual island for young children. In the center of this island was a garden where the children, represented by avatars a graphical representation of the person's body in the virtual world—could collaboratively plant, grow, and pick vegetables and flowers. They needed to ensure that the plants had sufficient water, sunlight, and space to grow, and kept a look out for hungry animals which might sneak in and eat the plants (Roussou et al., 1997a, b, 1999; Johnson et al., 1998). **[AQ4]**

The N-team had just completed a project called CALVIN that allowed several remote users, each standing in a CAVE or in front of an ImmersaDesk, to collaboratively arrange objects in a shared architectural space. Some of these users moved through the space at human-scale while others were giants. The giants were better at moving furniture and walls around, while the humans were better at judging the quality of the resulting space. The design evolved over time so users could enter the space, make a change, leave, and another user could enter the space later and see the new design. When the CALVIN project ended, the N-team was very intrigued by these ideas of asynchronous collaboration and heterogeneous views, and wanted to investigate them further.

Like CALVIN, NICE supported real-time distributed collaboration. Multiple children could interact with the garden and each other from remote sites. Each remote user's presence in the virtual space was established using an avatar—The avatars had a separate head, body, and hand, which corresponded to the user's actual tracked head and hand motions.

This allowed the environment to record and transmit sufficiently detailed gestures between the participants, such as the nodding of their heads, the waving of their hand, and the exchange of objects. Voice communication was enabled by a real-time audio connection.

In NICE the N-team also included avatars that were clearly non-human. Participants could be birds or whales, or bees. It can be rather limiting to always be represented as a humanoid avatar, and there may be advantages to looking like something else. In NICE adults could share the garden with the children without appearing as obvious authority figures. Continuing with our interest in heterogeneous perspectives, the children in NICE could shrink down to the size of a mouse and walk under the soil of the garden. This also allowed a full-size child to pick up one of the shrunken kids and carry them around.

In CALVIN the virtual world only changed when one of the users changed it. In NICE the development team wanted a more sophisticated world that could evolve on its own, even when all the participants had left the environment and the display devices were switched off. NICE's virtual environment was persistent; the server was left constantly running; the plants in the garden kept growing. The plants were simple agents with common rules of behavior based on simplified ecological models containing a common set of characteristics that contribute to their growth. The combination of these attributes determined the health of each plant and its size. This also allowed them to determine the pace at which the world evolved; choosing to see the plants grow very quickly, or extend their growth over several months.

Every action in the environment added to a story that was being continuously formed. The narrative revolves around tending the garden and the decisions taken while interacting with the other characters. These interactions are captured by the system in the form of simple sentences such as "Amy planted a tomato" that go through a parser, which replaces the nouns with their iconic representations and publishes it on a web page. This gives the story a picture book look that the child could print to take home.

As an educational environment there were problems. The most serious shortcoming was the inadequacy of its science model. The balance among reality, abstraction, and engagement is particularly difficult to achieve; in this case the application likely veered too far from reality. Secondly, instead of directing activity toward the discovery of the underlying scientific knowledge, the N-team assumed that the desired learning would take place naturally through exploration and discovery. This obscured the intended learning goals. Thirdly, the presence of avatars representing remote users spurred social interaction, but did little to structure cooperative learning to fostered positive interdependence among learners, or support reflection and planning. Social interaction became an end unto itself, rather than a mechanism to support learning.

Overall the successes and failures of NICE significantly influenced the design of the Virtual Harlem project. NICE represented an explicit attempt to blend several pedagogical themes within a single application. Constructionism, exploratory learning, collaboration, and the primacy of narrative, reflect several of the most important educational reform themes of the past three decades. These features of the NICE project were incorporated into Virtual Harlem which was designed as a collaborative environment that emphasized the primacy of narrative in that it is a hiSTORY. As in the case of NICE, students were invited to explore Virtual Harlem and to participate in its construction.

Another project that influenced the design of the Virtual Harlem project was "The Round Earth Project". The team that developed the Round Earth project was: Tom Moher, Andrew Johnson, Stellan Ohlsson, and Mark Gillingham (RE-team). This project investigates how VR technology can be used to help teach concepts that are not a part of students' mental model of the world. Virtual reality can be used to provide an alternative view of the world that alters the representation of it based on past experiences. In particular, we compared two strategies for using VR to teach children that the Earth is round when their everyday experience tells them that it is flat (Ohlsson, 2000: 364–368).

The concept of a round Earth is not a simple one for children to acquire. Their everyday experience reinforces their deeply held notion that the Earth is flat. Told by adults that the Earth is round, they often react by constructing a mental model of the Earth as a pancake, or a terrarium-like structure with people living on the flat dirt layer inside, or even a dual model with a spherical Earth and a flat Earth coexisting simultaneously. In effect, children attempt to accommodate the new knowledge within the framework of their existing conceptual models. Unfortunately, holding tight to the features of those prior models inhibits fundamental conceptual change.

One strategy, the "transformationalist", starts the children off on the Earth and attempts to transform their current mental model of the Earth into the spherical model. The second strategy, the "selectionist", starts the children off on a small asteroid where they can learn about the sphericality of the asteroid independent of their Earth-bound experiences. Bridging activities then relate their asteroid experiences back to the Earth. In each of the strategies, two children participate at the same time. One child participates from a CAVE while the other participates from an Immersadesk. The child in the CAVE travels around the Earth or the asteroid to retrieve items to complete a task, but can not find these items without assistance. The child at the Immersadesk with a view of the world as a sphere provides this assistance. The children must reconcile their different views to accomplish their task.

Virtual reality (VR) technologies are used to support both pedagogical strategies. In the transformationalist approach, VR is used to simulate the launching of a spacecraft from the Earth's surface and subsequent exploration within a fixed-height orbit. In the selectionist approach, VR is used to simulate a small diameter asteroid. Thus learners may walk on a body with a curved horizon, see objects "appear" from "below" the horizon, take a long walk around the entire globe and come back to where they started. In both environments, distributed VR technologies are used to provide a CLN promoting positive interdependence among pairs of learners. Although we do not employ the term, "selectionist" in our account, the Round Earth Project confirmed our main hypothesis, namely that virtual experiences can occasion changes in the learner's worldview.

The importance of the Round Earth project for the Virtual Harlem project team was that Stellan Ohlsson's research confirmed that virtual experiences can provide "deep learning" alterations in the learner. Stellan Ohlsson argues that ideas which are fundamental to knowledge domains are acquired through "deep learning". He writes: "Unlike other types of knowledge, fundamental ideas cannot be acquired through discourse or concrete experience, because those ideas are the very tools by which the mind interprets both discourse and experience". Such ideas are acquired through a process he terms, "deep learning", during which the cognitive frameworks (abstract general frames or concepts) persons use to understand their experience in particular knowledge domains undergo a transformation. "New fundamental ideas are acquired by instantiating an abstract schema in a novel way; the new instantiation gradually assimilates pieces of the relevant domain, until it has effectively become the new center of that domain. Abstract schemas, in turn, are generated by combining and transforming prior schemas". His research points to the following observation: Reading about a theory has little impact on students unless they have acquired an abstract schema of the fundamental concept *in another domain*.

Ohlsson's research includes experiments with VR scenarios which provide "another domain" through which students can experience "fundamantal concepts" before they learn them in the context of the knowledge domain with which they are associated by experts. Ohlsson writes: "New technologies for presenting interactive 3-dimensional worlds have been developed at UICs EVL. This technology is a means for presenting students with alternative experiences that contrast with everyday experience in educationally relevant ways" (Ohlsson, 2000).

Working from the circumstance that the "deep learning" process is often highly "analogical", we extended Ohlsson's research into the ways in which persons map their personal worlds. Since Virtual Harlem is a representation of African American culture, it comprises a "sector of a world-map" or worldview (the mental construction of space which persons use to locate their experience of distance from their present location). One hypothesis governing the project is that "sectors" of personal worlds parallel knowledge domains. Unlike knowledge domains, however, such sectors do not provide organizing frameworks to give order to abstract concepts; rather, they provide general narratives, "configurations" of experiences.[1]

A correlative hypothesis is that configurations undergo a process of transformation similar to the one Ohlsson describes with respect to "fundamental ideas". Because configurations are the stories that are fundamental to personal maps of the world, they can be said to constitute a "cultural domain" parallel to a knowledge domain. Such domains are often shared—in the case of knowledge domains by the members of a discipline, and, in the case of cultural domains, by the members of a culture. Theoretically, then, it is possible that a person may replace a stereotypical configuration of African American culture with one that reflects its history more accurately.

The sections that follow—Virtual Harlem, the Small Science Museum, and the Learning Games Initiative projects—came to be associated with EVL through the ASCEND network directed by Jim Sosnoski. ASCEND links UIC to other educational institutions interested in developing virtual learning environments featuring computer modeling. The ASCEND network is an outgrowth of the Virtual Harlem project that has as one of its goals furthering the engaged learning experiences observed in the projects we have described.

3. CLNS AS VR LEARNING ENVIRONMENTS

There are innumerable cultural heritage (CH) projects, including a few initiated at EVL. There are fewer VR projects that are the center of a CLN (Sosnoski & Carter, 2001: 115ff.). There are several reasons for this. Unlike CH projects, CLNs require exacting research into the subject matter as well as into the technology that displays it. In addition, CLNs depend upon a collaborative network that spans a broad range of educational institutions from high schools to museums and Cultural Centers. Further, they require a subject of study that constitutes an environment learners can "inhabit" and to which collaborators with significantly different skill levels, technological savvy, scholarly acumen, and cultural perspective can contribute.

CH projects can be anything from the restoration of a homestead such as those supported by Australia's CH Projects Program (CHPP) to North Carolina's, *Exploring Cultural Heritage Online* (ECHO) whose vision is that "*All of North Carolin's cultural institutions work together to make the state's unique cultural and historical resources accessible for the education and enjoyment of people of all ages in the state, nation, and the world*".[2]

Although CH and CLN projects have cultural sites as their focal points, a CLN has to meet strict academic standards and produce historically accurate representations of the cultural site being modeled. Whereas, it is not very problematic to render an existing site accurately, it is quite another endeavor to render an historical site like Virtual Harlem accurately when the buildings, signs, and persons who inhabited in the 1920s and 1930s are available, if at all, only in photographs or written descriptions. For example, there is a VR project consisting of 16 fullscreen 360-degree panoramas of the existing Vatican's basilicas and surroundings—including St. Peter's, Santa Maria Maggiore, San Paolo Fuori le Mura, and San Giovanni in Laterano. Because the project replicates existing buildings, it is not difficult to construct accurately by using photographs with software such as Maya. However, the fact that the VR application is "accompanied by Gregorian chants performed by Mina Mazzini, Italy's legendary Diva" would be highly problematic to an historian of the basilicas.[3]

UCLA's Cultural Lab,[4] for instance, has also built a VR version of the Santa Maria Maggiore basilica, but under quite different constraints. One of the goals of the lab is the creation of scientifically authenticated 3D computer models of cultural sites. For instance, the Basilica of Santa Maria Maggiore ("St. Mary Major") which was built by Pope Sixtus III in 432–440 A.D. on the highest point of the Cispian Hill is being restored in UCLAs Cultural Lab. Because it is a "virtual model" of the historical building. it requires historical research. For this reason the UCLA Cultural Lab is associated with the Center for Medieval and Renaissance Studies.

Though similar in intention to UCLAs Cultural Lab projects, the Virtual Harlem project focuses on the historical context of the Harlem Renaissance.

4. THE PEDAGOGICAL RATIONALE FOR THE VIRTUAL HARLEM PROJECT

According to the historian David Levering Lewis, the artists and writers associated with the Harlem Renaissance configured African American Culture as a counter to the prevalent racial stereotypes hoping to influence persons who could not actually experience African American culture to reconfigure it in "their mind's eye". As improbable as it seems that narratives of African American culture might have the potential to change the worldviews of persons who had never experienced it at first hand, nonetheless, current research suggests that it can be a very effective tactic for social change (Lewis, 1997: 90).

Recent studies of "narrative impact" support this strategy of social transformation. In *Narrative Impact: Social and Cognitive Foundations*, the editors state that the subject of their book is the impact of public narratives that are aimed at persuasing the public (Green & Brock, 2002: xiii–xiv). Several contributors refer to studies that show the widespread social impact of narratives such as the Bible or Uncle Tom's Cabin. Their remarks are often based on previous research that demonstrates the role narratives have played in social change. In the Introduction to the volume, Green, Strange, and Brock note that "the impact of public narratives on beliefs and behavior has received substantial scholarly investigation in disciplines such as sociology (e.g., Gamson, 1992), communications (e.g., Bryant & Zillman, 1994; Gerbner et al., 1994), **[AQ5]**
humanities (e.g., Booth, 1988), and political science (e.g., Iyengar & Kinder,

[AQ6] 1987)" (Green & Brock, 2002: 2). Since psychological research has focused on advertising without reference to its implicit narratives, Green and Brock have conducted a series of experiments involving "imagery-rich narratives". These experiments confirm that prior beliefs can be changed by imagery rich narratives that confirm or threaten their audiences' worldviews.

Research on the phenomenon of "psychological transportation", which 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), indicates that readers' propensity to experience transportation is dependent upon mental imagery evoked by the narrative. "A mental image is a representation of a particular stimulus that is formed by activation of a sensory system and, thus, is experienced by the organism as having similar qualities to the actual perception of the stimulus" (Dadds et al., 1997: 90). Such sequences of mental images contextualized by a narrative provide the sensations that accompany actual experiences. "Instead of seeing activity in their physical surroundings, transported readers see the action of the story unfolding before them" (Green & Brock, 2002: 317). Such virtual experiences, which are usually "seen" "in the mind's eye", can be remembered. When recalled, they can be applied to analogous situations in an experience transfer. Virtual reality narratives are likely to have similar outcomes.

Green and Brock's "Transportation-Imagery Model", consists of the following five postulates.

- Postulate I. Narrative persuasion is limited to story texts (scripts) (a) which are in fact narratives, (b) in which images are evoked, and (c) in which readers' (viewers) beliefs are implicated.
- Postulate II. Narrative persuasion (belief change) occurs, other things equal, to the extent that the evoked images are activated by psychological transportation, defined (below) as a state in which a reader becomes absorbed in the narrative world, leaving the real world, at least momentarily, behind.
- Postulate III. Propensity for transportation by exposure to a given narrative account is affected by attributes of the recipient (for example, imagery skill).
- Postulate IV. Propensity for transportation by exposure to a given narrative account is affected by attributes of the text (script). Among these moderating attributes are the level of artistic craftsmanship and the extent of adherence to narrative format. Another conceivable moderator, whether the text is labeled as fact or fiction (as true or not necessarily true), does not limit transportation.
- Postulate V. Propensity for transportation by exposure to a given narrative account is affected by attributes of the context (medium). Among these moderating attributes may be aspects of the context or medium that limit opportunity for imaginative investment and participatory responses. (Green & Brock, 2002: 316–317)

Restated as a sequence of cognitive experiences, Green and Brock's "Transportation-Imagery Model" would have the following stages:

1. The experience of a narration
   - which "deals in human or human-like intention and action and the vicissitudes and consequences that mark their course" and in which the sequence of events is both "logical" (cause-effect) and implicitly chronological.
   - and which portray situations that imply beliefs held by the audience.
2. The narrated events stimulate mental images from past experiences
   - that transport the audience into the world of narrative where they lose the sense of their physical surroundings.
   - and that evoke sensations (seeing, hearing, feeling) reminiscent of past experiences.
   - which are accompanied by emotions when the associated beliefs are threatened or confirmed by the implications of the narrative.
3. The narrated events enter the memory system where they can be recalled.

The flow of this "transportation" experience can be applied to VR narrative scenarios since both types of narration depend upon the impact of the mental images evoked. The major difference is that instead of "reading" the audience would be viewing the narrative. This difference is one that is anticipated by Green and Brock when they write: "The term 'reader' may be broadly construed to include listeners or viewers or any recipient of narrative information" (Green & Brock, 2002: 323).

The concepts of "suspension of disbelief" and "in the mind's eye" and both are conditions of "narrative persuasion", that is the use of narratives to change a person's beliefs and attitudes. Narrative persuasion depends upon the phenomenon of transportation. To be engaged by a VR narrative, viewers have to "suspend the belief" that they are in a darkened room looking at 3D images on a screen and listening to recorded sounds. Though readers see the narrated scene's "in their mind's eye", viewers in VR CAVEs, would seem to be looking at pictures directly. However, viewers actively supply "in their mind's eyes" much of the detail missing in the images and they also "correct" unrealistic images "in their mind's eyes". Though both of these conditions pertain to VR experiences, it is less clear that the sense of being "Lost in a book" (Nell, 1988), that is, being "transported" arises from the 3D images in the VR scenario.

In their delineation of the phenomenon of transportation, Green and Brock stress the "adherence to narrative format" as one of the chief conditions for the experience. Many VR narratives, including the current version of Virtual Harlem, do not meet this criteria. Virtual Harlem is a narrative but it lacks "story elements". For the most part visitors to Virtual Harlem experience the sequence of events that occur as they navigate their way through the cityscape as a "tour" a "chronology of events" rather than a "story". Stories set up expectations in their readers or viewers. As narratologists have argued, narratives require "resolution". Because they draw their audiences into identifications with characters in the story, the desires and conflicts they encounter are shared empathetically by readers or viewers. The difference is salient to audiences. In its format Virtual Harlem is closer to the videos one nowadays see on real-estate website that allow you to "walk" through the rooms of a house or apartment than it is to films like Fatal Attraction whose audiences shouted at the screen in the climatic bathroom scene where Alex (Glen Close) attacks Beth (Ann Archer) only to be saved by Dan (Michael Douglas).

Admittedly, Virtual Harlem or its recently developed companion, Virtual Monmartre, are not yet ready to transport their audiences into history. However, it is not beyond the capacity of VR scenarios to do so. In 1999, when we frequently gave tours of Virtual Harlem at UICs EVL bat-CAVE, we liked to follow it with Josephine Anstey's "The Thing Growing", a VR short story. Her website describes "The Thing Growing" as "a work of fiction implemented in VR, in which the user is the main protagonist and interacts with computer controlled characters.[5] It was originally built for a CAVE VR system at the Electronic Visualization Laboratory between 1997 and 2000. We believe intelligent agents are crucial elements for dramatic VR applications. The Thing was our first attempt at building a responsive character—a manipulative creature designed to encourage the user to jump through emotional hoops". As a VR narrative, The Thing Growing visualizes a short story Anstey had been writing in which she "wanted to explore a relationship that was cloying and claustrophobic but emotionally hard to escape. An immersive, interactive VR environment seemed an ideal medium to recreate the tensions and emotions of such a relationship".

The Thing Growing begins with a stark landscape in which a box is visible. Soon, the audience hears "Let me out" repeated in louder and louder tones. With instructions from the "voice" to use the remote control in the hands of their "leader", the audience frees her with a key that the remote becomes as it is pointed toward the screen. She jumps out and exudes joy, praising the audience. After a few moments, villainous figures appear in the landscape and the voice begs the audience to save her. Again following the voice's instructions, the audience, using their remote device which now looks like a gun, shoots the villains who disappear at they are hit. Again the voice expresses delight, suggesting that she and the audience leader dance. Once ~~away~~ giving instructions, this time by waving her arms up and down, she invites the leader to dance. If the leader does not move his remote in the manner she suggested, she complains loudly that ~~he or she~~ is not dancing with her. Depending on whether the leader "dances" or not, the voice becomes increasingly domineering and emotionally ruthless. After a time, the audience finds itself desperate to get out of the situation. Finally, again depending on the tactics of the leader, the voice is either killed by the remote control which still has the capacity of a gun, or after a lengthy period, she dissolves.

This story does succeed in transporting many of its viewers. Members of the audience have shouted at the screen and demand for her to stop berating them. One viewers shouted, “get me out of here”. Most find the experience disconcerting and even embarrassing if they decide to kill the voice. Some leaders, including women, shot the voice without compunction and expressed delight at being rid of her. The Thing Growing website concludes its gloss on the VR story with the following passage:

We believe that the use of narrative techniques can enhance interactivity in VR. Andrew Glasner suggests that, for the construction of interesting computer fiction, the author should control the sequencing of events, and the creation of a causal chain of action. Therefore the narrative in The Thing Growing has the classical bridge structure of plays and films; act one introduces the protagonists and the goal; act two revolves around struggles to reach the goal; act three resolves those struggles. The difference in our case is that the user is one of the protagonists and in each act she is involved in interaction. The narrative as a whole is moved on either as a result of the user’s actions, or by time. ~~See content.~~

Although we did not obtain a grant to incorporate stories into Virtual Harlem, we did design a story format, though not as yet a very dramatic one since we did not have the narrative freedom Anstey had because we were doing an historical narrative. We commissioned two stories based on the format we designed. As the project stands, we have some preliminary evidence from surveys we have conducted that visitors to Virtual Harlem have reconfigured their view of African American culture as a result of their experience of Virtual Harlem. The more systematic evidence that The Round Earth project and certain uses of VR in medical fields can produce effective learning experiences combined with audience feedback from Virtual Harlem warrant its further development.

5. THE VIRTUAL HARLEM PROJECT

In *When Harlem Was in Vogue*, David Levering Lewis makes the case that the Harlem Renaissance is one of the most significant eras in African American cultural history. Harlem, NY, is commonly thought to be its cultural center.

> The decade and a half that followed World War I was a time of tremendous optimism in Harlem. It was a time when Langston Hughes, Eubie Blake, Marcus-Garvey, Zora Neale Hurston, Paul Robeson, and countless others made their indelible mark on the landscape of American culture: African Americans made their first appearances on Broadway; chic supper clubs opened on Harlem streets, their whites-only audiences

[AQ7] in search of the ultimate "primitive" experience; riotous rent parties kept economic realities at bay while the rich and famous of both races" outdid each other with elegant, integrated soirees.

(Lewis, 1997, from the back cover of the paperback edition)

Until recently Harlem has been a forgotten site of American cultural history. Even today, its history remains largely unknown. This important cultural locale during the period that came to be known as the Harlem Renaissance needed to be represented as a part of the history of American culture. For this reason, Bryan Carter proposed that a VR representation of Harlem, NY in the 1930s would make a powerful component of courses in the Harlem Renaissance. The Advanced Technology Center at the University of Missouri accepted his proposal, which resulted in the creation of "Virtual Harlem", one the earliest uses of VR technology as a way of telling history.

Virtual Harlem is a digital model of 1930s Harlem, N.Y., at the height of the Harlem Renaissance. At this point in time, the model includes about 10 blocks of Harlem out of the 20 or so that are associated with Harlem during its Renaissance. Virtual Harlem includes buildings such as the Savoy, the Lafayette Theatre, and the Cotton Club; the only building that can be entered. As visitors move through the streets, they can encounter several famous figures-Langston Hughes, Marcus Garvey, and Paul Robeson, as well as several residents of Harlem in the 1930s in routine activities. Cars and trolleys move up and down the streets. Inside the Cotton Club, one can watch several very brief performances. In sum, this seminal model already presents a rich, though incomplete, environment to visitors. The team that began the Virtual Harlem project at the University of Missouri was Bryan Carter, Bill Plummer, and Thaddeus Parkinson. Since 2001, when the project moved to UIC, the team that is now continuing to develop Virtual Harlem is: Bryan Carter, Jim Sosnoski, Andy Johnson, Jason Leigh, Steve Jones, Tim Portlock, Kyoung Park, and Chris White.[6]

The digital model of Virtual Harlem can be accessed through several delivery systems. The fullest version, the immersive CAVE environment (see above) requires visits to a lab such as UICs Electronic Visualization Lab to experience the VR scenarios though it is available to be shown on the Immersadesk as well as on the AGAVE Geowall. Every effort has been made to allow for work done at the higher end to be translatable into programs at the lower end so that it can be circulated at locations that do not have high-end equipment. Even more important is the fact that work done at the lower end can be translated into higher end software. From a practical point of view, this enables students who have relatively modest experience with technology to contribute to the project and find their contributions shown in more sophisticated versions of Virtual Harlem. A 3D version of Virtual Harlem is available on the WWW. Several videotapes of Virtual Harlem tours are available and, upon request, specific tours can be videotaped for particular groups.

CD-ROMs of Virtual Harlem can also be made. Finally, web sites on Virtual Harlem are accessible through standard browsers the network's content.

An important aspect of the project is that it produces many versions of Harlem. This allows for alternative views of Harlem during its Renaissance. Constructing the definite Harlem is not the goal of the project. Instead, showing Harlem's past as one that has been constructed by its proponents and displaying the variety of perspectives that have been used in interpreting the Harlem Renaissance is its goal.

As a virtual experience of cultural history, the Virtual Harlem project serves as a prototype for similar projects being developed ~~around the CH~~ of the Bronzeville neighborhood in Chicago and Montmartre in Paris which are also significant sites for African American Culture in the 1930s. What is special about the Virtual Harlem project is that it is designed as a collaborative learning network—the builders of Virtual Harlem are collaborators in a network the aim of which is to learn about the Harlem Renaissance. Persons who are interested in the Harlem Renaissance or Harlem, NY. can contribute to the building of the model(s) as long as they follow the project's protocols. In addition, like other visualization projects (where models are constructed of the subject matter being studied), the cross-disciplinary collaboration is extraordinary (see below). These aspects of the project render it a potential prototype for other endeavors involving new instructional technologies.

As we envision it, a collaborative learning network (CLN) like virtual Harlem—because of its complex structure—requires that persons in the network be both teachers and learners. The technical staff has to learn about the Harlem Renaissance from the non-technical staff. Similarly, the non-technical staff has to learn about the technologies of networking from the technical staff. It may be helpful in understanding the structure of a CLN to introduce the idea of a "learning pathway". Sometimes discussions of learning seem to imply that learning takes place ONLY in a classroom. As we all know this is far from the case. We often learn more outside the classroom than in it about a particular subject. For this reason, and because the Virtual Harlem project requires students to go outside of their classrooms and visit other sites, we describe several typical learning paths (movements from site to site) that occur in the Virtual Harlem project. Let's begin with a student taking a course in the Harlem Renaissance.

If we think of a learning pathway as a journey of discovery, then we might designate a conventional English literature classroom as the site of departure. A student may be assigned to read a work introducing the Harlem Renaissance as a period of literary history from her textbook. This would lead her home or to the library where the reading might take place before she returns to the classroom. This "trip" would be repeated many times in the learning path. At some point, that student may go to the immersion CAVE instead of the classroom and experience Virtual Harlem, followed by a trip to a computer center to record her response to it. If she decided as her term project to take on a research endeavor that culminated in adding some information, say about a building that was yet to built in Virtual Harlem, this would necessitate a trip to the library and/or to a computer lab with Internet access in search of photos and accounts of, say, the Dark Tower (an important salon). This decision would likely lead to the preparation of a research paper not only submitted to the instructor but also presented for "publication" in Virtual Harlem. Since a literature student or instructor would probably not be able to build a 3D Dark Tower into the VR scenario, the "publication" of the Dark Tower would be handled by someone who could.

The learning path of the literature student, in all likelihood, would have to intersect with the correlative learning paths of several other students before the Dark Tower could be added to Virtual Harlem. These intersections would "deepen" the learning experience to the extent that the students and instructors involved were in dialogue with each other. Without going into the same detail, I hope it is easy to imagine an engineering student beginning his learning path in a classroom on C++ in the Engineering building and at some later point taking on the project of constructing in 3D code the image of the Dark Tower as his term project. A third student in Fine Arts might start out in a computer graphics class in the School of Art and Design and follow a learning pathway that eventually intersected with the first two students adding an aesthetic dimension to the design. A Women's Studies student might intersect with the group in an effort to portray the women in the Dark Tower setting accurately. If by collaborating they took perspectives on the materials that they would not otherwise have considered into account, this circumstance would enrich their learning experience.

Since it would be tedious to read the details of the many additional learning pathways that might intersect or be juxtaposed to those we have mentioned, we ask you to imagine the likely collaborative learning pathways that would go into building the Dark Tower into the current cityscape. Envision, for instance, students with a history or cultural studies learning pathway intersecting with the learning paths we've identified. Consider students from psychology or sociology or urban anthropology who might be studying the impact that the Dark Tower is having on visitors to Virtual Harlem. And let's not forget the dramatic scripts that creative writers and theatre students need to write and enact in order to dramatize the events that took place in the Dark Tower.

These learning paths would also inevitably intersect with those of students from other universities who were researching the Dark Tower or some of the persons that were its habitual guests. If ~~some of~~ the learning paths did not intersect smoothly but, instead, clashed and contradicted each other, the learning would take another turn as students would then be forced to encounter perspectives they had never before engaged, a likely scenario as more universities from abroad join the network.

Though the network formed by the intersections of these varied learning paths has the potential to be quite volatile, it is nonetheless governed by the same set of research ideals its professorial constituents are advocating and the situation is potentially a mirror of any lively intellectual or discourse community, which Mary Louise Pratt aptly describes as a "contact zone". All the learning paths come into contact with each other because they all lead to Virtual Harlem. Ideally, all paths are attempts to visualize the past.

Within this framework, everyone in the network is both teacher and learner at some level or with respect to some area of study. The unusual combination of disciplines in the project—African American culture, literary, historical, urban, gender, social, anthropological, artistic, graphic, dramatic studies, communication, psychology, engineering, computer science, and visualization—mandates that no one person in the network will be the master of any one perspective. At the same time, the diversity of perspectives allows each person in the network to view the subject matter and the technology from a previously unfamiliar perspective. Moreover, since the project is based on VR scenarios at the higher end of the technological spectrum, a certain excitement is continuously generated, especially when persons enter the network and view the work that has been completed.

There are several features of the Virtual Harlem project that contribute significantly to its potential as an instruction technology. From the point of view of its subject matter, Virtual Harlem is a learning environment in which participants virtually experience a dramatic, visual history centered in Harlem, New York during its "Renaissance" period. From the point of view of the mode of learning, Virtual Harlem is an environment that enables a subject matter like the Harlem Renaissance to be studied by modeling its historical context as a dynamic system of social, cultural, political, and economic relations, that is, as a "neighborhood" From the point of view of learning outcomes, Virtual Harlem is an environment that configures its visitors as a set of cultural counter-stereotypes.

Because of its subject matter—the Harlem Renaissance—this project has the potential to link scholars and students from all over the world who are studying and researching African American culture into a learning network. At the time of writing, nine universities and one super computer center are associated with the Virtual Harlem network: University of Illinois at Chicago (UIC), Central Missouri State University (CMSU), the University of Missouri-Columbia (MU), the University of Arizona (UA), Columbia University (CU), Växjö University, Sweden, Morgan State University (MSU), Vassar College (VC), the Sorbonne IV, Paris, and the SARA Super Computing Lab in Amsterdam. Several of these universities have already been linked to each other for discussions of the Harlem Renaissance in connection with courses about it. The Virtual Harlem CLN also has the potential to introduce learners to systems thinking and visual thinking, two evolving modes of intellection that have come to the forefront as educational goals due to the increasing availability of computer assisted learning (Park et al., 2001; Sosnoski & Carter, 2001).

As a consequence of interest in the Virtual Harlem project, the ASCEND network was created to link universities to other types of learning centers, for example, to small science museums.

6. VIRTUAL HARLEM AND THE SMALL SCIENCE MUSEUM LEARNING ENVIRONMENT

SciTech Hands On Museum located in (Aurora IL, U.S.A., just west of Chicago) joined the ASCEND network in 2001 to test and evaluate the VR hardware and software developed at EVL. By the summer of 2002 the first museum prototype VR learning lab was established at the museum with a Geowall on loan from EVL. SciTech's VR lab is beginning the process of testing and evaluating VR environment as it applies to museum visitors. Based on initial positive results, it is foreseen that the SciTech pilot implementation of VR will be expanded to other science museums in the near future. The team that is developing VR environments for small science museums in collaboration with EVL is: Ronen Mir, Diana Zajicek, and Sammy Landers from SciTech Hands On Museum, Aurora IL USA. Marcelo Milrad from Växjō University, Sweden, in association with Xperiment Hus, is engaged in extending the project to small science museums in Europe.

In the summer of 2002, VR Technology was brought to SciTech by a team from EVL headed by Andy Johnson and Jason Leigh. The lab for the VR set up is a $17' \times 20'$ room used previously as a computer class. The first thing that we did was to paint the room a dark color to give the feeling of entering a theater. Next, we made and framed an opening in one of the walls in the enclosed space to house the screen. The computer is located in the enclosed space with the projectors. The monitor, the keyboard, and the mouse are out at a station for the operator to use when setting up for a show. The last thing that we did was to install a curtain to keep ambient light from entering the viewing area. In a short time, the renovation of a room to use as a VR lab and the installation of VR equipment was completed.

The VR set up at SciTech has the following specifications:

screen; $5'$ long, $4'$ high

user area; $9' \times 6'$

rear projection (This system looks a lot better and makes a better experience since the viewer can get closer to the screen)

“starter” 3D model viewer application

rear projection requires $10'$ behind the screen for the projectors

dark room not necessary, but dimly lit is preferred

best to stand about $4'$ back from the screen for viewing

PC (Windows XP and Linux 7.2) platform used at SciTech

This system consists of joystick-controlled navigation of a set of 3D models a stereo projection upon a $6'$ screen, viewed with special polarized glasses.

We found it necessary to have a staff member to run programs and assist visitors.

The first phase of VR presentation at our site is ongoing and has consisted mainly of short, less than 30 minutes, VR sessions, in which a trained museum staff member has introduced the concept of VR to a variety of visitors to the museum, museum staff, and board members. This introductory session has included: ~~D~~efinitions of VR, a short explanation of the operation of the system in use at SciTech, an opportunity for viewers to manipulate the 3D models themselves. During the exploration of the available models, a trained SciTech staff member provides commentary about the models viewed, and answers questions. At the conclusion of this session, an informal evaluation of the experience is conducted and results recorded.

Since the VR equipment has been up and running, the VR lab has had approximately 500 visitors, a fairly even mix of adults and children, ranging in age from 7 to 75 years of age. Their comments on the experience have included both positive reactions: “Enjoyed it very much”!, “It was a wonderful thing”, “Very cool”! “Loved it”!; “It was good”; and critical ones: “. . . makes the stomach queasy if you move around a lot”; “. . . liked all the different models”; “I think you should put chairs (in)”. The development of educational programming is underway. Several approaches to the use of VR are being considered. Descriptions of two scenarios follow.

There are noteworthy limitations to the current VR set up at SciTech. Our set-up is fairly rudimentary. At the present time, the number of applications that can be deployed to SciTech is restricted because we can only run environments that are based on OpenGL or OpenInventor. Most of the VR worlds are still built on the Silicon Graphics machines, so there is a certain amount of work needed to port them to a personal computer. On the less technical side, the room in which SciTech's VR set up is housed is small limiting group size to 6–8 people. We find it difficult to stop people from touching the screen, which destroys its ability to preserve the passive polarization. Simulator sickness may be an issue. Projector based systems have a much lower rate of simulator sickness than head mounted displays and having a non-tracked system definitely reduces the amount even further, but a visitor can still get sick from watching a friend play a first-person shooter, so odds are that this will make a small percentage of people sick. Therefore we are showing 3D models floating in space rather than terrain to explore. We need to consider seating or a railing.

As part of SciTech's mission to make technology and science concepts accessible and exciting through exploration and discovery, an experience based on the concept area of perception is one avenue for development. This would include: ~~D~~efinition of perception, types of perception, scientific methodology, avenues of investigation, scientific tools, types of models, VR as a tool for exploration, and manipulation of the world around us.

A second area of development focuses on the content related to the VR 3D models at our disposal. At present, these models include: an ant, a bee, Round Earth, The Solar system, The Wright Brothers Airplane, A Human Heart, and Lungs. A model-based experience would address SciTech's goal to enhance the public understanding of science and demonstrate its relevance in everyday life. This experience would be based on exploration of and hands-on activities relating to a pre-selected 3D model, e.g., the heart. The organizational model would be a series of exploration stations through which the learners would proceed in small groups. The stations could include: Manipulation of 3D VR heart-lung model, internet virtual field trip; e.g.—a trip down a coronary artery, brief description of circulatory system, perhaps a video, create a poster of the heart and lungs using an overhead projection, create a simple lung model from a soda bottle, balloons, etc., heart rate, pulse and exercise activity web worksheet directed research, students model the heart and blood flow using themselves as parts of the model, tennis ball heart action simulation.

Our long-term VR goals include:

The construction of a dedicated VR environment on SciTech's main floor, and the development of additional educational programs to be used therein.

Expansion of VR experience to include not only science and technology, but also the areas of art, history and entertainment.

Implementation of similar systems in other museums with which SciTech collaborates.

Complementing the ASCEND experiments in non-university learning environments like SciTech, are experiments with non-academic technologies such as computer games.

7. VIRTUAL HARLEM AND THE LEARNING GAMES INITIATIVE

We regard computer games as virtual learning environments. The technology behind computer games runs in parallel with the technology behind VR applications. Virtual Harlem, for example, can be seen on a game engine and in collaboration with the Virtual Harlem project team, we have been considering introducing dramatic elements into the cityscape drawing upon game design. In collaboration with the ASCEND network, the Learning Games Initiative (LGI) team at the University of Arizona (Ken McAllister, David Menchaca, and Ryan Moeller) is working to accomplish three objectives:

1. Study: members of LGI use a variety of multi-disciplinary analytical techniques to reveal and understand the ways in which sociocultural tensions are embedded in, imposed upon, and taught through games;
2. Teach: members of LGI work to develop pedagogies that teach these analytical techniques to students so that as computer games become ubiquitous and their ideologies are naturalized in players, students will have a set of critical skills that they may use to critique them;
3. Build: members of LGI work to develop new games that draw upon their critique-oriented knowledge of computer games in order to generate new and more complex opportunities for game developers and game players.

Each of these areas is deeply informed by a wide range of multidisciplinary research, including sociology, cultural history, graphics programming, audio engineering, rhetorical studies, political science, music composition, media arts, communications, literary studies, philosophy, military science, pedagogy, organizational studies, and graphic design. In the remainder of this section, we will briefly discuss some of the current research and useful practices employed by LGI and others in these three areas.

There are basically two points of entry for the study of computer games: the point of production and the point of consumption. In both cases, there is a wealth of available material for scholars to examine, some of it originating in the academy and some in the materials circulating in the gaming industry. On the academic side, work that studies the psychophysiological nature of computer game playing (e.g., research on how computer games shape players' minds and bodies) is particularly abundant. It is in this area that one finds the dozens of studies attempting to discover causal relationships between computer game play and sociopathic and behavioral problems, the research on a variety of physical ailments caused by computer games (e.g., repetitive motion disorders and seizures), and the research on how computer games may or may not facilitate non-game related skill acquisition (e.g., accurately assessing collision probabilities, effectively interacting with complex dynamic systems, and the improvement of mental focus). Related to this is the application of anthropometrics to the development of alternative input/output devices and channels.

An emerging area of research in the academy focuses on the cultural implications of computer games, and studies, for example, how race, gender, sexual orientation, and class are constructed in particular games. Much of this research is to be found in academic publications like the journal Game Studies and The Journal of Popular Culture, although there are an increasing number of book-length treatments of these topics. Initially, members of LGI have focused their efforts on studying and applying multidisciplinary approaches to the study of computer games. Additionally, LGI members work to harness the learning elements inherent in computer game play to enhance the study of topics unrelated to game content—for instance, using computer game interactivity to study collaboration, communication, role-playing, task-oriented decision-making, analytical and organizational skills, and so on.

Most academics interested in studying computer games have not had the luxury of formal training in this area (e.g., "game studies"). Rather, they tend to be scholars who are naturally inclined to interdisciplinary work in interactive media, and as a loose collective comprise a rapidly advancing area of research and teaching. Much like the structure of Film Departments to which they are sometimes compared, the fledgling academic programs to which these teacher-scholars migrate tend to combine the technical skills of development with the critical skills of close technical, aesthetic, historical, and cultural analysis. Some programs emphasize certain skills over others due to particular resources available on different campuses: Some programs emphasize game programming, while others specialize in visual studies, narratology, or music. Increasingly, however, academic programs are being developed that consist of multiple tracks that combine basic programming skills (especially the mastery of scripting languages, such as Lingo and Actionscript for Macromedia Director and Flash, respectively) with advanced design concepts, or vice versa: advanced programming skills with basic design concepts. In programs such as these, both tracks culminate in the development of a playable computer game.

The Learning Games Initiative at the University of Arizona takes a somewhat different approach than other programs by focusing first on "reading" games as complex techno-cultural artifacts, then using these "reads" to build provocative educational games. LGI members are concerned with how games manifest various sociocultural dynamics through the design of non-player characters, level and interface design, types of interactivity, placement and content of cut scenes, audio effects and music choices, point of view and camera placement, and so on. This deeply interdisciplinary work requires its members to have a broad range of both analytical and technical skills. For this reason, LGI members rely upon their peer practitioner-scholars to learn, for instance, how an openGL programmer "sees" a game, or how a poet or priest "reads" a game's metaphors and justificatory logics. As a result of their ability to see computer games in such an unusually expansive way, LGI members are then able to teach these ways of seeing to their students.

The mechanisms behind this educational process are straightforward. LGI members participate in collective knowledge building by sharing research and teaching techniques via an electronic forum, and they meet twice a month for "Game Night", an opportunity for LGI participants to gather face to face and closely examine a particular game. From these two practices have emerged a variety of pedagogical tools that concern computer games, including instructional videos, how-to guides, course curricula, conference talks, and the development of educational game mods built from commercial game engines like *Quake* and *Neverwinter Nights*.

The third point of entry to studying computer games exists at the point of production. Here, LGI relies upon methodologies suggested by anthropologists and artifact historians: Investigate the techniques of production in order to extrapolate and interpret the cultural ideologies that support and inform such techniques.[7] LGI incorporates the research and teaching of its members into the actual production of complex educational games using a variety of commercial game engines. LGI wants to know what can be learned about computer gaming and classroom space, for example, especially when the latter has been reproduced digitally, using software designed to support a first-person shooter like *Quake* or a role-playing game like *Neverwinter Nights*.

LGI members hold that participation in the construction process is a vitally important part of gaining a complex cultural understanding of computer games. Such an understanding makes visible the constraints and operating assumptions of commercial game production—including, for example, issues concerning audience, content, timeliness, complexity, and playability. It also provides participants with an intimacy with production techniques uncommon in more traditional artifact studies, which are often removed in time, space, and circumstance from an artifact's method of production.

The study and use of computer games in educational settings works to enable students to develop the skills necessary to critically examine all aspects of game design. By understanding computer games as both commercial artifacts and as components in a much more complex sociocultural dynamic—that is, a material object that is continually reconstructed in play—students simultaneously learn the skills necessary to critique all those other elements of popular and specialized culture in which elements of Vr are used to shape belief and manufacture knowledge.

Since its creation in 1996, the Virtual Harlem project grown into a research network. Our belief is that the project demonstrates the vital importance of VR instructional technology to the humanistic disciplines.

8. CONCLUDING REMARKS: CONFIGURING THE PAST

Virtual Harlem is a visual history. Techniques of computer simulation and visualization have been developed to the point that it is now possible to present historical events in virtual space and time, not only showing the location of the event but also tracking it through a temporal sequence. Virtual Harlem, for example, is the most important historical location for events that comprise what literary historians refer to as the Harlem Renaissance. Technically, it is possible to show temporal sequences, or, for example, one can visit Virtual Harlem during the day and then later at night. Although, the project has not yet developed to this point, we plan to show the historical changes in Harlem from the 1920s to the mid-1930s. Concomitantly, we intend in our design to show the periods within the Harlem Renaissance that correspond to those changes by indicating the development or demise of movements and periodicals, the migration of artists and musicians, the changes in the character of the neighborhood.

Virtual Harlem is a dramatic presentation of the history of the Harlem Renaissance. Scripts of everyday life are built into the presentation to dramatize the historical events (see Sosnoski/Portlock). Students can interact with figures that “live” in Virtual Harlem and whose character and behavior are as historically accurate as we can make it. Though such experiences are fictive by definition, the dramatizations are governed by an effort to interpret what it felt like to live in Harlem during the 1930s and to encounter the many great artists who worked there. While admittedly an unconventional form of history telling, whose historiography has yet to be developed, every effort is being made to give students an experience of the past that matches scholars’ interpretation of it. The governing genre in this endeavor is history, not fiction, not even historical fiction. The fictive elements arise from the absence of video or audio documentation. Whereas it is possible to write sentences such as “residents of Harlem could purchase the ‘Crisis’ at a local news stand, a dramatization of that event requires a specific figure to approach the news stand and ask for a copy of the ‘Crisis’ ” ~~(see Tappan).~~ Since we do not have photographs of that event or recordings of what was said, that figure in Virtual Harlem cannot not represent a actual person who lived in Harlem at the time. Yet, to dramatize the historical generalization (residents purchased the ‘Crisis’ at local news stands) does not entail the genre of fiction. The stories told in Virtual Harlem are governed by historical constraints.

Hypothetically, Virtual Harlem is a "dynamic system of relations". Virtual Harlem is comprised of many elements: buildings, people, cars, events, communications, markets, and other phenomenon. These elements can be understood as a "neighborhood", a dynamic system of relations. People live in buildings, pay rent, buy goods, make decisions, respond to injunctions, talk, sing, dance, drive, and involve themselves in multifarious relations with the other elements in the immediate environment. Computer models allow for the computation of a variety of possible systemic relations and provide a way of understanding the historical period. "Systems dynamics" has been used for years as an instructional technology both in this country and abroad. This approach, as ~~I~~ tried to suggest above, is built into Virtual Harlem.

From another perspective, the Virtual Harlem project is a project in "urban archeology". We have plotted out the surface of historical Harlem and drawn a map of its topography. At various locations on the map, we have dug deeper into its history to obtain a closer look at the development of that site. For example, whereas some buildings are no more than facades to mark the space they occupied at a particular moment in history, others can be explored in much more depth of detail. What the researchers unearth about a particular place, is then recreated virtually. As a representation of a "neighborhood" in a city, the Virtual Harlem project can be extended to other neighborhoods in New York City. As a representation of a city, the Virtual Harlem project can be extended to other cities and their neighborhoods. ~~Virtual Chicago is already in the planning stages at the Great Cities Institute of UIC.~~

The significance of the Virtual Harlem project is the use of VR technology to model a humanistic subject. It opens the door not only to new modes of learning but also to new modes of historiography and interpretation as well as inter-disciplinary collaboration.

ENDNOTES

1. Configuring is a cognitive process through which persons create virtual experiences by re-assembling their past experiences into one that provides an analogous pattern to the one they are presented in VR applications or other modes of simulation ranging from TV and film to literary and artistic artifacts. See Sosnoski.
2. See http://www.ncecho.org/.
3. See http://www.fullscreenqtvr.com/minavaticano01-10.html.
4. See http://www.cvrlab.org/.
5. See http://www.ccr.buffalo.edu/anstey/VDRAMA/THING/index.html.
6. The remarks in this section are those of the authors who were on the Virtual Harlem teams. However, not all of the members of the project were involved in the decisions made or theories developed that are mentioned in this section. The project leaders were Bryan Carter, creator and director

of the project, and Jim Sosnoski, coordinator and instructional theorist. Steve Jones has been a key member of the project since it came to UIC and an invaluable consultant. Ken McAllister and Ryan Moeller brought the Virtual Harlem project to the University of Arizona and were instrumental in the development of the ASCEND network. Ronen Mir is the Director of the SciTech Hands on Small Science Museum and brought UIC VR projects to it in collaboration with Jim Sosnoski, Andy Johnson, and Jason Leigh (Sosnoski & Carter, 2001; Johnson et al., 2002).

7. Such a methodology is forwarded by Marcia-Anne Dobres in "Technology's Links and *Chaînes*: The Processual Unfolding of Technique and Technician". *The Social Dynamics of Technology: Practice, Politics, and World Views* (Ed.) Marcia-Anne Dobres and Christopher R. Hoffman (Washington, DC: Smithsonian, 1999), 124–146.

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