Visualizing the VLearn3D 2002 Conference in Space and Time

Katy Börner & Gyeongja Jun Lee
School of Library and Information
Science, Indiana University
Bloomington, IN 47405
{katy | gjlee}@indiana.edu

Shashikant Penumarthy
Dept of Computer Science
Indiana University
Bloomington, IN 47405
sprao@indiana.edu

Ryan Johnathan Jones
School of Fine Arts
Indiana University
Bloomington, IN 47405
ryjjones@indiana.edu

Abstract

This paper introduces a set of visualization tools that aim to support social navigation, the evaluation and optimization of three-dimensional virtual worlds and the study of their evolving communities. Previous work (Börner & Lin, 2001; Börner et al., 2002) demonstrated how this toolset can be used to analyze data acquired during a information treasure hunt. This paper extends and applies this tool set to visualize an entire virtual Conference on the topic *Virtual Learning in Three Dimensions* (VLearn3D) that was held in December 2002.

Keywords: information visualization, social visualization, virtual worlds, virtual conference

1 Introduction

This paper introduces a set of visualization tools. It extends and applies them to map the Conference on *Virtual Learning in Three Dimensions 2002*[1] in space and time. While there is an increasing amount of research that logs, analyzes, and visualizes user interaction data (see section 3 on related work) to our knowledge nobody has yet attempted mapping an entire conference involving multiple virtual worlds and a large numbers of interacting participants.

We claim that the visualization tools presented in this paper can ease social navigation in 3D virtual worlds, help evaluate and optimize the design of virtual worlds and provide a means to study the communities evolving in virtual worlds.

The next section introduces the virtual world technology we are using, discusses commonalities and differences between virtual and real world conferences, and motivates the need for visualization tools. Section 3 reviews related work. Section 4 presents a set of visualization tools and applies them to visualize the VLearn3D Conference in terms of the virtual places used to host diverse events as well the trails users take while attending the Conference. The paper concludes with a discussion of future work.

2 Virtual Conferences

Today's 3-D virtual worlds facilitate communication and collaboration with others around the globe bridging geographical and cultural boundaries. Most of these virtual worlds are freely accessible via a standard PC and modem. Commonly, visitors are represented by avatars that act as placeholders and stimulate interactions based on physical proximity to other avatars, objects, etc. Using Active World (AW) technology[2], visitors – potentially logged in from diverse physical locations – can meet, work, or build in a virtual world in real-time. One-to-one, many-to-many, and one-to-many communication is possible via a chat facility but also via real audio software. Private communication is supported by telegramming, whisper, separate email, or file sharing programs. Automatically recorded chat logs are convenient to have for following up on missed meetings.

Figure 1 shows the AW interface. In contains four main windows: a 3-D graphics window populated by avatars, a chat window below, a menu system for selecting a world, sending telegrams, selecting teleports, etc. on the left, and a Web browser window on the right. At the top are a menu bar and a toolbar for avatar actions. Users can collaboratively navigate in 3-D, move their mouse pointer over an object to bring up its description, click on 3-D objects to display the corresponding Web page in the Web browser window, or teleport to a different area. The browser maintains a history of visited places and Web pages so that the user can easily return to previous locations and pages.

More recently, 3D virtual worlds have been utilized to host entire conferences such as the VLearn3D 2002 or the Avatars 2002[3] conference. While chat communication is less efficient and misses the richness of face-to-face interaction at a 'real world' conference, the utilization of 3D virtual worlds has a diverse number of intriguing advantages. Among others, people can attend from home saving considerable amounts of time and money spent for travel. Attendance is typically free enabling everyone to attend. This is especially important for educational conferences as most K12 teachers have very limited or no travel budgets.

Virtual Conferences resemble 'real world' Conferences in that talks, panels, discussion sessions, and demos (virtual tours of different worlds, hands on building sessions, etc.) are used to disseminate new research results and practices.

---

[1] http://www.vlearn3d.org/conference2002/
[2] http://activeworlds.com/
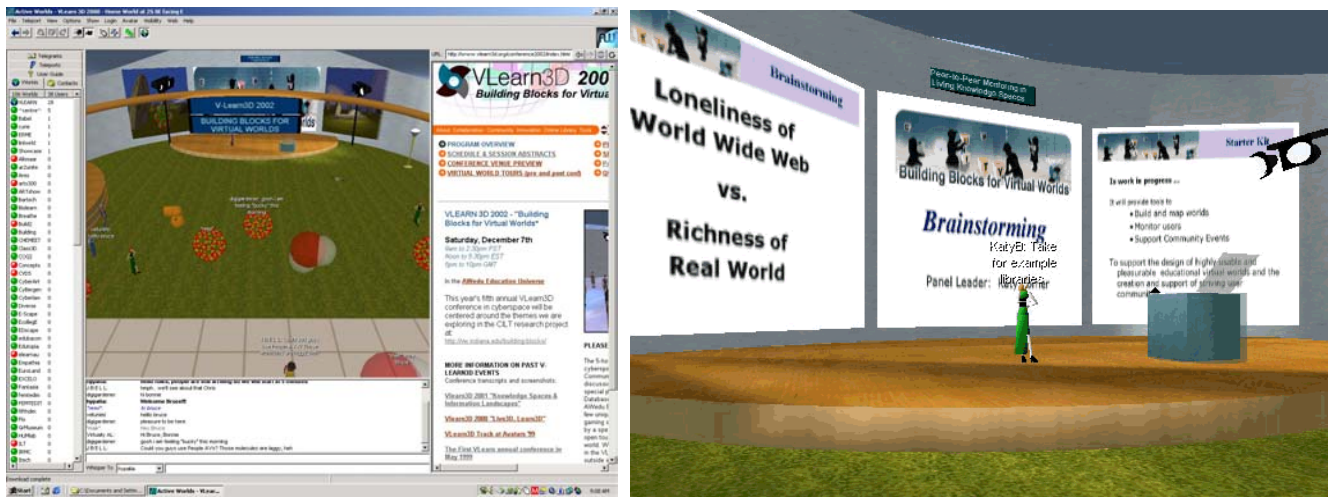[3] http://www.ccon.org/conf02/aw/

Figure 1. AW Browser Window (left) and Brainstorming Session at VLearn3D (right)

Figure 1 (right) shows the stage used during the Brainstorming session at VLearn3D. The speaker, wearing a green dress, stands in front of a three panel display wall.

Presentations are to the point. Commonly, speakers carefully prepare descriptive text for each slide in advance. During their presentation, they cut and paste the text into the chat window so that it matches the in-world slide show. At the same time, they try to address questions from the audience. Body language is missing but is partially replaced by emoticons such as the smiley (☺) and the ability to retrieve a wealth of information on the speaker from online resources.

Unfortunately, common lunches or dinners are difficult to arrange at virtual Conferences due to the diverse time zones from which people are logged in plus the inherent problems in materializing food and drinks for consumption. However, proximity in space does trigger spontaneous, informal discussions and again, the ability to immediately retrieve online information on any other visitor helps to quickly and very effectively talk research, to exchange hints and tricks, and to initiate follow ups via email. The opportunity to explore others works in form of virtual worlds, avatar designs, etc. in an interactive, collaborative, entertaining way (as opposed to reading a research paper) promotes informal discussions and future collaborations as well.

However, today's virtual worlds miss important social clues that would aid social navigation. Designers of virtual worlds as well as virtual world researchers are interested to learn how virtual worlds are used and how virtual communities evolve over time. Patterns of interest are:

- *Usage patterns*: Where do users login from? How long do they stay? Do they login regularly or irregularly? How many people are in the world at which time? Are there general bursts of activity?
- *Navigation patterns:* Which general routes do users take? What are the most popular places? How do people move and place themselves in urban space? Are there well-traveled paths that may indicate a particular problem solving strategy? Which places are multi-way branching places, pass through places, or (final) destination areas?
- *Manipulation patterns:* Who manipulates/accesses objects, which objects are manipulated/accessed and when?
- *Conversation patterns:* Where do people talk? Which places in 3D are used for long, intricate, never-ending discussions and which are sites of quick exchanges? How long, about what, whom do people talk to? What is the size of conversational groups? How do conversational topics evolve? How does the environment influence conversational topics?
- *Web access patterns:* Which web pages are accessed by whom, when, from where, and how often?

Subsequently, we review related work and introduce a set of visualization tools that aim to support social navigation, the evaluation and optimization of three-dimensional virtual worlds, and the study of their evolving communities.

3   Related Work

Research on social visualizations aim to analyze and visualize data about a person, to illuminate relationships among people, or to visualize user group activity. For example WebPath by Frécon and Smith (1998) unobtrusively visualizes a user's trail as s/he browses the Web to aid users in searching for previously attained data, and to teach or assist other users in their browse or searching techniques.

For a detailed review of lifeline visualizations, the visualization of very large-scale conversations, visualization of Web activity and user trails, representation of people by avatars, visualizations that support social interactions of participants, or visualization of MUDs or 3-D virtual worlds themselves, please consult Börner & Lin (2001).

Similar to web surfers that don't surf alone (Wellman & Gulia, 1999), visitors of 3D virtual worlds can benefit from each others footsteps through virtual space if they are visible. Today, most social visualizations visualize a static set of data. Notable exceptions are *Chat Circles* (Donath et al., 1999), Erickson et al.'s *Babble* system (1999), *Footprints* (Wexelblat, 1999), or *Anemone* (Fry, 2000).

Pioneering work by (Smith, 2000) used world mapping tools provided by Andras and Foxy and 3DMax to visualize the growth of a 3D world. However, to our knowledge, there exists no system that traces and visualizes spatially-referenced user interaction data such as navigation, object manipulation, Web access, or chatting in 3-D VWs. This may be due to the fact that most 3-D online browser systems provide an exclusive chat log (often restricted to a fixed number of proximate avatars) of a 3-D world experience. Information about when and where a certain utterance was made, user positions, object movements, teleports/warp usage, or web accesses is lost. However, the spatial reference is vital to identify places in which people typically speak, to find teleport designs that work, etc.

4 Visualizing VLearn3D

Börner & Lin (2001) introduced analysis and visualization techniques that help answer questions such as: How many users participated in a discussion as logged in the chat files? How much do specific users chat, and who did chat the most? How long is the average utterance length for different users? How often do users whisper? How many questions have been asked? In 2002, the Active WorldMapper[4] as well as tools to visualize user interaction data recorded utilizing bots (software programs) were presented (Börner et al., 2002). This paper goes beyond these efforts by applying and extending the developed tools to visualize VLearn3D – a multi-world, many participants virtual conference – in space and time.

VLearn3D[5] was the fifth annual educational conference held by vlearn3d.org. It took place in eight different worlds of Active Worlds Educational Universe (AWEdu), Noon to 7pm EST[6] on Dec 7th, 2002. Up to 60 attendees from literally all over the world, including many states in America, countries in Europe, Singapore, Australia, and Israel were present at each session. During the conference, user position data was acquired by running logbots in each of the conference venue worlds. Complete user position logfiles are available for *VLearn*, showcase, and *Chemeet*. Due to access right issues logging of *Unite1, MegaPath, Class3d*, and *Centre* started later (13:22, 16:14, 16:15, 16:16 respectively) but before the major demo activity around 5pm. In addition, respective world owners provided information on the kind of objects that make up their worlds as well as the position of objects so that a map of each could be generated.
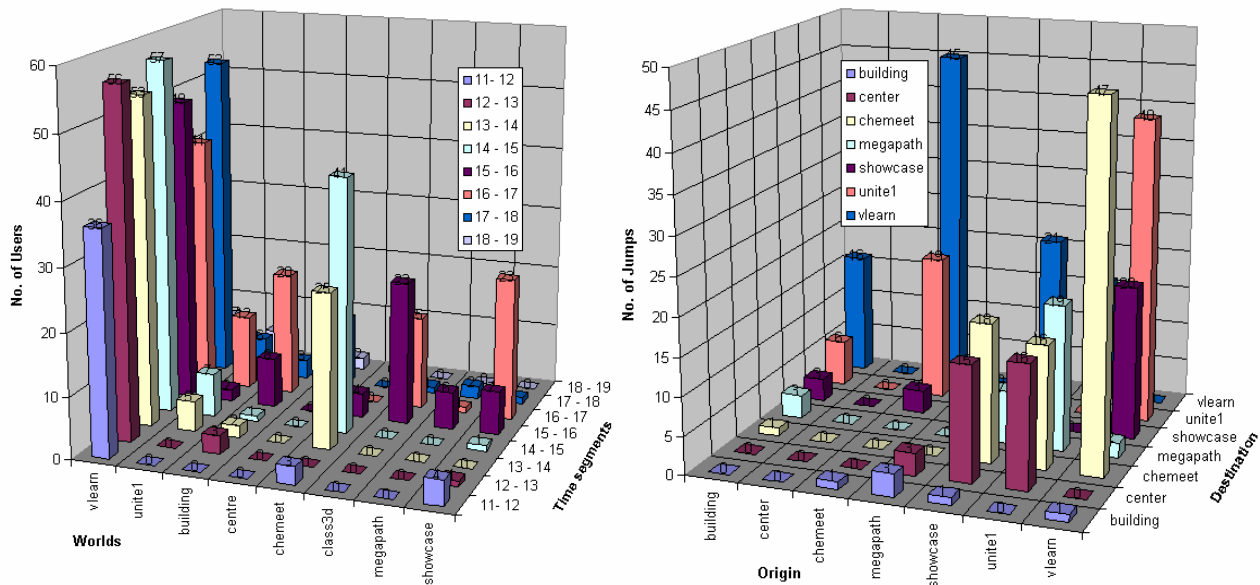

Figure 2. Number of visitors per world per hour (left) Number of users teleporting between worlds (right)

Figure 2 (left) shows simple statistics on the total number of unique users in the eight different worlds at different time segments. Altogether eight time segments were examined:
- 11-12, the hour before the conference started,
- 12-18 (12p–6p), the six hours of the conference (the conference ran late), and

---

- 18-19 (6p-7p), the hour after the Conference.

Figure 2 (right) plots the total number of users that teleported between an origin world and a destination world. For example, 47 visitors teleported from *VLearn* to *Chemeet*, 45 from *Chemeet* back to *VLearn*, and 40 teleported from*VLearn* to *Unite*.

Figure 3 shows user position data accumulated at different points during the conference overlaid on the *VLearn* map. Positions of virtual building objects are represented by white dots. Teleports and web links are indicated by red and blue dots respectively. The *VLearn* map was generated using the ActiveWorldMapper[7]. User trails are color coded to indicate the time sequence of traversals.

Figure 4 depicts squared, perspective maps of all worlds traversed by users during the conference. Worlds accessed at the beginning of the conference are placed at the bottom, worlds accessed later toward the top. Each world is labeled by its name. Next to each world is a circular snapshot of the virtual venue as a reminder of what the virtual world looks like. Short descriptions of the main sessions in each world are added as text. Overlaid on each map are the user trails of the Conference attendees. Major jumps between worlds are visualized by hand-drawn transparent lines. The thickness of each line corresponds to the number of users traveling (see also Figure 2). Like in Figure 3, color coding was used to denote the chronological paths of the conference sessions throughout the day. The trail of Bonnie DeVarco – the main organizer of the conference - is given in white.

Subsequently, the visualizations will be used to report the sequence of sessions organized in different worlds as well as the spatio-temporal distribution of attendees during the conference. Note that the chat log files of all sessions are available at the conference web site.

Throughout the conference, the *VLearn* world acted as the main venue. Typically, visitors entered the AWEdu universe via the *Centre* world. At noon, everybody met in the *VLearn* world, Pavilion 1 to attend a one hour session on the following:

Education, Innovation and Community Development in 3D Worlds.
This session welcomed all Conference participants, initiated an introduction of participants, gave an overview of some of the most innovative educational projects in AWEdu, and a preview of the day's presenters and activities.

The subsequent presentation and panel session was organized by Members of the Building Blocks Team: Katy Borner, Bonnie DeVarco, Margaret Corbit, Elijah Wright, Yael Kali:

Building Blocks for Virtual Worlds Study - Preliminary Results.
This took place in VLearn, Pavilion 2, 1pm-2pm EST. Keynote speaker Yael Kali, presented her work and vision for the Center for Innovative Learning Technologies (CILT) [8] Design Principles Database. Correspondingly, the maps in Figure 3 show increased user activity (user trails) close to pavilion 1 & 2 from noon to 2pm.

Subsequently, conference participants were invited to explore different interactivity areas:

CHEMEET WORLD AND LINKWRLD - Interactivity and New Avatars for Science and Guidance.
Many participants teleported to *Chemeet* to attend a session on new interactive avatars for science learning by Cinzia Gandini.

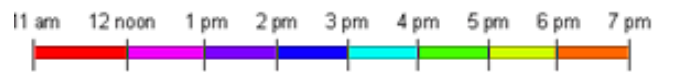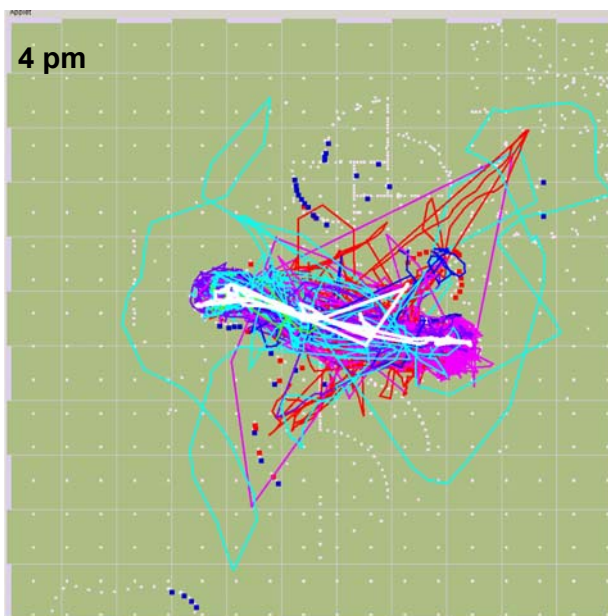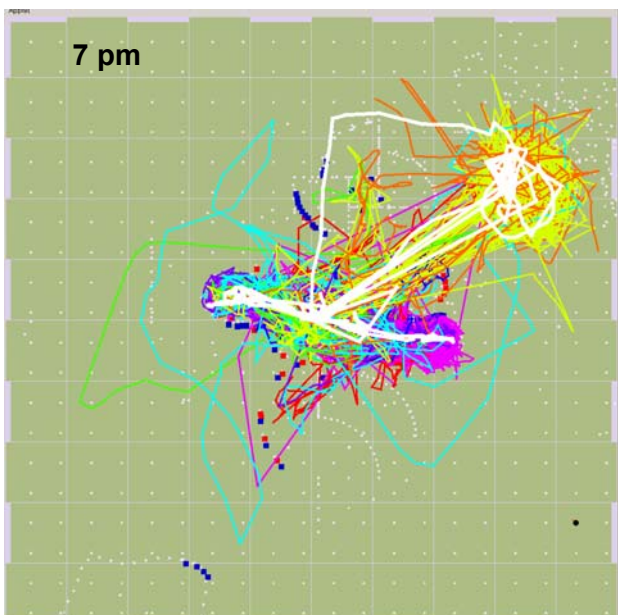The subsequent one hour roundtable discussion on

Brainstorming a Toolkit for Educational Virtual Worlds
started later as planned back in *VLearn*, Pavillion 2. Participants discussed the wide range of approaches that educators have found successful and the challenges in bringing together a suite of tools that will help educators and students use virtual worlds to aid the learning experience effectively. Figure 4 shows the intra-world jumps from *Vlearn* to *Chemeet* and back to *VLearn*.

The roundtable was followed by a

ActiveWorlds Hands-On Building Session for Students.
It took place simultaneously in five worlds: *Showcase, Building, MegaPath, Class3D*, and *Unite*. The sessions featured building demonstrations, a showcase of the latest bot technologies (machine agents that can be used to greet and help new users, to change slides, or to log user activity among others), a discussion on the collaboration of K12 using virtual worlds, and a demo of a new classroom generator in AWEdu. The intra-world teleport activity from the demonstration venues back to *VLearn* is denoted by hand drawn lines in Figure 4.

Subsequently, conference participants were invited to explore different interactivity areas:

CHEMEET WORLD AND LINKWRLD - Interactivity and New Avatars for Science and Guidance.
Many participants teleported to *Chemeet* to attend a session on new interactive avatars for science learning by Cinzia Gandini.
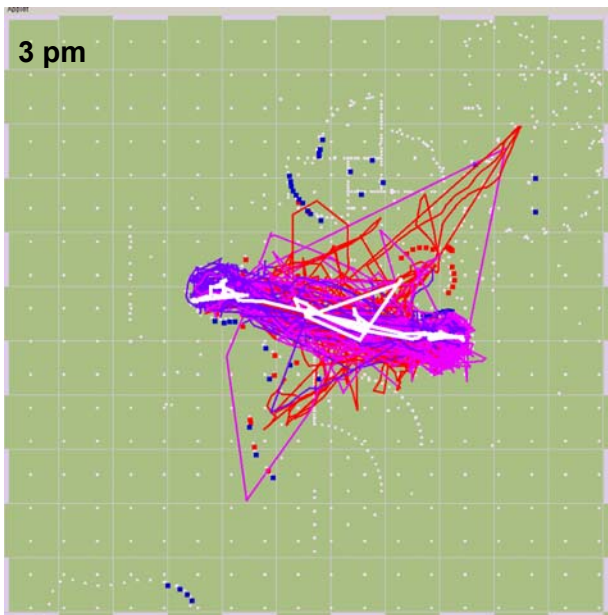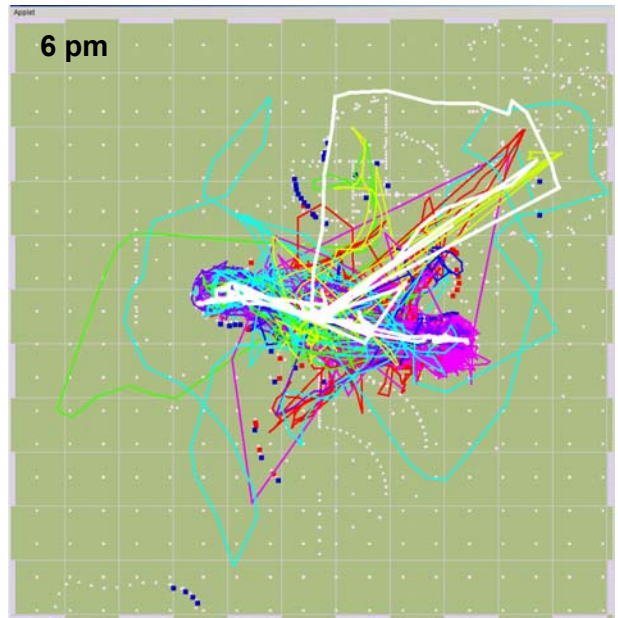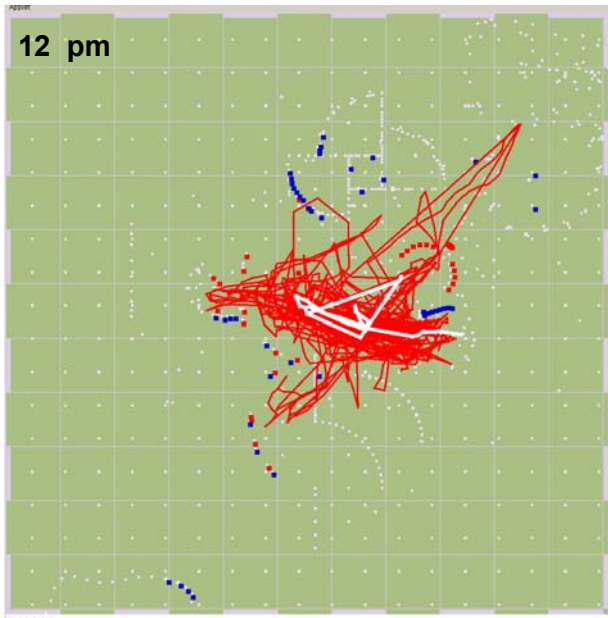
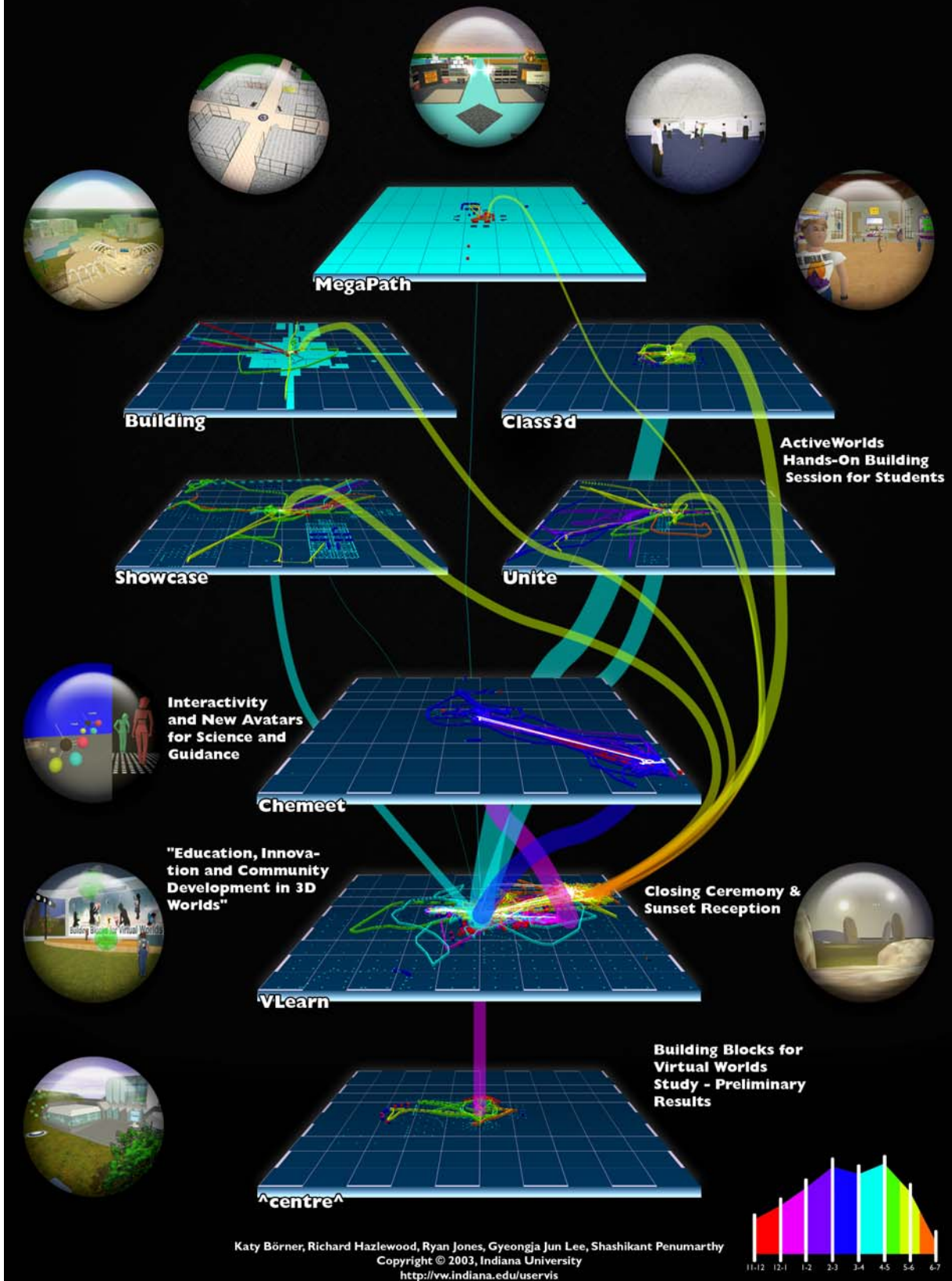**Figure 3. User Trails in VLearn, 12pm – 7pm**

Figure 4. VLearn3D Conference Mapped in Space and Time

The subsequent one hour roundtable discussion on

Brainstorming a Toolkit for Educational Virtual Worlds

started later as planned back in *VLearn*, Pavillion 2. Participants discussed the wide range of approaches that educators have found successful and the challenges in bringing together a suite of tools that will help educators and students use virtual worlds to aid the learning experience effectively. Figure 4 shows the intra-world jumps from *Vlearn* to *Chemeet* and back to *VLearn*.

The roundtable was followed by a

ActiveWorlds Hands-On Building Session for Students.

It took place simultaneously in five worlds: *Showcase, Building, MegaPath, Class3D*, and *Unite.* The sessions featured building demonstrations, a showcase of the latest bot technologies (machine agents that can be used to greet and help new users, to change slides, or to log user activity among others), a discussion on the collaboration of K12 using virtual worlds, and a demo of a new classroom generator in AWEdu. The intra-world teleport activity from the demonstration venues back to *VLearn* is denoted by hand drawn lines in Figure 4.
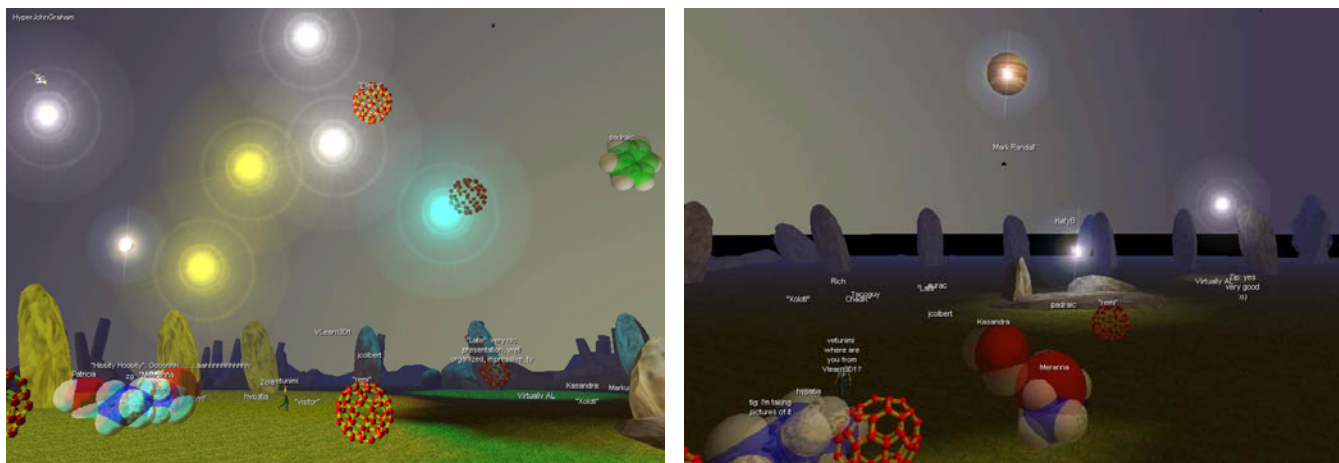
Figure 5. Closing Ceremony in the VLearn World

The Conference ended with an epic, effects filled

CLOSING CEREMONY AND SUNSET RECEPTION

This took place in the VLearn world. The 7 pm map in Figure 3 shows the excessive user movements at this time (in yellow and orange) and Figure 5 shows stills of this final event including molecule shaped avatars and virtual fireworks. The accompanying music generated from gene expression data is missing.

5   Conclusion

This paper reported the application of information visualization techniques to assist users in making sense of a distributed virtual conference event that took place over several hours and in diverse virtual worlds. The visualizations also provided valuable feedback to the designers of the virtual worlds as they show what areas, teleports, web links are used frequently, moderately or never; what areas are used for chatting, where people got lost, etc. In addition, the visualizations are the first comprehensive record of human conferencing activity in virtual space.

As our environment becomes increasingly smarter – sensing where we are and what we are doing via motion sensors, passive sensors (RFID tags), or active sensors (global position sensors) – the extensive collection of user position and interaction data becomes possible in the real world. A first successful attempt to track the positions of real world conference attendees in order to help them find each other, find events and places of interest, and to generate attendance statistics was made by Donna Cox an her colleagues (Cox et al., 2003). As the price tag for real world tracking decreases and the spatio-temporal resolution of tracking devices increases, we expect many more "location aware value-added services" such as the one implemented by Cox's team to follow. The visualization techniques presented in this paper can be applied to support social navigation by pointing out highly crowded places or user trails of other people, to analyze and optimize the utilization of public places, streets, etc., and to help study real world communities.

Our current research aims to extend the visualization tools so that real time and time lapse visualizations of user activity become possible. The tools are applied to identify general design patterns of virtual worlds as well as general patterns of user

interactions (Börner & Penumarthy, 2003). In addition, the visualizations are used to support diverse educational projects (Börner et al., 2004).

Acknowledgements

References

Börner, K., Hazlewood, R. & Lin, S.-M. 2002. Visualizing the Spatial and Temporal Distribution of User Interaction Data Collected in Three-Dimensional Virtual Worlds. In: *Sixth International Conference on Information Visualization*, pp. 25-31. London, England: IEEE Press.

Börner, K. & Lin, Y.-C. 2001. Visualizing Chat Log Data Collected in 3-D Virtual Worlds. In: *International Information Visualisation Conference*, pp. 141-146. London, England.

Börner, K. & Penumarthy, S. 2003. Social Diffusion Patterns in Three-Dimensional Virtual Worlds. *Information Visualization Journal*, **2,** 182-198.

Börner, K., Penumarthy, S., DeVarco, B. J. & Kerney, C. 2004. Visualizing Social Patterns in Virtual Environments on a Local and Global Scale. In: *Digital Cities 3: Local information and communication infrastructures: Experiences and challenges*: To be published by Springer Verlag.

Cox, D., Kindratenko, V. & Pointer, D. 2003. IntelliBadge™: Towards Providing Location-Aware Value-Added Services at Academic Conferences. In: *Ubiquitous Computing, 5th International Conference*, pp. 264-280: Lecture Notes in Computer Science, Springer Verlag.

Donath, J. S., Karahalios, K. & Viegas, F. 1999. Visualizing conversation. *Journal of Computer Mediated Communication*, **4**.

Erickson, T., Smith, D. N., Kellogg, W. A., Laff, M., Richards, J. T. & Bradner, E. 1999. Socially Translucent Systems: Social Proxies, Persistent Conversation, and the Design of "Babble". In: *Proceeding of the CHI 99 Conference on Human Factors in Computing Systems: The CHI is the limit*, pp. 72 - 79: ACM Press.

Frécon, E. & Smith, G. 1998. WebPath - A three-dimensional Web History. In: *IEEE Symposium on Information Visualization (InfoVis '98)*. Chapel Hill. NC: IEEE Press.

Fry, B. 2000. Organic information design. In: *Media Lab*. Master's Thesis: MIT.

Smith, A. 2000. Mapping 30 days in ActiveWorlds, http://www.casa.ucl.ac.uk/30days/mapping.htm.

Wellman, B. & Gulia, M. 1999. Net surfers don't ride alone: Virtual communities in cyberspace. In: *Communities in Cyberspace: Perspectives on New Forms of Social Organization* (Ed. by Smith, M. & Kollock, P.): Routledge Press.

Wexelblat, A. 1999. History-Based Tools for Navigation. In: *Proceedings of the 32nd Annual Hawaii International Conference on Systems Sciences*. Hawaii: Los Alamitos, CA: Institute of Electrical and Electronics Engineers (IEEE) Computer Society.