The Effects of a Sense of Place on the Learning Experience in a 3D Virtual World

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Abstract
This paper reports on a study of how a sense of place affects the learning experience of digital media design students in a virtual learning environment that encourages collaboration and constructivism. Using an immersive 3D Virtual World based on Active Worlds, we have created a virtual learning place for students in a Website Design course. The virtual learning place has two distinct parts: a classroom-like place surrounded by student galleries. Students can navigate and communicate (synchronous chat) within the environment in the form of an avatar (virtual person). We recorded the conversations and activities of the students in lectures held in the virtual learning place and applied a communication coding scheme to analyse their discussions. In this paper we interpret the results of our analysis to characterise the effects of a sense of place on the students learning experience in a virtual learning environment.

Introduction
Places are spaces which have meaning (Harrison and Dourish, 1996) and the physical world abounds with them. They evolve out of the activities of those that inhabit them on a daily basis and take on a meaningful attachment to those who pass through them.

Institutions of learning have long understood the importance of providing a 'place' in which students can engage and be supported in their learning activities. The types of places they provide are classrooms, lecture theatres, laboratories, libraries, and conference rooms. Universities, schools and colleges are all institutions which are designed to provide students with an environment in which to build a learning community and construct their knowledge. They provide tools, resources and facilities in which students are supported in the task of developing and building their knowledge and understanding.

Virtual communities became aware of the significance that a sense of place can bring to their societies during the 90s, contrary to Meyrowitz's (Meyrowitz, 1985) notion that virtualisation would create a sense of placeless-ness. Virtual places within the virtual community provided an environment in which dynamic interactions could occur (Harrison and Dourish, 1996).

A key role of virtual places for virtual communities is to provide a context for discourse. This notion of a virtual place providing some type of nexus for a community of individuals has led us to explore and study the possibilities of providing a sense of place for learners.

Traditional learning has focussed on the distribution of learning materials such as texts and course notes, the presentation of lectures, followed by assignments and examinations. While many of these approaches have been transferred to virtual environments, the development of places for learning is not as well developed. Examples of places as learning environments are: Diversity University (http://www.du.org) and Tappedin (http://www.tappedin.org). These environments focus on the development of rooms and tools for communicating while learning. They do not yet facilitate the learner-centred approach that allows the learner to construct external representations of their knowledge.

In our research we are interested in studying the learners' experiences rather than on the effectiveness of the technology. We are interested in the effects the virtual learning environment as place has on the learners; such as:

- How place is incorporated into their discussions during learning sessions.
- What kind of experience students have being immersed in a 3D Virtual Learning Place.
- Whether a sense of place influences the learning experiences of the students

We are also interested in whether the 3D Virtual Learning Place and its sensory environment encourage the students to be more collaborative and engaged in their learning experience. Does having a sense of place help the students to take a constructivist approach to their learning? Does the 3D virtual place enable and encourage a more tactile and visual approach by the lecturer to management of the learners?

To better understand how a sense of place affects the learning experience of design students, we developed a design model for guiding the development of a learner-centred virtual learning environment. This model shows how place and design can combine with learning theories and technology. The model is based on constructivist views of learning and supports the four key processes fundamental to a constructivist learning environment: context, construction, collaboration and conversation (Duffy and Cunningham, 1996. Jonassen, 1994).
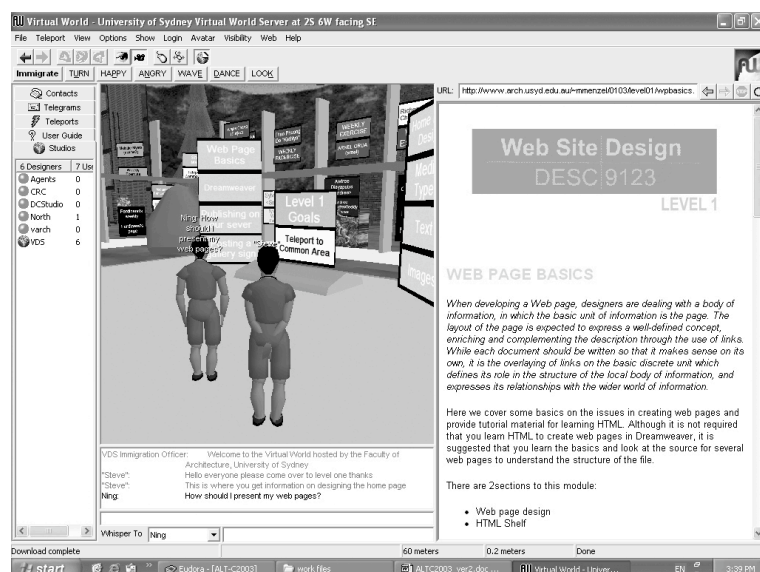
Figure 1: Students communicating and collaborating on a web page design.

Using an immersive 3D Virtual World based on Active Worlds, we have created a virtual learning place for students in a Website Design course. The virtual learning place has two distinct parts: a classroom-like place surrounded by student galleries. Students can navigate and communicate (synchronous chat) within the environment in the form of an avatar (virtual person) as shown in Figure 1 above. They can construct and display their knowledge and learning experience using contextual learning resources and tutorials in the virtual learning place. The student galleries provide a place for a visual representation of students' own design work submitted for peer review and collaborative feedback.

To study the effect of a sense of place we analyse the discussions that take place in the virtual learning place using a coding scheme. The coding scheme categorises the content of the discussion into place communication and learning communication categories. The coded discussions provide insight into the way in which a virtual learning place influences the learning experience. We augment the discussions by using screen shots of the student's activities in the virtual learning place to cross-examine and visualise the learning experience with the students' conversations.

A Learner-Centred Virtual Learning Environment for a Web Site Design Course

Design teaching emphasises the experience of designing as a major component of education. We build on this by emphasising the importance of learning as an experience. The development of place as the core of a virtual learning environment can provide the basis for a learning experience.

In our research we have been developing a model of a learner-centred virtual learning environment that provides a sense of place. A prototype of this model has been implemented into a web site design course where students work in a 3-D Virtual World. Students are supported in taking ownership of their own learning experience and encouraged to explore the boundaries of their own learning capabilities. They are supported in this environment by collaborative peer group interaction, facilitated by the course lecturer.

The Course
The web site design course teaches students skills and techniques in creating web pages, develops their understanding of the concepts and semantics of the World Wide Web, and gives them experience in designing, developing and implementing a web site. In previous years, web site design was taught using WebCT as the technology used to create the virtual learning environment. WebCT, a virtual learning environment based on a desktop metaphor, assists in the management of learning and the lecturer in putting learning resources and information on-line. What it lacks is the ability for students to engage each other and the lecturer in a place environment that is integrated with the prescribed learning materials and the construction of their identity and designs.

The Model

We wanted to provide a learner-centred virtual learning environment, based on our model (see Figure 2), that allows students to experience the process of designing in a situated context, engage in practical learning activities, enable representation of their practice, engage in peer critique and collaboration, and form a learning community. The pedagogy used is based on constructivist learning theories. This provides students with a learning environment that allows freedom of expression and creativity, and enables construction of knowledge, while the lecturer is provided with an environment that facilitates on-going mentorship.
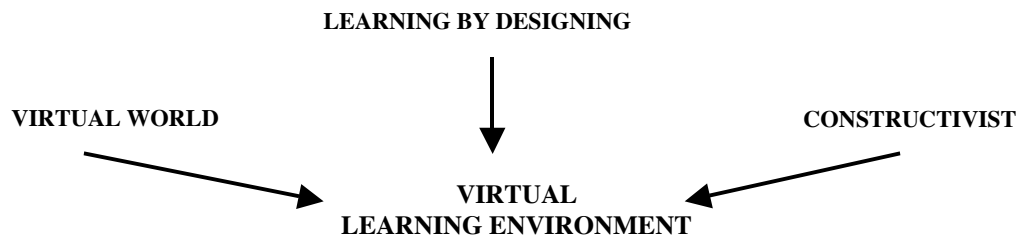
LEARNING BY DESIGNING

VIRTUAL WORLD   **CONSTRUCTIVIST**

**VIRTUAL
LEARNING ENVIRONMENT**

Figure 2. Model for designing a learner-centred virtual learning environment

The Environment

We used a Virtual World to underpin the technology. Virtual worlds, such as Active Worlds (http://www.activeworlds.com) and VWorlds (http://www.vworlds.org), are networked environments that create a sense of place and a sense of presence of others in the place. They are inherently collaborative especially when populated by other people. Active Worlds provides various tools for communication and collaboration. Users are able to navigate through the world in various ways by walking, flying or teleporting. They can change the shape, colour and texture of their world by adding new objects or modifying existing ones. Communication is not only in the form of language, but utilises expression of emotion in the form of facial and bodily gestures. They can also change their virtual persona to suit their mood or tone. Selecting a virtual world as the technology for a virtual learning environment provides the basis for a place. Figure 3, shows an aerial view and highlights the various areas of the virtual learning place used in the web site design course.
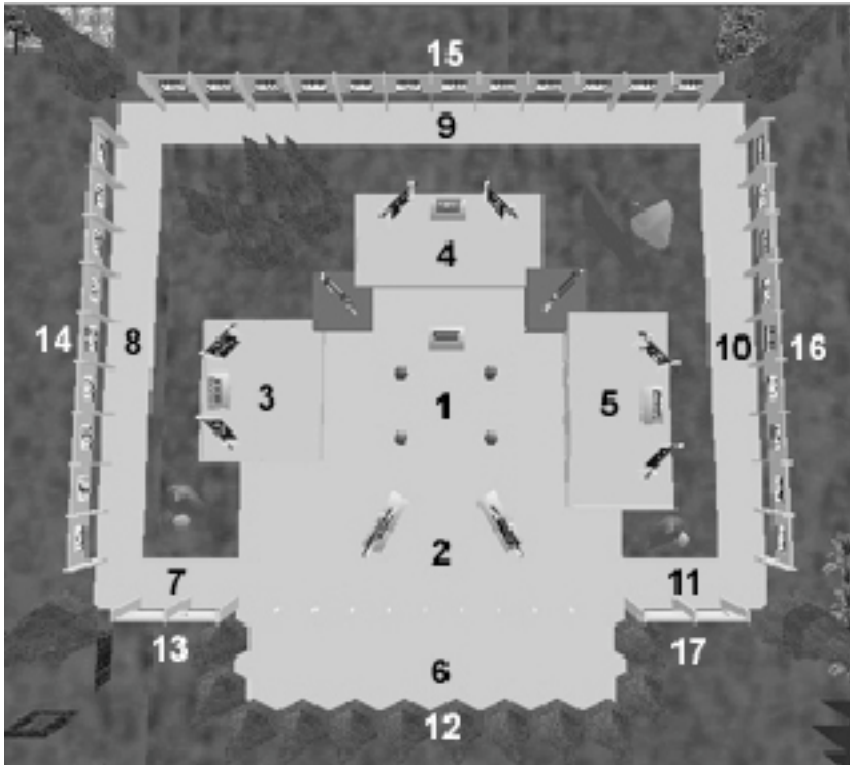
Figure 3. Aerial view of web site design course showing various areas.

1.   Common Area: a public space for discussion and general meetings.
2.   Entrance Area: entrance providing general information.
3.   Level One: an open platform providing level one course materials.
4.   Level Two: an open platform providing level two course materials.
5.   Level Three: an open platform providing level three course materials.
6 - 17 Student gallery spaces: places for students to display their designs and customise their own place.

In the virtual learning place students communicate by "talking by typing" and navigate the environment in the form of an avatar. Students are free to explore the environment and gather information (see Figure 4).
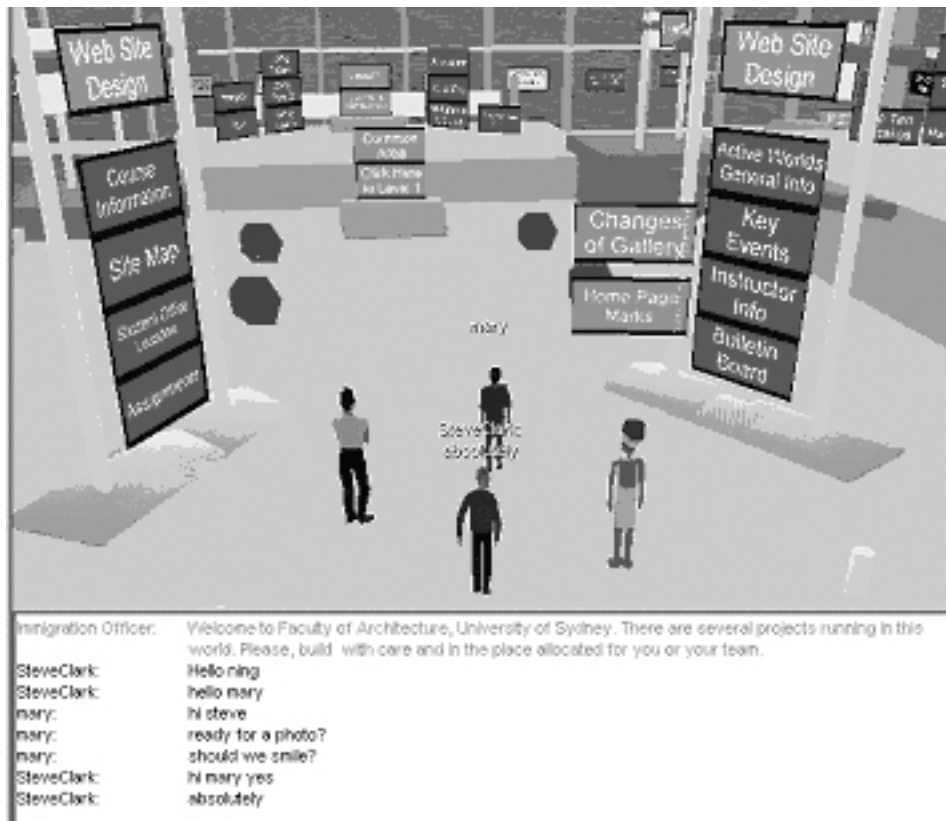
Figure 4. Students represented as avatars "talking by typing".

Communication Coding Scheme

In order to analyse communication in the virtual studio we adapted a coding scheme developed for studies of computer-mediated communication and cognitive studies of designers by Gabriel (2000) for analysing design communication.

Our communication coding scheme consists of five major classifications. Control, Technology and Social are based on those used by Gabriel (2000). Learning and Place are used to study the effects of a sense of place on the learning experience of students. Categories are shown in Figure 5.

1. 'Control Communication', a category which helps identify differences in how much of the design session was focussed on maintaining the floor, handing over control to another person, interruptions, and acknowledging presence.

2. 'Technology Communication', a category which looks at discussions held between participants related to the use of the tools and the collaborative environment.

3. 'Social Communication', a category which looks at the amount of time spent in social talk.

4. 'Learning Communication', a category which characterises the discussion in terms of 'learning by designing". Within this category, the coding scheme distinguishes different activities in communicating learning concepts, applying skills, knowledge, making critical analysis, and evaluation.

5. 'Place Communication', a category which helps identify the various references to the place in discussions such as gestures of avatar, identity of avatars, location, navigation and orientation within the environment, presence of others, ownership and citizenship.

We allow a single statement to have more than one code in each category. For example:

Lecturer: Please come over to level one.

This statement has two codes in relation to place communication: *Exploration* which is identified by *"come over"* and *Location* identified by *"Level One"*.
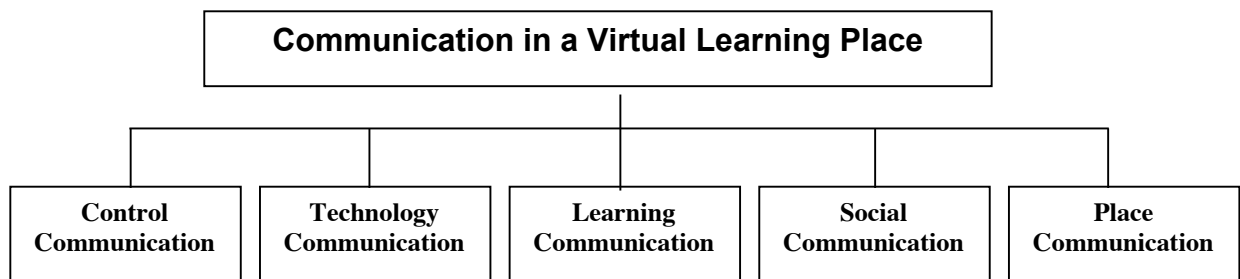

Figure 5. Tree diagram of the coding scheme for analysing communication

Study of a Virtual Learning Place
DESC9123 Web Site Design is a course in the Faculty of Architecture, University of Sydney. The course is run during summer school as an intensive six week course or during first and second semester as a thirteen week course. For this research we used the summer school session for January - February 2002, which had a small group of 8 students. As the course is an internet-based course, it is available for access 24/7. Students can connect using the Active Worlds client/browser either in the school computer labs or from their homes.

Timing
Weekly lecture/discussions are held for one hour twice daily in the virtual learning place. Each discussion is devoted to a particular theme. Students can access a key events board to find out the upcoming topic, and there is a question period at the end of each lecture. Students are encouraged to participate actively during the lecture period. These lectures are a compulsory component of the course and the only time when students can receive formal feedback from the lecturer and their peers. We collected data from the conversations that occurred during the lecture in the virtual learning place.

Gathering Data
The process of gathering conversations in the virtual learning place is a simple and seamless process. The client software has a number of features, including a facility to log the chat text as a file. The log files identify the time logging commences, participants' names and the chat text. For this research there was one log file per lecture with a total of 12 log files. We used these log files as the source of our research data.

During the lectures we also took time stamped screen grabs of the students activities at various key moments. These were used as a cross reference against the conversations that took place.

Multiple Coders

Qualitative research is based on the subjective opinion of the researcher (Purcell et al, 1996). Therefore, in order to maintain accuracy, integrity and reliability, two independent coders were used to code the same data. The coding strategy we applied in this research matches the methods used by Purcell et al (1996) and Gabriel (2000). The process follows the Delphi method which is a method for structuring a group communication process in order to achieve agreement (Linstone and Turoff, 1975; Purcell et al, 1996)

Using the coding scheme the transcripts of the conversations were coded with the various codes for each category. Once coding was completed an arbitration process took place to identify discrepancies and unify the two coders coding. After arbitration a final coded transcript was produced. All quantitative measures and qualitative observations were gathered using this final coded transcript.

Analysis of Communication in the Virtual Learning Place

In this section we present the analysis of communication for the first student group meeting in the web site design course. We use both qualitative and quantitative methods to analyse the coded communication. We describe through quantitative measures and qualitative observations the effects of a sense of place on the learning experience and the key elements that identify a virtual learning place.

JAN 9th 2002 Morning: Session 1

This is the first organised discussion for the students in the virtual learning environment. For many students it is the first time they have truly engaged in the virtual studio and for many their first experiences in a virtual learning environment. The purpose of this session is to orient students and to familiarise them with the virtual learning place. Students are taken on a tour of the virtual learning place and various tools and concepts are demonstrated. In this first session there were only two students and the lecturer in the virtual learning place. But even with this small number in attendance many characteristics of a virtual learning place emerge from out of the activities and various conversation topics.

Analysis of Major Communication

In Table 1 and Chart 1 below we show the statistical results of the discussion as coded into the five major communication categories: control, technology, social, learning, and place.

What we find is the design sessions are characterised by a high proportion of place communication with respect to the other communication categories. With 56% of the coded communication in the virtual studio relating to issues that concern *place*. The second dominant category, learning communication, shows 37% of all communication in the virtual studio involves the concept of *learning*. Combining the two highest rating categories we get a result of 93% of student's conversations involve issues that relate to the concepts of *Place* and Learning in the virtual studio.

The other categories, *Control communication*, *Social communication* and *Technology communication* all displayed very low percentages of utterances.

Control	3%	5
Technology	3%	5
Social	0%	0
Learning	37%	55
Place	56%	84
	TOTAL	**149**

Table 1. Statistics of Major Communication in the Virtual Learning Place.

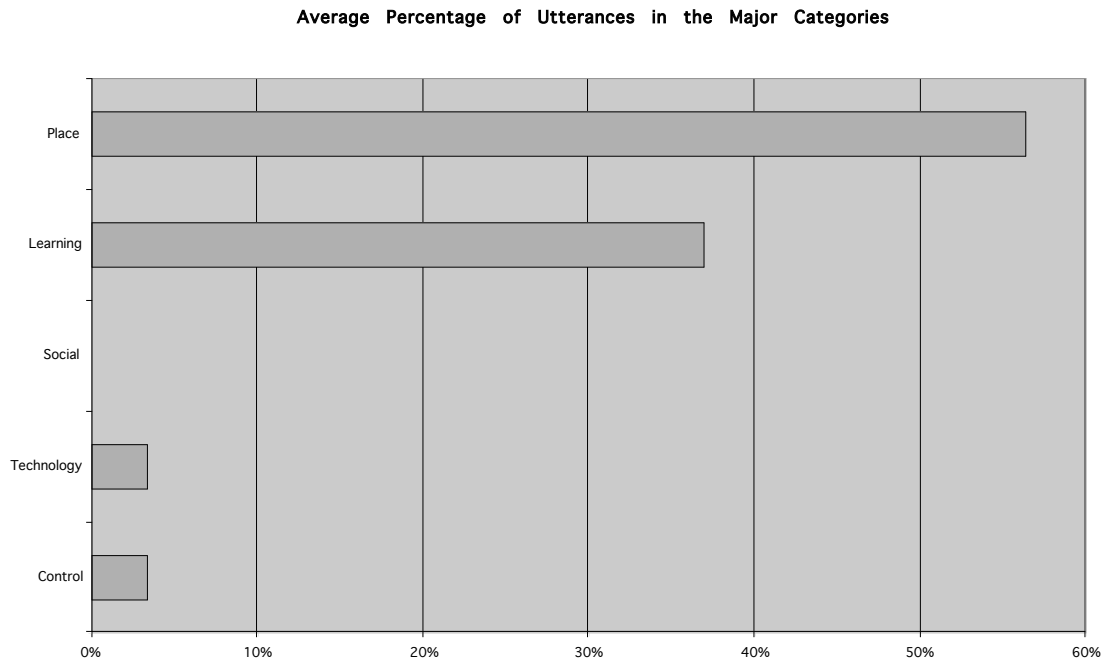**Average Percentage of Utterances in the Major Categories**

Chart 1. Distribution of Major Communication for session one.

Major Communication Conclusion

The strong dominance of learning and place demonstrated that the students had become engaged in these two issues immediately. To investigate the effects of a sense of place we focused on these two major communication categories.

The results for the other three categories: control, social and technology were expected results. Our results matched similar findings by Gabriel (2000) in the study of computer-mediated collaborative design. Social communication was kept to a minimum and when it occurred was often straight to the point. Technical problems with the use and interaction in the virtual learning place were virtual non-existent so there was very little communication in this area. Control communication was at a minimum as the nature of text based communication enabled participants to state what they wanted with no interruptions or floor holding.

Analysis of Place Communication

This section presents the average percentage of coded utterances that relate to place communication, broken down into their respective sub categories. Table 2 show the statistical results.

Gestures - GES	4%	3
Location - LOC	20%	17
Identity - IDT	31%	26
Exploration - EXP	6%	5
Presence - PRS	29%	24
Ownership - OWN	5%	4
Citizenship - CIT	6%	5
	TOTAL	84

Table 2. Statistics of Place Communication in the Virtual Learning Place.

In this session there are three dominant categories that stand out as significant areas of discussion as can be seen in chart 2 below: *Presence, Location* and *Identity*. Combined they make up 80% of the discussion relating to place. P*resence and Identity* combined give a figure of 60% of utterances relating to issues of students awareness in the virtual learning environment. The categories *exploration*, *citizenship* and *ownership* show very similar results with 5-6% each, with *gestures* showing 4%.
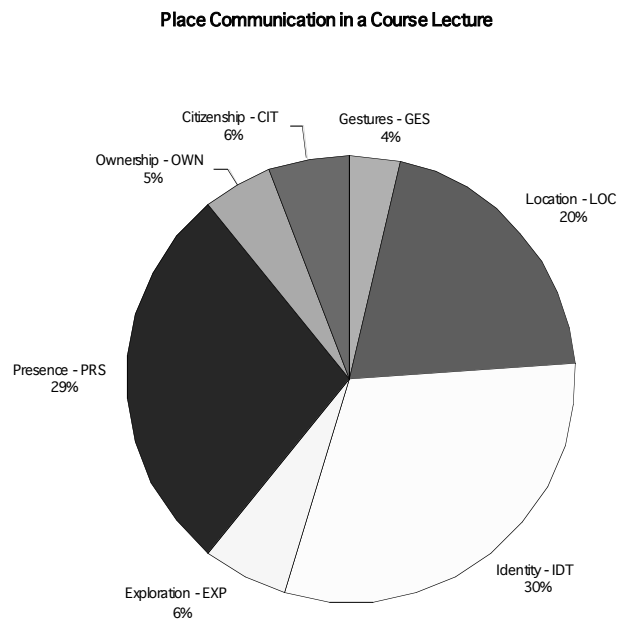
Place Communication in a Course Lecture

Chart 2. Distribution of Place Communication in session one.

Dynamics of Place Communication

The dynamics of place communication during the design session is shown in chart 3. These graphs represent parallel timelines (each time point corresponds to an utterance) for each category of place communication. We can see the clustering and scattering of communication events as they occur at various moments during the session.
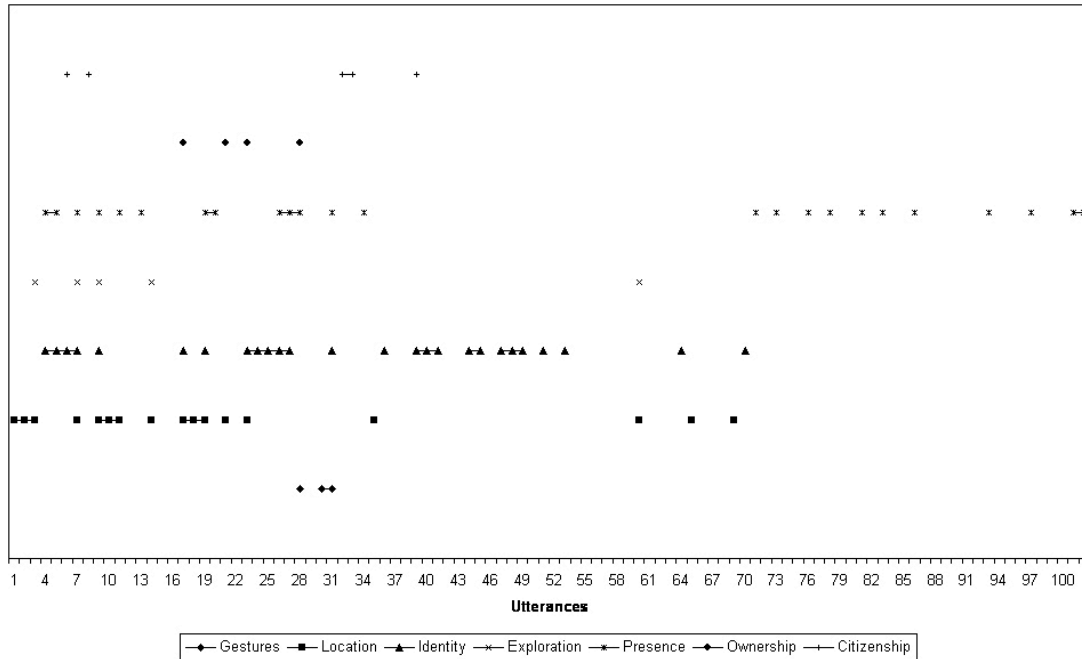
Chart 3. Dynamics of Place Communication for session one.

By looking at chart 3 above we are able to identify the clusters and patterns that emerge during the course of the discussion.

Characterising the Effects of a Sense of Place
In this section we identify the various clusters and patterns that emerge in relation to *Location, Presence* and *Exploration*. By identifying the various clusters that occur over the course of the discussion we are able to characterise the effects of a sense of place.

Management of Learning – Location, Presence and Exploration
The first major cluster group occurs at the very start of the conversation. Cross-referencing the text extract of the conversation, we find that students are being gathered to a specific location.

Lecturer: Everyone come over to the main entrance area please
Student 1: I am here
Student 2: I am here too.

In this instance we find that the students are being asked to gather together in one place, an indication to navigate somewhere, in this instance the "Main Entrance Area" for the start of the session. On arrival they acknowledge their presence at the specific location.

Further into the discussion we see two more major clusters occurring that relate to this issue.

The second major cluster involves students now moving from the starting point of the session to a new location in the virtual learning environment. This new location is identified as the student gallery.

Lecturer: Ok lets go over to the gallery

This notion of movement is identified in chart 3 by the exploration code, which is found to occur at a point close to the three major clusters for location.

The combination of location and exploration identifies a relationship between the two codes that implies a movement of students from one place to another. The implication of movement by the students which in this case is instigated by the lecturer can be interpreted to mean that some type of organisation or management of student movement is occurring in the environment.

Hypothesis

We can infer a hypothesis from the relationship of the two codes - *Location* and *Exploration*. This is illustrated by looking at a key point in the discussion where the two codes connect. At key point 60 in the discussion we find a connection between the two codes. Now looking at the text utterance for this particular occurrence we find a command by the lecturer to student 1 to move from their current location to a new locale in the virtual learning environment.

Lecturer: (to student 1) let us go to the level one area
Student 1: ok

The consistency of this relationship enabled us to conclude a hypothesis: For the Management of Learning:

Places enable students to be gathered to a specific location and to visualise their presence at the location to enable focusing of attention.

Key Place Elements: Location, Presence and Exploration.

Analysing the Learning Communication

In this section we analyse the learning communication that occurs in the virtual learning place in two phases.

In Phase One: "*Learning Communication in a Course Lecture*" using the coded transcripts we characterise the learning process by describing the statistical results of the *Learning Concepts*. We generate a set of charts based on these statistical results and then interpret the charts.

In the Phase Two: "*Dynamics of Learning Communication*" we study the collaborative process that occurs by following the threads of conversation in the discussion sessions that are coded *Learning Concepts*. This is achieved by extracting from the transcripts two threads of conversations, those initiated by the lecturer and those conversations initiated by the students. We look further at the types of collaboration that occur such as conversations that occur between:

- Student (question) to Student (answer/elaboration/development)
- Student (question) - Lecturer (answer) - Student (elaboration/development)
- Where the conversations go
- How long the conversations last

Learning Communication in a Course Lecture

Table 3 and Chart 4 show the statistical results in relation to learning concepts.

CONCEPTS		
Introduction - IOC	22%	12
Acceptance - AOC	0%	0
Rejection - ROC	0%	0
Clarification - CLC	36%	20
Confirmation - COC	13%	7
Development - DEC	16%	9
Repetition - RPC	0%	0
Referencing - RFC	2%	1
Revisiting - RVC	4%	2
Evaluation - EVC	7%	4
TOTAL		**55**

Table 3. Statistics of Learning Concepts for the session.

In this session out of the ten categories there are two dominant categories, Introduction with 22% and Clarification with 36%. The next two dominant categories are Development - 16% and Confirmation - 13%. The next three categories referencing - 2%, revisiting - 4% and evaluation - 7% show low results, while the remaining three categories acceptance, rejection and repetition registered no result.
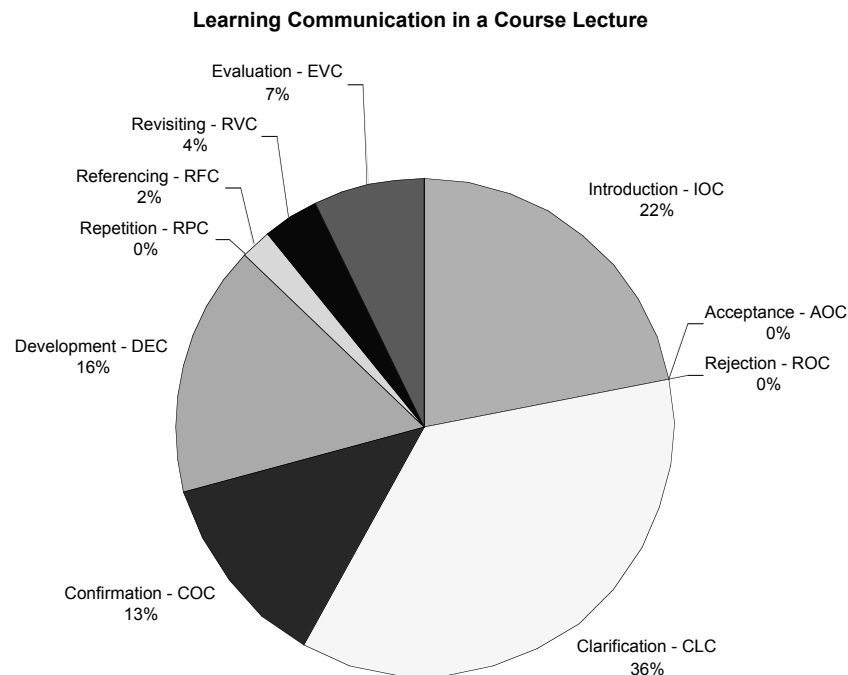

Chart 4. Learning Concepts in a course lecture for Jan 9th morning.

In this session we find that 22% of the course is dedicated to the introduction of concepts, which represent the starting point for a conceptual discussion on a learning topic. Combining clarification and development we find 52% of the course is then dedicated to developing or constructing understanding of the concepts presented. Combining acceptance and confirmation we find that out of the total concepts presented

13% of them are giving positive affirmation or acknowledgment, while no concepts were rejected or repeated, we find that 2%-4% were either referenced or revisited. In the final process of learning only 7% of the coded concepts were evaluated.

Interpretation of Learning Concepts Process
The majority of the conceptual learning process revolves around clarification and development of understanding of the learning concept. We see that 22% of the overall discussion involves introducing a new concept, compared to clarification and development this is a ratio of 2.5:1. Evaluation of learning concepts compared to clarification and development is around 6:1 and about 3:1 compared to introduction of a concept.

Dynamics of Learning Communication
In this section we follow the dynamics of learning communication in the discussion. We plot a chart using the learning communication codes (see chart 5 below). This chart outlines the scattering and clustering of the learning communication events as they occur during the lecture. We focus on the threads of the conversations isolating individual events and describing the type of collaboration, the instigator of the conversation and key points in the chart where this occurs. We interpret the findings using extracts from the transcript.
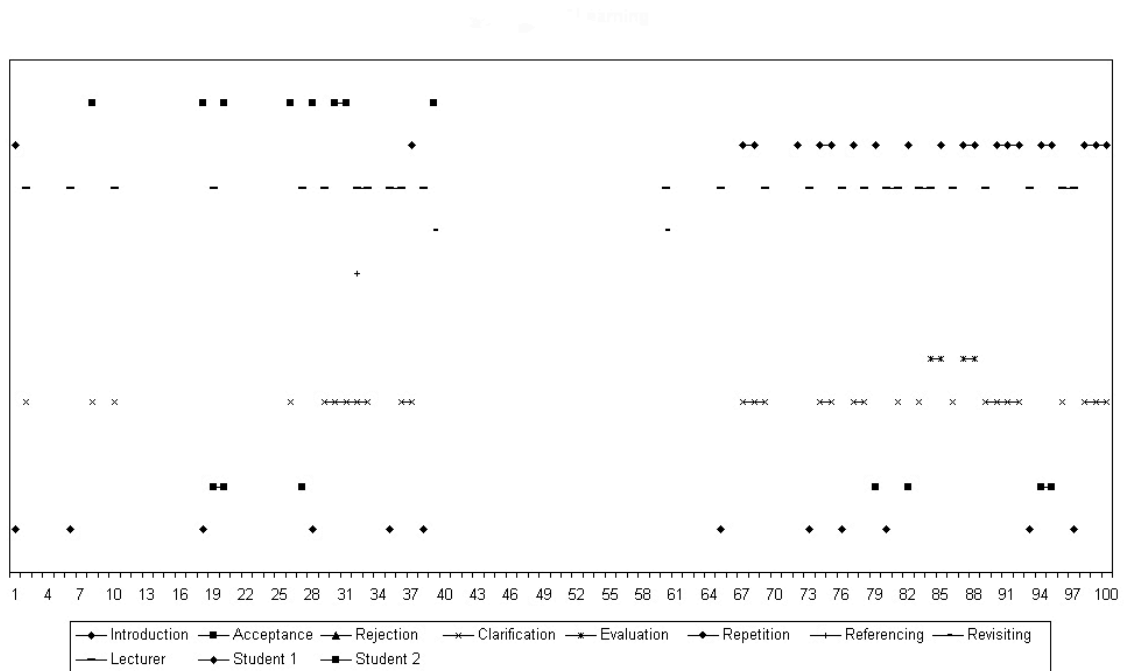

Chart 5. Dynamics of Learning Communication in a course lecture for Jan 9th Morning.

Conversation 1 – Student Gallery Sign
This conversation was initiated by student 1 and revolves around the concept of the student gallery sign.

- *Student 1: In this gallery or you build in another place*

The lecturer responds to student 1 by providing guidance and instructions on where the students are to put their signs.

We can see the thread and dynamics of the conversation by looking at the transcript and chart 5 above.

Here are the key transcript units which relate to conversation 1.
2-3-4-5-6-8-10-11-15-17-18

An extract from the discussion:

- *Lecturer: The gallery section for your signs is located behind me.*

- *Lecturer: Everyone come over to the main entrance area please.*

- *Student 1: I am here.*

- *Lecturer: Where are you at the moment student 2?*

- *Lecturer: I see you come over here to the main area where the entrance is and we can look at the gallery where you will put your sign.*

- *Student 2: OK*

- *Lecturer: Ok. As you can see student 1 and student 3 have already put their signs in the gallery.*

Conclusion for Conversation 1

Though the conversation was instigated by student 1 we find the majority of the conversation is dominated by the lecturer's instructions. An interesting observation is the conversation sounds like it could be taking place in a physical environment. The use of "I see you" and "come over here" gives the impression that the students are located in a specific place. This ability to visualise the location of the students and to gather them to a key spot in the virtual place is a typical characteristic of a sense of place in the virtual world.

Conversation 2 - Citizenship

Instigated by the lecturer this conversation relates to student 2 becoming a citizen in the virtual world. Student 2 asks about abilities that other students avatars have in the virtual place and finds that they need to become a citizen to have these abilities.

- *Lecturer: Student 2. Have you become a citizen yet?*

In this conversation the lecturer provides a step by step guide to student 2 on how to become a citizen.

We can see the dynamics of the conversation by following transcript units:
7-9-29-30-31-32-33-34-40

- *Student 2: No, not yet I am only on a temp visa at the moment?*

- *Student 2: How do you move yourself like that?*

- *Lecturer: Like what?*

- *Student 2: turn around and point things*

- *Student 2: why does Student 1 always look at her watch?*

- *Lecturer: When you become a citizen you are able to choose different types of avatars with different features such as happy dance and wave*

- *Lecturer: Just go to the menu bar and immigrate by clicking on the button*

- *Student 2: Sorry, Lecturer I was trying to immigrate just now*

Conclusion for Conversation 2

In this conversation we find student 2 more engaged in trying to develop a better understanding of what is happening around them and the meaning of being a citizen. Again as in conversation 1 we find visual observation occurring in the environment. In this case student 2 is instigating for clarity into what is happening around them and why. There is a sense of immersion and engagement occurring in the environment.

Conversation 3 – Context and Construction

This conversation is instigated by the lecturer. It involves a much more in depth discussion between the lecturer and student 1 (student 2 has departed the virtual learning place). The conversation revolves around the level one learning tasks. It especially focuses on the criteria for building a web site and how much skill and understanding student 1 has in this area of web design.

- *Lecturer: (to student 1) Let us go to the level one area.*
- *Student 1: Ok*
- *Lecturer: Have you been able to look at the level one material yet?*

In this conversation the lecturer is interested in finding out the depth of knowledge and type of work student 1 has done on their web page. By using a serious of questions and answers the conversation flows continuously around the subject matter of the web page.

Transcript units 61 – 103 relate to this conversation.

- *Lecturer: Have you looked at the web page basics section?*
- *Student 1: yes Lecturer*
- *Lecturer: Great do you have a copy of dreamweaver to build you web site?*
- *Student 1: yes*
- *Lecturer: Great do you have an understanding of html?*
- *Student 1: I understand only to build a simple web page*
- *Student 1: like a head and body*
- *Lecturer: Ok. Have you decided on what the main criteria for you web site will be such as screen resolution*
- *Student 1: That about 268 colour*
- *Lecturer: you mean 256 colours?*
- *Student 1: yes*
- *Lecturer: What about resolution ie 640x480*

- *Lecturer: do you know what the other resolutions are?*
- *Student 1: 800x600*
- *Lecturer: I notice you made your site with Gifs. Why did you decide to do this?*
- *Student 1: Because it is a small file and it is good in the web.*
- *Student 1: If it was a photo I would have use Jpeg.*

Conclusion for Conversation 3

In this conversation only the lecturer and student 1 were present in the virtual place so the possibility of diverse collaboration was limited to just two people. What can be seen is the way the conversation flows easily and how the lecturer uses the ability to reference the student 1 web page within the context of the conversation. This ability to contextualise learning concepts is a characteristic of the virtual place. By contextualising the communication the lecturer is able to evaluate the skills and knowledge of the student and give them support and guidance in specific areas of learning.

Conclusion

While many approaches to traditional learning have been adopted and transferred to the virtual learning environment, the development of places for learning is not as well developed.

We emphasise the importance of learning as an experience and have developed a learner-centred virtual learning environment that provides a sense of place based on collaboration and constructivism. We implemented this virtual learning environment into a 3D virtual world and captured the learning experiences and conversations of the students who were engaged in a web site design course.

Our analysis of the conversations using a communication coding scheme helped to identify the effects of a sense of place on the students learning experience. Based on a statistical analysis of the coded transcripts of the conversations we were able to identify key elements that characterise the virtual learning place.

Findings of Research

We found that analysing the dynamics of place and learning communication and cross-referencing key aspects with the threads of conversations enabled us to characterise the effects of place on the student's experiences. We identified that visualisation of avatars in the virtual learning place enables the management of learning. We have found that discussions about the location of the students' avatars with respect to the learning material in the virtual learning place can be a way of focussing attention and providing a context for the discussion. We found contextual discussions about a location in the virtual learning place supports students in constructing their knowledge by collaborating with their peers and lecturer. We have started to characterise the types of learning activities that we observe in a virtual learning place, with the dominant ones in the session we have analysed being the introduction, clarification, and confirmation of concept.

Future Investigation

In our future work we will analyse more conversations to provide a more comprehensive view on the effects of a sense of place and the key elements that characterise a virtual learning place over the entire semester. We will analyse large

groups of students in the virtual learning place and compare their learning experiences and the effects of a sense of place to small student groups. We will develop and implement intelligent software learning agents in the virtual learning place. We will investigate their role in collaborative and constructivist learning activities in the virtual learning place. We will investigate the role of intelligent software learning agents in adapting and modifying the virtual learning place to support the students learning activities.

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