

Virtual Community Orientation Project

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ABSTRACT

One of the major factors toward the persistence of college freshman with their education as discussed by Vincent Tonto is Social and Academic integration into the life of a university. Social integration is how well the student feels connected to other members of the university community. There has been a significant body of research done on the use of social networks to encourage social integration in a university setting. This project proposes the creation of a synchronous virtual community / social network to not only encourage social integration but also physical integration through use of the network.

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1 Introduction

The transition to higher learning facilities is a difficult one. There are multitudes of reasons why a student might leave college. Vincent Tinto has done a significant amount of work in this area and has postulated that there are several prominent reasons why a student may decide to leave college (Tinto 1987):

Academic difficulty: The student is unable or unwilling to meet the minimum requirements to remain in the institution.

Adjustment: The student is unable or unwilling to make the social or academic transition to what is required to live in a college environment.

Goals: Some student's goals may change during college, leading to pursue a different career path.

Uncertainty: If their goals are undefined and are just in college because they think that is what they are supposed to do, they will be more likely to leave when stressed.

Integration: Academic and social experiences help to integrate the student into the life of the college, and lack thereof will greatly increase the probability that they will leave.

Building off of this work, it has been shown that social integration is facilitated by providing opportunities to get involved (Braxton 1995). Many colleges provide orientation programs in an attempt to implement this, and are possibly the most widely researched and implemented of methods at increasing freshman retention. College orientation programs are designed to increase personal, social, and academic integration

with the college (Upcraft 1989). Several schools have created social networking websites that link students together through instant messaging, profiles, forums, and blogs so that they may get to know students before they even set foot on campus (IBM 2007). This kind of social interaction helps students to become integrated and connected with their campus socially and the ability to know students before they arrive helps ease the process of meeting new people and making new friends.

There used to be a fear that computers dehumanized interpersonal contact, and that emotional connections could not be fostered online. It has been shown, however, that virtual classrooms can in fact, allow students to exchange information, emotional support, and a sense of belonging. This is possible through the use of a social network on a computer from a distance (Hiltz 1997). This connection can increase a student's social integration with a university which will in turn increase the likelihood that they will remain in the university.

1.1 Problem area

Virginia Tech currently employs an orientation program as mentioned previously to facilitate the transition to the university. The program now consists of a summer orientation session where they educate students on different aspects on university life in an attempt to prepare them in some small extent to what they can expect when they get here, interest sessions on different aspects of college life, an introduction to the Hokie community, and ice breakers to help them get to know other students (Virginia Tech Orientation). Katie Medcalf, an orientation leader for 2 years, detailed the process that students go through during the orientation process, as well as some interaction for the students beyond the initial orientation weekend:

After orientation the students are invited to a Facebook group that is maintained by their orientation leader. An orientation leader is one of 30 Virginia Tech students who guide new students through the orientation experience. They become a focal point for the students who are in their group during orientation, and through the Facebook group are able to keep in touch with the other people they met during orientation and also keep in

touch with their orientation leader to ask any questions they may have about the university or other academic processes. One thing that was not stressed however was an orientation to the campus itself. There was not much done in terms of helping students to find specific buildings or to help them get their bearings. In several informal interviews with freshman, when asked about their first few weeks on campus, they mentioned that during orientation campus looked deceptively small, and that when they had actually come to move in, they had great difficulty finding buildings and getting their bearings. Katie Medcalf responded to these comments by agreeing completely. She said that the only thing the orientation weekend does for helping students to learn about their new campus is to “hand them a map, and say good luck”.

1.2 Specific problem

It seems that the stresses of learning about a new place could also be handled before students step onto campus for the first time. Just as the social networking that is going on before they step onto campus, it seems that there could also be an exposure to campus done through similar channels that would expand on the social networking services that they currently use to also allow them to not only meet new people, but also learn about campus, it's buildings, and activities that go on, allowing students to not only socially integrate themselves into the life of the college, but also physically integrate themselves before they even arrive. Something like this could possibly further assist in helping students gain knowledge and understanding about their campus before they set foot onto campus, easing that transition.

1.3 Claim

While it has been shown that is if difficult to create new relationships online (Hiltz 1997) and there is limited benefit when virtual communities are used to replace offline social relationships, they can be very effective when used to augment offline social relationships (Jonathan 2002). Therefore since students establish relationships in person during orientation week, it is possible to bolster these relationships online during

the transitional period between orientation and the start of the semester. To this end the creation of a virtual community is proposed. This community will encourage users to interact with each other as well as learn about their campus. Through use of this virtual community, it is expected that two things will occur:

- By participating in a virtual community designed to encourage exploration of campus a student can learn more about their campus and help them become better physically integrated and:
- Maintain friendships without actually being on location to assist with social integration.

By doing these two things, the virtual community is help helping students in an area discussed by Tonto as vital to their success and persistence with their education and also easing their transition.

2 System

2.1 Research

As mentioned in the previous section, virtual communities can provide many of the same benefits as physical communities, but with the added benefits of being distributed. They allow for collaboration of different parties that are unable to meet in a specific location or even in some cases, a specific time. The university already recognizes this fact through their use of Facebook groups that are used to help students keep in touch with other students that they met during orientation. The virtual community needs to have social networking aspects akin to Facebook, Myspace, and instant messaging so that users could build off of the knowledge they currently have about how these environments function.

Facebook and Myspace were originally considered as platforms on which to develop this virtual community, however these were both ruled out early. Myspace does not have much flexibility as a developer can only create a profile and a group of friends. Facebook's ability to create applications seemed promising at first, but upon further research the multitudes of privacy concerns about how Facebook applications work ruled out that as a basis as well (UVA Study on Facebook Platform Privacy).

Since the community was being designed to help users learn about their campus, it seemed that a virtual world would be a good starting point as students could navigate around a virtual world that corresponded to the actual campus. After some reading, Second Life (see Figure 2.1c) seemed like a good choice. Second Life is a virtual 3D world in which users can create an avatar and participate in a virtual world for free. This world has its own economy and users can create content using the fairly complex scripting system available in-game. They are then free to sell this content to anyone for game world currency or even real currency. There is even a currency conversion in which you can 'trade' your game currency for real currency, allowing players to actually make money off of the game. The drawback to this system is that any content developed for this project would be in the larger world of second life, and students would have to find this area. There is a lot going on in this world and it is not possible to have a private server where only a specific group could log on. There is also a large barrier to entry, as students would have to create an account, download the client (75MB) and then install it. The idea of this community was to make it as effortless as Facebook or Myspace to enter so as to encourage the maximum amount of participation possible.

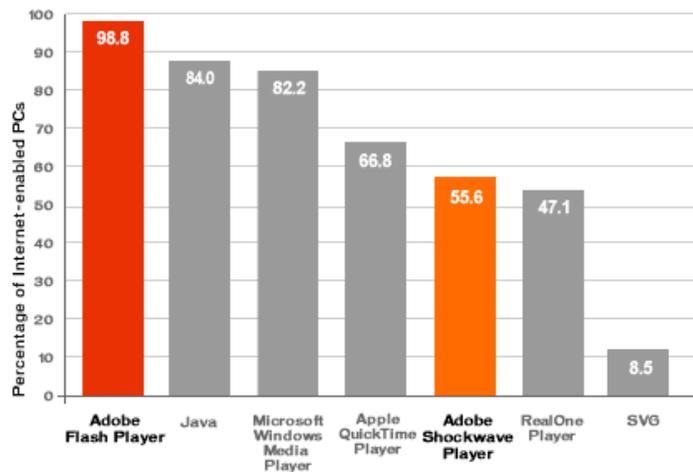


Figure 2.1 – Flash player penetration statistics [flash player penetration statistics]

With all of these conditions it seemed that the only solution was to develop a new community, with the requirements that it be able to be used simultaneously and have a virtual world-like appearance, all the while being easy to log in and use. It needed to be accessible through a web page so that users would not have to download or install anything, but yet have interaction more complex than simple HTML and JavaScript could offer. Since it would be necessary for the web page to not only talk to the server, but also talk to everyone else using the system concurrently to give the illusion that you were using the system ‘with’ other people, it was not enough to have simply a front end that the user interacted with. There needed to be a specialized server application that would enable the client to talk to and interact with the other people connected to the system. After a look at available web technologies it seemed as though the only two viable candidates were Java applets and Macromedia Flash. The pervasive nature of the flash player, with a stunning 98.8% (see Figure 2.1d) usage among internet enabled PC’s coupled with its superior graphics capacity made it the clear choice.

2.2 Architecture

The basic format for any webpage is client-server. This means there is one server which multiple clients connect to. When a user navigates to a web-page the server

responds by sending the html for the page. This is the same server that any user talks to when they navigate to a web page, but it is a one-time transaction. The client requests some information, the server responds, and then the connection is closed. If the server wants to tell the client some information outside of when the client asks it is unable to. In creating a community which needs data to be sent back and forth rapidly, as would be required to create an environment that appeared to be completely synchronous, web server architecture would not be sufficient. Socket server communication is a client server architecture that allows the server the added flexibility of communicating with the client whenever is necessary. It does this by maintaining an open line of communication, called a socket with the client at all times. This allows for fast communication both to and from the server.

Flash is able to handle socket connections with a server. It is therefore possible to use one application to host the webpage and virtual community, while having the flash application connect to a secondary application that handles all the communication between users. This removes the strain of having to host both the webpage and the communication at the same time, allowing for faster response times and an improved ability to handle more clients effectively. This secondary server needs to be able to handle sockets as well as have a way to store a user's information quickly, securely, and effectively.

PHP is a programming language developed in 1995 by Rasmus Lerdorf as a simpler version of PERL, another server programming language. PHP was designed to be easy to use, simple, and very easy to connect to and manage databases with (PHP History). PHP quickly became very popular and is now one of the most popular web programming languages. Recently PHP has been modified to include several libraries that allow for simple socket programming. There are three functions that are now included in the default syntax (if the interpreter has sockets enabled) that enable very easy-to-understand and non-complex socket programming. These functions are:

- `socket_stream_accept` This function returns a pointer to a new incoming connection
- `stream_select` This function takes an array of connected sockets and returns an array of sockets that are active (meaning the client is speaking to the server)
- `stream_socket_recvfrom` This function actually reads from a connected socket that is trying to say something.

By using these three built in functions it is possible to enable PHP to effectively handle multiple client connections. Along with its object oriented capacity, this allows for easy storage and communication with all connected clients and its ability to easily manage MySQL databases makes it an ideal candidate for handling the back end of the communication from the flash application.

The virtual community was developed using these two technologies. In technical terms it is a Flash application embedded in a webpage hosted on an apache web server that connects to a PHP socket server.

2.2.1 Design considerations

There are several important factors that stimulate participation in an online community. They are clear purpose, leadership by moderators, useful content, online and offline events, as well as a system that is easy to use and functions well. All these factors help foster the participant's sense of belonging and identity to the group and to each other (Godwin, Kim, William).

2.2.2 System overview



Figure 2.2.2a - Project login screen



Figure 2.2.2b – First view of the world



Figure 2.2.2c – Chatting



Figure 1.2.2d – Building detail pane

The virtual community is basically a large campus map broken up into grids. When a user logs in they are placed in the starting grid (see Figure 2.2.2b), right next to Burruss and the Drillfield. They are able to choose an avatar gender at the log in screen, and they are able to use any log in name they desire (see Figure 2.2.2a). If the system does not recognize the username, it is automatically created for them. The user moves their avatar around using the arrow keys and can chat with other users in the same grid by typing in the chat box and hitting enter or the return key. If the user clicks on a building name a detail pane appears, showing information about the building as well as providing them an area to comment about the building and its use not unlike the wall function of Facebook that allows users to write on other peoples profiles (see Figure 2.2.2d). Through prolonged use of the system, knowledge may emerge in these locations as aggregate knowledge forms from the various participants.

As can be seen from the third image on the right, other users appear in the world alongside the users own avatar. When a user first logs in they are presented with a clue either by name or function of a building. The first user to find this building is presented with 10 points, the second with 9 points, and the third with 8 points. After that a new building is randomly selected and everyone is informed of the new goal.

Each user also has a profile where they can write information about themselves. Their current score is also displayed here. Anyone can view another user's profile by right clicking on the player's avatar.

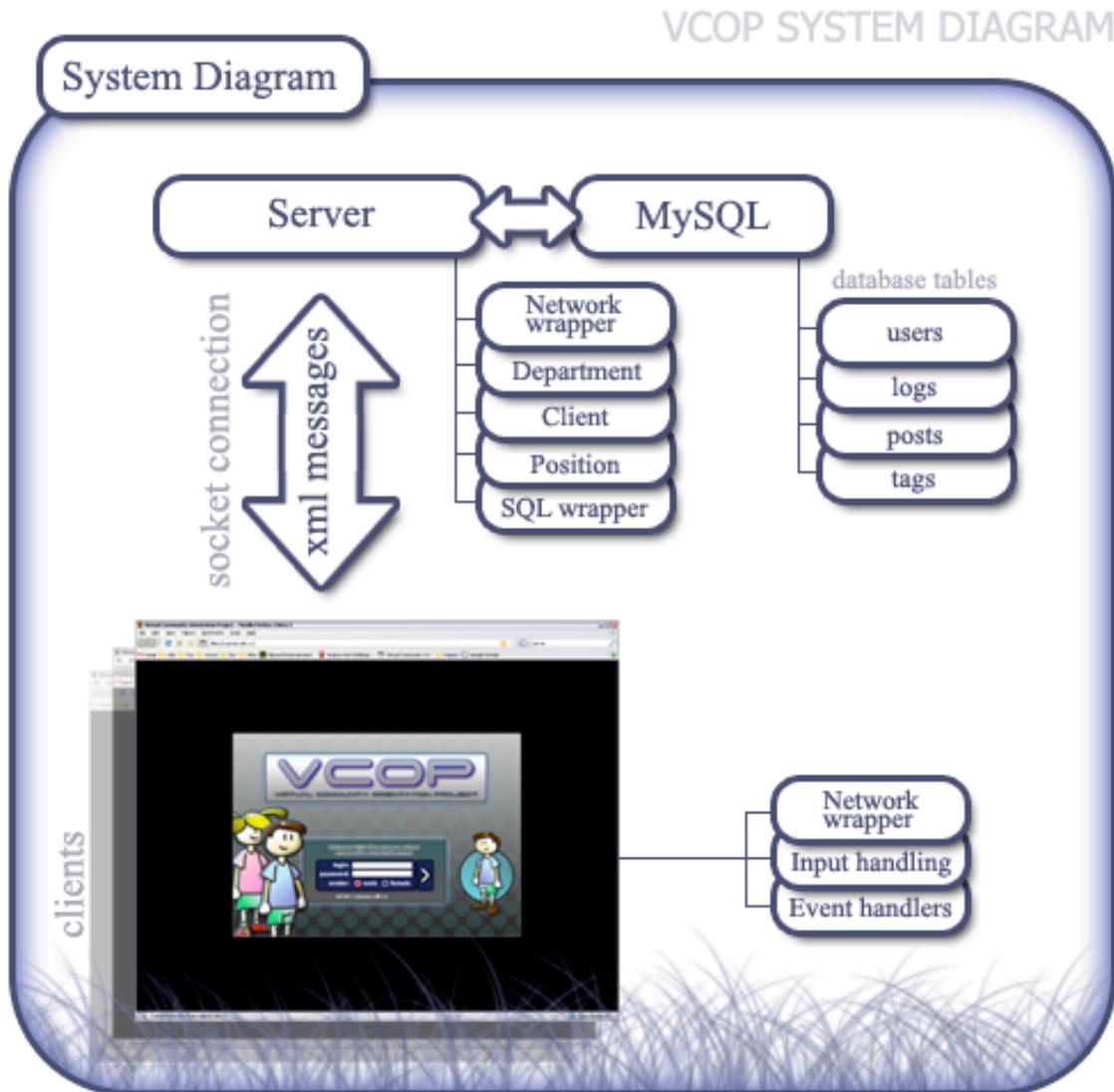


Figure 2.2 – System Diagram

2.2.3 Client

The client is a Flash application written in Actionscript 2.0. It is basically a shell for the server as every input that the user submits is validated by the server. For example,

if a user wants to move left, the client sends a message to the server saying that the client would like to move left. The server does all the calculations of where that will end the client, if he will be in a new grid now, or any other validation checks. The server will then tell the client how it should respond, and update all the other clients of what happened.

The client is made up of three basic parts:

- Input handling
 - This part is responsible for handling all input from the keyboard, whether it is typing for chat or wall input, or hitting the return key, or using the arrow keys for movement.
- Event Handlers
 - This part is responsible for all events that are triggered by commands received from the server. Once the command is parsed, an event is dispatched based on the type of command.
- Network wrapper
 - This part is responsible for initializing and maintaining the connection to the server, as well as status updates, specific functionality required by the server, and maintaining the error console.

2.2.4 Communication

The server and client communicate by passing XML formatted strings back and forth. They follow the following form:

```
<command param1="value" param2="value">
```

Command list:

- Client to server commands
 - *msg* chat message
 - *login* an attempt to log in, causes login validation

- *init* sent when a new client connects for the first time
- *move* a user tries to move
- *tag* a new tag is created by an admin
- *tag_detail* a request for a specific tag
- *post* a request to post on a tag
- *profile* a request to view a profile
- *profile_edit* a request to edit a clients profile
- *policy-file-request* a flash player security request. Needs a special xml response.
- Server to client commands
 - *msg* displays a message from a specific client
 - *login* clients attempt to authenticate were successful
 - *init* client tries to log in for the first time
 - *create* creates an avatar at a specific x,y coordinate
 - *move* moves an avatar to a specific x,y coordinate
 - *kill* destroys an avatar
 - *killall* destroys everything on the screen (avatars and tags)
 - *newmap* scrolls the map to a specific grid
 - *error* displays an error
 - *alert* displays a popup with whatever the server had to say
 - *tag* displays a tag
 - *tag_detail* displays a panel with tag information
 - *profile* displays a profile

2.2.5 Server

The server is a PHP 5 application run from the console as a standalone application. It has a main control loop which is responsible for detecting incoming data and when it does passes the information off to a function which checks what type of message is being sent by the client. This control loops runs indefinitely, waiting for new clients or messages, as long as the server is active. The control loop also monitors for

long periods of idle time, in which it closes the database connection to minimize network traffic.

There are five classes that make up primary objects of the servers architecture. They are as follows:

- Network wrapper
 - This class is responsible for managing the network and parsing all data to and from the client
- Department
 - This class is responsible for keeping track of what the current goal is for the users to find. It keeps track of who has already found the objective so that users cannot 'win' twice. When sufficient users have found it, it will randomly find a new objective and notify all connected clients.
- Client
 - This class is responsible for keeping track of all information about a specific client. This includes:
 - Username
 - Position object
 - Pointer to the actual socket this client is connected to. Used for sending commands to the client.
 - Other housekeeping items, such as whether the client has authenticated, is a valid client, etc.
- Position
 - This class is responsible for storing all data about the location of the client in the world. It also has functions for checking boundaries, grid movement, and detecting if users are in the same location.
- Database wrapper
 - This class is responsible for storing all connection information about the database, as well as handling all communication and requests from the database.

2.2.6 Database

The database for this system is a MySQL 5 database. It contains 4 different tables used by the system, they are as follows:

- **users** – this table contains all user data with the following fields
 - *id* [primary key]
 - *username* – the characters username
 - *password* – passwords are stored encrypted
 - *last_login* – date object of the last time the user logged into the system
 - *profile* – string of the users profile
 - *admin* – Boolean as to whether they are an admin or not. Admins can create new tags
 - *points* – how many points they have accumulated

- **tags** – these are the names that appear on the map
 - *id* [primary key]
 - *name* – the name of the building
 - *description* – the description of the tag to go in the panel
 - *grid* – the grid that this tag is in
 - *coord* – the x,y coordinate of the name in its grid
 - *user_id* – id of the user that created this tag
 - *dept_id* – string that contains the clue to be displayed by the game

- **posts** – things people write about a building
 - *id* [primary key]
 - *user_id* – user who wrote this post
 - *tag_id* – the tag that it was written on
 - *message* – what they wrote
 - *date* – a date object of when the post was written

- **logs** – used to record messages sent
 - *id* [primary key]
 - *user_id* – the user that sent the message
 - *message* – what they said
 - *grid* – where they were then they said it (used to follow conversations)
 - *date* – a date object that stores when the message was sent

2.2.7 Stress Testing

After development of the system but before user studies the system was put through two stress tests. The first stress test was to test how many people could effectively use the system at the same time. Through a mass e-mailing multiple students were recruited from the Center for Human Computer Interaction. With the hardware configuration of the machine (an old 1.5 GHZ AMD Athlon with 1.5 GB of RAM) the system was able to support 10 people with reasonable effectiveness. Were the server to be run on a faster machine it is expected that the server would be able to handle a larger load. The second stress test was to see how long the server could remain running without crashing or breaking down. Initially a null pointer error kept occurring after the system had been active for 2 days – the system would try to send data to clients that did not exist. Checks were put in to account for that which solved the problem. Secondly, MySQL connections are not meant to be maintained indefinitely, and as such, the connection would cease to be viable after several hours of inactivity. To fix this, whenever the server determined an idle period (20 minutes) it would close the connection to the database, and then when it was needed again would connect again.

3 Study

3.1 Design

The goal of the virtual community is to foster social and physical integration into the university. The body of work previously mentioned discusses the benefits of virtual communities on augmenting social relationships in an online environment, so the goal of the study became to evaluate the effectiveness of the physical integration. Participation in the virtual community would hopefully increase a users understanding of where things on campus are, their uses, and their relationships to each other. It is simple to increase the knowledge of the campus; you could simply hand a map to someone and tell them to study it. The goal of this community was to also enhance the users understanding of the places; what these places are for, what their significance is, and their relationship to other buildings.

To assess the effectiveness of the community a simple questionnaire was devised. There are three basic types of information the community is trying to convey:

- Factual information – facts about the building
- Relational information – what the building is near
- Importance – what the building is used for.

Then for each category of question there are three different formats that the question can be asked in. They are:

- Map – questions asked using this format will ask the student questions from the three categories above, but ask them by referring to a map.
- Pictures – these questions will refer to a picture to ask the same kinds of questions as map. These types of questions are more of a form of a control group as the use of the system will not directly influence this category as there are no pictures in the system.
- Name – these questions ask the same categories of questions, but only refer to buildings by name, no map or picture.

See Table 3.1 for an example of 9 question categories.

	Factual	Relationship	Importance
Map	Where is Cowgill hall? <i>(Show map of Cowgill area)</i>	Using the given NESW orientation of campus, describe the relationship of Dietrick to West Ambler Johnston <i>(shows a map with N,S,E,W on it)</i>	What goes on in this building? <i>(Show performing arts building on map)</i>
Pictures	What is the name of this building? [display image of Cowgill Hall]	[display image of Dietrick Hall] Which building is closest to the above? [display image of West Ambler-Johnston] - OR - [display image of Hillcrest Hall]	What happens in this building? [display image of Performing Arts Building]
Name	What is the name of this building? <i>(Highlight Cowgill on map)</i>	Is Dietrick Hall closer to West AJ or Hillcrest?	Name an event that happens in the performing arts building.

Table 3.1 – sample questions

3.2 Process

The questions would be asked before the students used the system to gauge their current knowledge of the system. The students would then use the system for 35 minutes and then complete a follow up questionnaire. 90 questions were created, 10 from each category, and 6 different forms were created randomly pulling questions from the pool of 90. Each student received a different form before and after.

Participants were recruited from classes taught by committee members, various student groups, including the Baptist Collegiate Mission which has more than a 100 members from a wide variety of majors and academic backgrounds that was a perfect pool to pull from to get a wide range of participants from more than just computer science.

Since the system was designed to be used in a community setting, user studies were done in groups of 4-6 people. There were three groups of 7, 5 and 4 people respectively totaling 16 participants. Each group used the system for 30 to 35 minutes after filling out their IRB consent form and preliminary survey. After their use of the system they completed the follow up questionnaire.

The first group only played the relay part of the game a little, but spent more of their time exploring and talking with other people. They actually looked at the building information and read and contributed. The second and third group treated it like a game and became very competitive. They would not help each other out in an effort to be the first to find the goal, then one they found it they would tell others so that they could move on to the next goal.

#	USER ID	Map	Pic	Name	Score	ID	Year	Ethnicity	Gender	On Campus	Major
1	jumpingrabbitfeet	2 1	2 2	2 3	309	96	Senior	Caucasian	Male	East AJ, West Egg	Marketing, Mgmt
2	anhal2	3 2	1 3	1 3	227	95	Grad	Caucasian	Male	Pritchard	CS
3	nursing	2 3	2 2	2 3	163	94	Junior	Caucasian	Female	West AJ	Chem, Nursing
4	woogie	2 2	3 3	3 3	252	62	Senior	Caucasian	Male	Pritchard, Lee	Hort
5	3.14159E+15	2 2	1 2	3 2	276	91	Grad	Caucasian	Male	Lee	CS
6	pam	3 1	1 0	3 2	48	92	Grad	Caucasian	Female	West AJ	CS
7	Maggalicious	1 1	2 2	3 3	391	87	Freshman	Caucasian	Female	Lee	Marketing
8	17d5	3 2	0 3	2 3	342	90	Freshman	Caucasian	Female	Johnson	Ag Econ
9	13g	3 1	2 2	2 3	259	89	Grad	Caucasian	Male	Pritchard	CS
10	135	2 3	3 2	3 3	421	86	Senior	Caucasian	Male	Lee,Payne	CS
11	88racer	3 3	2 2	2 3	375	88	Freshman	Caucasian	Male	None	Civil Eng
12	3829	3 3	2 2	2 2	9	63	Junior	Caucasian	Female	Main Egg	IDST
13	reevessa	1 2	1 2	2 1	10	65	Freshman	Caucasian	Female	West AJ	Physics, Math
14	Rambo	1 1	0 2	3 0	231	61	Freshman	Caucasian	Male	Pritchard	Eng
15	HokieBird	1 3	2 1	2 1	10	66	Freshman	Asian	Male	Newman	CS
16	samwyi	1 2	1 2	1 1	8	64	Grad	Asian	Male	None	CS
Total Correct before		33	25	36	Avg						
Total Correct after		32	32	36	208.2						

Table 3.2 – Demographics and raw study data

3.3 Results and preliminary analysis

Summary

- Overall improvement by category:
 - Map: -1 (33 before, 32 after)
 - Picture: 7 (25 before, 32 after)

- Name: **0** (36 before, 36 after)
- Overall improvement: **-2** (94 before, 92 after)
- Average Score: **208.2**

Underclassmen:

- 6 total underclassmen
- Average Score: **226.5**
- **Improvement by category**
 - Map: **1** (10->11)
 - Picture: **3** (7->10)
 - Name: **-3** (14->11)

There were a wide range of scores from the underclassmen. This could indicate a lack of broad knowledge and only specific knowledge of areas that they happened to know on the questionnaire they were given. The map category showed improvement as expected from use of the game. One freshman even commented while taking the follow-up questionnaire, “hey, I remember seeing that building in the game” and successfully answered the question. The name category showed a decrease which was unexpected. The game did include information about buildings and their uses, most participants were in such a rush to find the buildings faster than their opponents (that was not intended) that they passed right over this information.

Upperclassmen:

- 5 total upperclassmen
- Average Score: **230.8**
- **Improvement by category**
 - Map: **1** (11->12)
 - Picture: **-2** (12->11)
 - Name: **2** (12->14)

Upperclassmen scores were more consistent. This could potentially indicate a broader knowledge of the subject area as their scores did not vary so widely based on the questions they were asked. Both map and name categories (which would be directly influenced by participation in the game) showed an increase. All upperclassmen had lived on campus, as opposed to freshman and graduate categories in which some participants from each had not lived on campus. This could account for the more consistent scores.

Graduates:

- 5 total graduates
- Average Score: **163.6**
- **Improvement by category**
 - Map: **-3** (12->8)
 - Picture: **3** (6->9)
 - Name: **1** (10->11)

The graduate participants also had highly varying degrees of knowledge of campus. As with the underclassmen, this could indicate a highly selective knowledge of campus, and the scores varied drastically based on the form they answered. Map knowledge decreased indicating an ineffectiveness of the system to enhance their knowledge or understanding of the campus. Name did increase slightly but may have also been just because of the form they answered.

The freshman and graduate students were fairly unfamiliar with campus and may need something more significant than a map to help them to make links to where places really are and what they are. The upperclassmen, which had all lived on campus, and had significant exposure to campus had an increase in both map and name from playing the game. This could indicate that to have the map be a learning tool users need to be able to visualize what they are looking at. Users who already knew campus well were able to visualize buildings and their relationships better, and find things easier in the game

(which is evidenced by the higher scores from the game). To make this system more effective for freshman or other groups less familiar with campus, I should add in pictures of the buildings when a user views the buildings details. Hopefully this will help them be able to get a better visual of the building and its surroundings and to better relate to the map.

3.4 Usability issues

There were several usability issues that arose during user trials. The following are notes on the different difficulties discovered:



Figure 2.4 – Building detail pane example

- **Problem:** When users clicked on a building name and the building detail panel appeared (see Figure 3.4) the focus changes to that panel and the posts. Users who were in the middle of conversations with people continued to type to them, but all of a sudden were typing into the posts for a building, and did not realize it. However, when users clicked on a building name to open its information panel, they started typing immediately expecting that text would be inputted to the input box for the posts.
Solution: Since users had conflicting views on which way the system should operate, it was decided to have to the focus be on the new window they had opened.

- **Problem:** The purpose of the game was to find the building indicated by the clue presented. At first, it was unclear to users what was meant by 'find'. Users would go to the area of the building and stand on top of the building; they did not realize they had to click on the building name until they were instructed to do so.

Solution (Not implemented): The instructions should be clearer as to how to 'find' a building. Users should always be informed of exactly what is expected of them.

- **Problem:** It was not obvious that users could right click on an avatar to view their profile. This is partly a problem with fore-knowledge about how flash operates. It is a little known and rarely used trick to overwrite the right click menu in flash. Most websites that utilize flash don't use this ability, therefore most right click menus on flash websites contain the generic flash controls, so it seemed that most users never even bother to try. As such there were multiple questions about how to view a user's score.

Solution (Not implemented): There should be a more obvious way to view a player's profile, and also instructions that the only way to see your score is to view your profile. Perhaps an additional way to see your score could be implemented, like a running total in one of the corners.

- **Problem:** It was also not apparently obvious how to make your character move. Most interaction in flash games is done by mouse control. Most students when they first logged in were trying to move their avatar with the mouse.

Solution (Not implemented): Rethink interaction techniques. Perhaps some form of grid interface where they select the best possible route or click-to-move.

- **Problem:** Players found it difficult to sometimes read the username text. The red text was too high of a contrast. They also mentioned that sometimes the chat bubbles could be difficult to read.

Solution (Not implemented): Give the username text a higher contrast to the overall color scheme, and make chat bubbles more opaque.

- It was not obvious that all popup windows and message boxes could be moved. Players commented frequently that they would get in their way and obstruct their view of the map.

Solution (Not implemented): More instruction on how to interact with the system. It is not intuitively obvious, even with a drag bar, that a window can be moved, so therefore the user must be informed of that. Also adding more of a drop shadow to indicate that the window is not part of the background might help users differentiate it from the rest of the backdrop.

4 Analysis

4.1 Performance based analysis

Of the 16 people who used the system 7 people improved their number of correct answers on the questionnaire, 6 people stayed the same and 3 went down. Of the people who improved, there were 3 freshmen, 2 graduates, a junior and a senior. Of the people who stayed the same there were 2 freshmen, 2 seniors, a graduate, and a junior. Of the people who reduced in score there were 2 graduates and a freshman. Of the people who improved from pre-questionnaire to post-questionnaire the average score was 204, the people who stayed the same had an average score of 226, while the people who did worse on the post-questionnaire averaged 179 points. The overall average was 208.

These numbers would indicate that people who scored higher than average in the game were not affected by their participation in the game; those who scored low in the

game also did similarly poorly on their questionnaires. People who scored about average on the game were the ones who had improved performance on their questionnaires.

Overall the majority of people improved or maintained their performance. There was one performance that may be anomalous, as the participant went from a 7 to a 3, which looking at the questionnaires does not seem to make sense. If that is removed from consideration only 2 people had lowered performance and that was only by 1.

4.2 Group based analysis

The group of 7 participants had an average score of 295, with 2 performance improvements, 2 performances that stayed the same and 3 performances that dropped. The group of 5 had an average score of 245, with 3 improvements and 2 performances that stayed the same. The group of 4 had an average score of 9 and had 2 improvements and 2 performances that stayed the same.

These numbers indicate that those who scored the highest ended up performing on average the worst on their questionnaires. All of the people whose performances went down from pre to post questionnaire were in the high scoring group. Both other groups either went up or stayed the same. This gives a little more weight to the early concern that the competitiveness that the game unwittingly inspired actually detracted from the amount that participants were able to learn from it. It would seem that the group of students who were intent on having a higher score and thus scoring higher in the 35 minute period than others actually spent less time reading and learning about the buildings, but rather just tried to find the goal, which did them no benefit on their questionnaires.

4.3 Major based analysis

Despite efforts to the contrary Computer Science majors made up almost 50% of the majors represented by the participants. For this reason the analysis in this section is broken up into CS majors and non-CS majors. The CS majors had an average score of

178 and 2 improved performances, 3 performances that stayed the same and 2 reduced performances. The non-CS majors had an average score of 231 with 5 improved scores, 3 scores that stayed the same, and one reduced score.

It would seem that the CS majors did much poorer both in score and performance than the non-CS majors. This is interesting considering CS majors typically have more experience with games and it would follow they would be more likely to perform better. It is possible that people who are attracted to computer science would be more interested in more in-depth games rather than the simple almost mindless web games that are so prevalent today, giving the non-CS majors a slight advantage in that aspect.

4.4 Summary

It seems from the different types of analysis that the competitiveness that the game inspired may have actually detracted from the ability of the game to actually teach anyone anything. It is also seemed that those students who had little knowledge of campus to begin with, freshman and graduates, also did similarly poorly. It seemed that people who already had some knowledge of campus, but yet did not have very high scores, indicating a lack of competitive focus were the ones who benefited the most. This indicates that the system as it is may not benefit incoming freshman as much as it would students who have been here for a few years and are already able to somewhat visualize campus.

5 Further work

5.1 Overview

The project was received very well, the students enjoyed playing it and even told some of their friends to participate, and a few even logged onto the system outside of the study as the server is running continuously. While it was not an incredible success at increasing knowledge of campus it is not outside the realm of possibility that prolonged

use over the course of the summer between orientation and the start of freshman year might have a more significant impact. It also seemed that students who were not overly familiar with campus had a hard time visualizing the map. It might be interesting to see if the addition of pictures to each buildings information panel would help in getting a better visualization of where each building was in terms of the larger campus.

5.2 Design work

Another issue would be stimulating people to stay with the community over the course of a month or so. To do this the game could possibly be improved to make it more interesting or also give more potential for the points. Perhaps the more points you have the bigger your character is, or there might be a store in which you can buy things with your points. Another possibility is a scavenger hunt that would allow you to gain points or even department related games that allow you to earn points and also learn about the different departments at the same time.

Another potential for increasing the ability of the community to facilitate understanding about campus is to change the game altogether. Since the nature of the game as it is currently seems to inspire competition instead of cooperation, looking into developing a game that would be more conducive to cooperation rather than competition. Some examples of this may be modifying the game to operate more like a hide and seek game, where players must find another player that has hidden themselves in a building. The game could provide clues based on things that have been written on that buildings wall to help guide the other players. Then when the players had found the building containing the lost player they would have to guess which thing that player had added to the buildings wall.

5.3 Back end work

There is also some scalability work that could be done. Right now the system functions well with less than 10 people, but obviously the system would need to handle

much more if it were to be deployed in a production environment. One could start by evaluating the command structure to see if there is a way to minimize the network traffic required.

5.4 Other thoughts and suggestions on implementation

The following is a list of other possible additions to the system and a summary of the changes to the system that would be required to implement them.

Proposed Addition: Leave notes on a buildings wall to indicate its relation to other buildings and how to get to other common locations from this point.

Implementation Notes: The framework for this is already in place. It might make sense to add notes to encourage behavior in the building pane which is located in the ‘ws fla’ file.

Proposed Addition: Awarding points for notes left about how to find other buildings on a buildings wall.

Implementation Notes: This is a little more complicated. First one must determine what is worth giving points for. If a comment mentions another building do you just assume that it’s giving directions to it? Or should there be some form of voting on the appropriateness of the comment?

If the comment mentions another building, it would be simple to do a regular expression check on all the building entries in the database. If that posting does mention a building or part of a building name, award points using the same function that the game uses (setPoints located in sql.php).

If there is to be a voting system, a new field should be added to the ‘posts’ table to include that posts value. When a user votes for a post that score should be increased, and points awarded to the author based on how much his or her post has been voted for.

Proposed Addition: Allow users to send an e-mail from in-game to a friend that would provide them a url that would take them directly to where they were.

Implementation Notes: PHP has a built in email function that will automatically send an email, so it would just involve creating a new command that the server would parse to know that its supposed to send an e-mail, and then have the server do it.

There is an open source project called SWF Address (<http://www.asual.com/swfaddress/>) that translates a url like <http://www.game.com/#/meetingplace> into something that flash can understand. It is easy to parse the anchor request and use it to jump the client to a specific location once they log in. The ability to move a client around is available already by using the newmap command.

Proposed Addition: Support for mini-map - allow users to see overview of entire campus as well as where other people are.

Implementation Notes: The mini-map would basically use the x and y coordinates of the current avatar along with the grid position to show the clients position in the greater overall map. It would probably make sense to also break up the minimap into grids so that they can get a better feel for how far they need to go to get somewhere. Whenever the client sends a move command, the avatar and the marker for the avatar on the mini-map would both have to be updated.

Currently the server only informs clients of activity within their current grid. The server would have to be modified so that when any person moves, all clients are informed so that they may update their mini-maps with the new information. While this will incur more network traffic, it won't increase the load on the server, so should not have a large impact on performance.

Proposed Addition: Showing buildings on minimap

Implementation Notes: When a user enters an area the tags are all sent to the client for that grid location, and built dynamically. What would be required to implement buildings on the mini-map is that when the client first logs in, the client would receive a list of all tags that they could populate the mini-map with. Each tag has a grid location and an x

and y coordinate. Using this information relative placing could be determined to build the tags on the mini-map.

Proposed Addition: Panning and Zooming – allowing the client to move his map around and zoom in and out.

Implementation Notes: The system is not currently set up to allow this easily. The entire map is broken up into grids, and all calculations and communication is done on a grid by grid basis, as well as all tags and user information. If there were no more grids, and a fluid panning and zooming function, the grids would have to be removed. This is possible, but would involve a redesign of the server and its components.

Proposed Addition: Navigation by Vertices – allow users to click on navigation points to navigate through an area, as opposed to using the arrow keys

Implementation Notes: This would involve a redesign of the current movement system. The database would need a new table that would hold all the information for possible routes in a certain grid. When a new grid is being drawn, the server would also pass information about the possible grid routes. When a user clicks on a travel node, it would pass that information to all the connected clients, and then each client would be responsible for animating that progression. This would significantly cut down on network traffic and load on the server, as each pixel that the client wants to move does not have to be approved by the server, instead only one command indicating a desired route.

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