A Virtual World for Teaching German

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Abstract

In this research, a virtual world of an Austrian town centre was created to teach German to first year students at the University of Calgary. While interacting with characters in the City of Salzburg, students were able to take control of their own learning, and at the same time were exposed to cultural and linguistic realia that are often not present in other types of language games. In playing the game, students reported an improvement in their listening skills, and they also noted that the experience was beneficial for vocabulary learning, pronunciation, general fluency, and improving reading skills. Surveys and direct observation of student game play offer insights into attitudes towards personal use of games, the value of educational games for teaching language and impact of different testing environments on the success of playing a game. Examining the recorded paths taken through this world by students during the game, space syntax research offers some interesting perspective insights into strategies game players employ when looking for the correct path through an urban space. In fact, isovist and axial maps may be helpful in predicting the first line of action taken by game players as they navigate through a virtual world with no verbal clues.

Introduction

For the last decade, games have been used in many professions and trades to improve workplace skills (Stone, 2002). For educators, the instructional environment of serious games should aim to develop new skills, serve as a general resource, motivate and tutor students. For those involved in the creation of virtual games there is an added concern: to provide a level of entertainment that stimulates students' learning interest in the educational game.

Traditional formats for language instruction games include fill in the blank, multiple choice, grammatical judgment tasks (Hulstijn, 2000), sentence matching (Hulstijn, 2000), reading exercises (Cerratto, 2002), electronic dictionaries (Hulstijn, 2000), pronunciation training (Cerratto, 2002; Gaudart, 1999; Hulstijn, 2000; Noy, Raben, & Ravid, 2006) and speech pattern comparison. More recently developed as educational tools, virtual reality formats provide interactive "game" environments in which language learning may be enhanced. Games, when

designed with a particular pedagogical goal, may be classified as tasks. In task-based language instruction, the actual manipulation of the language is not the central focus; instead, "learners use language as a means to an end" (Lee, 2000, p. 31). Littlewood (2004) argues that the best tasks call for a high level of task involvement by the learner. Immersive environments, such as virtual reality, require the user to be an actively involved participant in the game. In the case of language acquisition, simulations of cultural experiences offer the greatest potential for relevant task-based learning. Two important aspects of task-based instruction (Swan, 2005) that are central to this game are natural language use and learner-centeredness (Skehan, 1998; Willis, 1996, 2003). We had two pedagogical goals to enhance these aspects:

- Enable students to interact in a real-life setting where a foreign language is spoken
- Provide students with exposure to and experience with carrying out commands in a second language

Historically, the teaching of culture in language classrooms has been quite superficial (Lange, 1999, cited in Omaggio Hadley, 2001, p. 346). In recent years, however, there has been a call to incorporate the instruction of culture into the language curriculum. (Omaggio Hadley, 2001). It has been argued that cultural understanding is especially important for students who never travel to the target culture (e.g., Dubreil, 2006). The difficulty lies, however, in presenting a representative picture of the target culture to students (e.g., Kramsch et al., 1996; Tseng, 2002). Robinson-Stuart and Nocon (1996) and Tseng (2002) call for new interpretation of culture as a *process* of learning "rather than an external knowledge to acquired incidental to the 'facts' of language" (Tseng, 2002, p. 13). While using foreign language versions of existing commercial games like "The Sims" may be helpful for vocabulary learning (Purushotma, 2005), we argue that they do little for the cultural aspect of learning languages since students are not interacting with a culturally appropriate version of the game.

One virtual environment, the "Tactical Language Training System", introduces students to Arabic, Farsi and Levantine languages and culture through a virtual world (Johnson et al., 2004). In these worlds, students have an opportunity to be immersed in a game space where they interact with animated characters in settings based on urban and rural life found in Iraq. An interactive story environment in which animated characters provide feedback on both pronunciation and dialogue engages the learner. Speech recognition technology that focuses on the most likely responses gives the student helpful feedback upon appropriate responses in interactions with native speakers. A further goal of this game is to provide trainees with cultural sensitivity by placing students in social situations where nonverbal cues including gesture are critical for communication. Initial evaluation of this approach shows promise even with students with limited prior experience in foreign language instruction (Johnson et al., 2004).

Our research focuses on the building and testing of games that support task-based learning in a virtual world. We present the results of testing a game for teaching German language within the cultural context of a virtual German language world.

A Virtual World for Teaching German

In our research, a virtual world of an Austrian town centre was created to teach German to first-year students at the University of Calgary. In the preliminary testing of the virtual world,

university students were given the opportunity to interact in a world where they would need to follow commands in German in order to play the game. While interacting within the virtual world, students were able to control the pace of their experience, and at the same time they were exposed to cultural and linguistic realia that are often not present in other types of language games. The pedagogical questions that were addressed by our research included:

- What is the value of a virtual environment for learning about a foreign culture?
- Which display format and teaching environment (i.e., classroom, language lab, CAVE) are most beneficial?

While developing this instructional game, questions arose over whether the response to the virtual world depends on the background or attitude of the student:

- Are there differences in response as a function of gaming experience?
- Do players of entertainment games do better at serious games?
- What are the expectations of the students in using a virtual world for language instruction?
- How is way-finding a factor in worlds where the architectural environment is built to scale?
- What impact does the testing environment have on the outcome of the game (classroom, language lab, CAVE)?

Game Environment

Development of the actual game environment began with focus groups with students and discussions with teachers. These discussions helped to define the plotline and shape the course of the game. The architecture of a European city with squares, plazas, markets and cathedrals provided a scale and design not encountered in everyday life in Canada. The architectural plan for the virtual world was loosely based on a plan and images of Salzburg. Many of the public squares and spaces would be recognizable to a tourist today, including the Domplatz, Salzburg Cathedral, Residence Square and Old Market. In this virtual space, students also had the opportunity to explore urban spaces with outdoor, cafes, kiosks, fountains, horse-drawn carriages and streetcars not usually found in North American cities, such as Calgary or Edmonton.

The game begins in front of the Domplatz, where students are told that the mayor's daughter has been kidnapped. The game itself is a mystery in which the students are expected to follow commands and collect clues, ultimately finding Laura, the mayor's missing daughter. In solving this mystery, game players interact with a hip-hop student and shopkeepers, listen to German radio, and follow a suspicious character in an attempt to find Laura. Students are exposed to a variety of clues including spoken commands, written commands, conversations between characters, radio and TV broadcasts, cell phone messages, and signs (figures 1–7).

Figure 1: Salzburg Cathedral. Starting point for the game

Figure 2:. Maximilian dancing in the Residence Square. Students learn about the possible kidnapping from a public radio announcement and Maximilian's remarks. The students are to keep their eye open for Laura's other red shoe

Figure 3: At the bakery we get another clue from Harald Stein while he is talking on the phone.

Figure 4: Market Near Residence Square. Here students learn a little about fruit and vegetables before getting their next clue. This market was based on the Naschmarkt in Vienna.

*Figure 5***:** Flower Stand. Here students get another clue to Laura's whereabouts from a friend.

Figure 6: At the cafe, a note and cell phone message give the next clue

Figure 7: In the Old Market. where the mystery is resolved

In developing the game, a 'wandering' metaphor became an important aspect. In this virtual landscape, students received reinforcement through their interaction with animated characters in a simulated urban space. As tourists wander through foreign cities, they note both linguistic and cultural data. These data in the past were preserved as memories with collections of photos, post cards and memorabilia (Settekorn, 2001).

Another aspect of this research was to understand how students will navigate through streets and plazas in a foreign landscape. The study of movement through an urban environment, "Space Syntax", may suggest some strategies that people take in the absence of any specific directions (Hillier, 2005). One feature under study is the direction the user will take from the virtual architectural environment in the absence of understanding the audio clues. Understanding the movement of the gamer in space may reveal that getting to a successful conclusion of the game depends as much on the design of the architectural space as on the audio and text clues (Hillier, 2005; Sitte, 1980).

Testing

Testing took place with first and second year German classes at the University of Calgary. Students ranged in age from 17 to 31 (mean = 20.52, st.dev. = 2.88). Of the 51 students who participated in the study, 22 were males and 29 were females. On the first day students were introduced to the German commands and vocabulary needed to understand the characters and directions in the virtual world by:

- Receiving and carrying out simple commands

- Learning the grammatical fundamentals of commands

- Participating in a listening activity

- Practicing commands with another student

- Watching a PowerPoint presentation, given by the teacher, of vocabulary needed in the virtual world

- Following directions on a map given by the teacher

The day before the actual virtual world exploration, students completed a pre-study questionnaire. The goal of this questionnaire was to determine the students' motivation for learning German and their level of familiarity with computers and games.

On the second day, students were first given a test world to explore on their own. This allowed them to become comfortable with the keyboard commands for navigation. After five minutes exploring the historic City of Vicenza, Italy, students begin solving the mystery in Salzburg. After students completed their exploration of the virtual world, they were tested on their ability to follow both and to create commands in German. When following directions, students were given a series of seven commands and were asked to demonstrate their comprehension by marking their ways on a map of a fictional German city. In the second task, students were asked to create their own directions in the forms of commands, as if they were giving them to a person trying to get from one place to another in a city.

Testing Environment and Survey Design

Three different testing environments were used with students. In one case, a traditional classroom setting with a data projector and computer were utilized. In this teacher-led session, a group decision-making process was created. Students were asked for their input on where the audio and text clues indicated the next steps should be taken. In the language lab, a single computer and headset were provided for each student. Thirdly, the use of an immersive CAVE gave small groups of two and three students the opportunity to work through the task after discussing the meaning of each clue. Videotape of the classroom, lab and CAVE was used to document and preserve interaction among students in each of the learning environments.

The post-task survey was designed to both capture student motivation for learning German and to determine which aspects of the virtual environment were salient from the students' point of view. Survey questions also explored the types and frequency of game play in two categories: education and entertainment. The survey was given to students in two parts. After playing the game, the survey tested their recall of the world to visual and audio stimuli. Students were also asked questions about the value of the experience for teaching a foreign language. Finally, students were asked to respond to a given series of semantic scales. This information is useful in comparing the student response to visual and audio qualities of each environment: lab, classroom and CAVE.

Game Development

The virtual world for this game was created in a 3D modeling environment (StudioMAX) and imported into Virtools, an interactive gaming application.

 The architectural backdrop for the game is based on photos, drawings and maps of Salzburg. First version users were literally confined to a single path through the space. Students were merely instructed to the last clue if they were lost. A cast of German speakers recorded audio clues. A subsequent version of the game relied on "bottlenecking" to provide additional clues if students misinterpreted the clues in the game. Cell phone messages (Figure 6) and in a later version, policemen (Figure 1) located throughout the space were always available to provide the pertinent information needed to "get back on track". During the course of the game, a student's progress through the space was recorded as position in space and time. This approach enabled researchers to analyze movement though the game space. Taking this approach permits an examination of way finding through a virtual space while discovering whether students followed the intended path designed to reach a successful conclusion to the mystery.

Research Findings

Though small numbers always pose difficulties in any multivariate analysis, preliminary results may be more suggestive of directions for future research than measures at general levels of acceptable significance ($p < .05$). When possible, statistical tests were used to discern differences between and within the group of users. Statistical evidence was supplemented by direct observation and by reviewing the videotapes and log files of each participant's path through the virtual world. These qualitative observations can add a level of detail and understanding not usually evident from an examination of survey data.

Among the university students, the age distribution was 17-30 (mean = 20.52, st. dev = 2.88), with males representing 43% of the total. All 51 were in their first semester of German study and none of the students had been to a German-speaking country.

The level of experience with video games ranged from over 30 hours a week to never playing a game. Game experiences were different for males and females (Table 1). Only 26% of the subjects in this study claim to be regular game players (at least once a week). Of this group, the average number of hours of game play is 7.5 hours/ week. At the other extreme, 25 % of the group had played only once in the last year while an additional 14% stated they had never played a computer game. Most significant among males was a higher concentration of gamers who play more than 10 hours per week (4 out of 19 valid cases). Among the female students, approximately 21% claim to have never played a video game in their lives. However, it does not appear that practiced gamers did any better in the post virtual world test. Rather than game experience, better listening skills and higher language proficiency may be better indicators. Higher scores also had a positive correlation with women players, while this correlates negatively with game play.

Table 1: Frequency of Game Play.

	Male	Female	Total	Male	Female	Total
Once a Day	6	0	6	27%	0%	12%
Once a Week	5	2	7	23%	7%	14%
Once a Month	4	2	6	18%	7%	12%
More than once a year	4	8	12	18%	28%	24%
Once in the Last Year	2	11	13	9%	38%	25%
Never	1	6	7	5%	21%	14%
Total	22	29	51	100%	100%	100%

Students indicated that they play these games for the following reasons: "they are fast and fun and you get to have a goal", "they are fun to play with challenging puzzles to solve", they are good to play "for relaxing and unwinding." Three students indicated that they play games to pass time, two indicated a social aspect of multi-player games, and two others noted that they play video games because they are lifelike. When students were asked which games they play, the most frequently mentioned commercial games included "World of Warcraft", " The Sims" and " Final Fantasy". "Oregon Trail," "SIM City" and "The Sims" were the titles given of educational games played by these students. When students were asked to name educational games that they enjoy playing, only 11 of the 51 students were able to name one.

On the pre-task questionnaire, students indicated that they believe that video games can be utilized in the classroom (mean = 5.16 on a 7-point scale). The most common responses included that the games are interactive (N = 10), that they are interesting (N = 6), that they are different from traditional classroom lessons (N = 4), that they are a familiar media (N = 4), and that they are entertaining (N = 2) or motivating (N=2).

After completing virtual world experience, students rated the usefulness of the value of the experience. Twenty-six of the 51 students indicated that the virtual reality task improved their knowledge of German. Students were asked to rate which aspects of their German were most reinforce by the virtual world experience. On a scale of 1-7 students felt that the virtual world was most helpful for developing their listening skills. The average responses given by the students as to the usefulness of the virtual world for bolstering various aspects of their German skills appear in Table 2.

Table 2: *Mean response to questions of best use of virtual worlds for teaching A foreign language*.

	mean
Listening Skills	6.00
Learning vocabulary	4.65
Learning about culture	4.45
Gaining speaking fluency	4.44
Improving pronunciation	4.60
Reading skills	4.18
Learning grammar	3.32
Improving their ability to write in German	2.67

From a teaching perspective, experience playing games for entertainment after school was not correlated with students' level of German success in the game. Not surprisingly, success in the game was probably more dependent on students' prior knowledge of spoken German. Marks on the linguistic post-test were higher for those whose frequency of game play was lower (ANOVA F = 3.92, *p* = .005.)

Table 3: *Game Players' Expectations: Commercial and Educational Games*

	Video Games	Serious Games	t
Game Play	5.953	5.750	0.926
Animation	5.304	4.910	1.621
Story	5.480	5.640	-0.595
Graphic	5.450	5.135	1.374
Audio	4.870	5.330	-1.624

Response to game quality questions, based on Paired Samples, N = 24

Measurement of user expectation in the game quality of commercial and educational games may show some differences (Table 3). Though none is significant to $p < .05$, larger sample sizes may reveal that students had lower expectations on measures of game play, graphics story line and audio for educational games, suggesting a slightly more forgiving attitude towards the maker of educational games. It is also possible that expectations in the production values are the same for commercial and educational games.

Wandering and Way-finding

When designing the world for this game there was an interest in creating an architectural space that provided students with a cultural appreciation of architectural scale and detail of a European city. When students were asked which aspect of the experience they enjoyed most, the greatest number (N = 13) mentioned the exploration aspect (seeing, exploring, navigating through the city). Students who were tested in this study were asked to write down features that were both common and different from their daily experiences (Table 4). The most commonly noted item (object) was the McDonald's Golden Arches followed by marketplace and cobblestones. Perhaps not surprisingly, McDonalds, though only appearing at a distance as a sign on one of the commercial store-fronts, was still noted by almost all subjects. Like most tourists, when we discover the familiar in a foreign land it becomes noteworthy. Most common experiences noted as being similar to those in Canada included transportation and shops, while differences noted in the world in rank order were marketplace, age of the city, and cobblestone streets.

Table 4: *Free Response: What did you remember from the Virtual Experience*

(total N = 42)

|	N
Aspects of the virtual world students remembered	
McDonald's	21
Marketplace	16
Cobblestone	7
How is the world similar to an experience in a Canadian city	
Transportation	14
Types of shops	12
Giving and receiving directions	4

How the city differs from Canadian Cities	
Marketplace not often found in Canadian cities	22
City is much older than a Canadian city	12
Cobblestone streets	8
Language (German)	7
European look	2

Actually getting lost is not so hard to do in this virtual real world. One of the goals in creating the architectural space of the game was to create a world that would not direct students along the correct path, but would rather rely on their understanding the clues given throughout the game. Using the log files of each student's journey through the world, a map of paths through the game was constructed. Research in the field of space syntax would suggest that a tourist confronted with a new world would most likely select routes that are dictated by an isovist. These isovists are defined by a polygon that contains the visible area from a point. Axial maps that consider the most likely path though a space may help describe the course of action of game player through the game, in the absence of understanding the audio or text clues. Examination of the log files of students who at first may appear to have taken a course of action resembling a random walk may be found to have paths correlate with a visibility analysis (Figure 8). For example, at the beginning of the game, students are asked to walk through a set of arches straight ahead towards a fountain to look for Maxmilian who will give them their first clue (Figure 1):

Welcome to Salzburg! Today you have the task to find the daughter of the mayor, Laura Koch. Unidentified men have kidnapped her. Start walking and follow the red bricks. Go to the fountain to receive your next clue.
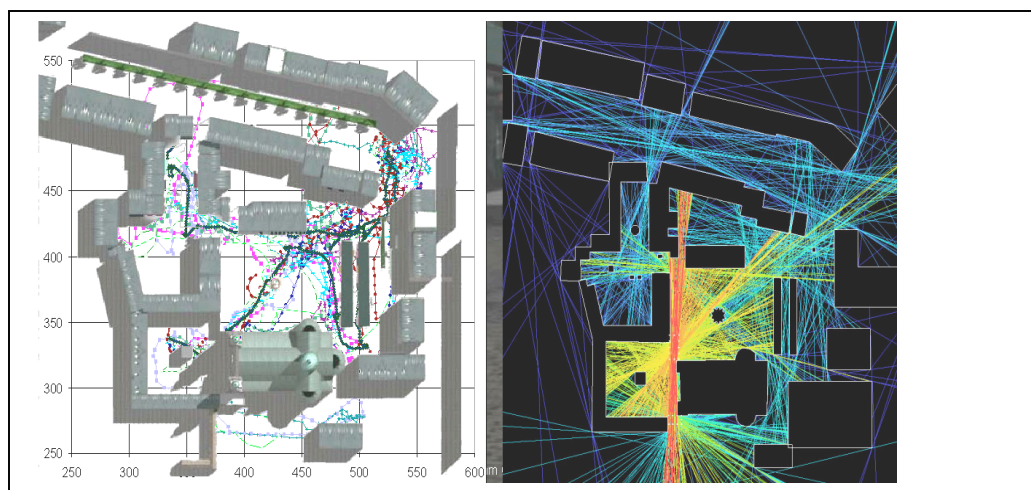
Figure 8: Paths of students (right), Axial map produced from LCL Depthmap version 6.0824. shows possible directions and linkages through the game space (left). Lines which are red are more likely paths than those that are blue.
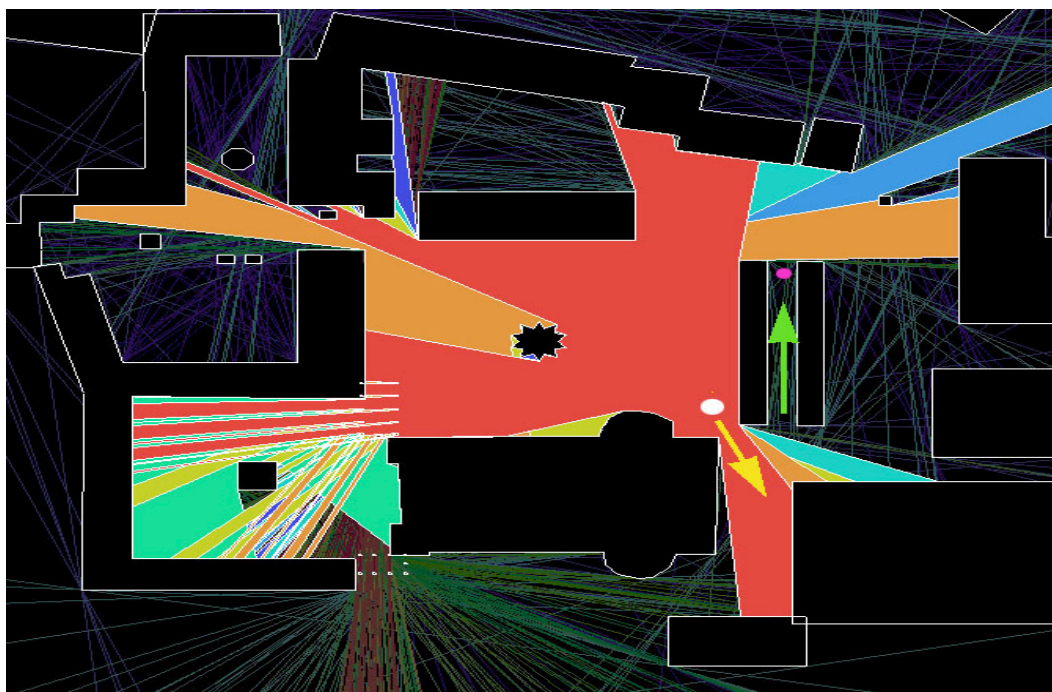
Figure 9: White dot indicates the location of the clue for Figure 3. Isovist from clue 3 would suggest a direction to the game player given by the yellow arrow. Next clue is the game is located at the purple dot.

Students who were unable to understand this first clue, would more likely turn right along the axis shown in red in Figure 8. Not surprisingly this is also predicted by the axial map, which would direct movement to the right if one were to look for a way out of the plaza. However, it is difficult to know from the existing data which clues the game players used when they were lost. A strategy may be to look for clues in the environment when one is lost, following the path of an isovist. This may explain why it was difficult for students to locate the fruit stand (Figure 4) at the far end of the Market. With no views from their last clue in front of the market (Figure 3), the tendency was to look for clues from the current position. Even for students who understood the auditory clue, this tendency to wander off to the right instead of proceeding down a narrow market lane is supported by space syntax analysis, which suggests we navigate our world along major axis and viewsheds.

Testing Environment

Because of the small number of participants, it was not possible to statistically distinguish the different benefits of CAVE, teacher-led or lab environments. However, observation data gleaned from video shows that students working in groups, as in the CAVE, had the opportunity to discuss an appropriate strategy through the game space. Unfamiliar vocabulary that may have kept them from understanding a clue could be discussed and a possible interpretation leading to the next clue could be arrived at. Even students in the lab environments appeared to share their knowledge by exchanging comments or viewing the other screens as they moved through the game. Clearly when the teacher led the solution to the game play, success was assured. In this one case the teacher, knowing the successful route, directed students during their interaction along the correct path.

Figure 10: CAVE with a group of 3 students

Immersive vs. Non-Immersive

Using a semantic scale, no differences were shown in the visual experience of the different test environments in the classroom with a large screen projection and in the language lab with individual PCs. When the CAVE experience was compared with the other environments, a difference was noted on two factors, expansiveness and immersiveness (Figure 10). The CAVE right and left screens were angled at135 degrees from the center screen, providing a panoramic view stretching approx 30 feet across and creating an immersive stereo experience.

Summary and Conclusion

Though a pilot study, this project has been useful in defining directions of future research efforts. In developing games for teaching language and culture, larger groups of subjects will probably reveal a stronger differences in attitude based on age, sex, and experience with games. In general, expectations in the production values are the same for commercial and educational games. However, the data suggest much lower expectations on measures of game play, interaction, graphics and audio for educational games, indicating a more forgiving attitude towards the maker of educational games.

In playing the game, students reported an improvement in their listening skills, and they also noted that the experience was beneficial for vocabulary learning, pronunciation, general fluency, and improving reading skills. None of the students in this study had ever traveled to a German-speaking city. Though only eight (out of 51) mentioned that they plan to visit a German-speaking country in the future, approximately one-third of the students mentioned that their favorite aspect of the experience was exploring the world. We are reminded of the importance of the process of learning: "culture is not just a body of facts to be acquired by learners, but something actively created by learners through interactions" (Tseng, 2002, p. 20). It is through the participation in the virtual world task that students in this study have come to truly

experience the target culture for the first time in their lives. From a teaching perspective, experience playing the games after school was not correlated with their level of German comprehension. Not surprisingly, success in the game may have been more highly dependent on students' level of achievement in the course than previous experience playing video games.

Observation of students in the lab, classroom and CAVE reveal a sharing of knowledge of the game. Comments or viewing the other screens as they move through the game may have much to do with getting to a successful conclusion. Clearly when the solution to the game is known, success is assured as in the case of the teacher-led experience.

Perhaps not surprisingly, like most tourists traveling abroad, when we discover the familiar in a foreign land it becomes noteworthy. Students wandering through a 3D virtual world of Salzburg noted similarities in the types of stores, and even logos of fast food restaurants. Actually getting lost in a foreign world is not difficult to do as travels abroad attest. Understanding directions in a second language can be a challenging exercise. When these directions are misinterpreted or misunderstood, we may fall back on clues from the environment. Research in space syntax may offer some interesting perspective insights into strategies game players employ when looking for the correct path through an urban space. Examination of the paths of students through the constructed space may first appear to have taken a course of action resembling a random walk; however, upon further examination they resemble (correlate with) isovists and axial maps predicted by Depthmap. In fact, isovist and axial maps may be helpful in predicting the first line of action taken by game players as they navigate through a virtual world with no verbal clues.

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