

**Measuring Flow in a computer game simulating a foreign
language environment**

Mark Chen and Shay Johnson

June 7, 2004

Abstract

This research study attempted to use a design-based experiment approach to look at Flow in a computer game simulation of a foreign language environment. Measuring Flow in this setting would allow us to look at how a computer game could be used to provide Spanish language students an environment to practice their language skills outside of the classroom. We also were testing the effectiveness of using a commercial off-the-shelf game, Neverwinter Nights, for rapid prototyping of an educational environment. We quickly discovered that a preexisting knowledge about computer games, in general, and about Neverwinter Nights, in specific, greatly enhanced participants' ability to become engaged with our game module. The study was hampered with usability problems, but, in the end, we are at least one step closer to measuring Flow in a game simulation.

Introduction

The ability to practice language skills outside of the classroom is extremely important for students in learning a foreign language, yet many students are not exposed to a foreign language environment in their daily lives. Indeed, there may not be an easy way to find one. One way of providing an out-of-classroom context is through a virtual environment or computer game which simulates a foreign language environment.

Video and computer games are the most interactive medium in our culture and as such can be leveraged to great effect in learning (Gros, 2003). Learning takes place in a situated environment where the best learning happens within real-life contexts and with just-in-time information. A computer game can model these complex environments in an engaging manner more so than traditional drill-and-practice educational software. This modeling in a game can off-load some of the cognitive processes from the player, letting the player focus on exploring rather than visualizing the system (Scaife and Rogers, 1996). Additionally, a computer role-playing game allows a sort of embodiment for the player to act through his or her on-screen character (avatar). This embodiment allows for a situated learning environment, letting players take on the role of the character who needs to learn, act, and make decisions within the world. A good computer game allows one to apply different strategies of play where failure in using certain strategies is not necessarily an indication of overall failure. In fact, it is through failing at specific strategies and then trying new strategies that players become able to construct their own knowledge of how the game system works.

MIT's Games-to-Teach project is exploring these ideas in games like *Revolution* and *Supercharged!* In fact, their proposed game *Periodista* (Games-to-Teach, 2002) has the player take on the role of a photojournalist with limited Spanish speaking skills sent off to Argentina. Through given missions and scenarios, the player must "solve" problems and obstacles by demonstrating skill in Spanish (e.g., asking for directions to a photo shoot).

This is very similar to our idea that the best way to learn a language is to be immersed in a place where the language one is trying to learn is the main language spoken and used.

Like MIT, we provide the context and narrative background and present players with problems or scenarios to be solved. Of utmost importance is the use of game-like features which promote exploration within the system (Egenfeldt-Nielsen, 2003). For example, setting problems within a context that players will want to solve in order to continue the story fosters an intrinsic motivation to explore and learn. Contrast this with drill-and-practice software where students' motivations are external to the system.

This concept of motivation is very important in a game to be used outside of the classroom. The simulated environment has to be fun and engaging or students won't take the time to use it. We decided to look at measuring engagement in games, in general, and Flow Theory (see Table 1), in particular (Csikzentmihalyi, 1988, 1990).

Table 1. A summary of Flow's characteristics.

- | |
|---|
| <ul style="list-style-type: none">• A sense that one's skills are adequate to cope with the challenges at hand• The task undertaken has clear goals and provides immediate feedback• Concentration is so intense that there is no attention left over to think about anything irrelevant, or to worry about problems• The sense of time becomes distorted• Self-consciousness disappears.• Sense of control over the actions• One acts with a deep but effortless involvement• Mental enjoyment of the activity for its own sake |
|---|

Flow is a state of mind in which a person feels so engaged by an activity that the person's **actions** and **awareness** merge. A person reaches an intense level of **concentration** that allows for the loss of outside circumstance, pulling the person wholly into an activity (Csikzentmihalyi, 1988). In other words, the person's ego temporarily disappears. A person in Flow has no dualistic perspective: he is aware of his actions but *not of the awareness itself*. One's attention is **undivided**. The end result of this phenomenon has been shown by modern researchers to create a highly enriched and enhanced learning experience.

This optimal experience is produced and maintained by intrinsic motivation. T.W. Malone, et al, (1980, 1981) have identified three components of intrinsic motivation that contribute to the exceptional appeal of computer-based gaming. The first component relates intrinsic motivation to our innate tendencies to solve problems. This natural drive to solve problems usually involves elements such as challenge, competence and mastery. (*Puzzles and information gap type activities that are used in language teaching would be an example of this type of motivation*). Malone's second component of intrinsic motivation depicts humans as information processors that focus on pleasure and curiosity. This component is centered on factors such as novelty, complexity, variability, and discrepancy. This can be demonstrated by our pleasure of getting caught up in a well-written novel or solving a puzzle. The third aspect of intrinsic motivation stresses perceived control and self-determination. People feel motivated when they have the

opportunity to exert control, determine their own fate, or at least maintain the perception that they are doing so. Csikszentmihalyi (1988) calls this **personal causation**. Skinner (1984) has noted, “When students move through well-constructed programs **at their own pace**, the problem of motivation is automatically solved...The video arcade is adequate proof”. Norman (1993) adds...”what would teachers not give to see their students applying themselves with the same eagerness”. We will talk more about the effects of this concept on learning when we address design issues and the use of virtual worlds.

Another characteristic of Flow is that “it occurs within sequences of activities that are goal-directed and bounded by rules—activities that require the investment of psychic energy, and that could not be done without the appropriate skills” (Csikszentmihalyi, 1988). Flow is universal, meaning that Flow can be experienced by anyone, regardless of age, gender, cultural background, profession or any other means of classification. Csikszentmihalyi found that the experience is not content-dependent; rather, it is the dynamics of the experience that determines the quality of Flow. These dynamics, he suggests, are hard-wired, not bound by cultural consideration or learning. Flow doesn’t need to be taught. We all possess an innate capacity for it. We only need the right circumstances or dynamics to activate it.

We explored the possibility that a stimulating, multimedia, narrative computer game could induce a state of Flow. In a role-playing game that modeled a foreign language environment, students would then be more inclined to spend time interacting with the language outside of class. Our assumption is that a virtual foreign language environment could promote language skills outside of the classroom by using game-like elements and inducing a state of Flow.

We’ve chosen to measure Flow by looking at presence and engagement in computer games using modified versions of the Immersive Tendencies Questionnaire and Presence Questionnaire (Witmer and Singer, 1998). Witmer and Singer’s definition of “presence” comes out of Virtual Environment literature. (It is different than the traditional view, like Mel Slater’s, of presence as being tied to the limitations of the equipment.) We are using the modified versions created by the Digital Games Research Group of the University of Washington, known as the Gaming Immersive Tendencies Questionnaire and the Gaming Engagement Questionnaire (Digital Games Research Group, 2004). DGRG is working on a model for engagement in computer and video games, and they have chosen to measure some components of their model with the modified questionnaires. It is important to note that the questions have been modified to look at engagement as a whole, of which Witmer and Singer’s concept of presence can be considered only one component, and the impetus for measuring presence is ultimately a way to measure Flow. Overall, however, the GEQ should give us a general idea of how “into” the game the player is, which we can then use to suggest levels of a Flow-like state.

Method

Participants

We recruited three participants for our study. Two of the participants were recruited from email lists that one of the researchers belonged to. The third and final participant was a colleague of the other researcher. The first participant was a 56-year-old white

male. He is a native-speaker of English. He described himself as a novice at computer game playing. He had studied Spanish for 3 months and has been speaking it for three years. He listed his weekly computer game playing as 0-1 hours per week (the lowest choice). The second participant was a 51-year-old white female, who was also a native speaker of English. She listed herself as a novice computer game player. She studied Spanish for six years when she was in high school and college. She chose 0-1 for the number of hours a week that she plays computer games. The third participant was a 29-year-old Latin American female whose native language is Spanish. She plays computer games on average 6-10 hours a week and rates her skill level as intermediate. No rewards were offered to the participants. Their primary motivation for participating in the research was to help the researchers.

Apparatus

The Laboratory for Usability Testing and Evaluation (LUTE) supplied the equipment used in this research. It consisted of a computer and monitor hooked up to a video mixer. Two video cameras were also feeding into the mixer, and we recorded both what was happening on-screen and the participants' faces while they played the game.

The computer was loaded with a Spanish-speaking module for the computer role-playing game *Neverwinter Nights*. *Neverwinter Nights* is made by Bioware and comes with a custom content creation toolset for fans to modify and create their own scenarios which they can then share with the player community. The toolset allows one to design locations (e.g., placing buildings in an outdoor area) and encounters for those locations (e.g., placing computer controlled people, a.k.a. non-player characters (NPCs), to interact with among those buildings and defining what they will say). We've chosen to do this so that we could rapidly create a simulated environment without having to create original artwork or programming. This game engine, however, has some hard-coded features which might preclude it from being ideal. Most of these features are hold-overs from the nature of the original game which emphasized combat between players and computer controlled people or monsters. Additionally, since the game was originally for a fantasy setting, the actual artwork which was available looks a little out of place.

We created a small outdoor plaza of a Spanish-speaking city. The plaza featured four points of interest, a hotel, a bank, a market, and a fruit stand. The first three had their own interior locations defined as well, so that when the player went to the bank, for example, he or she could enter the bank and see the interior. The module had the players take on the role of an American tourist named Michael visiting the Spanish-speaking city. The player starts out in the hotel and is prompted by one of the NPCs to talk to him. This NPC is Juan, the hotel manager who speaks English, and he explains to the player that his room is not yet ready. He then suggests the player go outside, walk around the plaza, and get something to eat and drink. By the time the player has done this, the room should be ready. The task for the player is to buy an orange and a soda. Through the course of play, he or she finds out that the fruit vendor has an orange and the market has a soda but they cannot take American dollars. The player is directed to the bank where he or she can get the correct currency and can then successfully buy the two items. Upon returning to the hotel, Maria, Juan's Spanish-speaking assistant, informs the player that Juan is out to lunch but can help the player check-in. She asks what the player has done and how the plaza was, as a sort of recap of the scenario. Her role was to help the player's

understanding of the module sink in. She then gives the player the key to his room and the game ends. Each of the characters, besides Juan, speaks Spanish and when the player converses with them, he or she has to choose what to say in response to what the NPCs say.

Each conversation follows the same pattern. Here's a sample from the fruit stand vendor including translated text for non-Spanish readers (NPC in red, player response choices in blue):

Hola, ¿quieres comprar fruta?* [Hello, would you like to buy some fruit?]

1. Sí, ¿cuánto cuestan los anaranjados? [Yes, how much are the orange colored (ones)?]

¿Quieres decir "las naranjas"? Diez pesos. [Did you mean to say, "the oranges?" Ten pesos.]

[conversation continues]

2. Sí, ¿cuánto cuestan las naranjas? [Yes, how much are the oranges?]

Diez pesos. [Ten pesos.]

[conversation continues]

3. erm. [erm.]

¿Eres Americano, verdad? Dije... [You're an American, right? I said...]

[go back to *]

4. uh... regreso más tarde. [uh... I'll come back later.]

Each branch of a conversation includes four choices, one of which is a grammatically correct sentence using the proper vocabulary that will continue the story in the game. Another sentence with the same idea but either using the wrong vocabulary or incorrect grammar is also presented, challenging the player to make the right choice. The other two choices are to show an indication of not comprehending, which causes the NPC to repeat what he had just said, or to end the conversation.

We had hoped that these conversations would cause players to give pause and consider the choices presented before making the wrong choice. At the same time, however, we did not want to discourage people struggling with Spanish from continuing the game, so if they chose the wrong way of saying something, they were corrected by the NPC yet could still continue through the story. Since we expected some people to have trouble with some of the vocabulary in the game, we designed an in-game mini-dictionary which could be accessed by examining the objects the player character, Michael, was carrying. The idea here was to provide people with just-in-time instruction within the game so their focus was still in the game.

We also designed a mini-manual to introduce the game mechanics to people who had played neither *Neverwinter Nights* nor a computer role-playing game before. This included a short tutorial to get them started. The player handouts can be viewed in Appendix C.

Two questionnaires were used along with a User Profile document. A researcher observation form was used during enactment. Post game interview forms were used to

wrap up the research session. Videotape was used to record the participants' expressions and voice.

Procedure

They were read to from a script, which explained the purpose of the research and what was expected of them. The participants were first asked to fill out a User Profile. This asked for their age, gender, amount of time spent each week playing computer games, how they rated their skills as gamers and their history and level of Spanish. It also asked for their permission to be videotaped as long as the results would not be published. The script was used to make sure that all the participants received the same instructions. Next they were given the Gaming Immersive Tendencies Questionnaire. The participants were then given the mini-manual, and they were told to read the tutorial and begin exploring the game, at which time videotaping began. The researcher took notes using a form created strictly for that purpose (field notes). A video transcription was made later of each participant. After the game was successfully completed, the participants were asked to fill out the Gaming Engagement Questionnaire. Finally, the participants were either interviewed by a researcher or asked to self-report on their experience by filling out a post-game interview sheet with questions designed to debrief them on their experience.

Results

The results for this research were gathered using 6 documents for each participant. The first of these is the User Profile that asked participants about their personal information, their gaming background, and their Spanish language ability. Two Questionnaires were used: the Gaming Immersive Tendencies Questionnaire (GITQ) and the Gaming Engagement Questionnaire (GEQ). The results of these questionnaires can be seen in Appendix A. The participants were also videotaped, and a transcription was written with time-stamps at key points of the participants' reactions to the gaming environment (see Appendix B). A researcher took notes while observing the participant playing the game. Finally, a post-game interview of the players' experiences was conducted by one of the researchers (see Appendix C). We correlated the different forms of data that we collected using a triangulation method to support our findings.

One example of this method will demonstrate how it works. We noted on the video script that the second participant was having trouble getting the hang of the game and its goal. She exhibited great frustration at not knowing what she was expected to do and at not being able to get out of the hotel lobby. The first problem was an access-to-knowledge issue; the second was a navigational one. In the researcher's field notes, under the heading of "How does the user deal with the manual?" he stated that the player was illiterate in terms of video game terminology. He also stated that she had trouble with the way in which dialog was presented in the game. Under the heading "How easy is it for the user to get used to the controls?" he noted that she doesn't understand the journal tabs and sort buttons. Then, looking at the post-game interview sheet, when asked, "What made sense about the game and what didn't make sense?" the participant stated that the beginning was confusing and also that she didn't know how to start. She told the interviewer that she needed the goals "spelled out". This information also matched her

User Profile entry of rating herself as a novice at computer games. On the GITQ, for the question “Do you easily become deeply involved in computer games or video games?” she wrote, Not Applicable because she had never played a computer game before. In this manner, we were able to make conclusions about the participant’s gaming experience as it might relate to Flow Theory.

The first two participants were self-described novices at gaming. This was confirmed on the Gaming Immersive Tendencies Questionnaire. The questionnaire consisted of 18 questions that were broken into three groups mixed together. The first group of questions, the Focus group, was related to the participants’ health and mental alertness at the time of the enactment. The second group of questions, titled Involvement, asked questions about their emotional response and personal involvement while participating in certain activities such as watching TV or reading a book. It also determined their level of distractibility. The final group of questions, the Gaming group, asked about their video game experiences. The first participant (P1) and second participant (P2) scored 11 respectively on the Gaming questions while participant 3 (P3) scored 26. In the other two categories, Focus and Involvement, all three scored relatively the same (see Appendix A). These data are backed up by the User Profile the participants filled out before starting the game and from the field notes taken by the researchers. For example, in comments from the field notes for P1, the researcher mentions that P1 read the tutorial but didn’t comprehend it, and he also enumerates the great difficulties P1 had with the gaming interface and controls. For P2, he states that she is not familiar with computer terminology (e.g., “mouse-wheel”). P1 and P2 experienced difficulty immediately upon entering the gaming environment. They were put off by the paper tutorial and spent several minutes trying to figure out where and how to begin. P2 did not make use of the paper tutorial, but rather began a streaming dialog with the researcher. P1 and P2 made statements throughout the session that made us aware of their discomfort with the experience. P3, as expected from her GITQ and User Profile, had no difficulties and became immersed with the game immediately upon sitting down.

P1 continually fidgeted in his seat. He sighed a lot and often scratched his head in obvious confusion. This is also confirmed from the field notes where the researcher refers to the difficulty he is having with the game interface and controls. On the interview sheet given after the game was over, P1 states that he was confused by the lack of voiced instructions and clearer goals. One interesting difference between P1 and P2 shows up on the post game Interview sheet. P1 felt the game was engaging based on the *challenge* in learning the rules. He “made a game out of learning the game” as one of the researchers commented on the Interview sheet. P2 had no such experience

P2 immediately began a conversation with the researcher taking notes and soon began to depend entirely on him for help. At one point on the videotape she is heard to say “I hope “R” doesn’t think I’m stupid” referring to one of the researchers who is also her friend. In the field notes the researcher refers often to her difficulty with the game and in using the computer in general. She had a problem with the background sound effects and asked the researcher to turn them off.

P3 scored highest on both the questionnaires and as anticipated, had no trouble navigating through the game or accomplishing the tasks. She was finished in less than half the time it took the others. She was also a native speaker of Spanish and gave the

researcher advice on how to improve the dialog. Both researchers remarked in their field notes on the ease with which she got through the game.

One of the immediate problems that surfaced was related to the Novice-Expert Paradigm. Both researchers are adept at computers and have played many computer and video games and, when designing the game, overlooked many important issues that new gamers would encounter. For example, while the original tutorial/manual made an attempt at defining the term “inventory,” it was clear that the brief description was not enough to understand for people who are unfamiliar with the term as used in gaming contexts. The video transcription shows that it took P1 twelve minutes to get out the hotel lobby to begin his first task. This was after several interventions by the researcher explaining things such as game directions and use of tools. Finally, he got into the plaza on his own. It took P2 seventeen minutes and she had to be told explicitly by the researcher what to do. For these reasons P3 was recruited for her skills at gaming. She left the hotel in four minutes on her own accord. This oversight, an underestimation of the importance of preexisting gaming knowledge, caused a general reconstruction of our research question due to the frustration level experienced by P1 and P2, which interfered with their onset of Flow. It also accounted for the several iterations the research went through and is discussed in the next section. Even with the changes made, it took P1 and P2 forty minutes to complete the game with verbal assistance from the researcher. The third participant, who was brought in specifically for her gaming skills, completed the game in sixteen minutes without any help from the researchers.

Discussion

When we started this research project we were looking to answer a specific question, whether a computer game could simulate a foreign language environment and induce Flow to attract students and allow them to practice language skills outside of the classroom. What we found, however, was that the study quickly became mired in other issues, namely those of usability, and the study, designed as a single iteration in a multi-iterated study, became a series of micro-iterations.

We had originally wanted to run our research in a computer language lab (meeting the goal of any good design experiment in being ecologically valid). Moving the study to LUTE seemed like a good idea at the time; the lab was already equipped with a video mixer and cameras, so we could record our participants’ on-screen actions and record their facial expressions as they played. In hindsight, we could argue that LUTE was too artificial an environment. The problems we had with our designed intervention, however, most likely would have emerged in any setting.

Our first participant was able to complete the game (buy an orange and a soda and return to the hotel) only after struggling with the computer game’s interface for half an hour. Watching the participant struggle with the interface rather than the game content was an eye-opener, causing us to realize that, even though we created a mini-manual, deep-rooted gaming conventions were not easily taught. Surprisingly, the participant didn’t seem to comprehend the manual and did not actually follow the instructions in the tutorial portion of the manual. In this iteration, it was clear that much of the text was not clear and was open to misinterpretation. Suddenly, it was synchronicity that we were

using a usability testing lab, even though doing a usability test was not our original intent. In fact, we helped our first participant get through the game controls as best we could and intervened many times to move him along and get to the actual content of the game.

Luckily, our participants were not available on the same day. This allowed us to make modifications to the game and testing materials before our next study. We added more in-game instructions from Juan, circumvented the use of opening containers in the game (a bookshelf the player used to get an in-game mini-dictionary—we placed the dictionary in the avatar’s possessions instead), and clarified the text on the handouts to the player.

Unfortunately, our second participant did not have an easier time of it. It seemed that many of the issues with poor wording and misinterpretation were resolved, but there still remained a general lack of comprehension with the material presented. It was as if she was reading the lines of dialog but not understanding the context of the words being presented. At this point, it became clear that some gaming conventions could only be understood through game-playing experience.

As a test to this new hypothesis, we recruited a third participant who has played *Neverwinter Nights*. Our third participant grew up speaking Spanish, but we were most interested in seeing if game-playing experience affected the level of engagement and Flow in our design. Interestingly, we found that, at least with her, previous game-playing experience of the game engine does indeed alleviate all of the interface problems, and our participant was able to self-report a higher level of enjoyment and engagement in our game.

Conclusion

It might appear that being a “gamer” is necessary for a game to induce Flow. This is disappointing, but it appears that at least some training with the game engine is needed in order for a player to not have interface issues. Whether this is due to the game itself (meaning training would be sufficient) or due to how games in general work (meaning being a “gamer” is necessary) is left for further study. It should be noted that the first participant actually claimed to be very engaged because he felt that learning the game itself was a challenge that he was willing to embrace. For him the game was actually the meta-game of learning how to play the game.

To explore whether using a game requires that the students have a preexisting penchant for games, we suggest these changes:

- **Change the process.** Perhaps we could train participants in the game controls before playing. This by itself might be enough to set all the participants at a more even level of expertise, one where the content of the game can be examined and Flow can be measured.
- **Enhance the game.** We could make the game less predictable in the way the conversations work, and prevent players from being able to guess the correct option in dialogs. We could also add more people and more situations which the player would likely encounter in real-life if he or she visited a Spanish speaking city. A richer world could be represented through the use of audio voice-overs for

- the dialog (Smith). These changes are meant to motivate the students in exploring the world and finding solutions to the obstacles and scenarios presented in it.
- **Make the game more like a commercial off-the-shelf role-playing game.** We could take advantage of the fact that *Neverwinter Nights* was designed as a combat focused role-playing game set in a medieval fantasy world. Maybe we could modify the scenarios that came with the game (in all its monster-bashing, quest-solving glory) so that it features Spanish instead of English. We might even be able to add a few choices to the dialog options so that they include choices with incorrect grammar and vocabulary. The idea here is that the commercial game itself is attractive to players already; we could use an already proven successful design.
 - **Start from scratch.** It has been suggested that this game engine is too complicated for non-gamers to feel comfortable in. The cognitive load is not being off-loaded for these people. We could start from scratch and create our own game featuring a very simple interface. Starting from scratch, however, could be a time-consuming and costly endeavor. When the results are not guaranteed to induce a Flow-like state, we might be better off continuing our rapid prototyping with an existing game engine.

Regardless of where future studies take us, it behooves us to conduct our studies in a more ecologically valid setting. Even though our data are probably setting-independent, our hope is that future research will have overcome the issues of interface and usability. In these future studies, it will be important to eliminate any doubts about the testing environment.

Our research study discovered many challenges regarding the use of computer games for learning, and we now have a clearer idea of the danger in assuming computer and video games can appeal to all people. If interface and usability issues stemming from a lack of gaming conventions in participants can be dealt with, it seems that there is hope for a computer game modeling a foreign language environment to induce a state of Flow, and therefore allowing players to receive an optimal learning experience.

References

- Bioware. (2002). *Neverwinter Nights*.
- Csikszentmihalyi, M., & Csikszentmihalyi, I. (1988). Introduction to part IV. In M. Csikszentmihalyi & I. S. Csikszentmihalyi, (Eds.), *Optimal experience: Psychological studies of Flow in consciousness* (pp. 251-265). New York, NY: Cambridge University Press
- Csikszentmihalyi, M. (1990). *Flow: The psychology of optimal experience*. New York, NY: Harper & Row.
- Digital Games Research Group. (2004). Modeling and Measuring Engagement in Computer Games (work in progress).
- Egenfeldt-Nielsen, S. (2003). Exploration in computer games – a new starting point. *Digra – Level up conference*.
- Falstein, N. (2003). The Flow Channel. *Game Developer*, 11, 5, 52a.
- Games-to-Teach. (2002). *Periodista: The Photojournalist*. MIT. Retrieved June 5, 2004, from <http://cms.mit.edu/games/education/Periodista/>
- Gee, J. P. (2003). *What Video Games Have to Teach Us About Learning and Literacy*. New York: Palgrave Macmillan.
- Gros, B (2003). The impact of digital games in education. *First Monday*, 8, 7. Retrieved June 5, 2004, from http://www.firstmonday.org/issues/issue8_7/xyzgros/index.html
- Johnson, S. (2001). Story Mazes: Flow in Immersive Language Environments. *IATEFL: Implementing CALL in EFL: Living Up To Expectations*. University of Cyprus, Nicosia.
- Jones, M. (1998). Creating Engagement in Computer-based Learning Environments. *IT Forum*.
- Malone, T. W. (1980). *What makes things fun to learn? A study of intrinsically motivating computer games*. Unpublished doctoral dissertation, Stanford University. (University Microfilms International No. 80-24707)
- Malone, T. W. (1981). Toward a theory of intrinsically motivating instruction. *Cognitive Science*, 4, 333-369.
- Norman, Donald A. (1988). *The design of everyday things*. New York: Currency Doubleday.

- Norman, Donald A. (1993). *Things that make us smart*. Reading, Massachusetts: Addison-Wesley.
- Scaife, M. and Rogers, Y. (1996). External cognition: how do graphical representations work? *International Journal of Human-Computer Studies*, 45, 185-213.
- Skinner, B.F. (1984). The shame of American education. *American Psychologist*, 39, 9, 947-954.
- Smith, G. M. (2002). Computers Have Words, Too – Dialogue Conventions in Final Fantasy VII. *Game Studies*, 2, 2. Retrieved June 5, 2004, from <http://gamestudies.org/0202/smith/>
- Witmer, B. G., and Singer, M. J. (1998). Measuring Presence in Virtual Environments: A Presence Questionnaire. *Presence*, 7, 3, 225-240.

Appendix A: Questionnaire Results

Gaming Immersive Tendencies Questionnaire (GITQ)

Question	P1	P2	P3	Category
Do you ever become so involved in a TV program or book that people have trouble getting your attention?	3	4	5	i
How mentally alert do you feel at this time?	6	5	4	f
Do you ever become so involved in a movie that you are not aware of things happening around you?	6	6	5	i
How frequently do you find yourself close identifying with the characters in a story line?	5	7	6	g
Do you ever become so involved in a video game that it is as if you are inside the game rather than manipulating physical controllers and watching the screen?	4	NA	4	g
How healthy do you feel today? (How physically fit do you feel today?)	5	6	5	f
How good are you at blocking out external distractions when you are involved in something?	5	5	5	i
When watching a sporting event, do you ever become so involved that you react as if you were one of the athletes?	5	6	4	i
Do you ever become so involved in a daydream that you are not aware of things happening around you?	4	5	5	i
How well do you concentrate on enjoyable activities?	6	7	5	i
How often do you play computer or video games? (OFTEN should be taken to mean almost every day, on average)	1	1	5	g
Have you ever gotten excited during a chase or fight scene on TV or in the movies?	4	7	4	i
Have you ever remained apprehensive or fearful long after watching a scary movie?	2	6	5	i
Do you ever become so involved in doing something that you lose all track of time?	3	6	6	i
Do you easily become deeply involved in computer games or video games?	2	NA	5	g
How interested are you in playing games that are role-playing games?*	4			g
How interested are you in playing adventure-based computer games?		4	6	g
How interested are you in playing computer role-playing games?		6	6	g
Total (out of 112 for P1, 119 for P2 and P3):	65	81**	85	
Total for Focus questions:	11	11	9	f
Total for Involvement questions:	43	59	45	i
Total for Games questions:	11	11	26	g

*Participant had no understanding of the term “role-playing games” so the question was changed for Participants 2 and 3.

**Participant 2 might have scored higher if she had answered the two questions she didn’t feel comfortable answering, but Participant 1 might have scored lower if he used the same procedure of putting NA about previous game-playing experience.

Gaming Engagement Questionnaire (GEQ)

Question	P1	P2	P3
Were you able to anticipate what would happen next in response to the actions you initiated?	4	3	4
*How much delay did you experience between your actions and the expected outcomes within the game?	4	7	2
How appropriate were the physical controls for the game? (Game pad buttons, keyboard mappings, etc.)	3	7	5
How well were you able to understand the physical controls for the game? (Game pad buttons, keyboard mappings, etc.)	3	4	6
How appropriate was the graphical interface for the game?	5	4	6
How well were you able to understand the graphical interface for the game?	3	2	6
How proficient at controlling the game did you feel at the end of today's gaming session?	3	7	6
How enjoyable did you find the graphics in this game?	4	1	7
How well were you able to identify what game pieces/objects/models represented?	2	2	4
How enjoyable did you find the sound effects in this game?	4	NA	6
How well were you able to identify the sound effects during game play?	4	NA	5
How consistent were the audio and graphics together?	3	NA	4
How involved were you in the game experience?	5	5	6
Were you involved in the game to the extent that you lost track of time?	6	5	7
How much did you feel like you were inside the game world?	4	4	6
How often do you play other games of this genre?	1	1	5
How enjoyable do you find the content and theme of this game?	3	5	6
How interested are you in playing this game again?	3	1	7
*How much did the game's user interface interfere with your ability to perform actions within the game?	3	7	3
*To what extent did you feel spatially or disoriented within the game environment by the end of the game experience?	3	6	3
To what extent are you interested in engaging in further exploration of the game's environment?	4	5	7
How completely were you engaged in the game?	5	5	6
Total:	79	81*	117

*Participant 2 chose to turn off the computer speakers and wasn't able to answer questions about the game's audio. Given this fact, Participant 2's score might reflect a tad more engagement which might be due to the changes we made to the design between iterations.

Appendix B: Videoscript Sample

Each participant was videotaped with his or her permission. Each session was recorded on a machine that captured the participant's computer screen and a small picture-in-picture view of the participant's face in the bottom-right corner of the screen. One of the researchers viewed the tapes and made notes on all of the participants' expressions and noteworthy actions and words. The notes were time-stamped to show the participants' progress through the game.

Sample of Videoscript for Participant 1

Participant 1	Notes from Videoscript
00:59	Spends one minute reading before starting to use the mouse
02:30	Reads notes at bottom of screen and seems confused about what to do
03:40	Asks researcher for directions and explanations
04:15	After explanation, he understands he is supposed to "read" the choices and not "hear" them
06:25	Looks frustrated - researcher offers some help Having trouble navigating the characters
08:04	Still in lobby trying to find Juan Looks from instructions to game several times (seems confused)
10:32	Having difficulty trying to get to the plaza (hand on chin: chuckles)
11:27	Researcher provides help on how to rotate camera view

Appendix C: Post-test Interview Results

Participant 1

What were you most frustrated with and why?

- Need overview of the point of the game. (This reflects what Jim Gee says is a fundamental difference between the way baby-boomers and the video game generation think. Baby-boomers always want to know what the goal is and go straight for it, while people who grew up playing video games like to explore different solutions and possibilities on the way to reaching the goal.)

Would you like to see anything changed about the game?

- The Spanish challenge level was good. The game needs voice-overs. Participant was confused and didn't know what to do because expecting voice-overs.

How engaging or fun was the game?

- Problem-solving the game itself and the controls of the game was engaging.
- It was "more than fun." Made a game out of learning the game.

What made sense about the game?

- We should focus our study on enjoyable experience OR intuitive experience, not an undefined player experience. (I think what he meant was that the study should either be an engagement study OR a usability study, not both.)

Participant 2

What were you most frustrated with and why?

- Wants to talk to people of all sorts in context
- Journal and guests weird
- Give rewards for number of conversations (maybe points)
- No penalties

Would you like to see anything changed about the game?

- Would like to see more people and more types of conversations
- But not for free-form sentences because too intimidating
- Cut out "uhg" use other words
- Need real step by step instructions for non-gamers
- Narrative as answer? Motivated to learn issue
- Use really common phrases

How engaging or fun was the game?

- It became fun after getting into it

What made sense about the game and what didn't make sense or was confusing?

Didn't

- The beginning didn't make sense
- Didn't know how to start
- Need more of a tutorial
- Need goal spelled out

Did

- Once conversation was clear, it was good

Are there any other comments you would like to make about the game or testing methods?

- Offer to pay 10 dollars to first year Spanish students

Participant 3

What were you most frustrated with and why?

- In the bank, I didn't know if I had changed my money, since I couldn't see the currency change

Would you like to see anything changed about the game?

- It would be good if the avatars could speak Spanish (Spanish voice)

How engaging or fun was the game?

- It was fun, but I wish I could have more interaction with the Avatars, and hear some jokes from them

What made sense about the game and what didn't make sense or was confusing?

Didn't

- The Spanish grammar was a little confusing.
- There was an option when you are asking about the bank, that says "where is the banca"
- And it is important to keep track of the places where you have been, otherwise it can be confusing

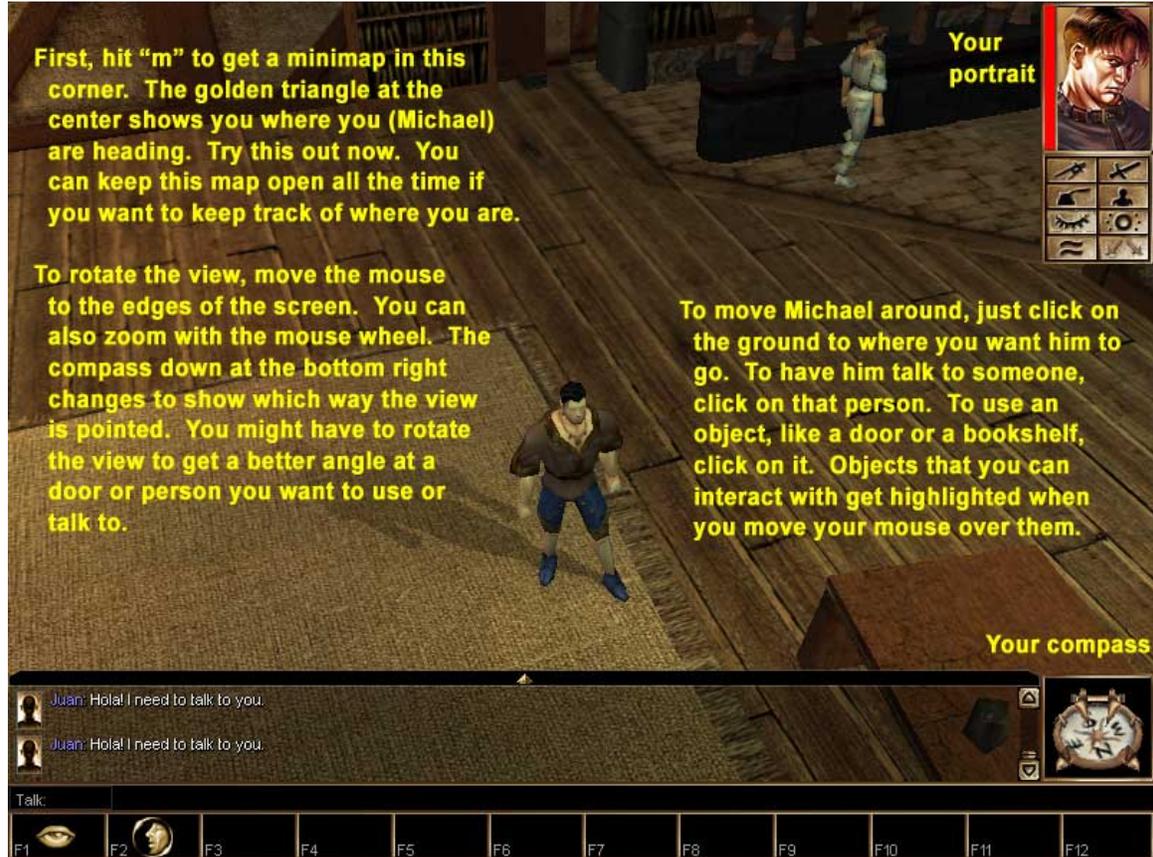
Did

- Since I know Spanish it was very easy for me to distinguish what was the incorrect grammar or sentences, but for the non-Spanish speaker it could be confusing or distracting

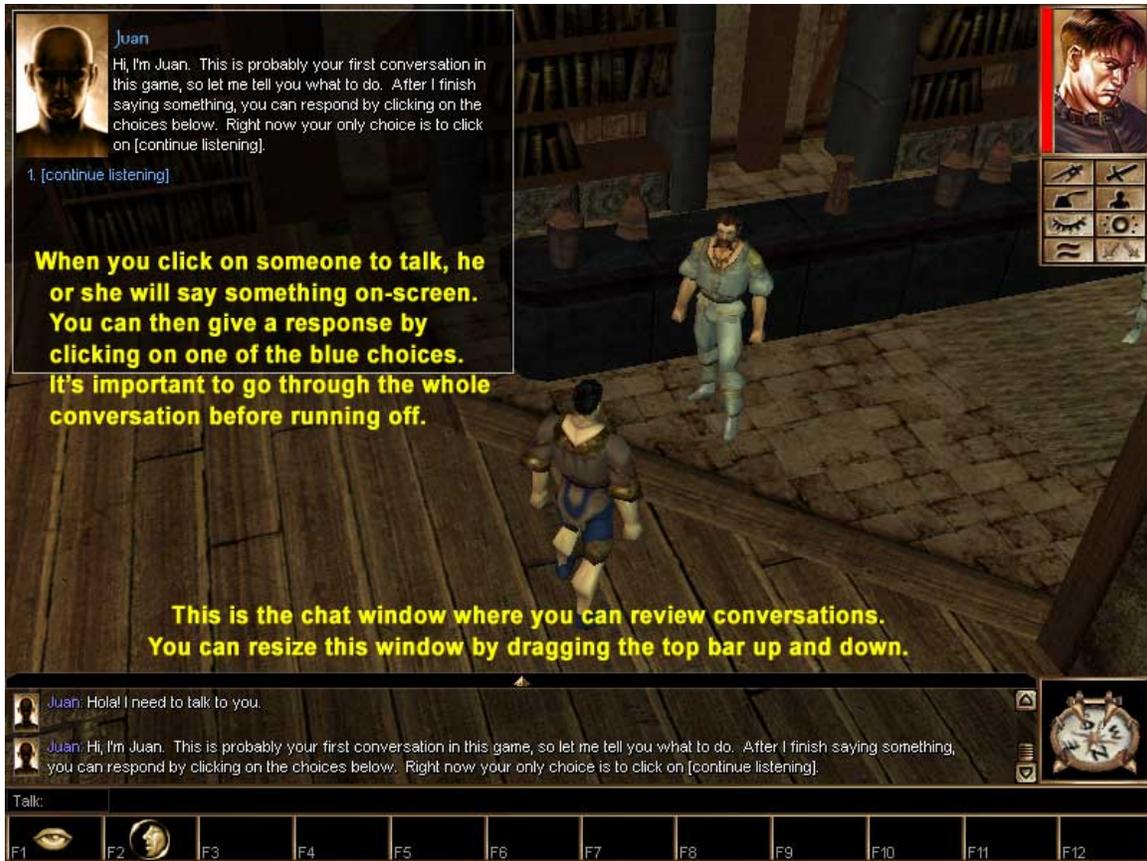
Are there any other comments you would like to make about the game or testing methods?

- For people who are not familiar with the game controls, it may be worth it to give them a small tutorial about the elements in the game.
- For instance, Explain a little bit more about the map and where you are and more explanation about the inventory

Appendix D: Player Hand-outs



First page of hand-out given to Participants 2 and 3.



Second page of hand-out given to Participants 2 and 3.

On the following page: Examples of changes made to hand-outs between Participants 1 and 2. In an effort to simplify the game for non-gamers, the task of interacting with the bookshelf was removed and the top image was not given to Participants 2 and 3.

Bookshelf 01/01

You can sometimes pick up items from a container like this bookshelf. The top part of the window to the left represents items in the container. The bottom is what you are carrying. To move an item from the top to the bottom, just click on it.

Hola! I need to talk to you.

Whenever you want to check out an item that you are carrying, you can hit "i" for "inventory". From there, to examine an item, click on the eye icon on the bottom left of the inventory window and then click on the item you want to look at. Hit "i" again to close your inventory window.

GP: 48

Lost Item: Return of the Beast
 Juan: Hola! I need to talk to you.

Talk: F1 F2 F3 F4 F5 F6 F7 F8 F9 F10 F11 F12

Inventory: Michael

Whenever you want to check out an item that you are carrying, you can hit "i" for "inventory". From there, to examine an item, click on the eye icon on the bottom left of the inventory window and then click on the item you want to look at. Hit "i" again to close your inventory window.

AC: 11

GP: 48

Journal

Get an orange and a cola.

Day 01, Month 06, 1372 [14:00]

Your room at Hotel Pension is not ready, yet. Juan thinks that by the time you get something to eat and something to drink, your room might be ready. You've got a craving for an orange and a cola.

After talking to Juan and other people, your journal may have been updated. To access your journal, press "j". To read more about your goal after you have received it, click on "Get an orange and a cola."

PAUSED
UNPAUSED
 Acquired Item: Spanish-English Dictionary
 Acquired Item: Welcome to the Plaza de País!

Talk: F1 F2 F3 F4 F5 F6 F7 F8 F9 F10 F11 F12