

CATHIE: The Implementation and Evaluation of an Interview Simulation

Module for Distance Education Students

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ABSTRACT: *The Computer Agents Teaching Helping Interactions Effectively (CATHIE) training system is a distance training environment for entry-level human service professionals. A brief discussion of the theoretical motivations behind the CATHIE system design is given. Seeing an animated pedagogical agent synchronized to recorded dialog, the trainee interaction resembles a face-to-face counseling session. The training exercise is defined by a structured script where each step includes agent dialog, a set of choices, and choice feedback. To support distance training, CATHIE is a web-based application and its implementation is described in detail. Furthermore, the script structure enabled the implementation of CATHIE in a generic fashion, independent of the script content. The system tracks user responses, time to respond with learning measured by comparing the differences between pre and posttest results.*

Keywords:

Pedagogical Agents, Communication Skills, Web Based Training

1. INTRODUCTION

In this paper, a web based training system, Computer Agents Teaching Helping Interactions Effectively (CATHIE), is described. CATHIE is designed to be an interactive training environment for entry-level human service professionals. The training exercise consists of a tutorial that provides didactic knowledge followed by a pretest. After completing the pretest, the trainee completes the exercise. Once the exercise is completed, a posttest measures improvement in professional skills. In order to support a geographically dispersed population of trainees, a web-based application has been created to support the exercise.

Human service professionals (HSPs) hold jobs in a variety of settings, including homeless and domestic violence shelters, community mental health, correctional facilities, and family violence, aging, alcoholism, and drug abuse programs. While HSP services vary depending upon the employment setting and the clients, HSPs share a primary purpose: to assist individuals and communities in functioning as effectively as possible [1]. To achieve this purpose, a primary goal in training HSPs is to give them effective helping skills necessary to work with a broad variety of clients on a daily basis. Communication skills are so important for the HSP that the Council for Standards in Human Service Education (CSHSE) identifies effective communication strategies and skills as one of the 12 skill sets that entry- and mid-level human services workers use daily in their jobs [2].

A structured script defines the training scenario. The training is presented with a visual/audio agent that sets the plot for the activity. At each step, the agent presents a short visual, audio, and emotional presentation of the current state of the "client". After each speech turn, the trainee must select from a number of responses. Upon selection, the application records a score for the response and then branches to reflect the changed state of the "client" in response to the trainee's responses. In addition, the trainee receives feedback on the suitability of the response.

In order to facilitate delivery of the training content and to meet the needs of students at a distance, CATHIE is a completely web-based application. The agent is embedded in a web page using the Haptek web client. Reality in the application is achieved by using pre-recorded audio from a human rather than relying on computer generated speech. Furthermore, the Haptek web client provides the ability to set the emotional appearance of the agent. The web page communicates with a simple web based application built on Apache Jakarta. Seamless operation is ensured through communication in a hidden web frame in the source code and the web server. This avoids distractions that may result if the web pages were reloaded during the exercise. In addition to scoring for each step in the exercise, the application also records response time. A database was

designed to hold the script content, providing the opportunity to offer alternate scripts without changing the rest of the application. The application operated in several web browsers including Microsoft Internet Explorer, Firefox, and Netscape. In addition, the application supports both fast and slow Internet connections, an important consideration for trainees in rural settings.

This paper is organized into five sections including an introduction, a discussion of the theoretical motivation for the exercise, an overview of the CATHIE prototype implementation, a discussion of the results from the study, and a summary.

2. THEORETICAL MOTIVATION FOR EXERCISE AND STUDY OBJECTIVES

2.1. Learning Issue

Human service educators have long struggled with how to best educate students in the helping skills required of entry-level professionals. While teaching such skills is easier to handle in a traditional face-to-face environment, this problem has become more complex due to the emphasis on delivery of instruction in a distance learning setting. One way to solve this dilemma is through the use of pedagogical agents embedded in a web-based learning environment. Pedagogical agents, animated characters used to deliver information in multimedia instruction, have been used in many domains such as computer literacy, conceptual physics, and medical patient assessment [4-6].

The primary objective of this ongoing research has been to investigate the use of pedagogical agents to teach helping skills to human services students at a distance. The first prototype of the CATHIE system has been developed and evaluated. Findings from this implementation indicate that the environment is effectively transferring helping skills and can be used for students at a distance [3]. However, much work still remains to be done to make this environment easily accessible to students at a distance.

Project CATHIE focuses on the further development of an interactive pedagogical agent environment that affords the opportunity for a more realistic role-playing experience for students at a distance. As such, we will continue to explore the following research question: Is CATHIE an effective tool for teaching helping skills to students at a distance? To answer this question, we will be adding to and evaluating the CATHIE system to examine measurable learning outcomes and user

perceptions of the motivational qualities of the new implementation.

2.2. Learning Outcomes

Human service educators face constant challenges to provide learning experiences that assist students in developing their helping skills for use with clients. Human service programs offered through distance learning face even more difficulties as educators struggle with designing online and interactive video courses that provide opportunities for helping skills practice along with the evaluation of such skills. Techniques used in traditional classes such as role-plays, group work, and even videotapes are much more difficult to adapt for use in a distance learning setting. Add to this the challenge of large class sizes often found in distance learning, and teaching interpersonal communication skills at a distance becomes even more overwhelming. Therefore, educators may want to consider other less traditional methods to provide opportunities for their distance-learning students to learn and practice helping skills appropriate for the field. Outcomes associated with this approach include:

- An improvement of overall helping skills after using the CATHIE system
 - Assessed via pre- and posttest assessments
 - Assessed by tracking student responses during the CATHIE interaction
- Student perceptions of CATHIE
 - The correlation between improvement in helping skills and perceived motivational qualities of CATHIE

These outcomes are relevant in that a system that can teach helping skills effectively online and possesses high motivational qualities will benefit students both at a distance and as supplemental practice for students in the traditional learning environments.

2.3. Evaluation and Assessment

To assess the efficacy of CATHIE, participants interacted with the CATHIE system. Participants for this study were volunteers enrolled in HMSV 468 (Internship in Human Services) offered via TELETECHNET during the summer of 2006. Participants received extra credit after completing the interaction and posttest measures. Students were informed of the project prior to the beginning of class, and the researchers attended the first class meeting to explain the project and provide the link to the CATHIE website. Students were given two weeks to complete their participation. Pre, post and attitudinal data was collected and analyzed to answer the research questions from the previous section.

2.3.1. Measures

Both pre-test and posttest are based on the Carkhuff Helping Skills Model [7] and contain two components: a scenario followed by an open-ended response measuring Communication Skills and a scenario followed by a Discriminating Measure consisting of an effectiveness rating scale of pre-written helper statements. In the Communication Skills component, participants were asked to imagine that they have been talking to the client for approximately 15 minutes and then read the scenario that follows. They were then asked to record the exact words they would use when speaking with the client. Researchers rated these responses to provide the Communication Skills score for each participant.

The Discriminating Measure asked participants to again imagine they have been talking to a client for approximately 15 minutes and read a scenario. This time they were given a list of helping responses and rated the effectiveness of each response on a scale of 1 (very ineffective) to 5 (very effective). These responses were scored against the correct rating to provide a Discriminating Measure for each participant. As an additional measure of helping skill acquisition, the CATHIE system was designed to track student responses as they proceed through the interaction demonstrating a positive or negative trend in helping skills.

Participants also completed five survey questions assessing their perceptions of the environment. They were also asked to determine whether they thought their helping skills improved after the interaction. Six Likert-type items were used to assess motivational qualities, knowledge development, interest, helpfulness and believability on a 1 (strongly disagree) to 5 (strongly agree) scale. The five items from the attitude measure will be combined to create a single attitude measure.

2.3.2 Previous Work

Previous research [3] indicates that the interactive CATHIE system is an accessible, effective delivery mode to practice these skills and will add to the tools available for distance education. As the project is still in development, researchers are continually assessing features that might increase meaningful learning.

The research described in this paper sought to answer the question; Is the beta version of the CATHIE simulation environment an effective tool for the online practice of communication skills? To determine this, the researchers measured helping skills, perceptions of the learning environment and examined time on task as participants worked through the program.

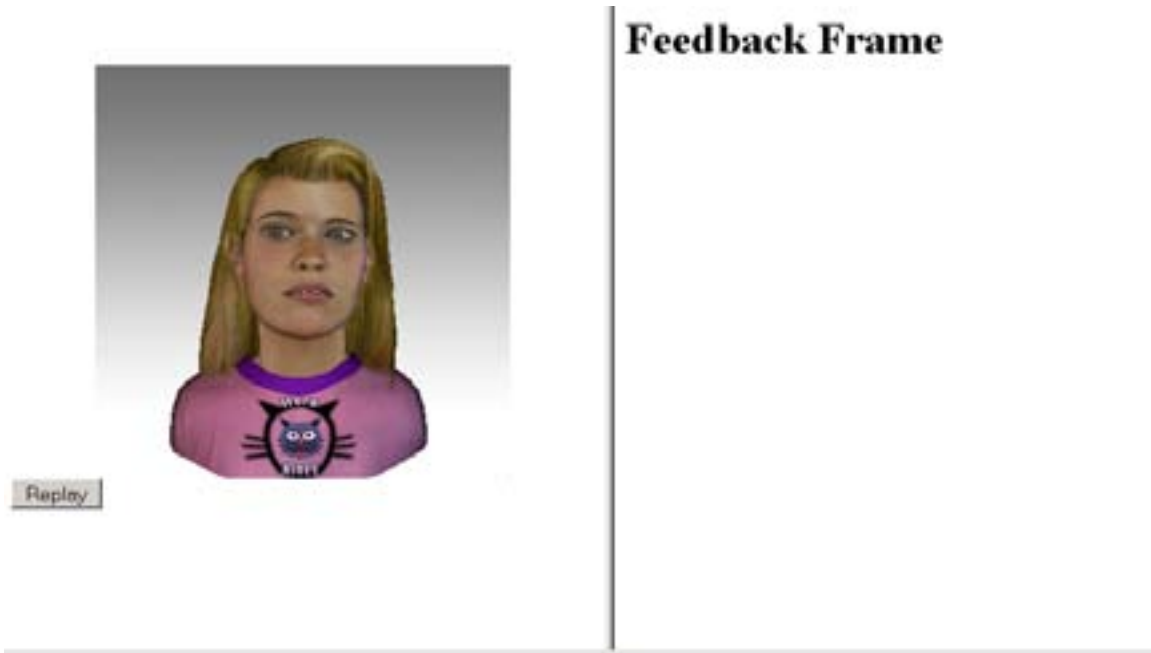
3. APPLICATION ARCHITECTURE

People expected to perform the exercise are spread across the Commonwealth of Virginia and cannot be expected to come to one location to complete the exercise. As a result, the only suitable way to deliver the exercise is with a web-based application. Participants are assumed to be able to use a web browser and can install a web plug-in when requested to do so. In addition, participants are assumed to have access to the Internet in some manner but are not expected to have access to a high-speed connection. The web page showing one step in an exercise is shown in Figure 1.

3.1. Interface Design

The design of the implementation is examined in the context of the overall exercise. Figure 2 gives the overall structure for one step in the exercise. Each step in the exercise is characterized by an emotive dialog that is produced by the agent followed by three possible responses from the trainee. Because each step in the exercise has the same structure and the exercise has no feedback, the database organization is straightforward, requiring only two tables. The User table holds user information and exercise results. Because some users may complete the exercise over slow or unreliable connections, the state of completion for the exercise is maintained with the user data record. In addition, all responses and other data associated with the responses are recorded with each user table entry. The second table holds the specific exercise. Each entry in the exercise table holds on stage of the exercise. Included with each stage includes the agent emotive dialog (in grey), choices (in white), and response feedback (in yellow callout).

Figure 3 gives the appearance and internal organization of the web page interface to the application. In order to prevent trainee bias in the exercise, the choice order is randomized and choices are not shown until the agent dialog is complete. Exercise updates and other server requests are made through a hidden frame to prevent distractions that may be caused by web page reloads. Haptek content can be bundled into a single content file that includes all audio resources. Because this file is large and may cause problems for users on slow, unreliable connections, the audio files were unbundled and provided on demand, to spread content downloads throughout the exercise. In addition, audio content for the subsequent step in the exercise is downloaded while the user is working on the current step in the exercise. Once the trainee has made a choice, those not selected are hidden and any feedback for that choice appears in the feedback frame.



- You sound upset.
- You're sad because you haven't seen your family and friends recently and you'd like to see them again.
- You sound unhappy because you don't know what to do to make things better.

Figure 1 Web Page Interface

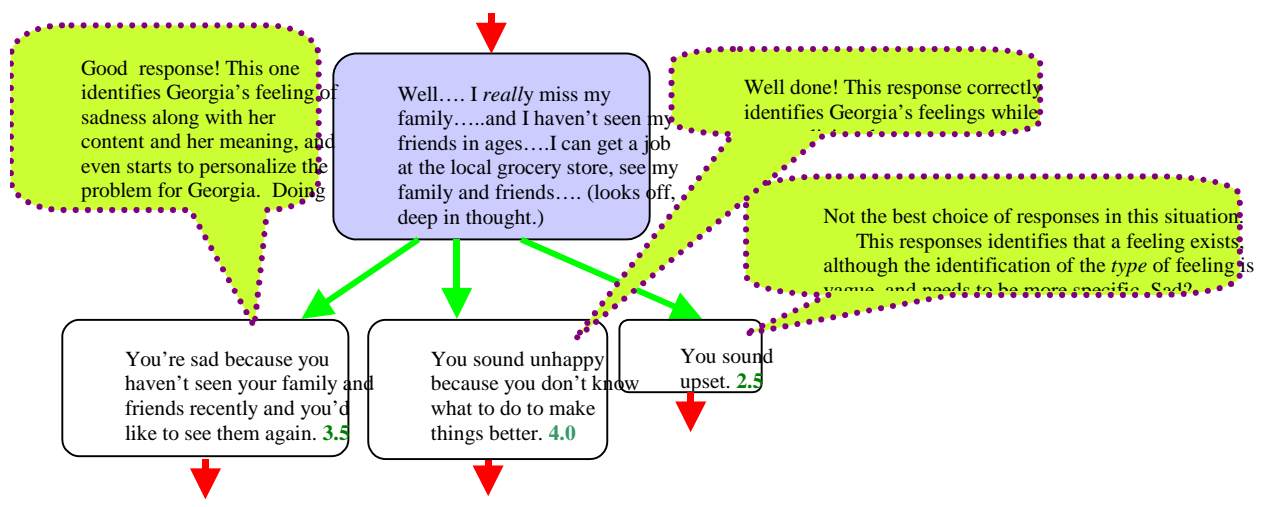


Figure 2 One Step of Exercise

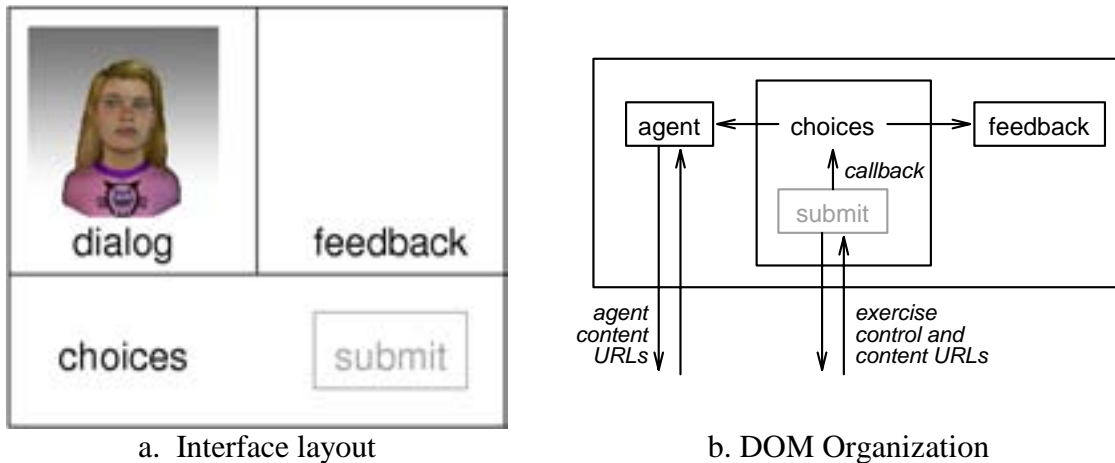


Figure 3 Interface layout and organization

In Figure 4, the flow chart for each step in the exercise is shown. Initially the agent dialog is cued and all associated audio files are loaded into the browser. Once the agent is cued, the agent dialog plays. Once the dialog play is complete, the allowable choices are displayed for the trainee. The trainee selects the desired choice by picking the choice using a radio button. Once the trainee makes the selection, the results are recorded and the unselected choices are hidden. The trainee is not permitted to go back and make a new selection. In addition, feedback, if any, is displayed immediately following the selection. The trainee can then move on to the next step when ready. If this step is the last step, the training exercise is complete. In the flowchart, interactions with the server are indicated in blue.

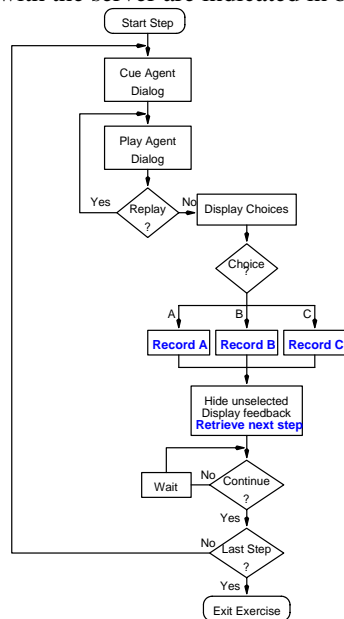


Figure 4 Step Flow Chart

3.2. Server Processing

The server is required to perform several processing tasks. The overall organization of server resources and processing are shown in Figure 5. Static content includes web pages, Hapttek content and audio content. Users request web pages in the normal way. Processing on the server side is accomplished using the four Java Servlets shown in the figure. Servlets interface with the database using the JDBC interface to the MySQL database application.

3.2.1. Access Control and Session Management

As noted, users log in with a username and password provided by the instructor. In addition, a special administrative account allows for certain administrative activities described in the next section. Username and password entered on a static web page are processed with the Login servlet allowing the user to proceed to the exercise. At the time of login, the user is either started at the beginning of the exercise, resumes at the point where the exercise was interrupted, or is not allowed to proceed because the exercise has already been completed. This information is managed using cookies in a transparent fashion.

3.2.2. Account Management and Results Retrieval

Users gain access to the application using a username and password provided by the instructor. Because this is a prototype application, accounts are added by manually adding entries to the database. Results can be retrieved either by querying the database directly or through a special administrative account. The results from the exercise are formatted in a comma-separated fashion, suitable for pasting directly into a spreadsheet.

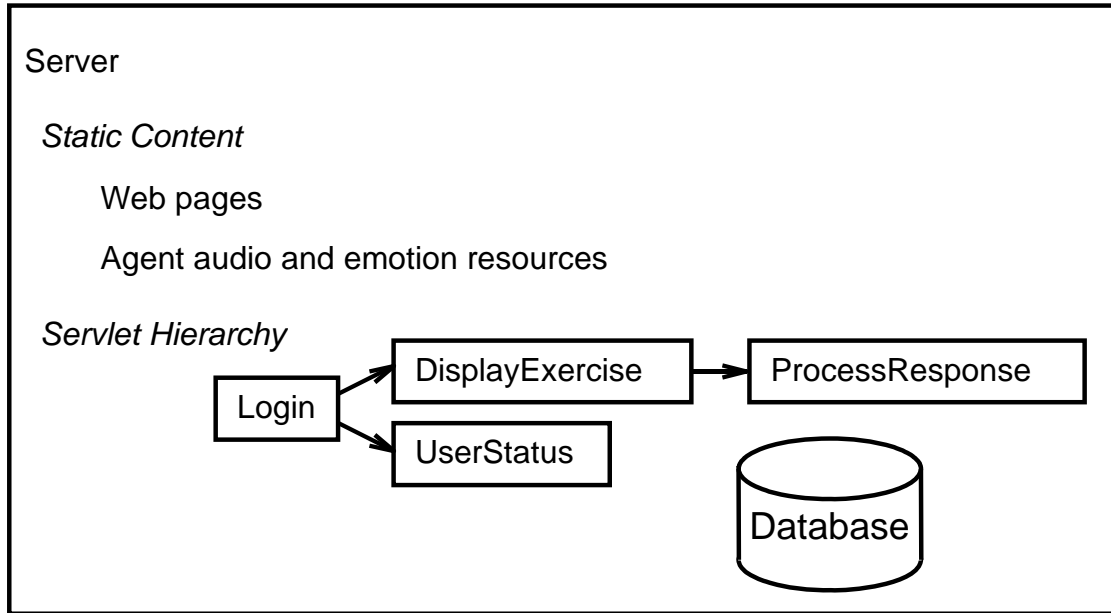


Figure 5 Server Application and Resources

3.2.3. Exercise Sequencing

The overall organization of the full exercise is shown in Figure 6. The exercise consists of sixty steps. In addition, the exercise can end in several places (light blue)

Each stage in the exercise consists of the agent dialog that is presented to the trainee along with a set of three courses of action, offered in a multiple-choice format. A score is credited with each choice and, in addition, remaining course of the exercise may be change to reflect the changed mental state of the agent. Once the choice is made, the score is recorded as well as the amount of time elapsed between the end of the agent dialog and when the choice is made. The regular structure of the exercise makes design of the database to support generic exercise formats straightforward.

4. STUDY RESULTS

In a trial run of over 90 participants, the training exercise

shows an improvement in the trainee's critical communication skills. Future work will include expanding the number of participants completing the exercise, the addition of more scripts via a database driven authoring tool, and refining the application for increased access and usability.

5. SUMMARY

Project CATHIE is currently being developed to teach helping skills to distant learning human services students. It is hoped that after completion, the CATHIE system can be adapted to implement scripts from other disciplines that require practice in communication or helping skills. The CATHIE instructional environment takes advantage of the positive aspects of pedagogical agent environments (i.e., the opportunity for a realistic interaction with a human like character) and allows learners at a distance the opportunity to practice skills in a realistic situation. Future plans include the improvements to the system as listed above, further evaluations, a wider scale implementation and the addition of more and varied scripts.

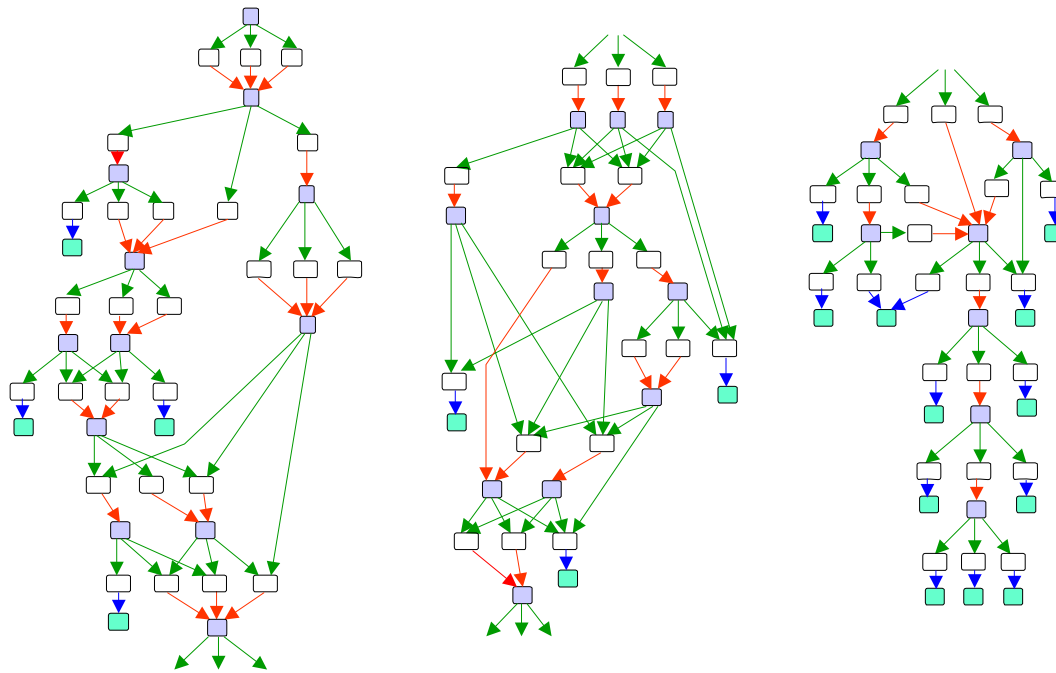


Figure 6 Exercise Structure

- [7] Carkhuff, R. R. (2000). *The art of helping in the 21st century*, 8th ed. Amherst, MA: Human Resources Development Press.

REFERENCES

- [1] National Organization for Human Services. (2006). *The human service worker*. Retrieved February 7, 2007, from <http://nationalhumanservices.org/public-resources/about-human-services>.
- [2] Council for Standards in Human Service Education. *Community support skills standards*. Retrieved February 7, 2007, from <http://www.cshse.org/community.html>
- [3] Adcock, A.B., Duggan, M., Nelson, E. & Nickel, C. (2007). Teaching Effective Helping Skills at a Distance: The Development of Project CATHIE. *Quarterly Review of Distance Education*, 7(4), 349-360.
- [4] Graesser, A., Wiemer-Hastings, K., Wiemer-Hastings, P., Kreuz, R., & Tutoring Research Group. (1999). *AutoTutor: A simulation of a human tutor*. *Journal of Cognitive Systems Research*, 1, 35-51.
- [5] Graesser, A. C., Van Lehn, K., Rose, C., Jordan, P., & Harter, D. (2001). Intelligent tutoring systems with conversational dialogue. *AI Magazine*, 22(4), 39-50.
- [6] Hubal, R. C., Frank, G. A., & Guinn, C. I. (2003, January). *Lesson learned in modeling schizophrenic and depressed responsive virtual humans for training*. Paper presented at the Intelligent User Interface Conference, Miami, FL.

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