JUST-TALK: AN APPLICATION OF RESPONSIVE VIRTUAL HUMAN TECHNOLOGY

Geoffrey Frank, Curry Guinn, and Robert Hubal
RTI International
Research Triangle Park, North Carolina
Pamela Pope and Martha Stanford
North Carolina Justice Academy
Salemburg, North Carolina
Deborah Lamm-Weisel
North Carolina State University
Raleigh, North Carolina

ABSTRACT

In this paper, we describe an application of responsive virtual humans to train law enforcement personnel in dealing with subjects that present symptoms of serious mental illness. JUST-TALK provides a computerized virtual person to interact with the student in a role-playing environment. Students were able to converse with the virtual person using spoken natural language and see and hear the virtual human s responses a combination of facial gesture, body movements, and spoken language. The JUST-TALK project, funded by the National Institute of Justice Office of Science and Technology and developed by RTI International, involved integrating virtual reality training software within a 3-day class at the North Carolina Justice Academy. The course was structured to include classroom-based lecture, videos, discussion, live human role-playing, and virtual human role-playing.

A scientific evaluation of the class and the software system was carried out by North Carolina State University. This assessment investigated the contribution of natural language interfaces and virtual reality technology to learning in this applied setting. Results of the evaluation are extremely encouraging. The vast majority of students (88 percent) found the simulation easy to use. A majority of the students said the virtual trainer enhanced their learning in the course. As a training tool, students rated the computer simulation on par with other training methods including lecture, role-play and discussion. A total of 59 percent of students felt the simulation was better for learning or comparable to role-play; 77 percent felt simulation was better than or comparable to lecture; and 59 percent felt the simulation was better than or comparable to discussion.

Biographical Sketches

Geoffrey Frank is a Principal Scientist at RTI International. He has a Ph.D. from the University of North Carolina at Chapel Hill in Computer Science. He was project leader for the JUST-TALK project, and is a principal investigator on an NSF grant on Responsive Virtual Human Technology (RVHT), leading efforts to assess the use of RVHT for training applications.
Curry Guinn is a Research Scientist at RTI International. He has a Ph.D. in Computer Science from Duke University. He has led the development of natural language processing at RTI. He is a principal investigator on an NSF grant on RVHT, leading efforts to develop tools for creating RVHT applications.
Robert Hubal is a Senior Research Engineer at RTI International. He has a Ph.D. in Cognitive Psychology from Duke University. He led an experimental evaluation for the Army National Guard of the effectiveness of a virtual maintenance trainer. He is currently the Project Leader and a principal investigator on an NSF RVHT grant.
Martha Stanford is Director of the North Carolina Justice Academy. She has an E.D. from North Carolina State University. She has over 20 years of experience in training law enforcement officers.
Pamela Pope is Instructor and Developer of the Response to Mental Illness In-Service training course at the North Carolina Justice Academy. She has over 10 years of experience in training law enforcement officers.
Deborah Lamm Weisel recently joined the Department of Political Science and Public Administration at N.C. State University as the director of police research. She previously was a senior research associate for the Police Executive Research Forum. She has conducted numerous studies on policing including decision-making in police agencies, community policing, and drug enforcement tactics.

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INTRODUCTION

The Need for Police Officer Training in Responding to the Mentally Ill

The need for training of law enforcement in managing encounters with the mentally ill is well established [Engel02]. Rising prevalence of mentally ill in communities have raised issues of liability of police in responding appropriately, based on departmental policy and training [Greenberg01]. Police responses to mentally ill persons differ from those with normed behaviors [Dupoint00]; officers must learn to verbally de-escalate situations rather than rely on forceful verbal and physical actions.

Increased access to training is necessary, as many police departments cannot afford to send personnel to training. The actual costs of training as well as the absence of the officer impose financial costs on the department.

JUST-TALK Project Goals

The overall objective of the JUST-TALK project was to research ways of using natural language processing and virtual reality technology to improve law enforcement training [Frank02]. The educational objective was to determine how best to use computer-based role-playing for law enforcement training. The technical objectives were to demonstrate that these technologies provide experiences that are realistic and engaging enough to provide valuable law enforcement training, and to implement these materials so that they could be delivered on computers accessible to the law enforcement community.

JUST-TALK SYSTEM OVERVIEW

JUST-TALK teaches students basic techniques for managing encounters with the mentally ill by having them work through a series of one-on-one scenarios with a simulated subject. It also teaches them to look for indications of particular forms of mental illness so that they can adapt their responses appropriately. Through observations of the virtual environment and a dialog with the virtual subject, the student must stabilize the situation and decide whether to release or detain the subject.

The JUST-TALK virtual environment and subject are shown in ***Figure 1***. The environment is the sidewalk in front of a hardware store, where there is a bench. There is a patrol car parked on the side street next to the hardware store. The subject is a somewhat-disheveled white male adult.

JUST-TALK has been implemented with five scenarios, all of which start in the same environment and with the same dispatch call:

- A schizophrenic who is hearing voices;
- A paranoid who is afraid of a conspiracy of the police with federal agencies;
- A normal individual who is nevertheless excited and angry because he was almost run over;
- A depressed individual bordering on suicidal because of marital and child custody problems;
- A normal individual who is depressed in trying to deal with marital and child custody problems.

A session with JUST-TALK starts with an introduction to the current scenario. The virtual environment for the scene is displayed in the scenario window. First, the student is expected to introduce himself or herself to the subject, although a novice may skip this step and start asking questions or demanding responses.

Figure 1: The JUST-TALK Virtual Environment

After the introduction, the student can then interview the subject. The interactions with the subject in this trainer are all verbal; this trainer does not teach apprehension techniques. Either the subject or the student may initiate the dialog. Sometimes the subject may be very withdrawn, so the student will have to open the conversation. Other times the subject may be very agitated and will start talking at the student from the start. The student uses the conversation to stabilize the situation, assess if the subject is anchored in reality, and determine what action is needed (i.e., leave, attempt an arrest, transport the subject to a mental health facility, or subdue the subject).

The student can stabilize the situation by talking with the subject to determine the problem and getting the subject to agree to a solution (e.g., asking the subject if he or she is taking prescription drugs, asking the patient if he or she hasn't taken a dose recently, then persuading the patient to reinitiate his or her medication, or persuading the subject to visit a mental health facility), talking with the subject and acknowledging that the subject's delusions are real to the subject, offering to help, but not agreeing with the delusions. The student can destabilize the situation by using inflammatory language or by challenging delusional or hallucinatory statements. The system also monitors the student's language. Authoritative, commanding language can actually escalate the intensity of the interaction, particularly with subject's who are paranoid, distrustful, or afraid. Language that is more conciliatory, such as expressions of understanding, or requests rather than commands, can result in reduced tension. The student can assess if a subject is delusional by asking the subject about his or her mental illness history, listening for delusional or hallucinatory statements, seeing if the subject can respond rationally to questions about the problem and the subject's physical status. Students should also make note of physical gestures such as head movements, eye movements, and other body language. Often, a subject who is hearing voices and other sounds will display distinct physical manifestations; also, some anti-psychotic medications have side effects that are visible (such as tardive dyskinesia).

The student can at any point decide upon a course of action. For voluntary actions by the subject, the student should get a verbal acknowledgement before proceeding. During the dialog, the student should be listening for clues from the subject that would indicate that a crime has been committed.

USE OF RESPONSIVE VIRTUAL HUMAN TECHNOLOGY IN JUST-TALK

The JUST-TALK virtual subject maintains an emotional state that is driven by the verbal inputs of the student, by the nature of the mental illness, if any, and by initial conditions. The emotional state consists of graded levels across a range of several emotions including anger, fear, depression, and confusion. The virtual subject responds both vocally and with gestures and body movement to student verbal inputs. If the student is threatening, commanding, or insulting, then the virtual subject s fear and/or anger will increase. If the student allows the situation to continue to escalate, the virtual subject will run away from the student, threaten the student, or enter a catatonic state--the three negative outcomes of the training. If the student is polite, personal, and understanding, then the subject s fear and/or anger will decrease, and the subject will become more cooperative. As the subject becomes more cooperative, he will sit down on the bench and ultimately get in the police car if so requested by the officer. If the student determines that the subject should be in custody, or during the interaction they agree that the police officer will take the subject to get some help, the student should persuade the subject to get in the patrol car--a successful outcome. If the officer determines that the subject is not a threat to himself or the community, then releasing the subject is another successful outcome.

USE OF VIRTUAL REALITY IN JUST-TALK

JUST-TALK uses a collection of gestures to provide cues to the user about the emotional state. These gestures are divided into four groups:

- **Lower body:** These gestures include standing, sitting, walking, and running away.
- **Torso:** These gestures include upright, bent over, and rocking.
- **Arms and hands:** These gestures include pointing, shaking a fist, arms at sides, hands clasped, and hands braced.
- **Head:** These gestures include looking straight ahead, looking at the student, nodding, and shaking the head.
- **Facial expressions:** These gestures have been developed for specific emotions.

Gestural cues from groups are independent to the extent that they don t overlap. An intelligent reasoning routine manages execution of the animations showing these gestures.

USE OF NATURAL LANGUAGE PROCESSING IN JUST-TALK

Each of the student s verbal inputs are analyzed and allocated to one of the following categories:

- Commands
- Queries
- Requests
- Informative statements
- Statements of appreciation
- Statements of understanding
- Threats
- Insults and/or use of profanity

The results of this analysis are used to adjust the virtual subject s emotional state. The results are also tracked and used in the After Action Review, as shown in ***Figure 2***.

The virtual subject s verbal responses are based on a psychological model of interactions developed by Dr. Randy Dupont at the University of Tennessee, Memphis as an aid in developing role-playing scenarios for training police about interacting with the mentally ill [Dupont97]. This model includes five different types of responses: Challenging, questioning, denying, getting confused, and responding to the officer s request or query. The virtual subject software chooses which type of response based on the current emotional state.

JUST-TALK EVALUATION

JUST-TALK was integrated into a class titled Managing Encounters with the Mentally Ill held on the campus of the North Carolina Justice Academy (NCJA) [Pope02]. An evaluation of JUST-TALK was developed and carried out by N.C. State University [Weisel02]. The evaluation used a sample of in-service law enforcement personnel who attended the three-day class.

Evaluation Goals and Design

The evaluation sought to evaluate the

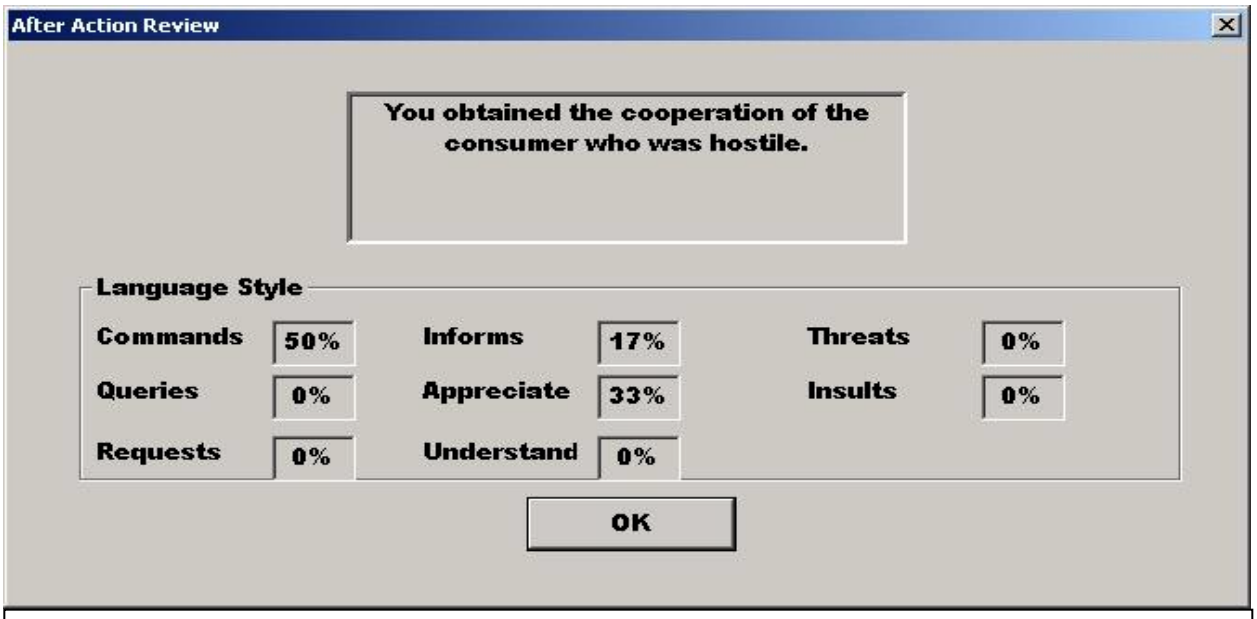

Figure 2: The JUST-TALK After Action Review Screen

computer simulation independent of the instructor, the material being covered, and other training aids including videos, role play and guest speakers. The primary objective of the evaluation was to assess reactions such as perceived utility, ease of use, comfort and learning enhancement associated with the virtual trainer. The evaluation sought to determine how these key variables were affected by constructs such as length of service, gender, and experience.

The training course was designed with multiple methods of delivery consistent with principles of adult learning. This design feature increased the difficulty in isolating the contribution of JUST-TALK as a training tool. No measure on its own would provide an adequate evaluative measure of JUST-TALK. Thus, several measures including qualitative and quantitative methods were used to evaluate the computer simulation. These measures included the following:

- Written pre-test and post-test instruments measuring the student s knowledge of mental illness;
- Course and instructor evaluation, the standard NCJA course evaluation consisting of open-ended questions;
- In-class observation throughout the training course;
- Post-test written questionnaire measuring reactions to the virtual trainer and documenting key evaluation constructs; and,
- Discussion group with students and instructor, providing qualitative feedback on the simulation.

Students in the Sample

The class consisted of 17 sworn law enforcement students represented campus police, sheriff s and municipal law enforcement, the state s Division of Motor Vehicle enforcement, and law enforcement agencies of mental health medical centers. The class also included two students who were police recruit instructors from a community college. The class consisted of four women and 13 men; three African Americans and 14 Caucasians. Four students had 10 years or less experience in law enforcement, while 10 reported more than 10 years of experience including four students with more than 20 years of experience. The students were a class which are highly experienced: 27 percent of students had 10 years or less experience, while the remainder of respondents reported 11 or more years of experience in law enforcement. Similarly, 10 of the students reported being more than 40 years old.

Evaluation Results

Performance on the pre-test administered by the instructor suggested that students entered the class with relatively low levels of knowledge about the subject matter. The pre-test consisted of 20 objective questions, both multiple choice and true-false, about characteristics of persons with mental illness,

behaviors and treatment.

Among the 17 students, a mean pre-test score of 56 was measured, with individual test scores ranging from a low of 20 to a high of 75. A minimum score of 70 is required by NCJA in order to pass the class. In contrast to the pre-test, post-test scores (consisting of the same set of questions) ranged from 80 to 100, with a mean post-test score of 95.

The vast majority of students (88 percent) found the simulation easy to use. A majority of the students said the virtual trainer enhanced their learning in the course. As a training tool, students rated the computer simulation on par with other training methods including lecture, role-play and discussion. A total of 59 percent of students felt the simulation was better for learning or comparable to role-play; 77 percent felt simulation was better than or comparable to lecture; and 59 percent felt the simulation was better than or comparable to discussion.

In reviewing course evaluations, students recommended course modifications which related more to process rather than content. A total of four respondents (of 15) recommended that additional time be allocated for interaction with the computer once technical difficulties have been addressed.

Specific recommendations from students regarding the computer simulation included:

- Make the computer program more realistic.
- Modify computer simulation appearance so that it is less game-like.
- Expand subject dialogue in simulation.

Students strongly supported continued development of the technology, citing its utility for a wide variety of police departments which have resource constraints. The simulation exercises would be particularly useful when officers cannot attend training because of shifts. Students noted that new officers have much better computer skills and could use the simulation either at home at night or come into the station and work in small chunks of time.

Students acknowledged that computer simulations will always have limitations. For example, in a simulation exercise, students are seated and speaking in a normal tone of voice into a microphone. This experience is somewhat artificial in that their gestures, tone and loudness of voice, word choice, and body movements cannot yet be incorporated into the interaction.

Students pointed out that no training tool will ever replace interpersonal experience built up over time, but advocate the use of simulations as practice. Such a training experience will not tend to make students over-confident, but will prepare them for the interpersonal experiences with individuals they will encounter on the job.

CONCLUSIONS

There is a need for training police about interactions with the mentally ill. This training can reduce injuries to both police and subjects. The need for this training is increasing as the mentally ill are returned to local communities, where frequently police are the first public servants interacting with the mentally ill. Even though the need for this training is moving into smaller communities, the police departments and sheriff s offices in those communities have very limited resources to support the needed training.

The best forms of training involve combinations of case studies, discussion groups, and role-playing. Role-playing, in particular, is both an effective training method and an expensive method, typically requiring more than one instructor/actor per student during the interactions. This sophisticated form of training is not easily accessible for small departments. Technology assisted training shows great potential for bridging this training gap [Hubal01].

The training course at the NCJA demonstrated the potential of the prototype JUST-TALK system to provide students with additional role-playing experience. JUST-TALK can be employed on multi-purpose personal computers, including portable notebook computers, and thus this kind of training can be taken to the officers in the field, rather than requiring them to come to regional training centers for multi-day resident training courses.

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