

Chapter 11

Embodied Conversational Virtual Patients

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ABSTRACT

Recent research has established the potential for computer generated virtual characters to act as virtual patients (VP) for the assessment and training of novice clinicians in interpersonal skills, interviewing, and diagnosis. These VPs are embodied interactive conversational agents who are designed to simulate a particular clinical presentation of a patient's illness with a high degree of consistency and realism. In this chapter we describe the architecture developed for virtual patients, and the application of the system to subject testing with virtual patients that exhibit a set of clinical conditions called Post Traumatic Stress Disorder (PTSD). The primary goal of these conversational agents was evaluative: can a VP generate responses that elicit user questions relevant for PTSD categorization? The results of the interactions of clinical students with the VP will be discussed. This chapter also highlights a set of design goals for increasing the visual, physical and cognitive realism when building VP systems including the design of the language, scenarios and artwork that is important when developing these characters. Finally, future research directions and challenges will be discussed for conversational virtual patients.

1. INTRODUCTION

The development of the Eliza program by Joseph Weizenbaum (1966) which was capable of engaging humans in a natural conversation and simulated a Carl Rogers empathic psychologist was one of the first conversational agents with a medical

theme. Although simple in design and driven by a script called DOCTOR that performed keyword matching and replacement, it was a very powerful mechanism that tricked some people into thinking they were talking to a real psychoanalyst. Today these kinds of conversational programs are more complex with fully embodied characters that exhibit facial expressions, gestures, animation and

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speech. However one of the more challenging aspects that still remain is the conversational dialog.

A general model for conversational agents should account for the intentional and non-intentional aspects of verbal and nonverbal communication as well as the contextually grounded natural biologically based aspects of conversation (Buck, 1994). A further refinement of this understanding may view conversation as something that occurs whenever one agent's (i.e. sender's) behavior influences the behavior of another agent (i.e., receiver).

Our work includes a general theoretical commitment to understanding virtual human conversation as a feedback process, in which interpretation of verbal and nonverbal data (i.e., message reception and production) alone, although potentially useful, are deficient. To make up for the incompleteness of limiting virtual human conversation and to provide more situational context to these two criteria we add psychophysiological information (e.g. heart rate) from the user into the conversational processing as we believe it reflects the conversation found in human agents.

While a full elucidation of this interactionist theory is beyond the scope of this chapter (Buck, 1984, 1989, 1994) we do mention it as the theoretical underpinning of much of what we are trying to do in our work toward an integrated view of virtual and human conversation. Further, our data analytic approach to understanding the utility of virtual human conversation requires that the assessment of the communicative efficacy of the conversational agent's behavior involves the extent to which it reduces uncertainty in the behavior of another (Wilson, 1979). Herein we discuss the development of our virtual patients (VP) and the general assessments that we make when assessing the virtual and human conversation. For our work this involves the integration of verbal communication, nonverbal communication, and contextual factors (e.g., psychophysiological data).

This chapter provides an examination into applying embodied conversational virtual patients for medical simulation and training. These VP's are interactive characters designed to simulate a particular clinical presentation of a patient with a medical illness with a high degree of consistency and realism. This chapter describes the virtual patient architecture used for research and evaluation, the subject testing conducted with VP's that exhibit a clinical condition of Conduct Disorder, Post Traumatic Stress Disorder (PTSD) or assessing racial bias. The development of the characters and dialog for the scenarios will also be addressed. The primary goal of the subject testing was evaluative: can a VP generate responses that elicit user questions relevant for PTSD categorization? The results of the interactions of clinical students with the virtual patient will be discussed along with areas of further research.

2. NEED FOR CLINICIAN TRAINING IN CONVERSATION SKILLS

Developing good conversational skills is essential for clinicians to establish good doctor patient relationships. Many undergraduate and postgraduate medical education and training programs have begun to place greater emphasis on the importance of high-quality conversation skills (ACGME; 2007). Traditional approaches to training clinicians in the conversation skills needed for assessment, diagnosis, and interview performance rely upon a combination of classroom learning and role-playing with human standardized patients.

The importance of conversation is reflected in recent requirements for communication evaluation in medical schools. The Accreditation Council for Graduate Medical Education (ACGME; 2007) has emphasized the importance of interpersonal and communication skills in training clinicians. Residents are expected to: 1) create and sustain a therapeutic and ethically sound relationship with the patient; 2) use effective listening skills, eliciting

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