

## Panel on “Artificial Agents for Psychotherapy”

**Eva Hudlicka<sup>1</sup>, Christine Lisetti<sup>2</sup>, Diane Hodge<sup>3</sup>, Ana Paiva<sup>4</sup>, Albert Rizzo<sup>5</sup>, Eric Wagner**

<sup>1</sup>Psychometrix Associates, Inc.  
Blacksburg, VA , US  
[hudlicka@ieee.org](mailto:hudlicka@ieee.org)

<sup>2</sup>School of Computing and Information Sciences  
Florida International University  
Miami, FL, US  
[lisetti@cis.fiu.edu](mailto:lisetti@cis.fiu.edu)

<sup>3</sup>School of Social Work  
Radford University  
Radford, VA, US  
[dmhodge@radford.edu](mailto:dmhodge@radford.edu)

<sup>4</sup> INESC-ID  
Instituto Superior Técnico  
Porto Salvo, Portugal  
[ana.paiva@inesc-id.pt](mailto:ana.paiva@inesc-id.pt)

<sup>5</sup>Institute for Creative Technologies  
Dept. of Psychiatry and School of Gerontology  
University of Southern California,  
Marina del Rey, CA, US  
[arizzo@usc.edu](mailto:arizzo@usc.edu)

<sup>6</sup>School of Social Work  
Florida International University  
Miami, FL, US  
[wagnere@fiu.edu](mailto:wagnere@fiu.edu)

### Introduction

Computer-assisted psychotherapy represents a major new development in clinical practice and is expected to play an increasingly important role over the next 10 years. Use of computers in therapy ranges from relatively simple communication-support tools, to the use of complex simulations and synthetic agents in virtual reality environments. At the simpler end of this spectrum, computer-mediated communication (CMC) has already entered clinical practice, in the form of internet communication, email and video-conferencing. While clearly important, these technologies are not as potentially revolutionary as the use of synthetic agents and simulated virtual environments. It is these more sophisticated computer technologies that are the primary focus of this panel.

The success of existing virtual environments to treat phobias and post-traumatic stress disorders (PTSD) suggests further exploration of these technologies. Specifically, the augmentation of existing virtual environments with virtual synthetic agents, capable of playing a variety of roles, such as social therapeutic companions for supportive therapies, participants in interactive models of internal dramas or conflicts for psychodynamic therapies, coaches and ‘practice partners’ for cognitive-behavioral therapies, and virtual ‘stand-ins’

in virtual reality group of family systems therapies.

The creation of artificial agents for use in psychotherapeutic interventions will require contributions from a broad range of disciplines, including: psychology (emotion, personality, belief and behavioral change), clinical psychology and social work (psychodynamic, cognitive-behavioral, family systems, and eclectic therapies), and computer science (artificial intelligence, intelligent user interfaces, virtual environments, embodied conversational characters, interactive narratives, computer persuasion).

This panel will focus on interdisciplinary discussion among panelists specialized in several of these sub-disciplines. The panel will focus specifically on questions to help advance the use of computer technologies for therapeutic simulation and companionship (vs. the simpler issues in CMC-assisted psychotherapy) such as:

- Are there specific types of therapeutic approaches and diagnostic categories that would particularly benefit from the use of agent technologies?
- Are there therapeutic approaches, or diagnostic categories, for which agent technologies are inappropriate or contraindicated?
- What are the best means of integrating synthetic agents into the therapeutic practice, and how does this vary depending on the therapeutic modality and diagnosis?
- What are the main features and functionalities required for agent-augmented psychotherapy?

- To what extent does the current state-of-the-art in embodied conversational agents (ECA's) and social dialogue support the development of these functionalities? What new developments are required to achieve the necessary degree of realism and believability?
- What essential aspect of embodiment would need to be incorporated in such ECA (empathy, non-verbal behaviors, personality traits, ethnicity, social dialogue)?
- What would be the expected impact of using embodied conversational agents as the interface for computer-assisted psychotherapeutic systems, compared to an interface without an ECA.
- Which advances in cognitive and affective models, and agent architectures, can be exploited for the construction of the therapeutic agents and what additional advances need to be achieved?
- How can the recent progress in interactive narrative research be used to help this endeavor?
- What are the ethical questions that need to be addressed by researchers and practitioners?
- What are the pragmatic and cultural issues that must be addressed to facilitate the integration of synthetic agents into existing clinical practice?

### Panelists Position Statements

**Diane Hodge:** As a social work educator who uses technology to teach practice skills, I am very interested in the possibilities for computer-assisted psychotherapy. For years, the field of social work has struggled with even the most modest attempts to use technology for both teaching social work practice, and doing social work practice. Skeptics within the field still debate the use of even modest communication-support tools, particularly in relation to the National Association of Social Worker's (NASW) Code of Ethics for social work practice. In fact, the concerns led the NASW and the Association of Social Work Boards (ASWB) to issue "Standards for Technology and Social Work Practice" guidelines in 2005.

Most social work practitioners also maintain a strong belief in the inherent benefits of person-to-person relationships, making it very difficult to imagine the uses for synthetic virtual agents and simulated virtual environments. Moreover, the discipline has become more

focused on the use of evidence-based practice, for which there is little literature on the use of more sophisticated technology in practice.

Thus, the questions that come out of the social work discipline in regards to use of synthetic agents and virtual environments reflect social work's inexperience: Which approaches and diagnostic categories lend themselves to these agents and environments? Which populations would benefit from these agents and how will we be able to address diversity? How would the personal relationship cues, body language, and cultural cues be given using these agents? How would the codes and guidelines for practice shape the use of these agents? How and who will provide the training of social workers to use these agents? And on a practical level, who would be responsible for the training, costs, insurance reimbursement, recognition by licensing boards, etc. of these agents?

I personally believe that the tremendous potential and rapid development of these agents will continue despite the social work profession's hesitancy to consider and incorporate their potential use. I believe it is more fruitful to be on the "front-line" of the development and dialogue of the possibilities than to wait on the "side-lines" to see what may or may not become an integral part of practice.

**Eva Hudlicka:** Existing virtual environments for psychotherapy show great promise, particularly in the cognitive-behavioral approaches to the treatment of phobias. Yet the full potential of these environments has barely been tapped. When coupled with synthetic agents, and affective computing technologies, virtual environments hold the promise of revolutionizing psychotherapy: not by replacing clinicians, but by augmenting the typical once-a-week therapy session with daily exposures to environments and situations targeted to address specific symptoms.

Affective computing technologies and methods represent a core critical component of these synthetic agents-augmented virtual environments. All three of the core areas of affective computing (Hudlicka, 2003) are relevant: *emotion recognition*, *affective modeling*, and *affective expressions by agents*. *Emotion recognition* is critical in accurately assessing the client's reactions to a particular person, event or situation, whether actual, recalled or imagined, and emotion recognition methods by machines are beginning to reach human levels of accuracy, when conducted in constrained settings. *Emotion expression* by synthetic agents is important in enhancing the sense of believability and presence necessary for the type of affective engagement that is a critical component of effective psychotherapy. Less visible, but equally critical, is *affective computational modeling*. This includes: (1) the ability of the agents to dynamically generate emotions in response to the evolving situations in the virtual environment, and, more importantly, to the behavior of the client; (2) the ability of the agents' emotions to influence their behavior, as emotions and personality traits influence

human behavior, and thereby enhance their realism; and (3) the ability of the therapeutic system to maintain a dynamic model of the client that includes both the cognitive and the affective components.

I believe that it is the affective modeling component of agent technologies and user modeling that will have the greatest impact on agent-augmented therapies of the future. Not only can these affective, and cognitive-affective models, contribute to more realistic agents, and client models, but they can also be used to advance our understanding of the etiology and treatment of a variety of affective and cognitive-affective disorders. By enabling the modeling of the mechanisms of cognitive-affective interactions that play central role in these disorders, and in their treatments, these models hold the promise of developing more accurate assessments of individual disorders, and correspondingly targeted treatment approaches.

**Christine Lisetti:** Whereas the most obvious applications of virtual reality and simulated environments are in the treatment of phobias, it is becoming increasingly possible to apply some of the latest progress in HCI and AI to the development of engaging therapeutic computerized devices to help people with a variety of mental health problems. Multiple reviews of the use of computers in psychotherapy, found that indeed computers can present questions to patients in a flexible way, that patients find the interaction acceptable, and more interestingly that patients are often willing to reveal personal information to the computer during an initial interview, than to a clinician. It was predicted that advances in the use of computers in psychotherapy will depend upon making explicit the strategies of interaction involved as well as on the capacity of computers to adequately interpret natural language inputs.

Because of their anthropomorphic form and their potential functionalities – from expressive abilities to dialog functional possibilities – we are particularly currently interested in studying the potential of Embodied Conversational Agents (ECAs) for psycho-therapeutic interventions. We will discuss how ECAs software-based could be integrated as part of the interface for personal coaching social companion systems for people with mental and/or social problems, such as phobias, addiction, and other unhealthy patterns of behavior. People of all sorts can benefit, and devices carrying the support can be accessed through typical Personal Computer (PCs) or installed on personal digital assistants (PDAs) as well as mobile devices, already studied as powerful platforms for therapy. These artificial ECAs could also be coupled with affective sensing to enhance their empathetic responses and improve on the engagement of their users with the companion.

**Ana Paiva:** Can we build emotional synthetic agents that are used for personal and social education? Personal and social education (PSE) (or more recently as Personal,

Social and Health Education - PSHE in the UK) covers topics such as education against bullying and racism, on drugs, including smoking and alcohol, and sex education. These topics are addressed in many forms in the European curricula, in particular with the inclusion of specific targeted activities that, in a horizontal way, are developed across different disciplines. A common thread in these topics is that they involve emotions and change in attitudes which are at least as important to producing desired rather than undesired behaviour. One system that was developed to address this type of education is FearNot!, which aims at helping children victims of bullying on how to cope with the problem. FearNot!, uses synthetic emotional characters and role playing, developed as a set of bullying situations, which emerge from the actions and interactions between synthetic characters in a 3D virtual world.

The system was designed to evoke affective responses by the users, and the use of an emotional architecture has allowed for the creation of rich enough behaviour that indeed allows for empathic responses by the children. The results of evaluating FearNot! in schools in the UK and Germany show that the use of emotional agents had a great impact in the believability of the characters in FearNot! and thus in achieving the emotional response we aimed at.

**Albert Rizzo:** Virtual Reality (VR) is rapidly evolving into a pragmatically usable technology for mental health applications. As the underlying enabling technologies continue to evolve and enable the design of effective “structural” clinical virtual environments (VE), the next important challenge involves “populating” these environments with virtual representations of humans. The technology for creating virtual humans (VHs) has evolved from simple background characters to agents that can serve a functional interactional role. This will be vital to create mental health training tools that leverage the use of VHs for applications requiring human-human interaction and communication, and opens up possibilities for clinical applications that address interviewing skills, diagnostic assessment and therapy training.

One effort in this area that produced virtual patients for medical examination training is (Johnsen et al., 2005). Instead of exclusively relying on the costly and labor intensive approach of hiring professional “standardized” patients for novice medical students to practice on, they constructed a VE to represent an examination room where a virtual patient could be interviewed verbally using *Dragon Naturally Speaking*. The goal in this application was to determine, via clinical interview, whether the virtual patient’s ailment was due to appendicitis.

VHs must integrate three broad influences on their behavior, they must: perceive and act in a 3D virtual world, engage in face-to-face spoken dialogues with people and other virtual humans in such worlds, and exhibit human-like emotions. Classic work on virtual

humans in the computer graphics community focused on perception and action in 3D worlds, but largely ignored dialogue and emotions.

Building on prior work in the areas of embodied conversational agents, animated pedagogical agents, and interactive agents used for leadership training, the USC Institute for Creative Technologies has been conducting similar virtual human research to construct a natural language-capable virtual human agent, “Justin”, to act as a virtual therapy patient for training novice clinicians the art of clinical interviewing with a resistant client.

Justin portrays a 16-year old male with a conduct disorder who is being forced to participate in therapy by his family. The system uses a sophisticated natural language interface that allows novice clinicians to practice asking interview questions in an effort to create a positive therapeutic alliance with this very challenging virtual client.



**Figure 1: Images of Virtual Patient “Justin” and “Justina” From Initial Test Prototypes**

We are currently creating another virtual agent, “Justina”, who represents a female sexual assault victim. The aim of this work is two fold: 1. Explore the potential of this

system for use as a clinical interview trainer for promoting sensitive and effective clinical interviewing skills in clinicians in training; and 2. By manipulating the dialog content in multiple versions of “Justina” we are testing whether novice clinicians ask the appropriate questions needed to determine if Justina reports symptoms that meet the criteria for the DSM-based diagnosis of Posttraumatic Stress Disorder. If this exploratory pilot work shows promise we intend to expand the work to address our long term vision—that of creating a comprehensive DSM diagnostic trainer having virtual humans that are modeled after each diagnostic category. A variant of this system is also intended for medical interview skill training and this option is being explored during the current prototype R&D.

**Eric Wagner:** “Expert systems” are receiving increasing attention as brief, feasible, low demand but high impact interventions for a wide array of health and mental health behaviors (Prochaska et al., 2005; 2007). Instead of relying on expert clinicians, counselors, or teachers, expert systems involve interactive computer programs that conduct psychological or health assessment and provide intervention in the form of an individualized feedback report. One advantage of the expert system approach is reliability; unlike human guidance, there are no variations in the quality of the expert system guidance provided from session to session or client to client. A second advantage of the expert system approach is its reach; it can be delivered in schools, homes, worksites, clinical settings, or on the internet. A final advantage of the expert system approach is its ability to tailor feedback to the unique presenting concerns and characteristics of individual clients. Developing expert systems requires collaboration among behavior science experts, computer experts, and curriculum and content experts. Software must be sufficiently sophisticated to link assessments of key behavioral constructs (e.g., marijuana consumption in the past month) to relevant databases (e.g., average rates of marijuana consumption for same age, same gender peers; previous reports of marijuana consumption by the same client) in order to provide personalized and ipsative feedback. At present, there is considerable evidence that expert system approaches can be successful in modifying health and mental health behaviors (Prochaska et al., 2005, 2007), and considerable interest in enhancing expert systems through the incorporation of social companion systems or avatars. For some contexts and for some applications (e.g., substance abuse intervention among adolescents), introducing avatars to complement human interventions may have a strong positive impact on users. My presentation will focus on the challenges of incorporating avatars into health and mental health expert systems interventions, from the overlapping perspectives of behavioral scientist, clinician, and client consumer.

## Summary and Conclusions

We have outlined a number of questions that should be addressed as we explore the emerging research and practice area of agent-augmented virtual environments for psychotherapy. The questions addressed theoretical, technological and ‘cultural’ challenges, the latter referring to issues of acceptance of these technologies by the clinical community.

The panelists’ statements discussed progress toward some of these goals. The panelists also discussed a broad range of issues that need be explored, to establish both the development guidelines for synthetic therapeutic agents, and the evaluation and validation criteria for their effectiveness.

We should emphasize that we are not suggesting that synthetic agents should replace experienced clinicians. However, existing research indicates that humans can, and do, establish affective relationships with agents (e.g., Brave & Nass, 2003), and it is on this premise that the potential of these technologies in psychotherapy should continue to be explored.

## References

- Brave, S., Nass, C., (2003). Emotion in human–computer interaction. In *The Human–Computer Interaction Handbook*, Jacko, J., Sears, A. (Eds.). Mahwah, NJ: LEA.
- Hudlicka, E. (2003). To feel or not to feel: The role of affect in human-computer interaction. *International Journal of Human-Computer Studies*, 59(1-2), 1-32.
- Johnsen, K., Dickerson, R., Raij, A., Lok, B., Jackson, J., Shin, M., Hernandez, J., Stevens, A., & Lind, D.S. (2005). Experiences in Using Immersive Virtual Characters to Educate Medical Communication Skills In *Proceedings of the 2005 IEEE Conference 2005 on Virtual Reality*, 179 – 186.
- Prochaska, J.O., Velicer, W.F., Redding, C., Rossi, J.S., Goldstein, M., DePue, Geoffrey, J., Greene, W. , Rossi, S.R., Sun, X., L. Fava, J.L., Laforge, R., Rakowski, W. & Plummer, B.A. (2005). Stage-based expert systems to guide a population of primary care patients to quit smoking, eat healthier, prevent skin cancer, and receive regular mammograms. *Preventive Medicine*, 41, 406-416.
- Prochaska, J.O., Evers, K.E., Prochaska, J.M., Van Marter, D., Johnson, J.L. (2007). Efficacy and Effectiveness Trials: Examples from Smoking Cessation and Bullying