SAMHT — Suicidal Avatars for Mental Health Training

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Abstract

Psychosocial assessments and treatments are effective for a range of psychological problems. One particular area of concern is youth suicide. This paper reports on the SAMHT intelligent tutoring system, which provides youth suicide risk assessment training. SAMHT's interactive avatar interface is based on an intelligent backend, and provides a believable interaction that is effective for training mental health professionals.

Introduction

Many empirical studies have documented the effectiveness of specific psychosocial assessments and treatments for a range of psychological problems. However, these Evidence-Based Practices (EBPs) are rarely used in community settings, where they can help the most clients. One particular area of concern is suicide risk assessment training. Although empirically informed risk assessment protocols exist, only 50% of psychologists report receiving formal training in risk assessment by the time they begin a clinical internship (Dexter-Mazza and Freeman 2003).

One obstacle to the widespread use of EBPs is training therapists in ways that are engaging, cost-effective, and improve skills. Brief, affordable trainings (e.g., 2-day workshops) can increase therapist knowledge, but rarely result in durable improved skills. Intensive live trainings offer abundant opportunities for practice and feedback, but face several practical constraints (Herschell et al. 2010). A promising solution to these challenges is the use of standardized virtual patients (VPs) embedded in an Intelligent Tutoring System (ITS). VPs have been associated with positive outcomes in medical training, including improved skills with live patients (Cook and Triola 2009). However, VPs have rarely been used in mental health training. VPs allow safe behavioral rehearsal of skills with high risk "clients", and ITS features can track individual competence to provide targeted training experiences with feedback that supports learning. Two examples of existing VP systems are (Stevens et al. 2006) and (Kenny and Parsons 2011).

This paper reports on the SAMHT intelligent tutoring system, which provides youth suicide risk assessment training. The system is based on an interactive avatar interface with an intelligent backend that provides parameterized avatar personae. SAMHT provides a believable interaction that is effective for training mental health professionals.

The Avatar Interface

A trainee interacts with SAMHT through a web browser. A conversation is initiated by selecting an avatar. Each avatar has a face and voice, and a persona based on over 60 personality and life-experience parameters, such as family relationships, prior suicide attempts, drug use, etc. Figure 1 shows the interface seen by a trainee after a conversation has been started. The *avatar pane* on the left shows the animated life-like avatar that moves as a whole, has eyes that move as if tracking, and whose lips move when speaking. The main component of the *interaction pane* on the right is the list of questions that can be asked. The questions are in the boxes in the top part of the interaction pane. The question boxes are tagged and color coded according to their domains: Rapport, Ideation, Capability, Plans, Stressors, Connections, and Repair. (The next section explains the origins of these domains.) The tags and colors allow the trainee to quickly identify questions in each of the domains. The control buttons in the interaction pane provide options to show questions in only a selected domain, to change the sort order of the questions, to undo an interaction, and to replay what the avatar has just said.

A trainee converses with the avatar by selecting a question, which is spoken back by a disembodied voice (as if the trainee were asking the question). The question is sent to an intelligence server (described in the next section) that provides an appropriate answer based on the persona of the avatar. Alternative answers with the same underlying meaning are available for many questions, so that multiple conversations with a selected avatar are randomly different. The answer is processed by a graphics/speech server, and rendered in the avatar as speech with corresponding movement. After each exchange the list of questions is updated, removing the question just asked and adding new questions that have become meaningful in the context of the conversation. A sample conversation starts as follows:
Trainee: "Hello. How are things going?" (Rapport)
Avatar: "I've been doing really bad in school."
Trainee: "Have things ever gotten so bad that you've thought

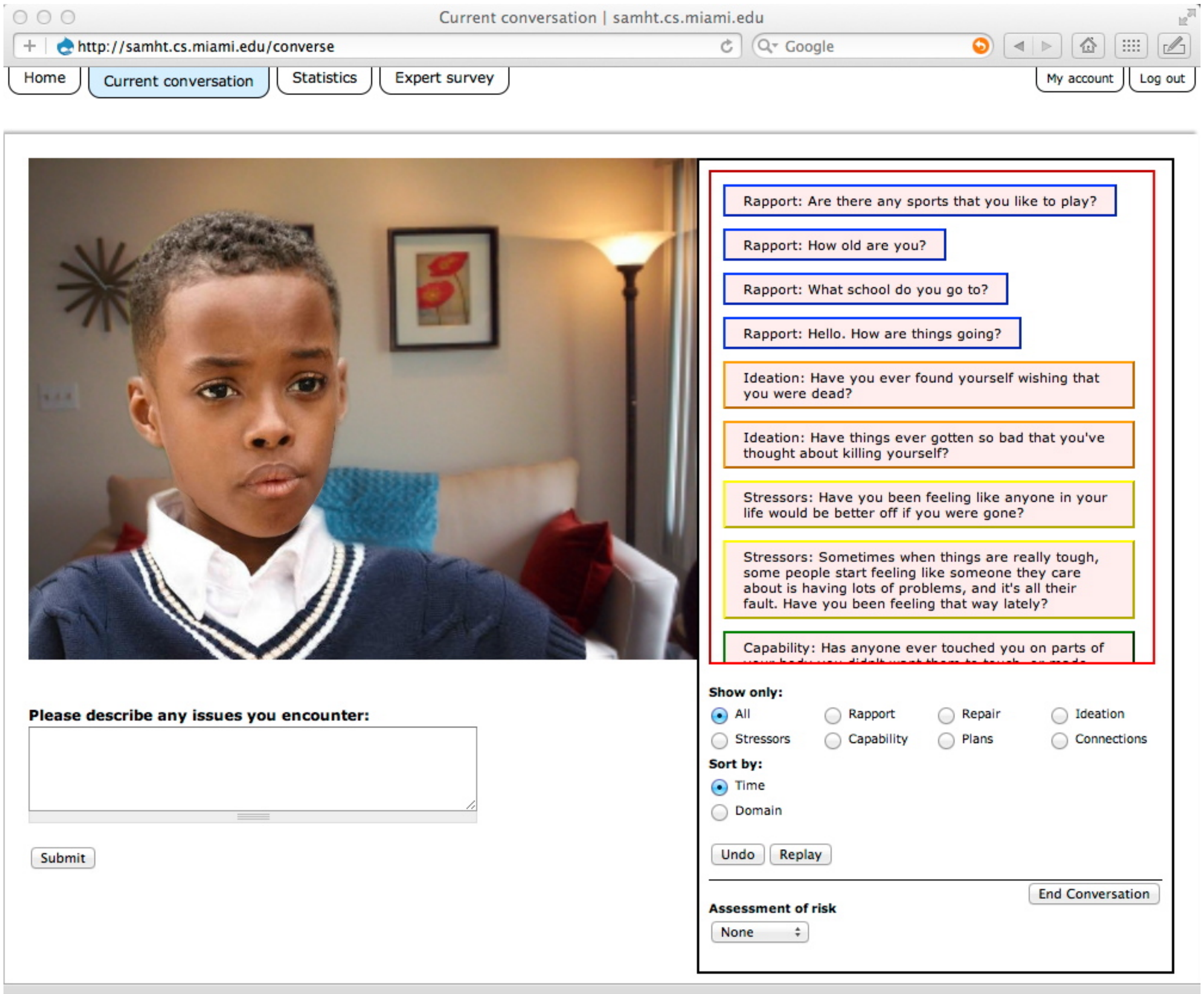

Figure 1: Avatar Interface

about killing yourself?" (Ideation)
Avatar: "Yeah, I've been thinking about it lately."
At this point a new question becomes available, and the trainee chooses to ask it next. Note that this question would not have made sense before the previous answer, and is thus made available only in this new context.
Trainee: "How often do you think about it?" (Ideation)
Avatar: "Oh, probably like once a week."
Trainee: "Have you ever tried to kill yourself?" (Capability)
Avatar: "Well, I've thought about it."
etc. etc. When the trainee believes (s)he has enough information to make a risk assessment, the conversation is ended by selecting the level of risk from a pulldown menu, one of None, Mild, Moderate, High, or Extreme.

In order to support assessment of trainees' activities, all interactions in a conversation are logged with a time stamp. In future work this data will be mined to evaluate the system and the trainees, and will also be used to provide real-time feedback to trainees.

In addition to the avatar and interaction panes, the trainee interface provides a panel that allows the trainee to add arbitrary notes to the conversation log. This feature is initially aimed at obtaining suggestions and debugging information from trainees during their use of the system, but in the long term will be useful for trainees to make clinical notes during their conversation with the avatar.

Intelligence Architecture

Figure 2 shows the SAMHT system architecture. The heart of the avatars' intelligence is the *decision tree*, which provides the answers for the questions sent from the trainee's web browser interface. Figure 3 shows an excerpt from a graphical rendering of the decision tree. The decision tree is an irreflexive directed tree with four types of nodes: question nodes (rectangles in Figure 3), decision nodes (ovals), randomizer nodes (diamonds), and answer nodes (hexagons). Each *question node* has one outgoing edge, leading to either a decision node or a randomizer node. Each *decision node* is labelled with one of the persona parameters (recall, there are more than 60 parameters), and has one or more outgo-

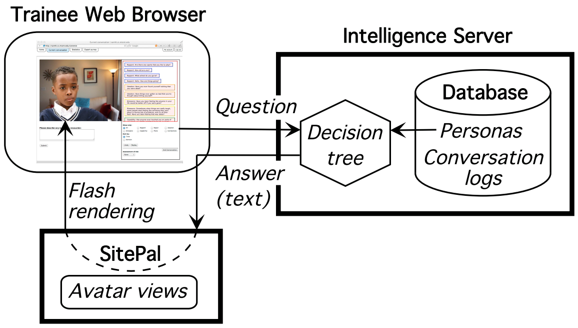

Figure 2: Intelligence Architecture

ing edges, each leading to another decision node, a randomizer node, or an answer node. These edges are labelled by a value or value range of the decision node's parameter. The parameter values can be null, boolean, integer, real, string, enumerated, or an array (of boolean, integer, real, string, or enumerated) values. Each *randomizer node* has one or more outgoing edges, each leading to a decision node or an answer node. Each *answer node* contains an answer to a question.

When a question is delivered to the intelligence server a traversal of the decision tree starts at the corresponding question node, following the outgoing edge (the solid edges in Figure 3). Whenever a decision node is encountered the avatar's parameter value determines which outgoing edge is followed. Whenever a randomizer node is encountered an outgoing edge is chosen randomly. Randomizer nodes are used to randomly select an answer from several that have the same underlying meaning, or to direct the traversal to another decision node. When an answer node is reached it is returned as the answer to the originating question. Aligning Figure 3 with the conversation extract above, when the question "Have things ever gotten so bad that you've thought about killing yourself?" was asked, the avatar parameter `LIFEIDEA` had the value `current`, leading to the answer returned. If the value had been `past-and-current` then randomly one of the answers below the randomizer node would have been returned.

In addition to the tree edges, there is a separate layer of edges leading from answers to questions (the dashed edges in Figure 3). When an answer has been reached, these edges lead to questions that have become meaningful in the context of the conversation, and they are added to the list of questions in the interaction pane of the web browser interface. For the conversation extract above, in Figure 3 this is the dashed edge to the question "How often do you think about it?".

The decision tree was hand-crafted by the second author, who has direct experience working with children and adolescents in clinical settings. A well established framework for suicide risk assessment (Joiner et al. 1999; 2009) was used as a guide for which topics to cover, and for how to integrate the information obtained from the avatar to determine the level of risk. The framework organizes the content of a thorough risk assessment interview into five domains: Desire and Ideation, Acquired Capability, Plans and Preparations, Stressors and Perceived Burden, and Caring Connections. Questions within each domain were created by consulting literature on suicide risk assessment, and in consultation with child clinical psychologists and experts in suicide risk assessment. In addition to these risk assessment domains, the Rapport and Repair domains were created, again in consultation with child clinical psychologists. Rapport contains questions and statements used to open a conversation. Repair contains questions and statements used to address a client's negative reactions during a conversation, and thus "repair" any threats to the therapeutic relationship and productiveness of the session. The decision tree has been reviewed by clinical psychologists and psychology graduate students, who provided feedback on the structure, age-appropriateness, context-appropriateness, and believability of the content.

The SitePal[1] component of the architecture provides the moving avatar image and speech rendering in Flash format, based on the answer provided by the decision tree. The interaction with SitePal goes via the trainees' web browser, which receives the answer as text from the intelligence server, forwards it to SitePal, and directly receives the rendering in the image view of the interface.

Conclusion

This paper has described SAMHT, an intelligent tutoring system for youth suicide risk assessment training. Its interactive avatar interface is based on an intelligent backend that provides a believable interaction that is effective for training mental health professionals.

Immediate future work is to provide trainees with real-time performance feedback, by analyzing the conversation logs. New interface elements that indicate the trainee's progress in the conversation are being planned, e.g., time spent in the interview, the percentage of questions covered from each domain, the level of rapport achieved, and the amount of useful information obtained from the conversation. More directed feedback to trainees might also be automated, e.g., indications of whether a selected question is (in)appropriate. An ability to compute each avatar's level of risk, based on risk assessment literature, e.g., (Joiner et al. 1999), will be added. This will allow trainees to receive feedback about the accuracy of their assessment at the end of each conversation. The feedback features will enable the trainer to scaffold learning for novice trainees. A medium term goal is to automate the process of creating new avatar personae, by randomly selecting parameter values subject to constraints that avoid combinations that are illogical, unrealistic, etc. In the longer term the conversation logs will be used to guide the selection of parameters values, so that new avatars help trainees focus on weaknesses in prior conversations. Additional planned features include functionality to encourage rehearsal of behaviors that should happen in a live risk assessment. Examples include adding a medical chart containing patient history data to encourage trainees to consult charts prior to interviewing patients, and adding voice

[1] `http://www.sitepal.com`

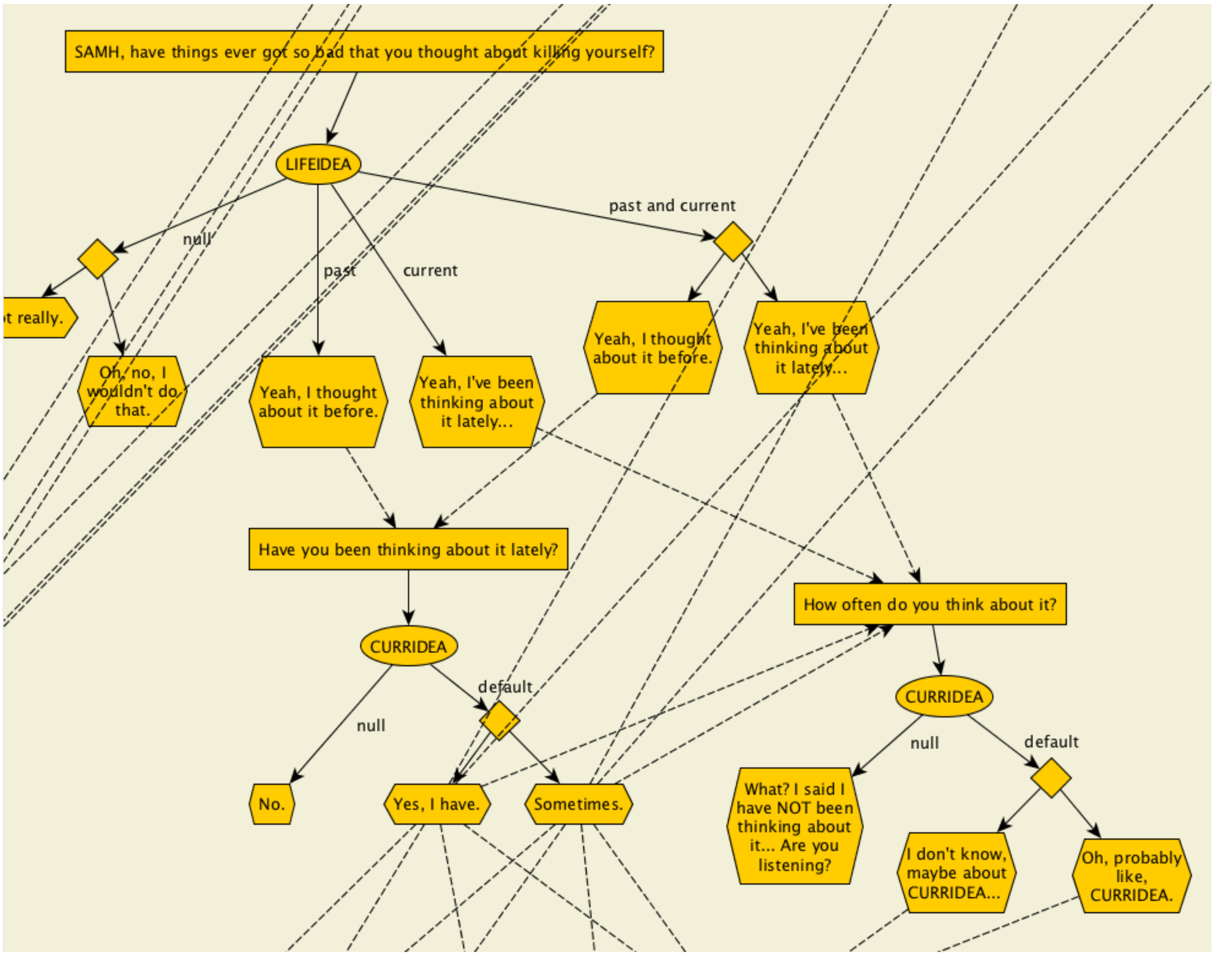

Figure 3: A Decision Tree

recognition and question matching capability so trainees can behaviorally rehearse asking questions.

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References

Cook, D., and Triola, M. 2009. Virtual Patients: A Critical Literature Review and Proposed Next Steps. *Medical Education* 43(4):303–311.

Dexter-Mazza, E., and Freeman, K. 2003. Graduate Training and the Treatment of Suicidal Clients: The Students' Perspective. *Suicide and Life-Threatening Behavior* 33(2):211–218.

Herschell, A.; Kolko, D.; Baumann, B.; and Davis, A. 2010. The Role of Therapist Training in the Implementation of Psychosocial Treatments: A Review and Critique with Recommendations. *Clinical Psychology Review* 30(4):448–466.

Joiner, T.; Walker, R.; Rudd, M.; and Jobes, D. 1999. Scientizing and Routinizing the Assessment of Suicidality in Outpatient Practice. *Professional Psychology: Research and Practice* 30(5):447–453.

Joiner, T.; van Orden, K.; Witte, T.; and Rudd, M. 2009. Risk Assessment. In Joiner, T.; van Orden, K.; Witte, T.; Rudd, M.; and David, M., eds., *The Interpersonal Theory of Suicide: Guidance for Working With Suicidal Clients*. American Psychological Association. 53–81.

Kenny, P., and Parsons, T. 2011. Embodied Conversational Virtual Patients. In Perez-Marin, D., and Pascual-Nieto, I., eds., *Conversational Agents and Natural Language Interaction: Techniques and Effective Practices*. Information Science Reference. 254–281.

Stevens, A.; Hernandez, J.; Johnsen, K.; Dickerson, R.; Raij, A.; Harrison, C.; DiPietro, M.; Allen, B.; Ferdig, R.; Foti, S.; Jackson, J.; Shin, M.; Cendan, J.; Watson, R.; Duerson, M.; Lok, B.; Cohen, M.; Wagner, P.; and Lind, D. 2006. The Use of Virtual Patients to Teach Medical Students History Taking and Communication Skills. *American Journal of Surgery* 191(6):806–811.