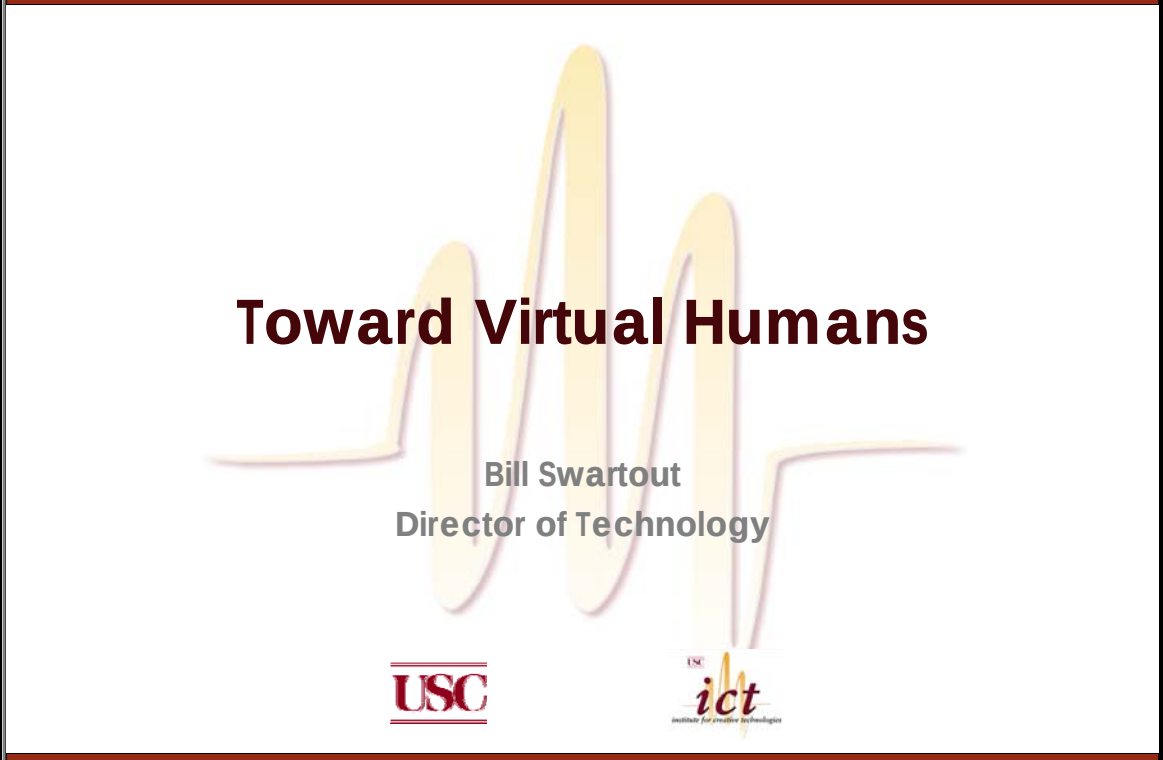

Bill Swartout

Bill: I'm going to talk about what I think where technology will be in a few years and what we've been developing in current commercial games.

The ICT Mission

*The ICT is intended to serve as a **bridge** between the entertainment and simulation communities*

Focus on cognitive decision-making under stress

The Institute for Creative Technologies, is an institute that was set-up at the Univ. of Southern California by the Army about five years ago. The mission was that they were interested in exploring the possibility of people doing research in simulation and who understood the technology of simulation, if they were to work along side with people from the entertainment industry, the gaming industry, and the film entertainment, Hollywood industry which understands character, and how to create a compelling experience. If you had those two groups of people working together, would it be possible to create simulations that were much more compelling than the military simulations that were current about five or so years ago.

Virtual Humans:

- *Our goal:* Virtual humans to simulate the ***human*** element
- Behaviors not pre-scripted
  - Behave by understanding situation and reasoning about possibilities
- Communicate in natural language
  - Can explain actions & coach
  - Coordinated gestures and non-verbal communication
- Understand social situation
- Respond emotionally to situation

The key idea here is that unlike most game characters that you will see in computer games, the behaviors of these characters are not prescriptive. They are actually working out dynamically, using AI, to reason through the situation, and figure out what they ought to do next, based on what's happening, their understanding, and their predispositions about things. It is important that they understand that they are in some sort of a social situation.

Very often, the kind of things we are looking at deal with the kinds of operations that the Army finds itself, for example now in Iraq, where they are engaged in nation building. You have to deal with local people in the environment, you need to understand the culture, and understand how they are going to interact with you. You are confronted with all sorts of situations that are not part of the standard training manual. So these characters have to be able to inhabit that kind of an environment and support you in your training.

Key Idea: Model-Based Approach

7 *Traditional approach:* Pre-compiled animations and behaviors worked out in advance (e.g. branching story line)

Model-based approach: Virtual human generates gestures, natural language interactions, behaviors based on what's actually going on in this world

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So, in terms of the technology the key idea here is that instead of taking a traditional approach, where you basically might be taking in the game industry where you pre-compile animations and behaviors, work them out in advance, and have a branching story line, we take what we call a model based approach. So that there is, in the computer, a model of the world that this character inhabits and the virtual human then derives, generates in real time, the gestures, the natural language interactions, the behaviors based on what's actually going on in this world. That allows you to both, on the one hand, move these characters into new settings, much more rapidly, because instead of having to recreate this whole branching story structure, you just make changes to the model, plop the character down in this new situation, and basically let them figure out how to operate.

And the other thing is they can be more robust in unanticipated situations. With the branching story structure, if something happens that you have not anticipated, you're stuck, there's no branch to take. In this kind of environment, because the characters are actually doing some reasoning about what is going on, there can be a more graceful failure path for them, in terms of dealing with unanticipated situations.

Virtual Humans:
Mission Rehearsal Exercise Project

Holodeck version 0.001 alpha

One of the early projects we worked on was called The Mission Rehearsal Exercise Project. In our virtual reality theater, people actually interact with the system. The screen here is about thirty feet wide by about eight foot high so these are actual life-size characters. A trainee, in this case typically in the role of an Army Lieutenant, would stand in front of the screen, and through a microphone, interact with the characters on the screen that use speech recognition and natural understanding to understand what he is saying.

For those of you who are Star Trek fans, you can think of this as the 00.1 Alpha release of the holodeck. The setting is in Bosnia, and the scenario is that you as the

Lt., are in charge of this platoon of soldiers. The scene opens with you driving around in the environment in your Humvee. You get a call on your radio that you're supposed to go, deal with a problem, to reinforce some troops that are dealing with a weapons cache that's been discovered in the downtown area of this village. You are to go and reinforce them with your troops. As you are on the way there, one of your Humvee's gets into an accident with the local civilian car and now you must make some decisions. You have to decide first of all, whether you are going to stop and render aid or are you going to continue on with your mission. If you decide to stop and render aid, you are going to get some calls on the radio from the folks who are already downtown saying "Hey, where are you guys?? Then you have to make some decision whether you should send half your troops on forward or not: would that be a good idea? In this environment, the main character that you interact with is the Platoon Sergeant, and he, just like in the actual army, functions not only as your main interface for the rest of the troops, but also because Army Sergeants typically have about 10 years of experience, whereas Second Lt. typically have about 3 months of experience. The Sergeants act as a kind of advice giver and can make suggestions. So here's a little clip that shows you how the system can operate.

(Clip is shown: sound of Emergency alarm. Background dramatic music)

A: What happened here?

B: There was an accident, sir. This woman and her son came from the side street and our driver didn't see them.

A: Who's hurt?

B: Our driver and the boy.

Narrator: Moments ago, this platoon was enroute to reinforce a unit dealing with a civil disturbance. It may have created a new disturbance all on its own. What should this Lt. do? Stop and render aid or continue on with his mission. But maybe the real question is what could we have done to prepare the soldier for unexpected problems like these.

Woman: (Hysterically) Where are you all going? My boy needs help!

(Sound of vehicle moving)

Narrator: Advances in simulation technology will make it possible for soldiers to interact with virtual humans. These prototypes at USC's Institute for Creative Technologies hold the promise of a rich complex interaction at the fraction of the cost of live role players.

A: What happened here?

B: There was an accident, Sir. This woman and her son came from the side street and our driver didn't see them.

A: Toochie, how's the boy?

B: The boy has critical injuries, Sir.

B2: We need to get a medic back in here ASAP.

Radio: Eagle 266 this is Eagle 016. We're downtown. We've got a ride. You're supposed to be here ? where are you?

B3: Sergeant, send two squads forward.

Narrator: From speech recognition, the system forms an internal representation of human speech. This maps against a knowledge model of the situation including a general knowledge of tactics, techniques, and procedures. By this means, the system can serve as a coach offering suggested courses of action.

B1: Sir that is a bad idea.

A: We shouldn't split our forces. Instead, we should send one squad and recon forward.

Narrator: Finally, these characters include a basic emotional model to make their behavior more human-like, thus more believable. Their emotional states can be adjusted all for an infinitely varied interactive experience.

Researcher 1: Let's try that again but this time, let's make the Sergeant more defensive.

Researcher 2: Ok.

(Background noise)

A: Sergeant what happened here?

B: He rammed into us, Sir. They just shot out from the side street and our driver couldn't see them.

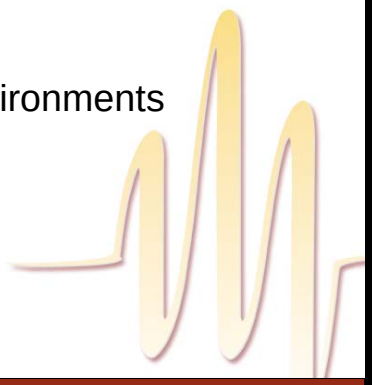
Narrator: Virtual humans such as these are still research prototypes. But in the not too distant future, they will give soldiers the training they need to succeed in a constantly challenging world.

(Background sound of moving large vehicle, planes)

Radio: Eagle 26, this is Men of Act Team 1 turning file now Z in sight. (background two-way radio sound, helicopter)

MRE Accomplishments

- Integrated Virtual Human Architecture
  - Most comprehensive integration in world today
- Basic science advances
  - Emotion modeling
  - Multi-party dialogue model
  - Speech recognition in noisy environments
  - Natural language pragmatics
  - Social reasoning
  - Negotiation about tasks



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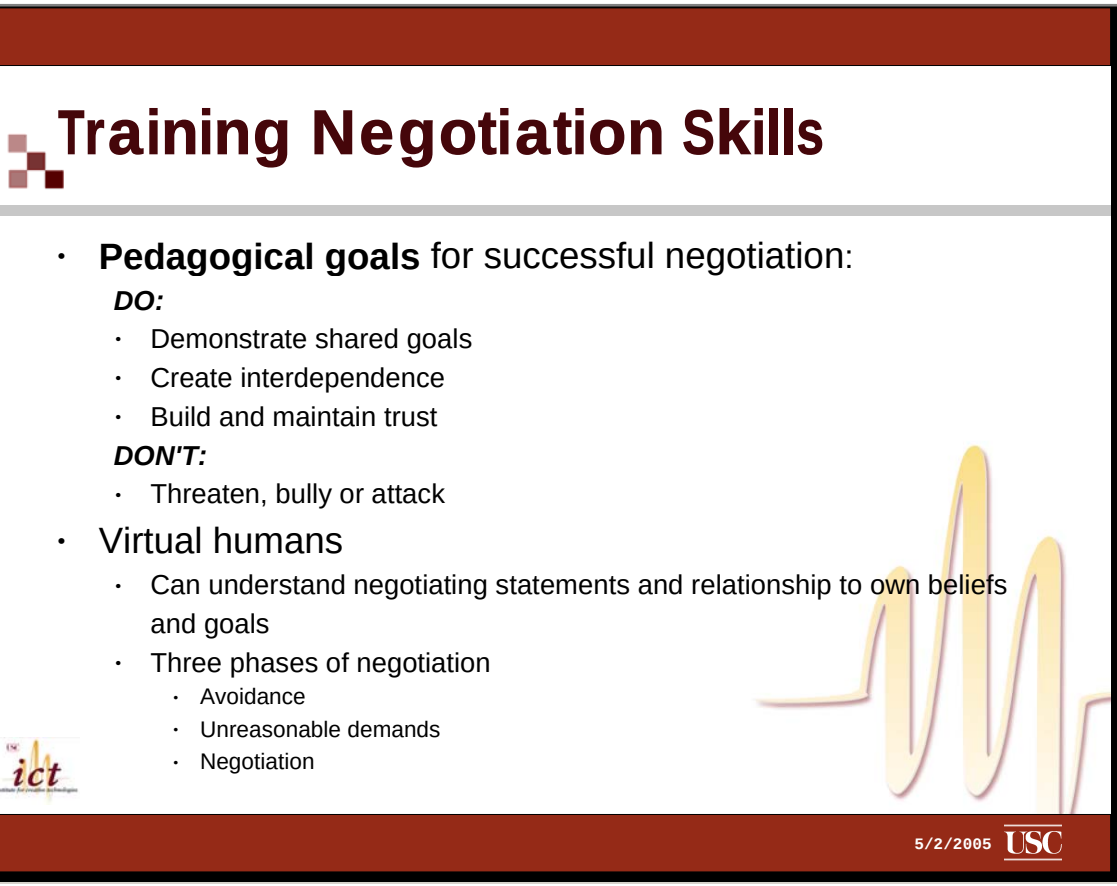
Bill: The major accomplishment in this system we are developing is this virtual human architecture which in terms of the kinds of functions and the kinds of reasoning it supports, it is probably one of the most comprehensive around today.

We have made some basic science advances in things like emotion modeling. Dealing with multiple characters in the environments so that you deal with dialogue models that can support, talking to many different characters at once, where intentionally making this environment noisy to make it natural or realistic and that means that the speech recognition has to deal with a noisy environment so that's been an issue for us. And again, there are these issues about social reasoning that I mentioned earlier.

Another new area is dealing with negotiation. This is actually one of the things that is a big skill now for the army in the Iraq situation where they have to deal with lots of locals and negotiate issues with them. And we've done some initial work in that area.



The way the army teaches negotiation is that, they say that basically what they want to do is they teach, they train soldiers to, as they approach the negotiation, instead of basically saying, you know, we are from the US Army, and you have to follow what we're saying?.

?.rather, demonstrate shared goals, build trust and really try to be more persuasive in terms of your negotiating style. We have put together, for training purposes, some virtual humans that basically are set-up to essentially resist negotiation. And they can understand what a trainee says in terms of the statements he makes about the negotiation and the relationship of his statements to the virtual humans own internal beliefs. And the other thing that they do is that they go through three phases of negotiation, something that we've gotten out of the psychological literature.

The first phase might be called an **avoidance phase**, which is: I have got nothing to gain from this negotiation, so what I'm going to try to do is tell this guy that I'm really busy, change the topic and hope that he'll go away. So then you go into a second phase, which is sometimes called an **unreasonable demand phase** or an attack phase where you say, :I can sell you this but it will cost you a million dollars. So you make very unreasonable demands, you're not really yet negotiating. The third phase, that you can get into, if you as the trainee have been going through dialogue moves that help to build trust and demonstrate shared goals, is to actually get into a **negotiation phase** and reach a resolution on things.

Demo: Dealing with Doctors

- ***Background:*** Operations are planned in area of NGO clinic
- ***Your mission:*** Persuade doctor to re-locate clinic (without revealing operational plans)
- ***Resources:*** Medical supplies and transportation

Demo built in about 90 days

QuickTime™ and a TIFF (LZW) decompressor are needed to see this picture.

Intended as integrated research prototype, not full training system

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This demo is called "Dealing with Doctors? and basically, the background here is that you are an Army captain, and there are military operations that are being planned in the area of a NGO, that's non-governmental organization clinic, something like a Doctors without Borders type clinic. Your mission is to persuade the doctor to relocate the clinic without revealing to him any operational plans. You have negotiating resources of medical supplies and transportation that you can use.

This demo was built in about ninety days and we just got it working

Avoidance phase

So the first phase is a kind of avoidance phase.

(background noise)

A: Hello Dr. Perez.

Speaker: That's the Captain.

Dr. Perez: Hello (foreign accent)

A: I'm Capt. Kirk. (sound of metal tools shuffling) Very nice to meet you.

(sound of things shuffling in a box. someone coughs),

Dr. Perez: What do you want?

A: I have orders to assist you in moving this clinic to a safer location.

(sound of things shuffling in a box)

Dr: You want to move the clinic.

A: Yes.

(sound of metal tools shuffling)

Dr: Do you see that girl? She lost her mother today.

Attack phase

Bill: Ok. So he's trying to change the topic. Get you off this idea, you know, let's forget about this idea of moving the clinic. And he goes through that quite a bit more in the actual demo. Once you're in his face long enough he switches into attack mode:

Dr: You are the problem. Your bombs are killing these people.

DR: We're trying to help these people too.

Speaker: So we're trying to build trust.

Dr: The patients are here.

Speaker: keeps pointing out problems to the move?

Dr: To move the clinic is not possible. We have many patients in critical condition.

A: We can move you to a safer location

Dr: There are no supplies there

A: We can provide you with supplies.

Negotiation & Resolution

Bill: So you're trying to build-up trust and then eventually, if you're successful, you will have achieved the desired goal.

Dr: I can't move all these patients

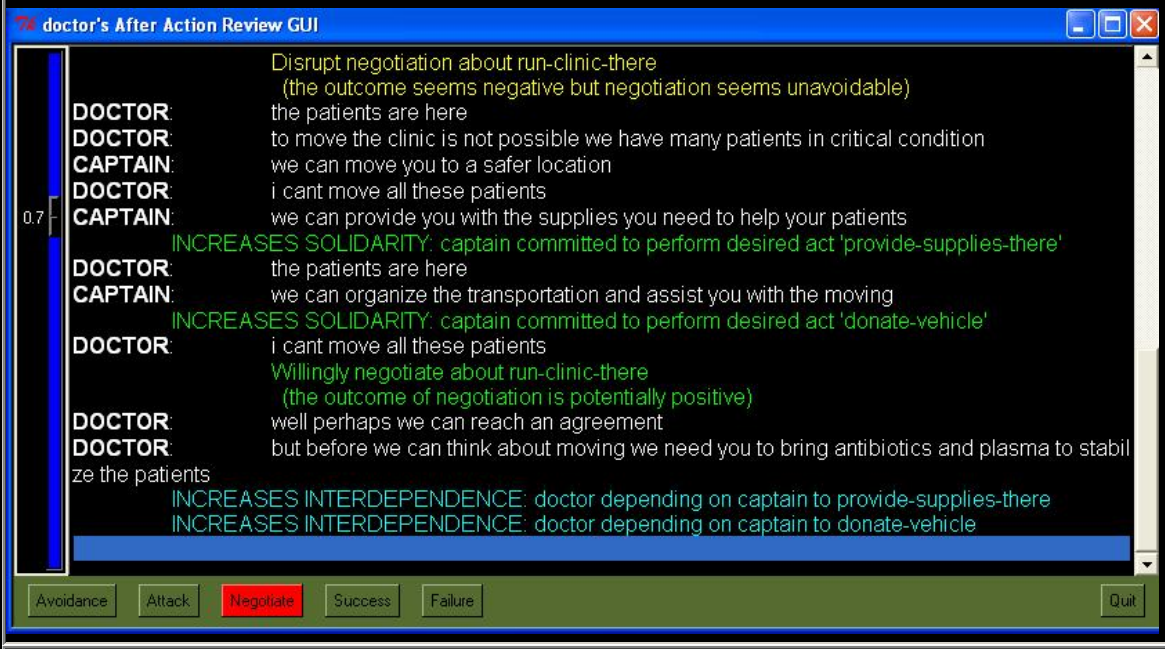
A: We can have locals move you.

Dr: I understand your position. Well, perhaps we can reach an agreement. But before we can think about moving, we need you to bring antibiotics and plasma to stabilize the patients.

A: We can do that.

Dr: Well, very well Capt., contact my assistant to make further arrangements.

After Action Review
with Explainable AI



Summary

- Virtual humans are becoming a reality
- Possible medical uses
  - Emergency medicine
  - Doctor/patient interactions
    - Pt History & Present Complaint
    - Pt compliance
  - Cultural sensitivity

Bill: Because we are using AI to do the role play, the computer can remember the entire interaction that has taken place and later on you can go back with a student and review it. Furthermore, because we have access to the reasoning that the AI system did, we can annotate the transcript of what the Dr. and what the Capt. were saying, and explain to the student, how each of the moves that he made were perceived by the doctor. That's something that you can't really do even if you're doing human-to-human role-playing. So, this gives you an ability to look inside the head of the character and see how your things were perceived. So you did certain things that helped to increase solidarity, other things that were disruptive to the negotiation, you can see all of that in the transcript as it goes forward.

So, to summarize, although there are still some major technical hurdles to overcome here, this kind of virtual human technology is beginning to become a reality. I think that you can envision a number of possible ways that this can be used in a medical setting ranging from things like, crisis medicine, emergency medicine, dealing with doctor-patient interaction, in that kind of negotiation mode. Very often in taking a patient's history, one of the problems is that they don't always tell you exactly what's going on; there's a little bit of deception going on, sometimes they're ashamed to admit certain things and, also dealing with issues in cultural sensitivity and how that can change the doctor-patient interaction. Thank you very much.