

# Hosting Activities with a Robot Host

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# Introduction

- What are hosting activities?
  - a class of collaborative activity in which an agent provides guidance in the form of information, entertainment, education or other services in the user's environment (artificial or the natural world).
  - Examples: sales, tutoring, tour guide, museum docent
- Hosts: 2D animated agents or physical robots

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# Hosting activities

- situated or embedded activities;
- social activities
  - depend upon the social roles of/with humans to:
    - determine next actions,
    - timing of actions, and
    - negotiation of among the choice of actions.

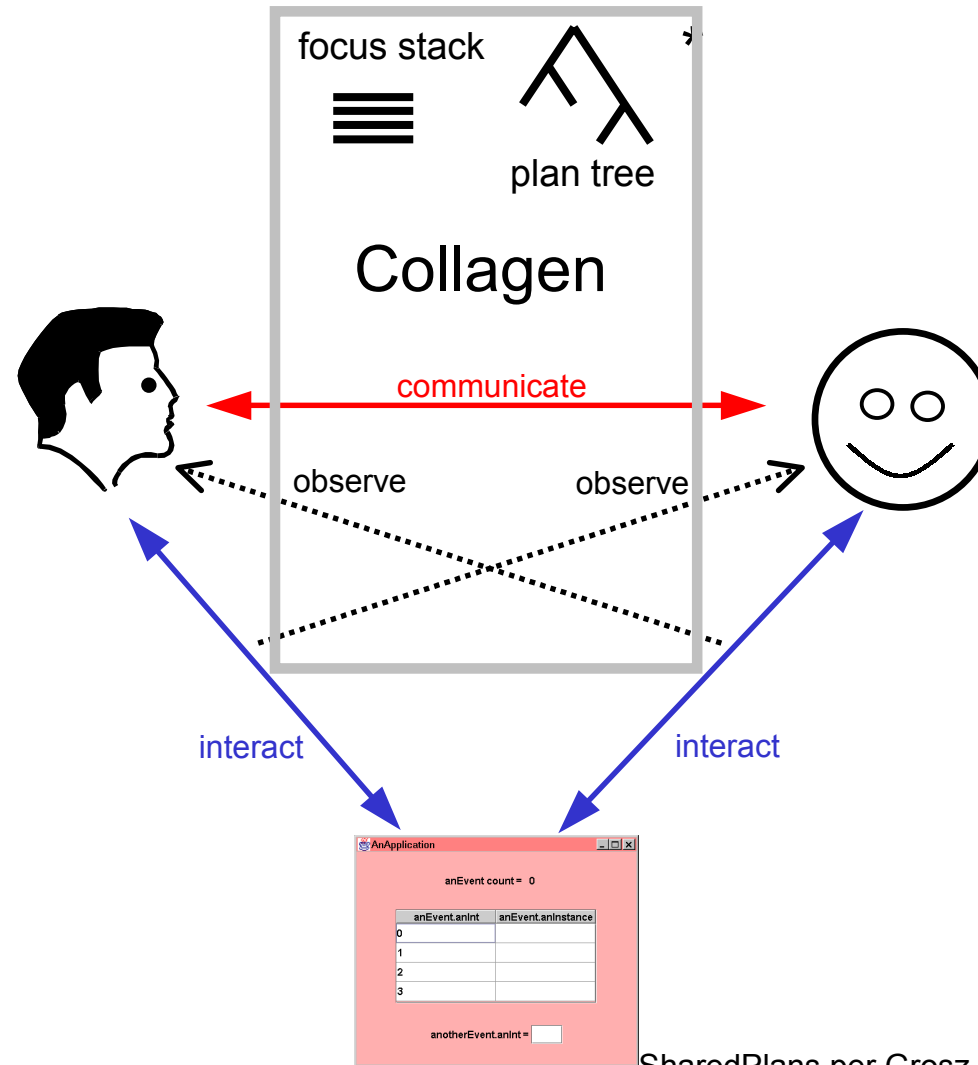
# Roadmap for today

- Experience with a (very simple robot) host\*
- What can we learn about hosting in general for robot hosts (and other hosts)?
  
- Non simple robot with simple but multi-media hosting:  
Burgard, Cremes and others, The Interactive Museum Tour Guide Robot, AAAI-98 best paper, pg. 11.

# MEL: an embodied agent

- Adds a physical body to the Collagen agent for tutoring,
  - An animatronic bird (penguin) designed at MERL
- Uses BEAT (Cassell et al 01) to generate gestures,
- Implements beat gestures, head nods and pointing.

# Collagen: Collaborative Interface Agent



SharedPlans per Grosz, Sidner, Lochbaum, Kraus, et al.

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# Next Step: Embodiment

- Natural Gestures
  - Easier communication
    - Example: Rea  
(Cassel et al, 2000)



- Physical Presence
  - Needed for applications in physical world
    - Example: Room guide

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# A Collagen Tutoring Agent

- Paco (Rickel, Lesh et al, 01)

The screenshot displays a complex control panel for a gas turbine engine simulation. The interface is divided into several sections:

- Left Panel:** Contains status indicators for 'TEMP HIGH', 'PRESS LOW', and 'STARTING AIR'. It features three vertical gauges: 'PWR TURB INLET TEMP' (DEG F, 0-2), 'TURBINE SPEED' (RPM X 1000, 0-12), and 'LUBO SUPPLY PRESSURE' (PSIG, 0-100). Below these are buttons for 'On', 'Norm Stop/CL DN', 'Engage', and 'Dis-engage'. At the bottom are 'FUEL CONTAM' and 'MODULE FIRE' indicators, along with 'BLEED AIR', 'FUEL VALVE 1', and 'FUEL VALVE 2' controls.
- Center Panel:** Features a 'GAS TURBINE GENERATOR' section with a large circular gauge for 'AC Volts' (0-600) and a 'HIGH VIBRATION' indicator. A hand icon is shown pointing at the 'Reset' button. To the left is a vertical scale from -4 to 10 with labels: Flank, Full, Std, Ahead 2/3, Ahead 1/3, Stop, Back 1/3, Back 2/3, and Full.
- Right Panel:** Mirrors the left panel with its own set of gauges and control buttons.
- Agent Window:** A window titled 'Agent' with a smiley face icon. It contains the text: "Before starting a generator, always make sure that the alarm light is off so that you'll know when a new alarm appears. Press the alarm reset button on the generator to extinguish the alarm light."

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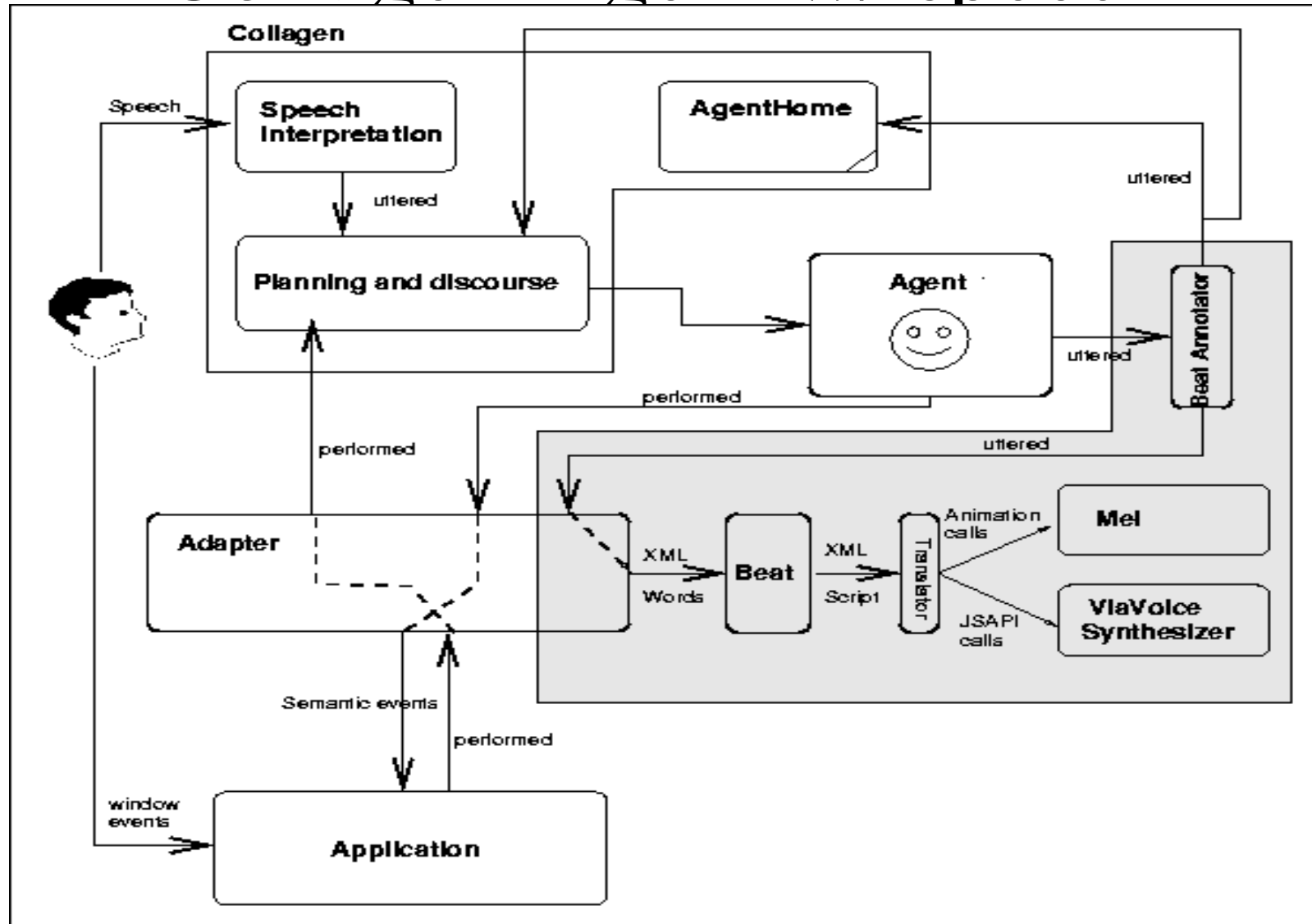
# Videotape of Mel as Tutor

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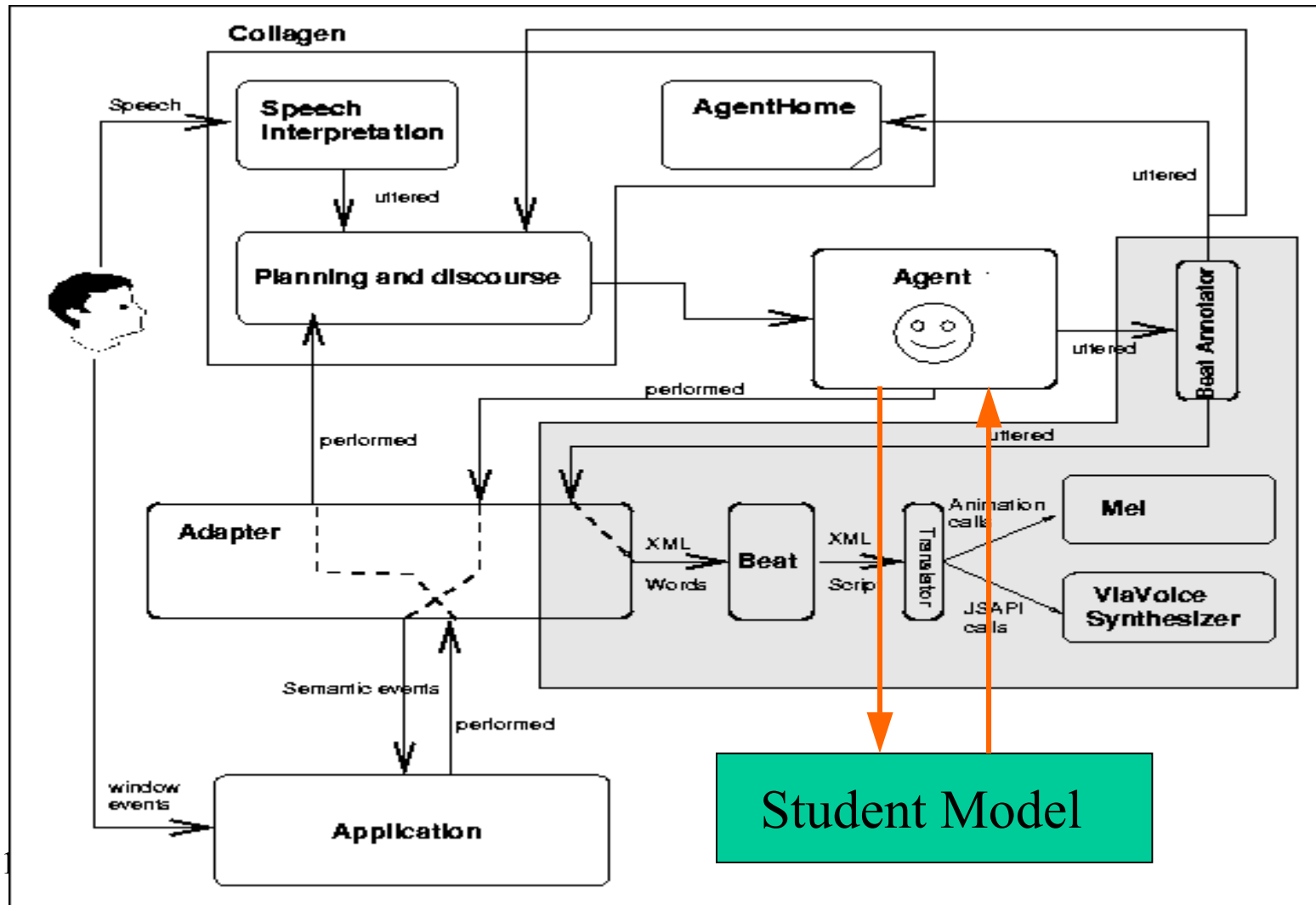
# Generating realistic gestures

- BEAT: Behavior Expression Animation Toolkit (Cassell et al, 2001)
  - Text  $\Rightarrow$  XML script with nonverbal behavior commands
  - Default generation based on information structure, customizable to domains
  - Requires annotation for linguistic constituents and new information

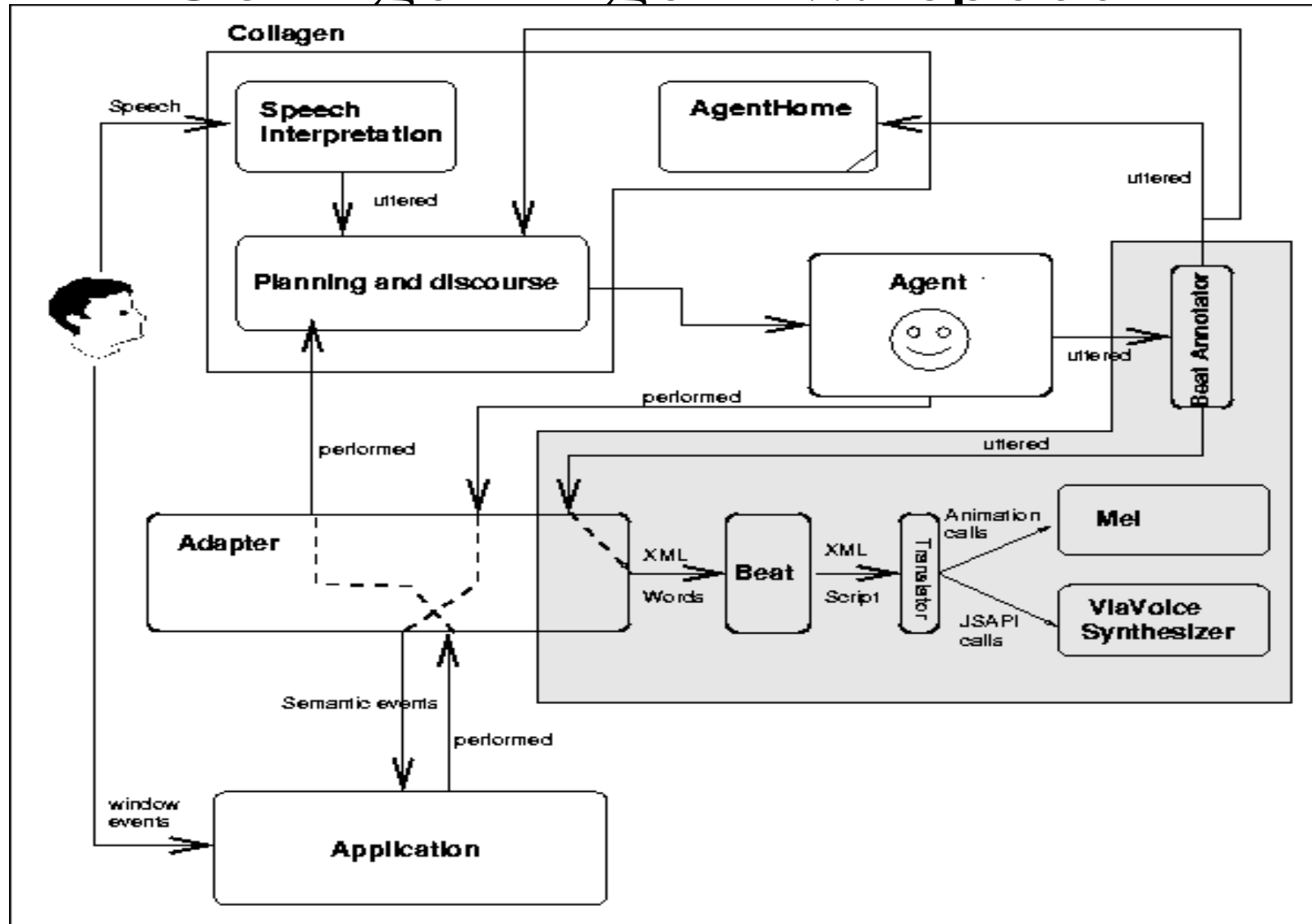
# Architecture for Embodied Collagen Agent w/ speech



# Architecture for Embodied Collagen Tutor w/ speech



# Architecture for Embodied Collagen Agent w/ speech



# Changes to Collagen: Lessons about Multi-modal input

- Components on previous slide
- Annotation of Collagen output for:
  - new and old information
  - clause boundaries
  - deixis (especially concerning on screen layout)
- More annotation would be needed for mobile robots.

# The Bigger Picture: Hosting Agents

- Room Hosting
  - Visitor wants to see interesting objects and activities;
  - Host has descriptions (recipes) for:
    - demoing equipment and describing objects;
    - different ways to tour the room.
  - Host and visitor need to negotiate on what will be shown, and what they know.

# The Bigger Picture: Hosting Agents

- Hosting in general
  - Visitor wants to see interesting objects and activities;
  - Host has recipes for:
    - demoing procedures and describing objects;
    - different ways to tour location/tutor.
  - Host and visitor need to negotiate on what will be shown, and what they know.
- Success criteria
  - (different for tutors, sales agents, room hosts)

# Capabilities of host

- Converses orally (takes turns, interruptions),
- Collaborates (both private and shared goals),
- **Locates**, points to and **manipulates objects**,
- **Moves in space as part of accomplishing goals.**
- Recognizes & tracks visitor, determines location of visitor gaze,
- Engages and maintains visitor's interest,
- Relates to and affects social status of self and visitor.

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# Example behavior

- Visitor: <enter room and looks around>
- Host: <host moves to visitor and looks at her> Hello, I'm the room host. Would you like me to show you around?
- Visitor: <Visitor ignores host and continues to look around> What is this? <Visitor looks at host and points to an object>
- Host: That's a camera that allows a computer to see as well as a person to track people as they move around a room.

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Alan Bierman: “The point is that when people talk, they maintain conscientious psychological connection with each other and each will not let the other person go. When one is finished speaking, there is an acceptable pause and then the other **MUST** return something. We have this set of unspoken rules that we all know unconsciously but we all use in every interaction. If there is an unacceptable pause, an unacceptable gaze into space, an unacceptable gesture, the cooperating person will change strategy and try to re-establish contact.

Machines do none of the above, and it will be a whole research area when people get around to

11/9/01 working on it.”  **Mitsubishi Electric Research Laboratories**

# Social Status and Relationship: Who cares?

- The host is the servant of the user.
- The host is the servant of the user except when they negotiate.
- The host is the servant of the user except for negotiating and for when the host is an authority on a procedure or device.
- Closer: The status of host and user change dynamically.

# Roles and Relationships

- Katagiri et al (01)--authority of agent affects user's willingness to interact and to accept advice.
- Cassell & Bickmore (01)--trust makes some information more readily available; small talk institutes trust so human shares info (even for agents who do small talk).
- Parise et al (96)--users trust animal faces more than human ones.

# Trusting the host

- Host may need to persuade, coax or coerce (for embarrassing or dangerous procedures).
- Host may need to demonstrate safety of a procedure.
- Stance of host will affect different users differently (lesson of Parise, Cassell)

# Evaluating Hosts

- Get the job done & efficiently (known measures for this)
- Normative human behavior--behavior demonstrated by humans when hosting
- Normative host behavior--behavior demonstrated by hosts
- Compare for engagement, focus of attention, human use of social rituals as well as task measures.

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# Continuing the hosting...

- Host: Let's take a look at the multi-level screen over there. <points><then starts to move to the screen>
- Visitor: <does not observe or follow host>
- Host: <host notices user behavior and makes decision about how to proceed>  
Is there something else you want to see?
- Visitor: No, I think I've seen enough. Bye.

# Conclusions

- Hosting activities with robots require robots that
  - talk and listen, gesture,
  - move around,
  - plan for and maintain engagement with users.
- They are social creatures, aware of their status with users, and
- they change that relationship to accomplish their goals.

# More information

- For Collagen, see:
  - [www.merl.com/projects/collagen](http://www.merl.com/projects/collagen)
  - [www.merl.com/papers/TR2000-38/](http://www.merl.com/papers/TR2000-38/).