

The Next Best Thing to Really Being There:

*Increasing the Emotional Bandwidth of
Mediated Communication Using
Robotic Avatars*

Cynthia Breazeal

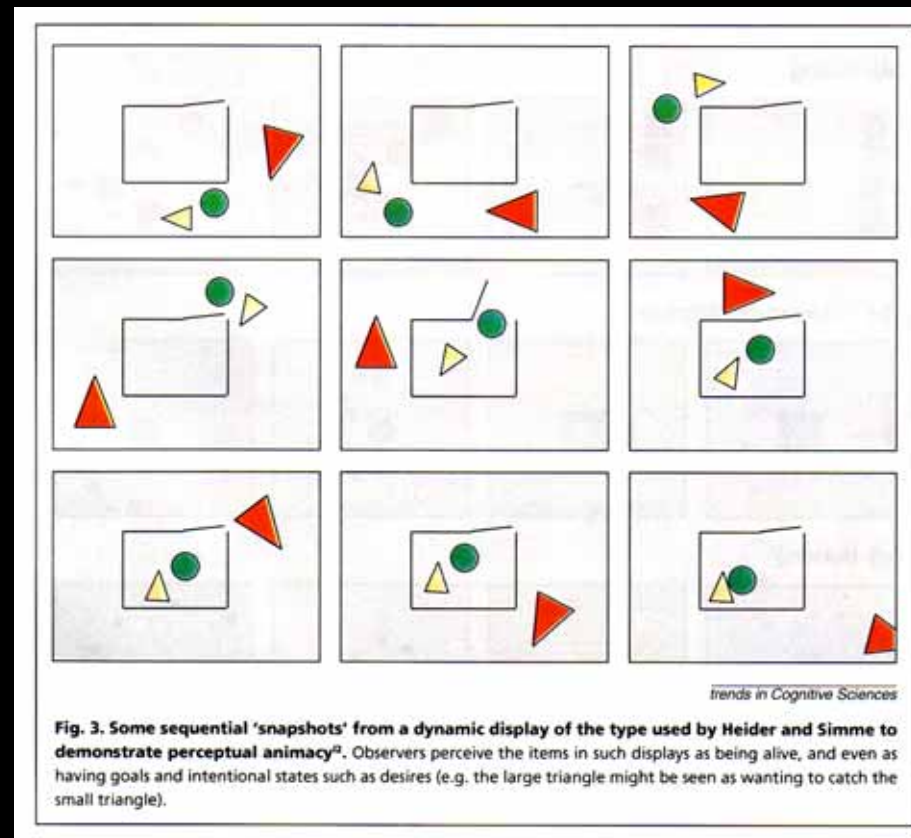
Human Communication

When We Are Together



We Coordinate Minds Through Coordinating Bodies

- Non-verbal cues are important indicators of states of mind and play an important role in coordinating minds
 - Bodies do not have to be human



Heider & Simme

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 - Bodies do not have to be human
 - Presents an interesting design space for robots

OperaBots
May 8th, 2007

Robotic Life Group (Mikey Siegel & Jeff Lieberman) in collaboration with Opera of the Future

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 - Or everyday artifacts with robotic technologies

2004 iMac G4 commercial

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 - Bodies do not have to be human
 - Presents an interesting design space for robots
 - Or everyday artifacts with robotic technologies
- The same “animate” artifacts can understand our intention through our non-verbal cues



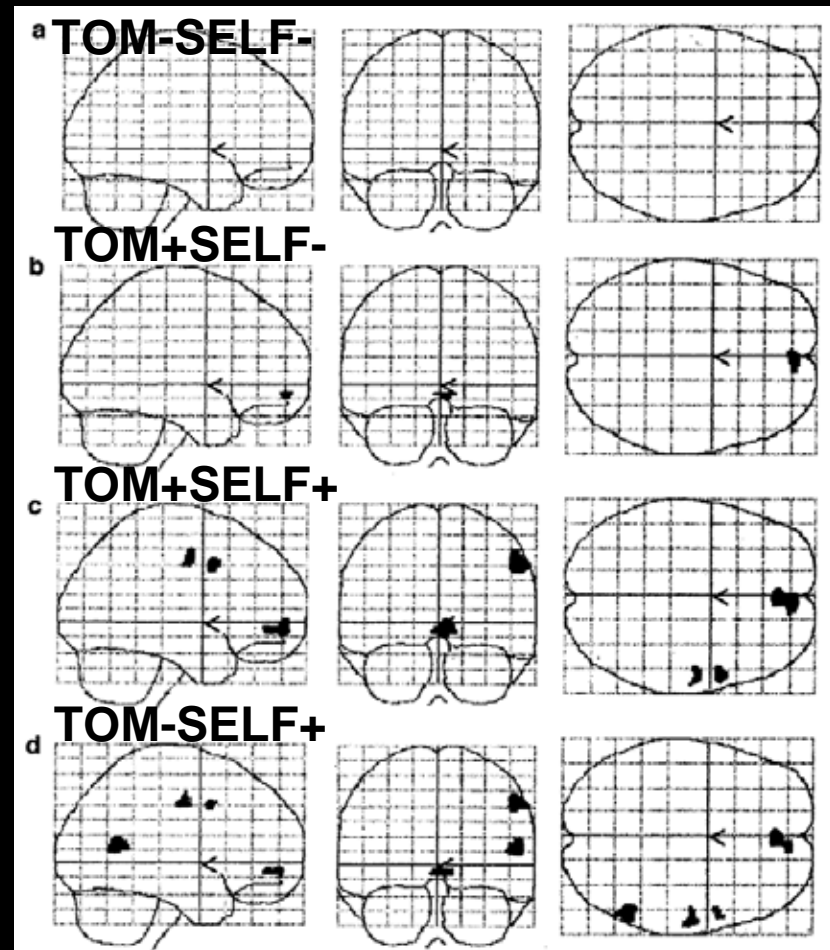
AUR: A Robotic Desk Lamp
(Guy Hoffman)

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We Coordinate Minds Through Coordinating Bodies

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- **Simulation Theory:** certain parts of the brain have dual use - they are used to not only generate behavior and mental states but also to predict and infer the same in others



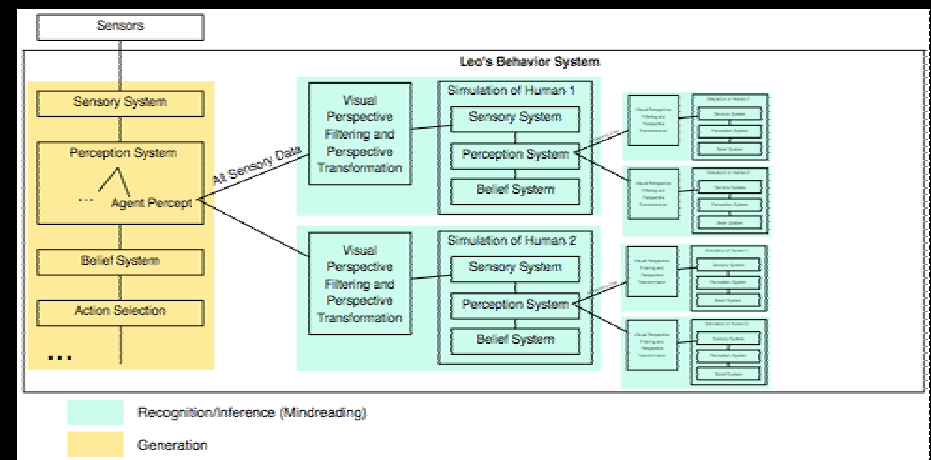
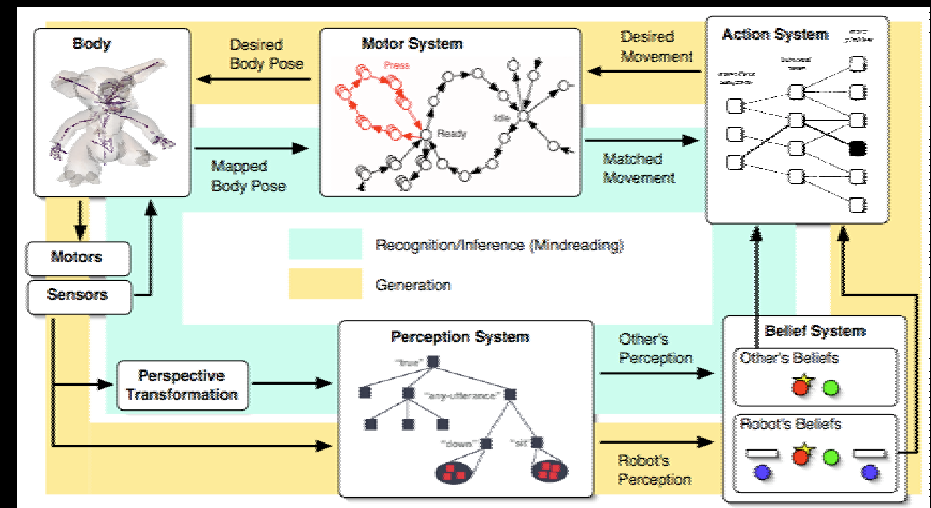
Vogeley et al, Neuro Image 14, 170-181 (2001)

We Coordinate Minds Through Coordinating Bodies

- Processes are often subconscious, underlying mechanisms not well understood.
- How might interactive robots help us to understand these processes more deeply?

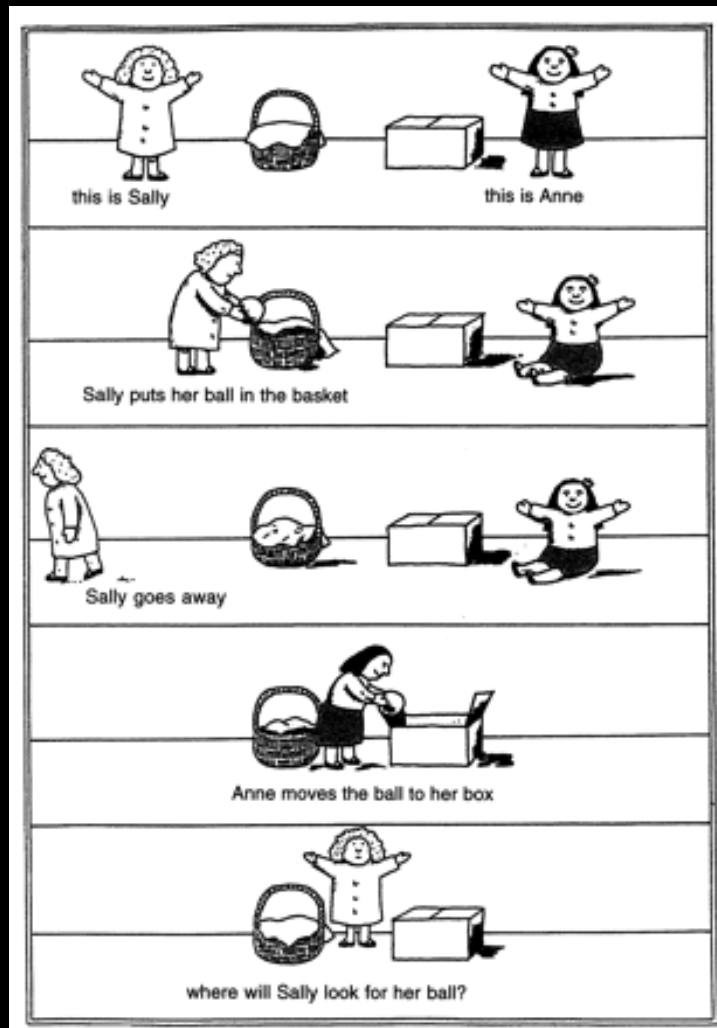
We Coordinate Minds Through Coordinating Bodies

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“I think that you think...
That I think...”

Perspective Taking & False Belief Task



- Use own belief maintenance mechanisms to model and relate beliefs of others to its own beliefs

Multiple People, False Beliefs and Goal Inference for Collaboration

Task	Correct Object	Guidance Gesture	Grounding Gesture	Other	No Action	Incorrect Object
Task 1	16	0	0	1 [†]	1	2
Task 2	14	1	2	0	0	3
Task 3	13 [*]	2	2	0	0	3
Task 4a	14	2	1	0	3	0
Task 4b	13	0	1	1 [‡]	1	4

* One participant produced the object only after the key had been retrieved from box C.
† Participant successfully pried open the locked target box.
‡ Participant discovered the combination lock code and revealed it gesturally.

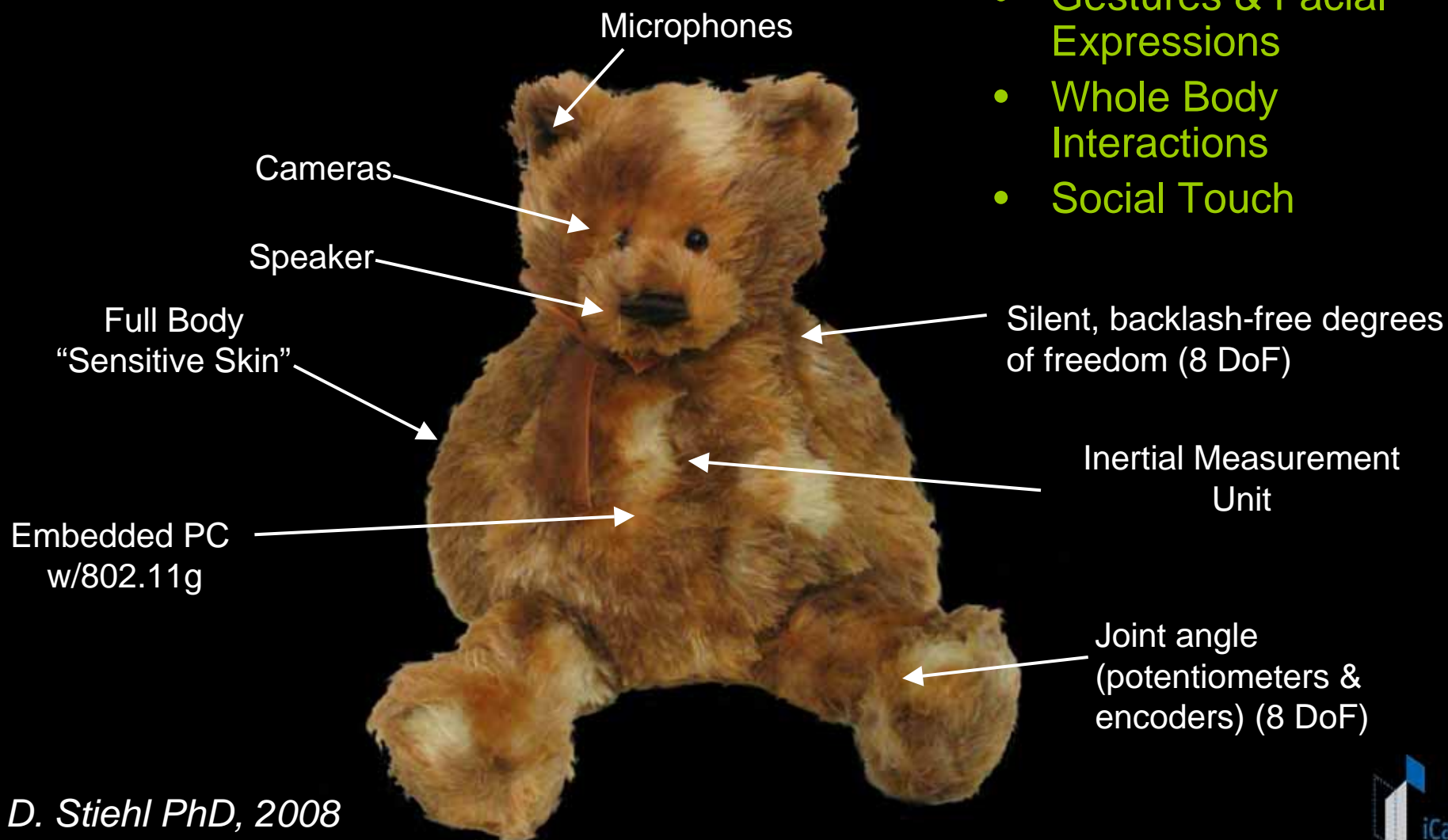
Performance on same task with 20 Human Subjects

Coordinating Minds and Bodies with Robots

- ✓ Robots that can **exhibit** non-verbal cues to help people attribute mind & coordinate their mind with it.
- ✓ Robots that **perceive & interpret** these non-verbal cues to coordinate their “mind” & behavior with people (collaborative machines)
- Robots that **enable** people to interact with others remotely using these same cues

The Huggable

- Mutual Gaze
- Gestures & Facial Expressions
- Whole Body Interactions
- Social Touch



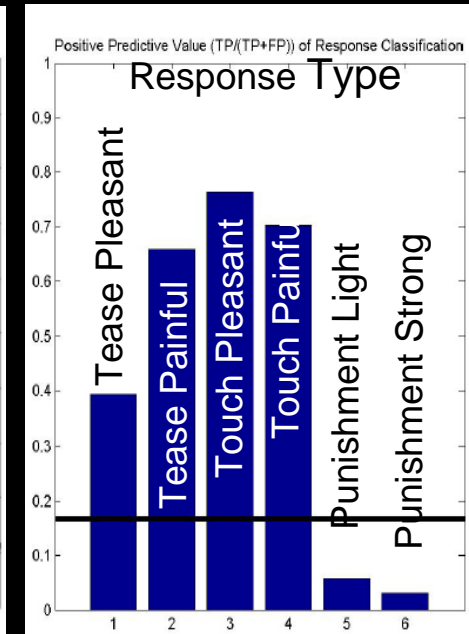
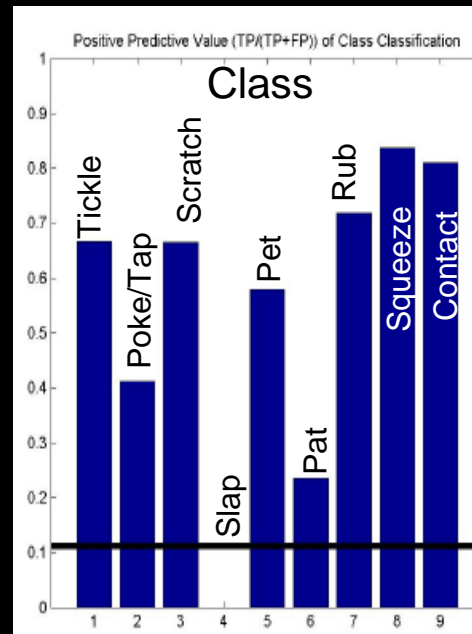
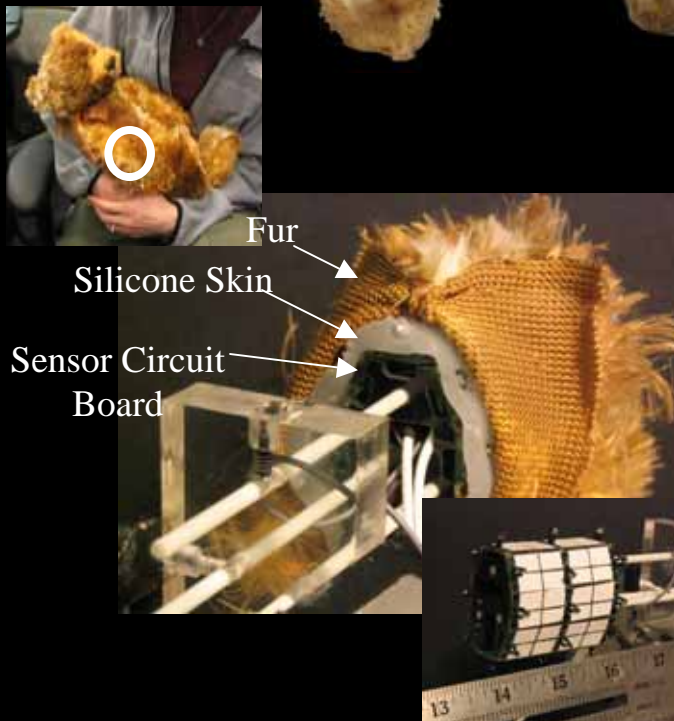
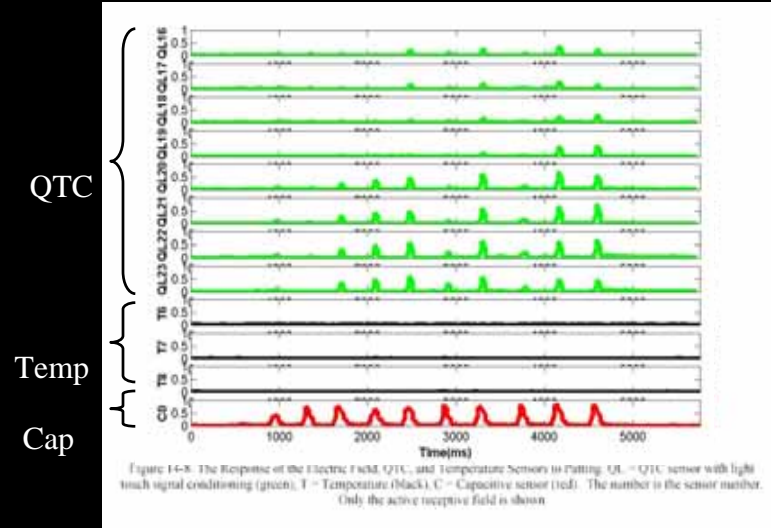
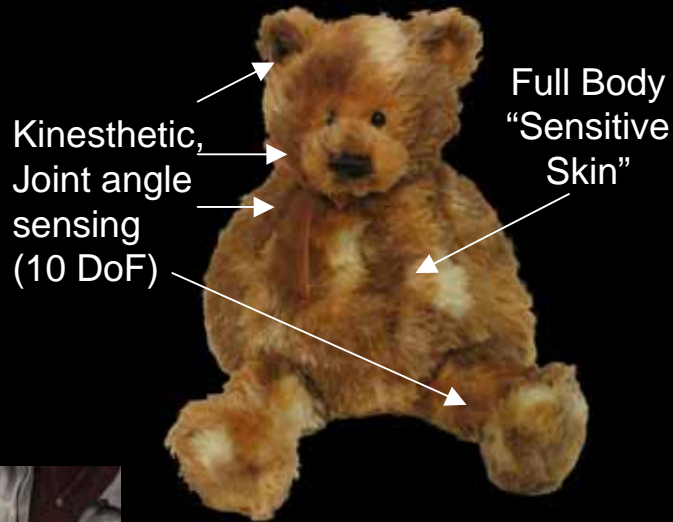
D. Stiehl PhD, 2008

Whole Body Interaction

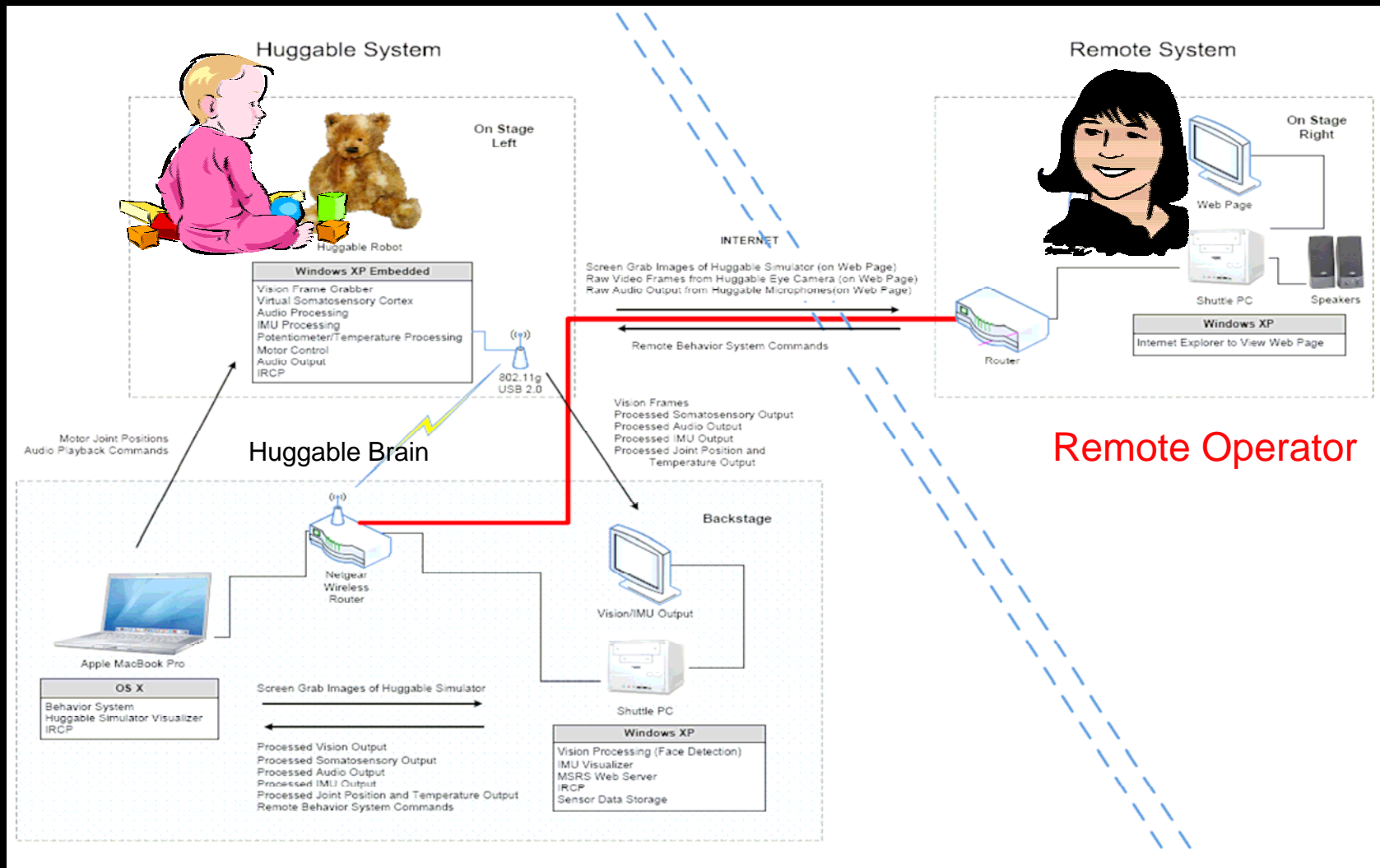
- One that can **perceive** these non-verbal cues
- One that can **actively participate** with people using these same cues face-to-face
- One that **enables** a human to interact with others remotely using these same cues



Social-Affective Touch



Communication Avatar Demo

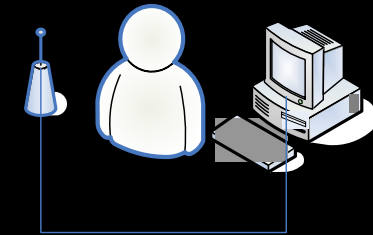


Imagine: Playing with Family from Anywhere

Tuck your child in bed from across the world



Web Interface



Remote Family Member

Goal:
Strengthening
Family
Connections



Daughter, Granddaughter

Huggable



Zoe and Olivia Hockenberry

First Impressions...

Imagine: Improving Experience in Hospitals

Your Child's first night alone at the Hospital



Parents@Home



Nurses



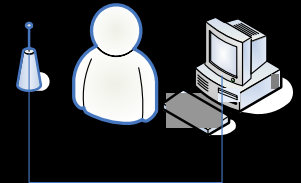
Child in Hospital



Huggable

Goal:
Improve
Experience of
Child & Family

Nurses Station



- 1.) Collected Data
- 2.) Distress Signal
- 3.) Live Video Feed
- 4.) Live Audio Feed
- 5.) Live Sensor Feed

Imagine: Empowering Care Providers

Provide Benefit
of Pet Therapy
and Tool for
Nursing Staff



Hospital/Nursing
Home Staff

Goal:
Promote
Health and
QoL of
Person

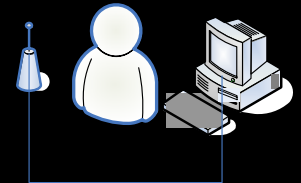


Resident/Patient



Huggable

Nurses Station



- 1.) Collected Data
- 2.) Distress Signal
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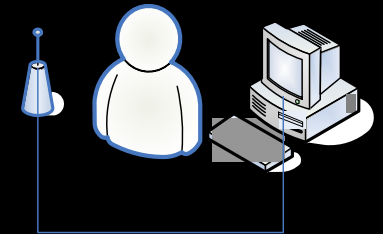
Imagine: A Private Tutor for Every Child

High Quality Early
Education for
Disadvantaged
Children



Remote Tutor

Web Interface



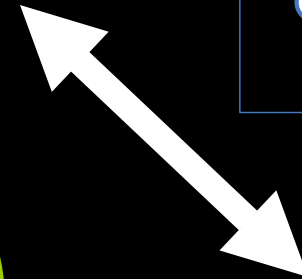
Goal:
High Quality
Early Education
For All
Children



Toddler/Child



Huggable



Thank You!

Grad Students and Postdocs

- Dan Stiehl
- Mikey Siegel
- Jeff Lieberman
- Matt Berlin
- Jesse Gray
- Guy Hoffman
- Dr. Andrea L. Thomaz

The Huggable UROP Army

- Robert Toscano
- Allan Maymin
- Dave Foster
- Yingdan Gu
- Iris Cheung Lily Liu
- Dimitrios Pouloupoulos
- Yi Wang
- Nicolina Akraboff
- Kristopher Dos Santos