Human-Computer Interaction

Artificial Agents

Professor Bilge Mutlu

Questions

To ask questions during class:

» Go to slido.com and use code **#2938904** or direct link or scan QR code

» Anonymous

» I will monitor during class

Today's Agenda

» Topic overview: *Artificial Agents*

» Discussion

Topic overview: *Artificial Agents*

Why do we have to think about computers as agents?

Software agents

Definition: A software agent is a computer program that acts for a user or other program in a relationship of *agency*.

Agency

Definition: An agreement to act on one's behalf.

Agency implies intelligence, autonomy, decision-making

Why do agents need bodies?

We need to locate intelligence, and this need poses problems for the invisible computer. The best example of located intelligence, of course, is the body.

— Cassell, 2001[1]

[1] Cassell, 2001, Embodied conversational agents: representation and intelligence in user interfaces

What does a body give us?

» A *locus of attention*—a target toward which we can our attention and behavior

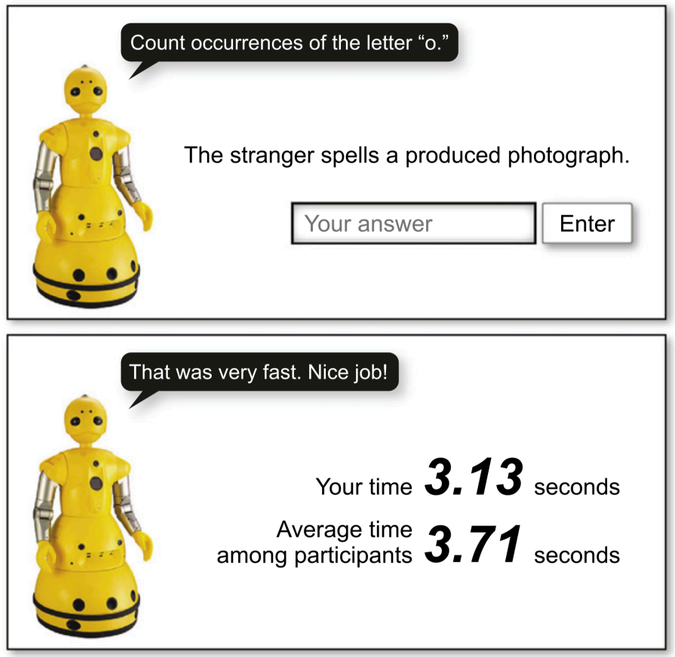
» Cues about the agent's status (e.g., functioning, not broken, speaking, waiting)

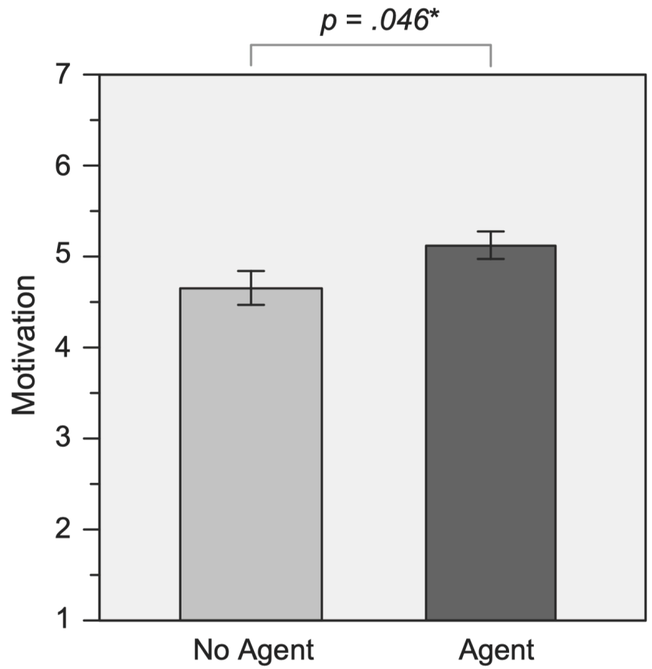
» Opportunity to create plausible, coherent characters that signal the agent's role (e.g., a butler, a personal assistant, a collaborator)

» Ability to utilize social mechanisms in interaction design

Why do we need a locus of attention?

Increased presence of, arousal toward, and commitment to another entity with agency.[3]

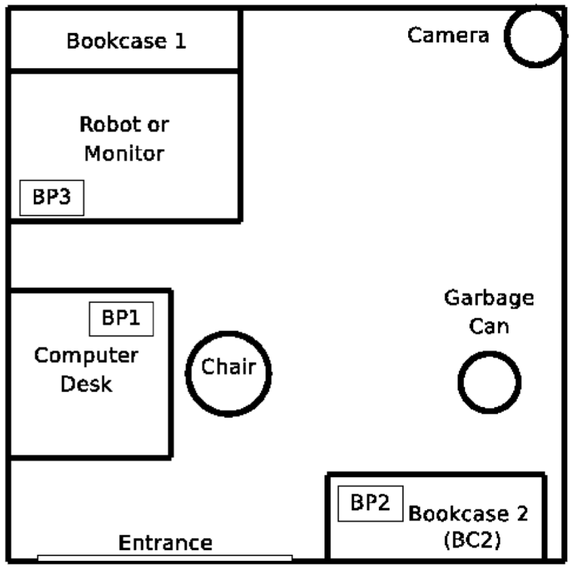


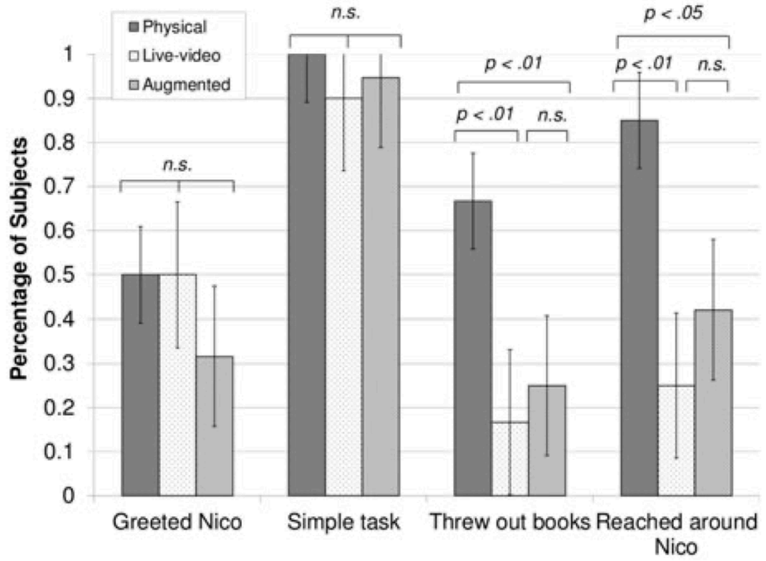


[3] Mumm & Mutlu, 2011, Designing motivational agents

Where should the body be?

Physical bodies further improve social outcomes.[4]





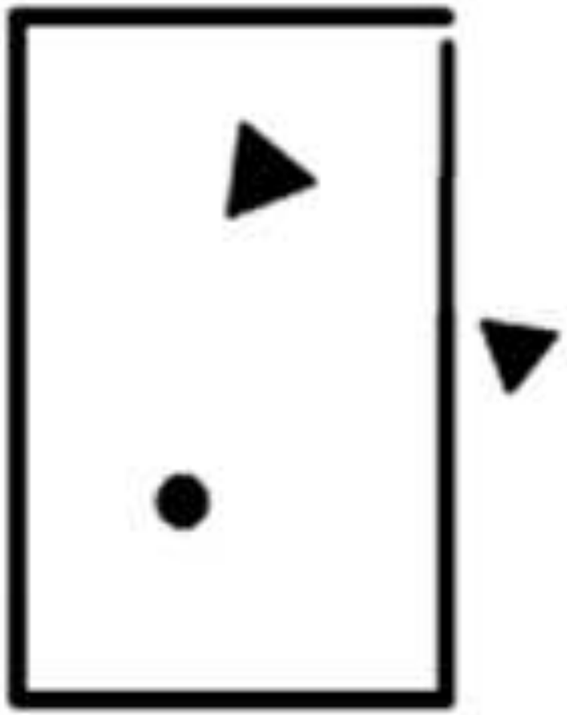
[4] Bainbridge et al, 2011, The benefits of interactions with physically present robots over video-displayed agents

Why do agents need human-like (or animal-like) bodies?

Faced with non-living things of sufficient complexity (i.e., when the observable behavior is not easily understood in terms of its underlying mechanisms), we often apply a social model to explain, understand, and predict their behavior.

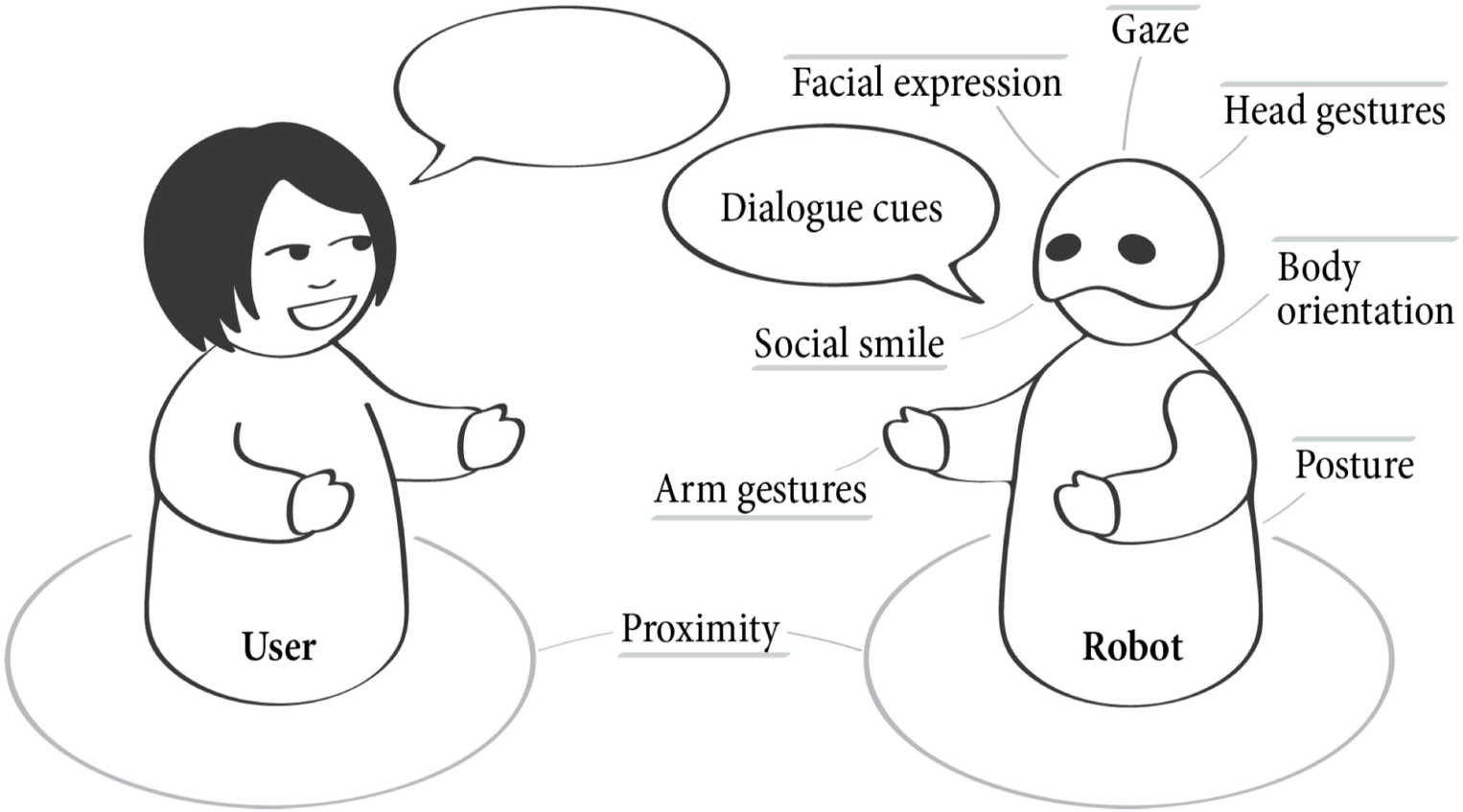
— Breazeal, 2003[5]

[5] Breazeal, C. (2003). Toward sociable robots. Robotics and autonomous systems, 42(3-4), 167-175.



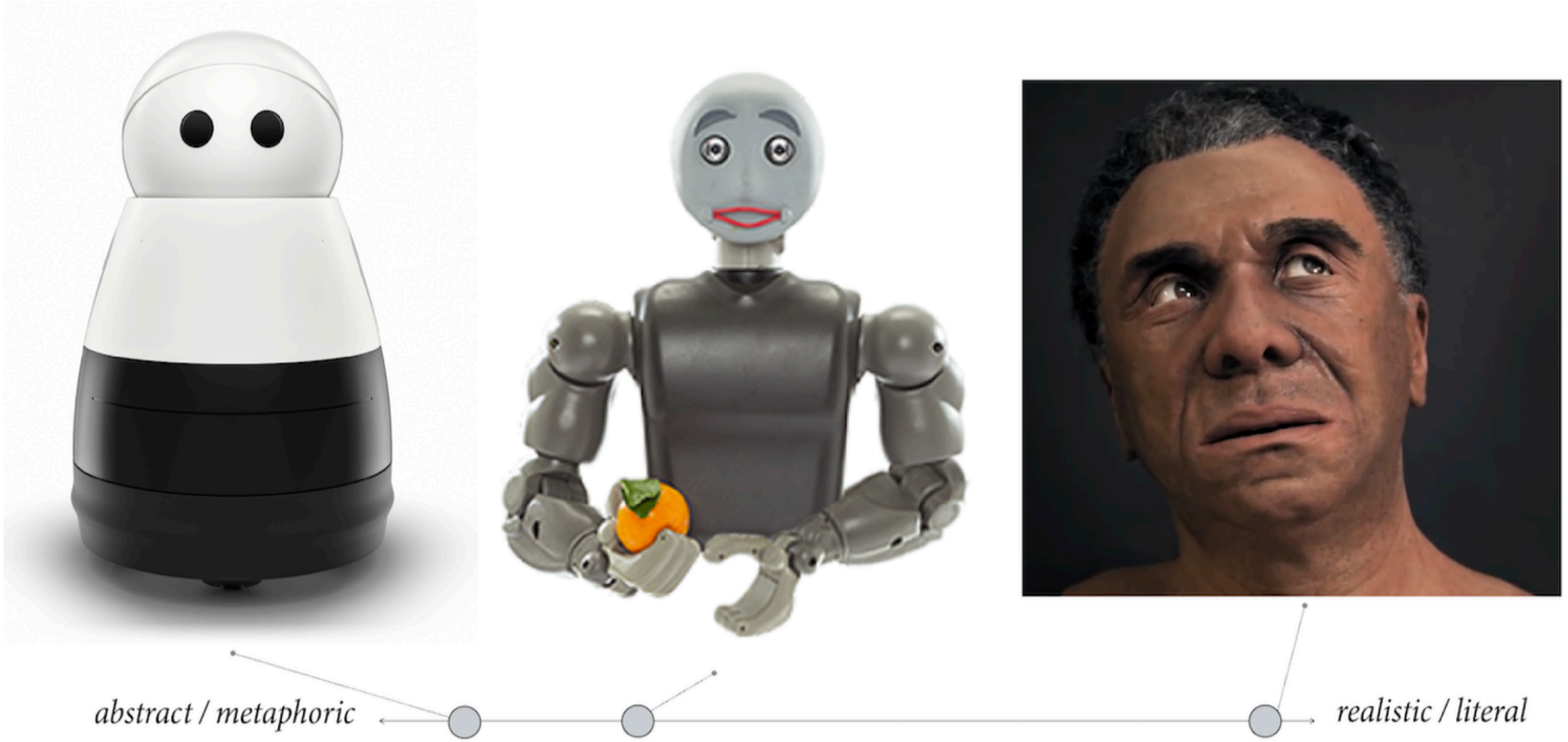
mmel, 1944, An experimental study of apparent behavior

How do we capitalize on social models?[8]



[8] Mutlu, 2011, Designing embodied cues for dialog with robots

How do we design for social interaction?[9]



[9] Deng et al., 2019, Embodiment in socially interactive robots

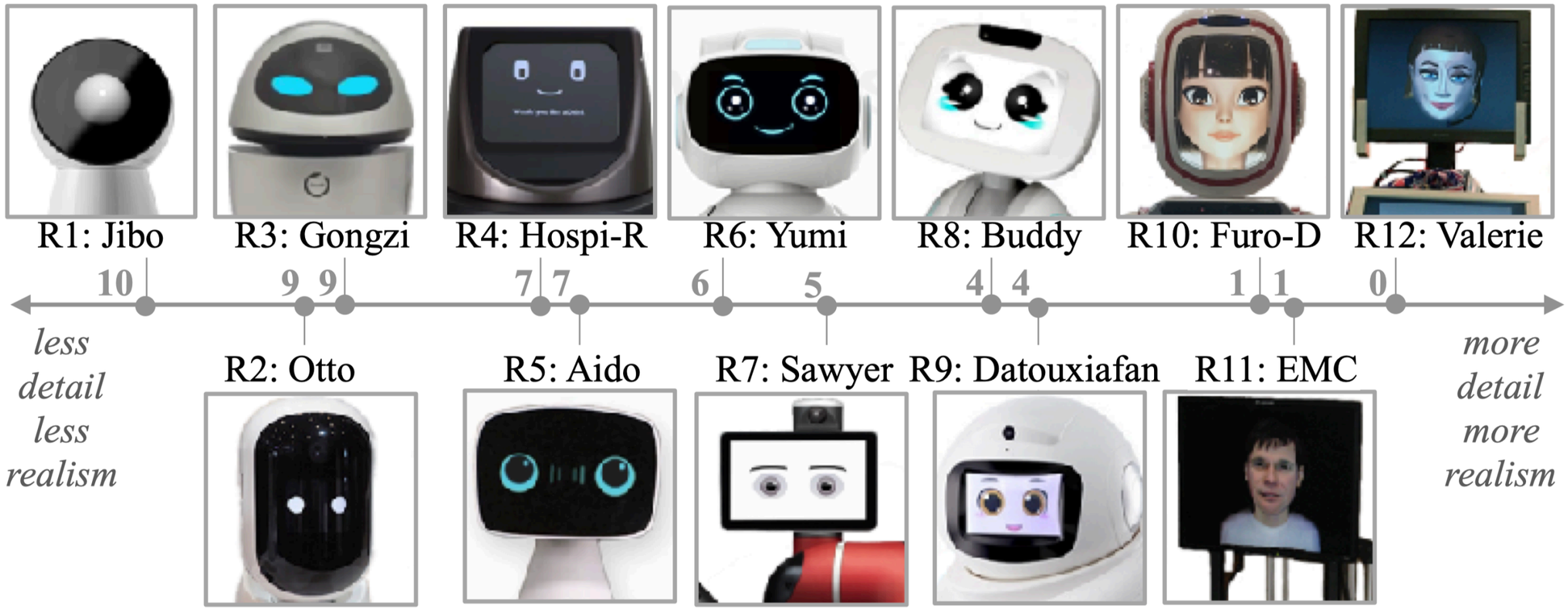
What is the design space of bodies?

Embodiments → Frames of Mind[10]

- Physical frame*
- Virtual frame*
- Blended frames
- Mediated frames
- Immersive frames

[10] Mutlu, B. (2021). The virtual and the physical: two frames of mind. *iscience*, *24*(2).

Blended Frames[11]



[11] Kalegina et al. (2018). Characterizing the design space of rendered robot faces. *HRI 2018*.

Mediated Frame[12]

Immersive Frame

[12] Images: left, right

Virtual Frame

"I am in a theatre play."

Physical Frame

"What am I encountering?"

Mechanism	Physical	Virtual
Situativity	Co-situated in the user's environment	User is brought into the agent's environment
Interactivity	Emerges from join action/intention	Invites users to participate in a crafted, patterned plot
Agency	Seen as independent agent pursuing own goals	Engagement is at the user's discretion
Proxemics	Dynamic, co-managed to follow human norms	Constrained, involving learned conventions
Believability	Real-world, self-relevant agent	Safe environment to experience emotion

Characteristics	Physical	Virtual
Applications	Physical, situated collaboration, assistance	Counseling, instruction, education, coaching
Activities	Activities interspersed across time and space	Focused, time-bound activities
Interactions	Interactions situated in day-to-day life	Metaphorical, rich, crafter interactions

Discussion Format

- Group discussion ~15 minutes
  - Separate to 9 groups randomly
  - Discuss with your group members
  - Take notes in the shared doc – pick your group number
- Summary from each group & discussion ~15 minutes

Discussion Questions

» What are some of the agents you interact with day to day?

» What are your interactions like?

» What are advantages and disadvantages of agents with bodies?

» What are advantages and disadvantages of applying a social model?

» Interesting findings from your external source?

» ...