

# CS 309: Autonomous Intelligent Robotics

## FRI I

### Lecture 09: Introduction to HRI

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[http://justinhart.net/teaching/2019\\_spring\\_cs309/](http://justinhart.net/teaching/2019_spring_cs309/)

# Human-Robot Interaction

- Briefly, the study of how humans and robots interact with each other
  - There has been some form of interacting with machinery since the very first robots, including simple electro-mechanical devices that arguably may count from the turn of the 20<sup>th</sup> century (Shultz & Goodrich, 2007)

# Human-Robot Interaction

- Research encompasses many themes
  - Newer hot topics:
    - Measuring human emotion & engagement
    - Human-robot autonomous collaboration
    - Physical human-robot interaction
    - HRI as design



# Human-Robot Interaction

- Research encompasses many themes
  - Long-standing hot topics:
    - Generating and interpreting gaze & joint attention
    - Language and HRI
    - Gesturing
    - Back-channel communication (things other than gestures and language)
    - Proxemics
    - Vocal prosody

# An explosion happened in the 90s

- Show Kismet video

# Interesting points from Kismet video

- One of the more interesting angles on HRI is that the human interpretation of the stimulus is the most important factor
  - Robots as evocative devices
  - The use of psychological methods to describe and interpret results

# Experimental HRI & HRI as Psych

- User studies as a primary driver in HRI
  - The assigned paper is an example
- Likert scale measures
  - The robot was lifelike 1 - - - 5
- Cognitive difference scale measures
  - The robot was <not at all lifelike> - - - <very lifelike>

# Experimental HRI & HRI as Psych

- Intra-participant vs Inter-participant designs
  - Will the study be harmed by users seeing all possible conditions?
  - Can you get enough data?
  - Does the order in which a participant sees stimuli affect the outcome? Can you account for this?



# Experimental HRI & HRI as Psych

- Establishing meaningful results
  - Statistical testing
    - t-tests
    - ANOVA (and variants)
      - Post-hoc tests
    - Correlation tests
    - p-values
    - Statistical significance

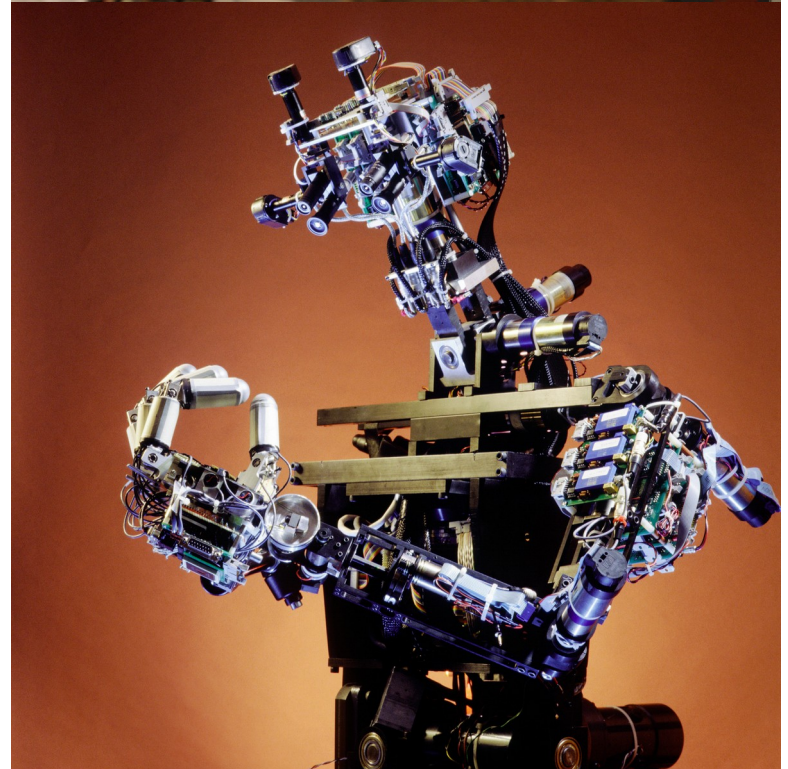
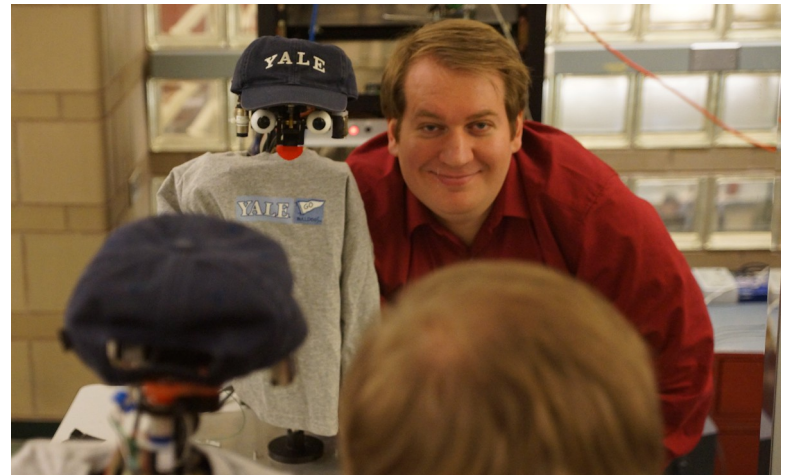
# Androids

- Often tele-operated or partially tele-operated
  - Geminoid
- Newer ones are autonomous
  - Erica
    - Erica video



# Humanoids

- Androids are designed to look very human
  - Appearance emphasized
- Humanoids have a roughly human form
  - Functionality emphasized

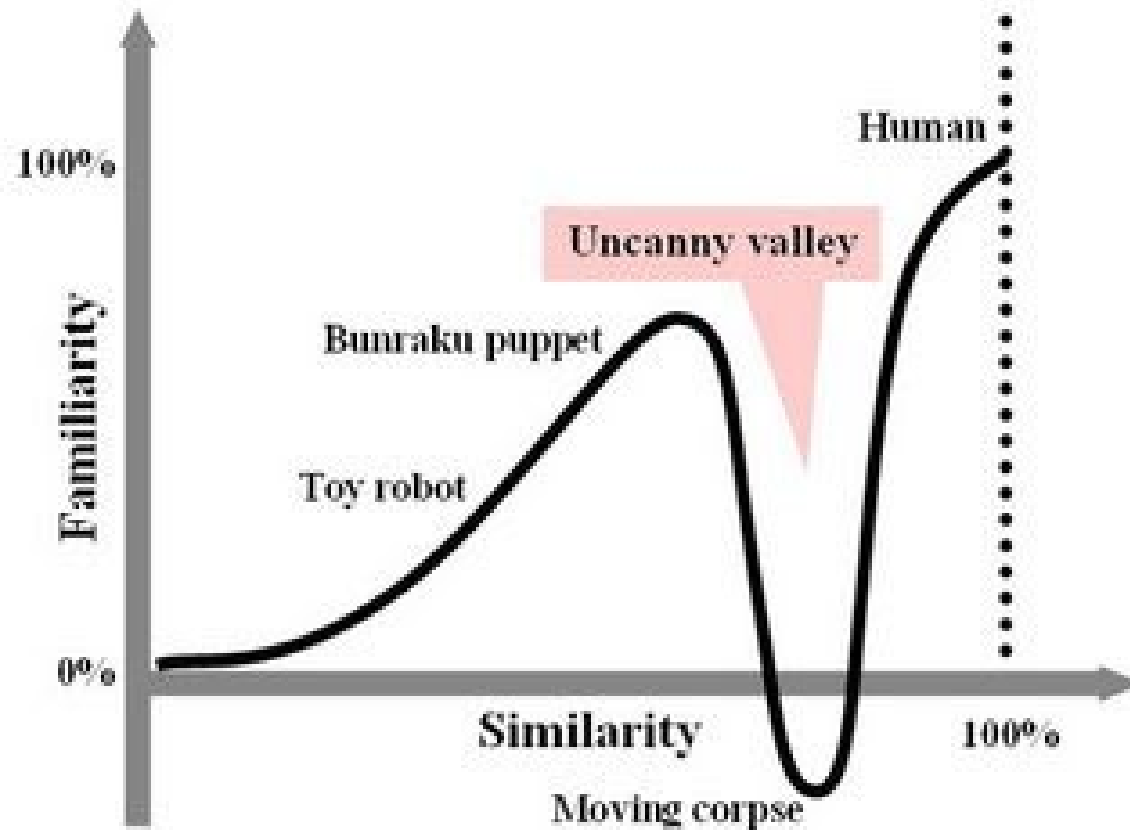


# Humanoids

- Sometimes, similar experiments appear on both
- Erica
  - Pre-programmed conversation engine
- Robovie
  - Learning dialogue from humans



# The Uncanny Valley



# Physical HRI (pHRI)

- Handovers
  - Video
- Shared carrying
- Exoskeletons
- Collaborative assembly and manufacturing
  - Video

# Today's paper

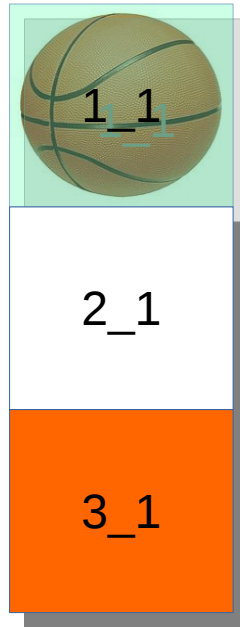
- No Fair! An Interaction with a Cheating Robot
  - Short documentary
  - Control
    - Robot Plays Rock Paper Scissors
  - Verbal
    - Robot verbally announces itself the winner
  - Action
    - Robot changes its gesture before announcing itself the winner

# Hallway






# Hallway



|  |     |     |
|--|-----|-----|
|  1_1 | 1_2 | 1_3 |
| 2_1  | 2_2 | 2_3 |
| 3_1  | 3_2 | 3_3 |

|     |   |     |
|-----|---|-----|
| 1_1 | 1_2   | 1_3 |
| 2_1 |  | 2_3 |
| 3_1 | 3_2   | 3_3 |