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## A BIOLOGICAL INSPIRED COGNITIVE MODEL OF MULTI- SENSORY JOINT ATTENTION IN HUMAN ROBOT COLLABORATIVE TASKS

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# Background



Different attention  
computational  
models \*



Few are addressing  
cooperative task



Neglecting the  
mutual presence

- N. Pfeiffer-Lessmann, T. Pfeiffer and I. Wachsmuth, "An Operational Model of Joint Attention--Timing of the Initiate-Act in Interactions with a Virtual Human,"
- A. Frischen, A. Bayliss and S. Tipper, "Gaze Cueing of Attention: Visual Attention, Social Cognition, and Individual Differences"

# Our Research Goals



ASSESSMENT  
DURING ATTENTION  
PROCESS



CONSIDER THE  
MUTUAL PRESENCE



COMPARE THE  
BEHAVIORS

# OUR CONTRIBUTION

1

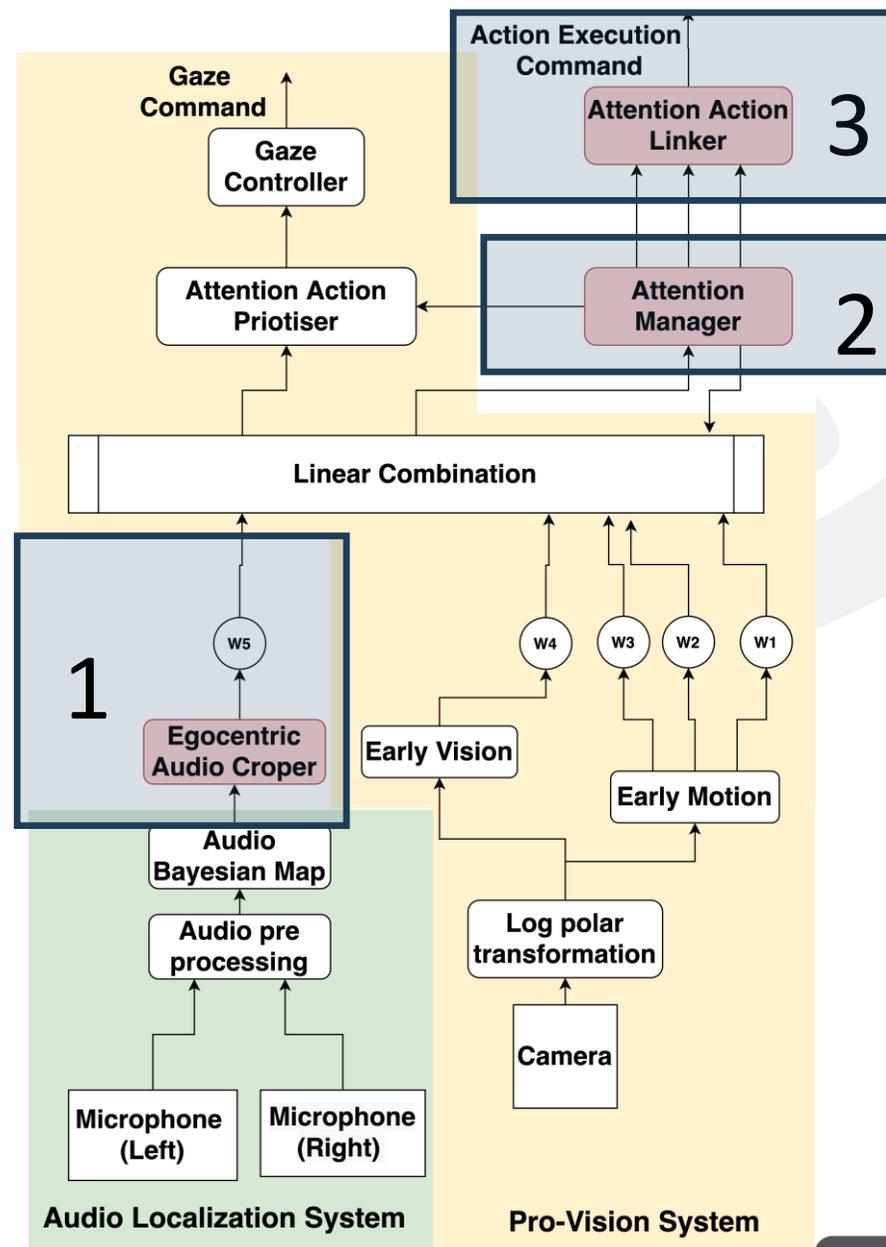
Integration (Audio + Visual)

2

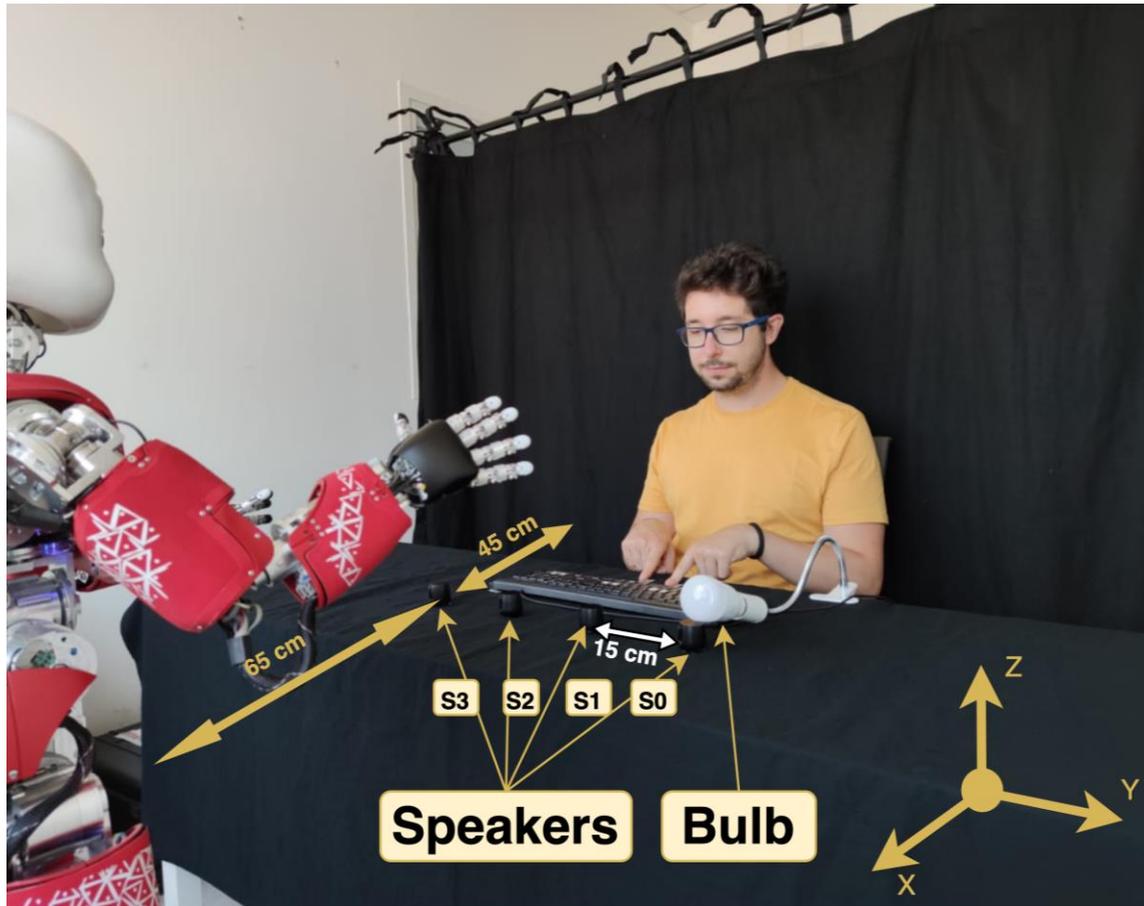
Acyclic extraction of a saliency (hot Point)

3

Retinotopic response projection into allocentric spatial representation



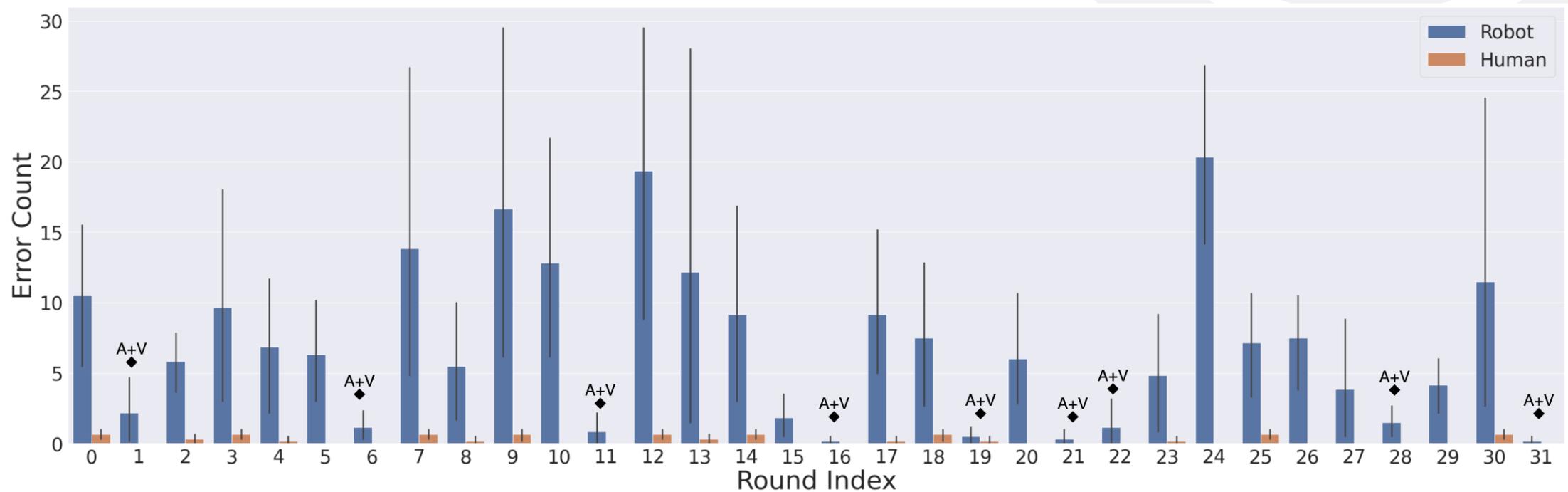
# THE EXPERIMENT



- Stimulation
  - 3 location Audio only
  - 1 location Audio + visual
- Temporal Stimulus
  - 240 Hz audio signal
  - Blue color
- Running the experiment
  - 6 subjects
  - 32 rounds each
  - 10 sec. on / 10 sec. off

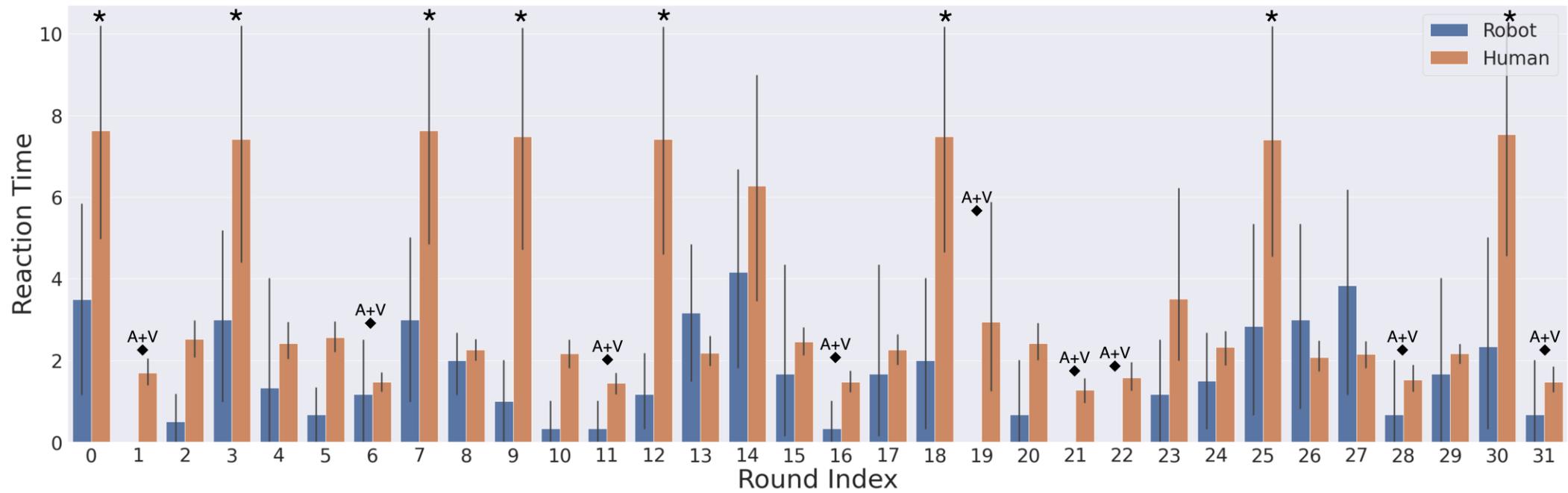
# RESULTS (ERROR COUNT)

- Compared error count between the human and the robot in A+V trials
- Significant deference in audio only trials



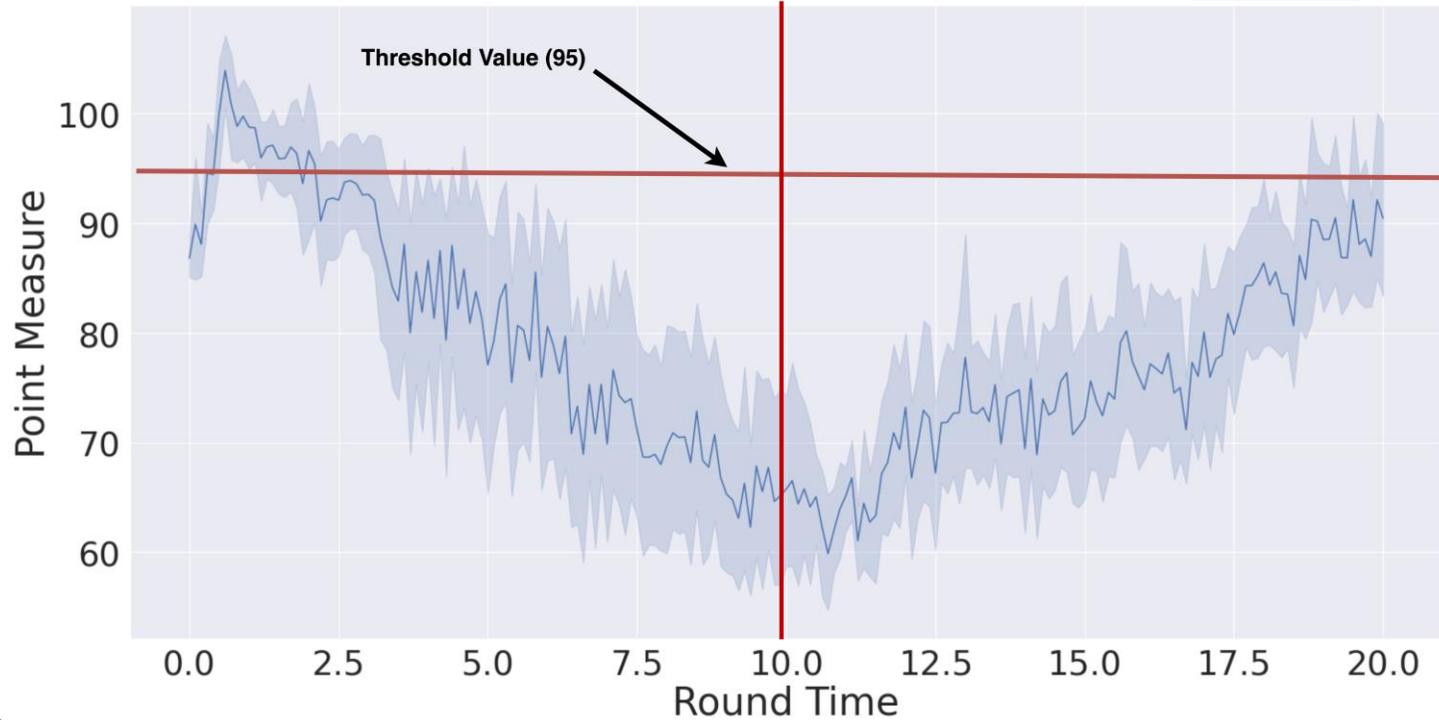
# RESULTS (REACTION TIME)

- Wide Variability in RT for the robot
- Compared RT in average
- The robot isn't as accurate as the human



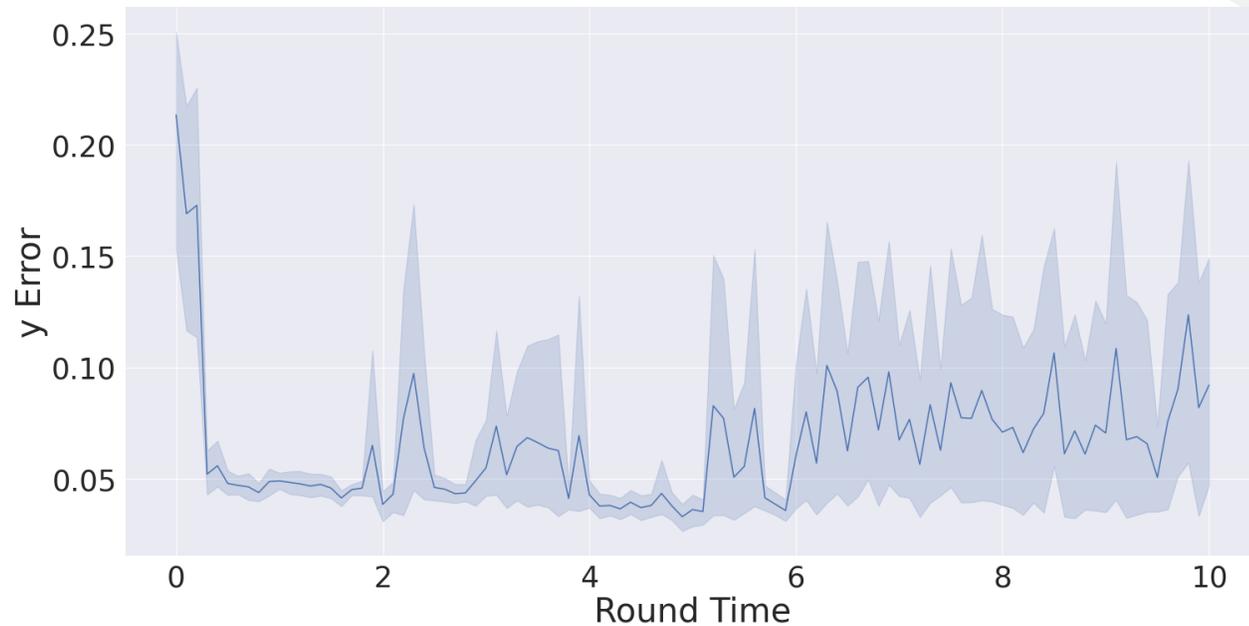
# RESULTS (HOT POINT MEASURE IN A+V)

- Swift increase when the stimuli is presented



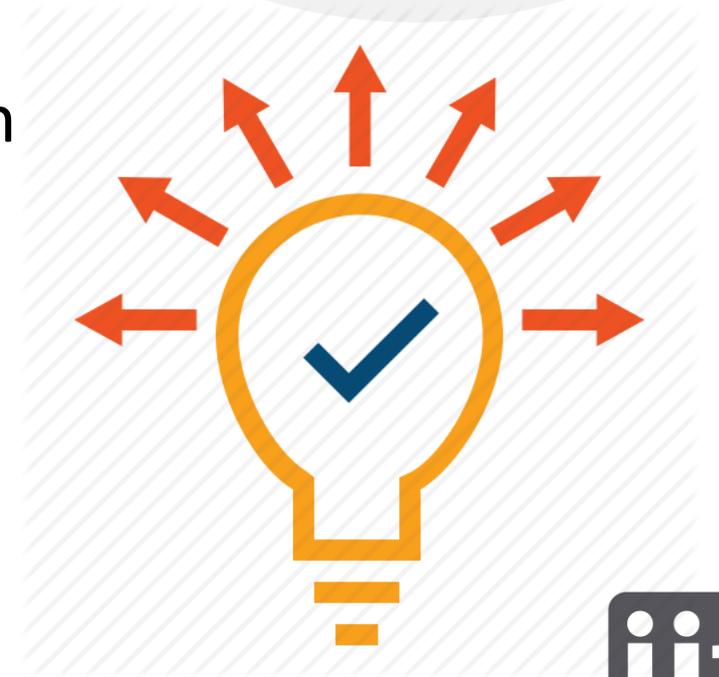
## RESULTS (LOCATION ERROR IN A+V)

- Error drop when the stimuli is presented
- $< 0.1$  error in most of the on time on average
- Error rise again when the stimuli is off



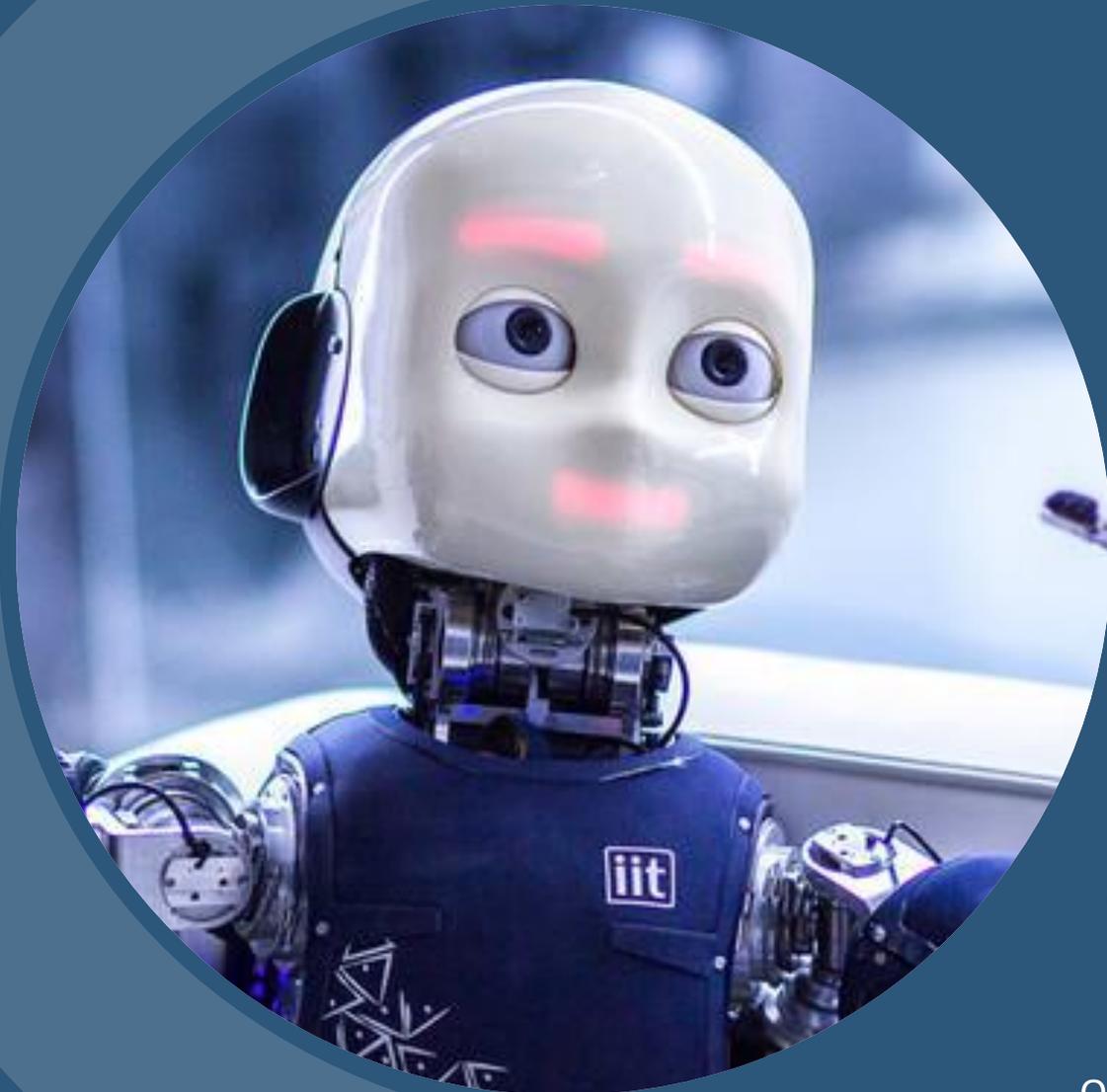
# CONCLUSION

- Importance of joint attention
- It is difficult task for the robot
  - Reaction time
  - Localization accuracy
- Comparable robot and human performance when Auditory and visual stimuli is presented
- localizing the auditory stimuli is challenging





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# THANK YOU!



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