

1 Robots supporting groups

Group dynamics are crucial for group performance, individual well-being and generalized trust. Robots can shape a group's dynamics but must recognize "what's going on" as in these examples:



What should a robot do to support groups?

- 1 Perceive group dynamics
- 2 Select action considering
 - a) Current dynamics
 - b) Individual differences

Task cohesion

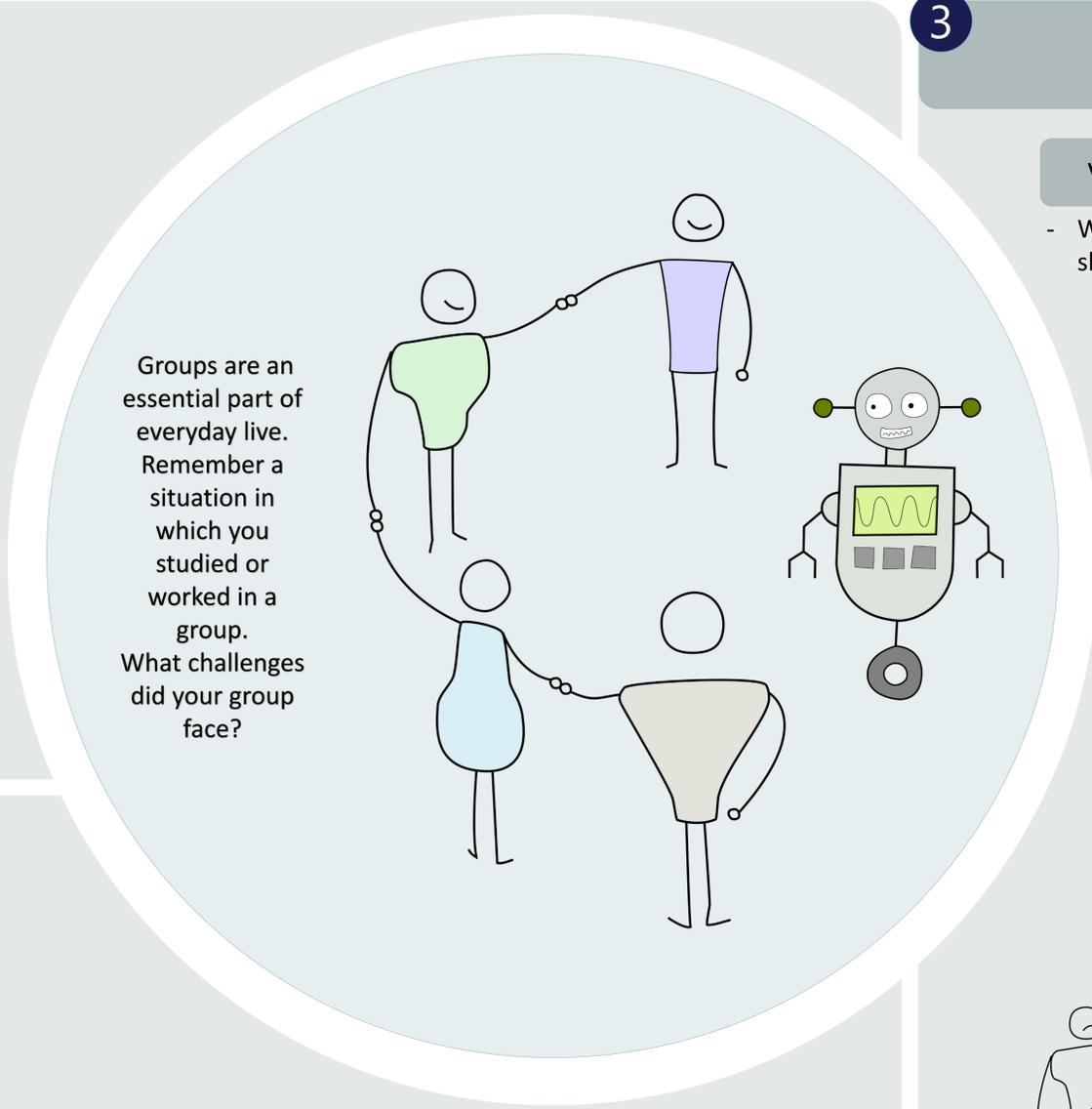
- Uneven work distribution
- Who is doing too much, who too little?

Collaboration

- Conflict between group members
- Who to ask to apologize?

Inclusion

- "Us vs them" feeling
- Whom to bring closer (ingroup ↔ outgroup)?



3 Learning beyond heuristics

Verbal vs. non-verbal

- Which *modalities* of actions should the robot use?

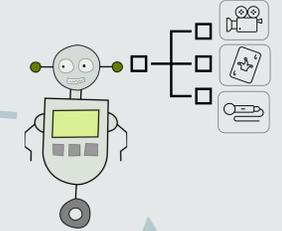
Let's hear everyone's opinion.

We could prepare cards to collect our thoughts.

Indirect vs. direct

- What *types* of actions should the robot use?

2 Action

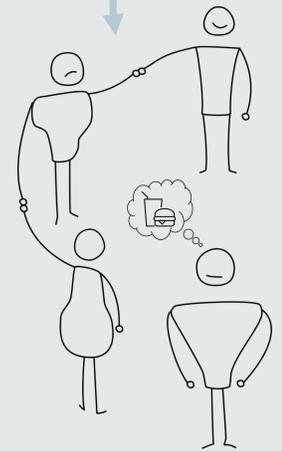


Sparse data

- How can we use previously collected data for learning, e.g. using BatchRL?

When and what?

- How can we transfer Interactive ML approaches to robots in groups?



1 State, Reward

Prediction vs selection?

- Can we efficiently select actions from predicted cohesion?

State = Reward?

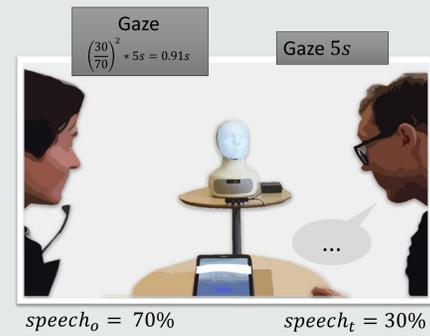
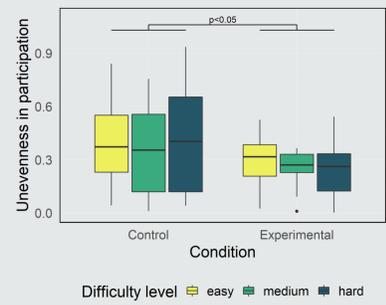
- Can we use the same social signals for state and reward?

2 Group dynamics awareness

Gaze balancing participation in skill-imbalanced groups

- 1 Perceive participation behavior → dominance / imbalance
 - 2 If someone talks a lot, the robot looks less at that person
- adaptation** based on voice activity:

$$r = \min\left(\left(\frac{speech_t}{speech_o}\right)^2, 1\right)$$



Between-subjects (N = 27) : online adapting gaze vs. gaze following the speaker (control).

Procedure: One Swedish learner, one Swedish native speaker played a language-focused word game with the robot.

Results: More even participation, indicating that a robot's gaze can shape group interactions.

Fostering inclusion and collaboration among children

- 1 Perceive game behavior → Group dynamics
- 2 Prompt least active child
Follow play and encourage



Between-subjects (N = 8) : group dynamics aware vs random robot behaviors

Procedure: One newly arrived child, two already present children play a music puzzle mediated by the robot.

Results: Children take first steps towards inclusion and act more prosocial.