

# Exploring Prosociality in Human-Robot Teams

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What is Prosociality?



TP-42

471E DOKN

WALMART

SHARP  
TOILETRIES DRIVE

SHARP  
TOILETRIES DRIVE

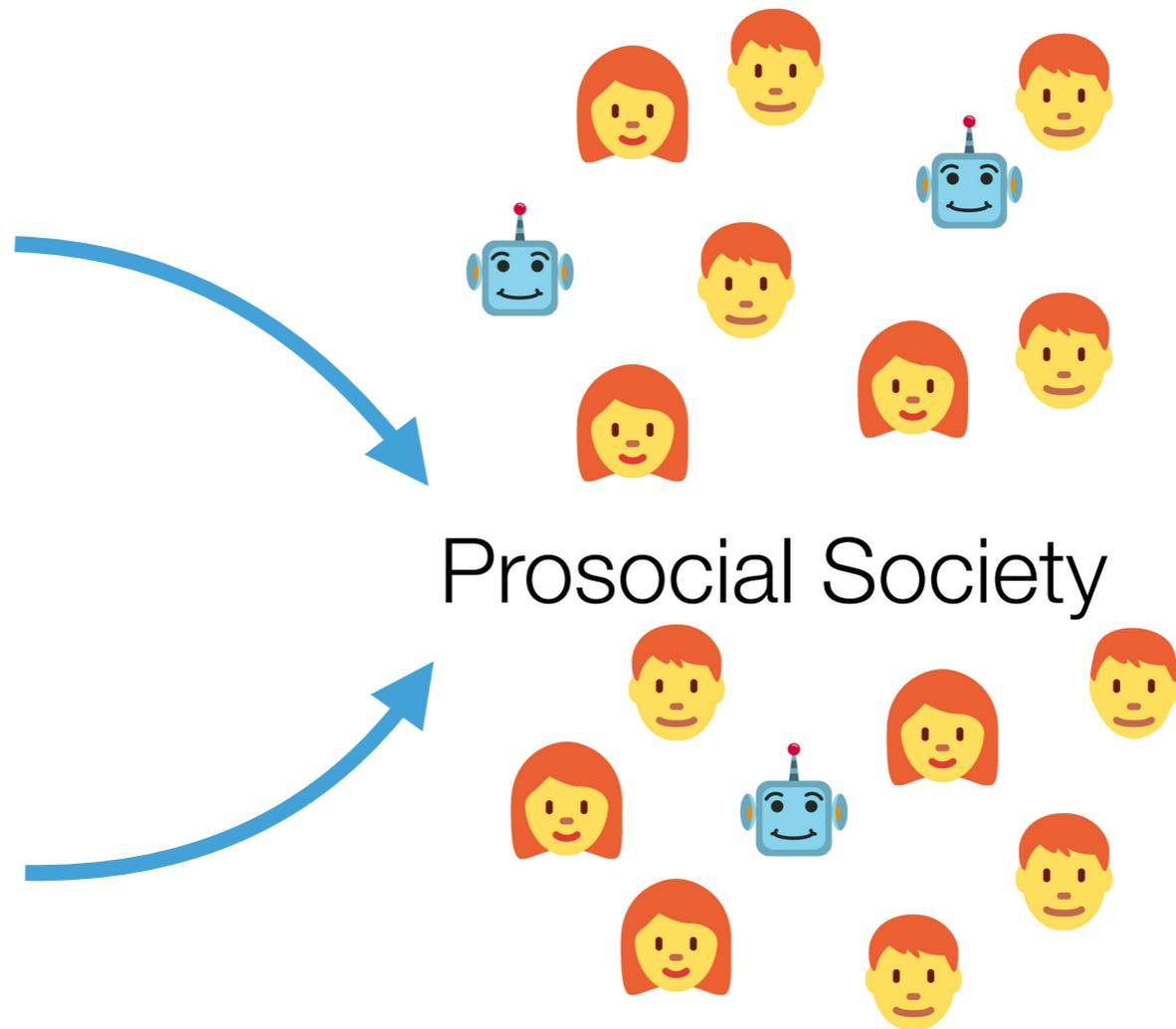
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**ARUP**  
BLOOD SERVICES

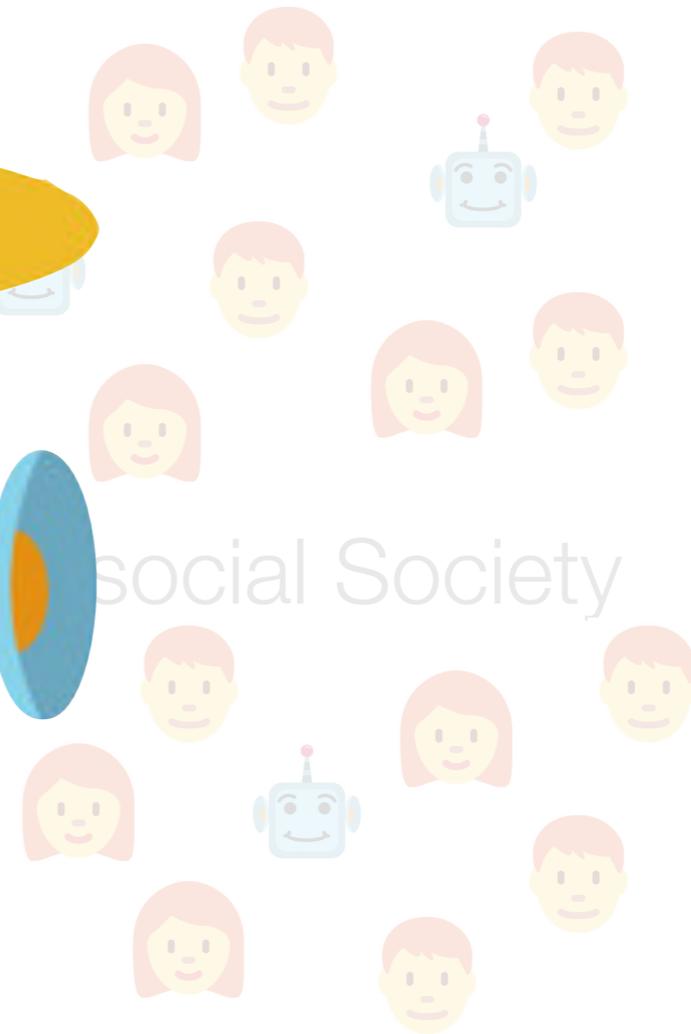
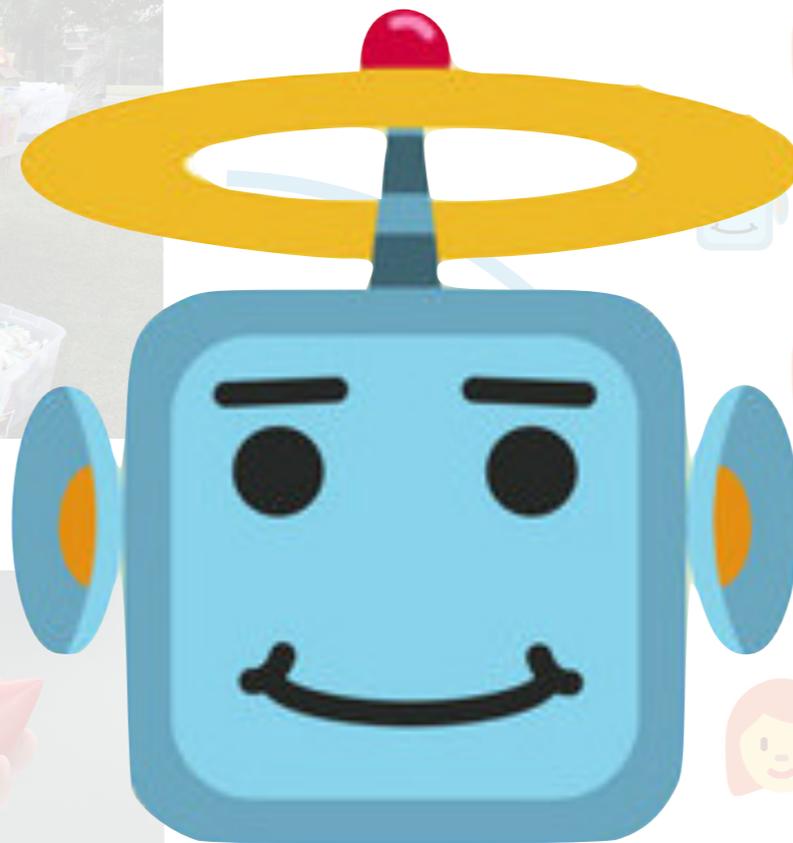
# Motivation

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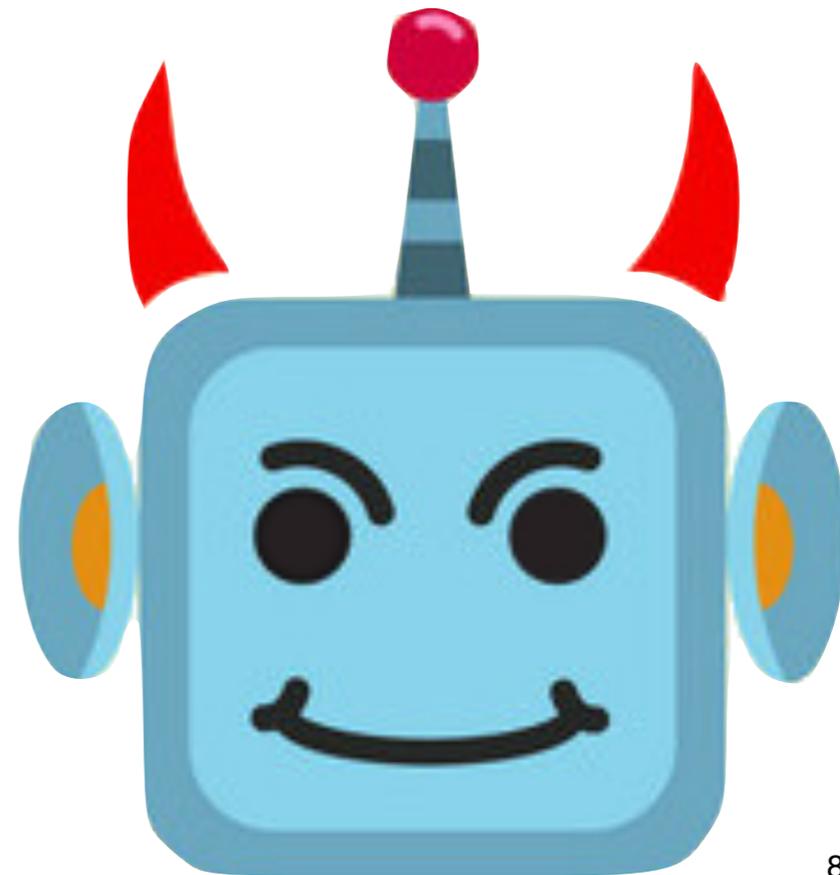
Why wouldn't  
we create  
prosocial robots?

# Motivation

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Robots will always somehow reflect the interests of...

- Developer
- Owner
- Company
- Government



# Research Questions

# Research Questions

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In a collaborative setting...

- How do people perceive a prosocial robotic partner?
- How do people perceive a selfish robotic partner?
- Do those perceptions change according to the team performance?

Scenario

# Scenario

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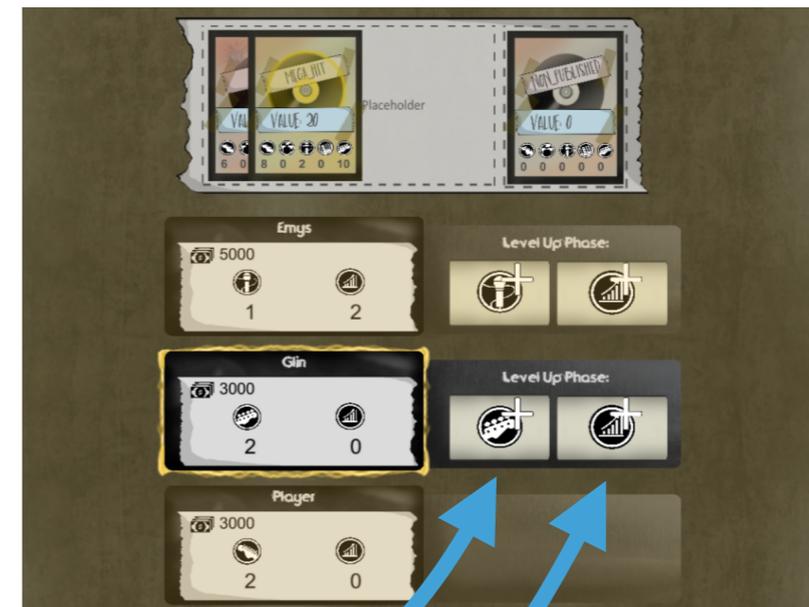
- “For The Record”
- N-player collaborative game
- Musical metaphor:

*“The band needs to collect the maximum number of successful albums without collapsing”*



# Scenario

- Threshold game with uncertain returns (public goods game)
- Each round:
  - Social dilemma



Defect

Cooperate

# Scenario

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Threshold game with **uncertain returns**



digital dice

control the outcome (win/lose)

# Scenario

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3 players

- 1 person
- 2 autonomous robots

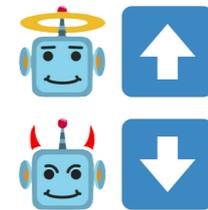


# Hypotheses

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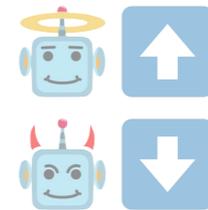
**H1** - The **prosocial robot** will be perceived **more positively** in its social attributes **than** the **selfish robot**.



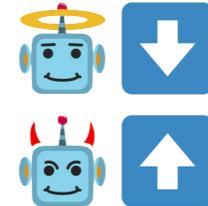
# Hypotheses

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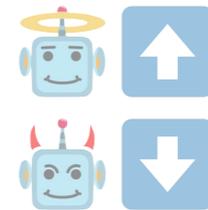
**H2** - The **prosocial robot** will be perceived as **less competent than** the **selfish robot**.



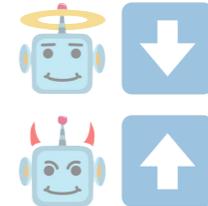
# Hypotheses

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**H1** - The **prosocial robot** will be perceived **more positively** in its social attributes **than** the **selfish robot**.



**H2** - The **prosocial robot** will be perceived as **less competent than** the **selfish robot**.



**H3** - Group **trust** and group **identity** will be **positively associated** with the team **performance**.



# Hypotheses

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**H4** - When the team **wins**, people will attribute higher **credit** to the **prosocial robot**.



**H5** - When the team **loses**, people will **blame** more the **selfish robot**.



# Hypotheses

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**H6** - The **prosocial robot** will be **preferred** as a **future partner**.



# User Study

# Experimental Design

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- Mixed experimental design
  - Within-subjects variable - robotic partner

Cooperator/Prosocial

Defector/Selfish

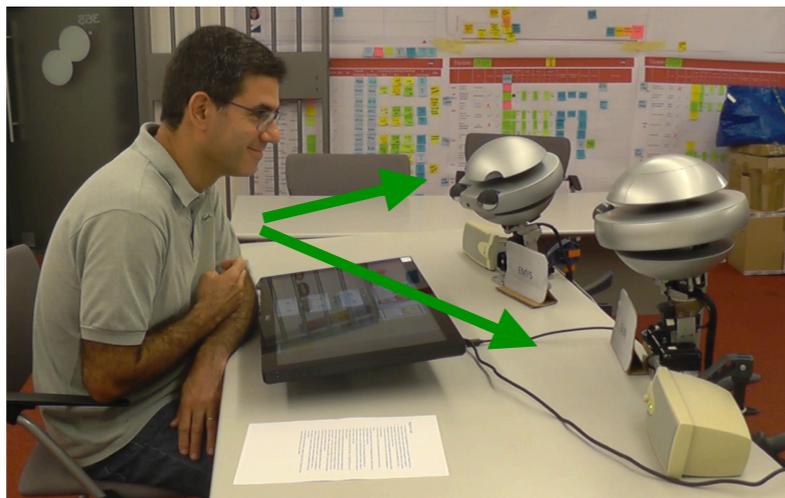


# Experimental Design

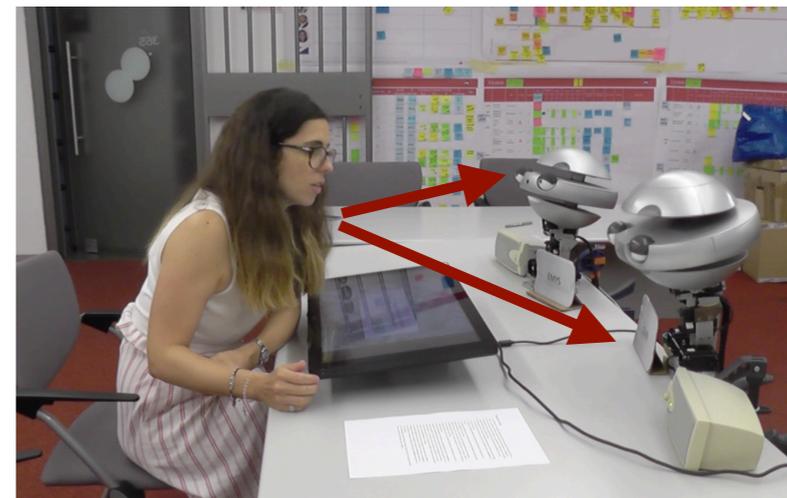
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- Mixed experimental design
  - Within-subjects variable - robotic partner
  - Between-subjects variable - game result

Winning



Losing





# Participation

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- 70 participants
  - 37 males, 32 females, 1 unknown
- 35 per condition
- **large corporation** in the energy sector
  - [22-63] years old (M = 43.6, SD = 11.557)

# Measures - Social Attributes

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## RoSAS Questionnaire [1]

- Warmth
- Discomfort
- Competence

[1] C. M. Carpinella, A. B. Wyman, M. A. Perez, and S. J. Stroessner, “**The robotic social attributes scale (rosas): development and validation**” in *ACM/IEEE Int. Conf. on Human-Robot Interaction*, 2017.

# Measures - Group-related

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- Group Trust Questionnaire [2]
- Group Identification [3]

[2] K. Allen and R. Bergin, “**Exploring trust, group satisfaction, and performance in geographically dispersed and co-located university technology commercialization teams**” in In Proceedings of the NCIIA 8th Annual Meeting: Education that Works, 2004, pp. 18–20.

[3] C. W. Leach, M. Van Zomeren, S. Zebel, M. L. Vliek, S. F. Pennekamp, B. Doosje, J. W. Ouwerkerk, and R. Spears, “**Group-level self-definition and self-investment: a hierarchical (multicomponent) model of in-group identification.**” Journal of personality and social psychology, vol. 95, no. 1, p. 144, 2008.

# Measures - Responsibility attribution

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Credit / Blame attribution to...

- randomness
- self strategy
- strategy of the prosocial robot
- strategy of the selfish robot

# Measures - Partner selection

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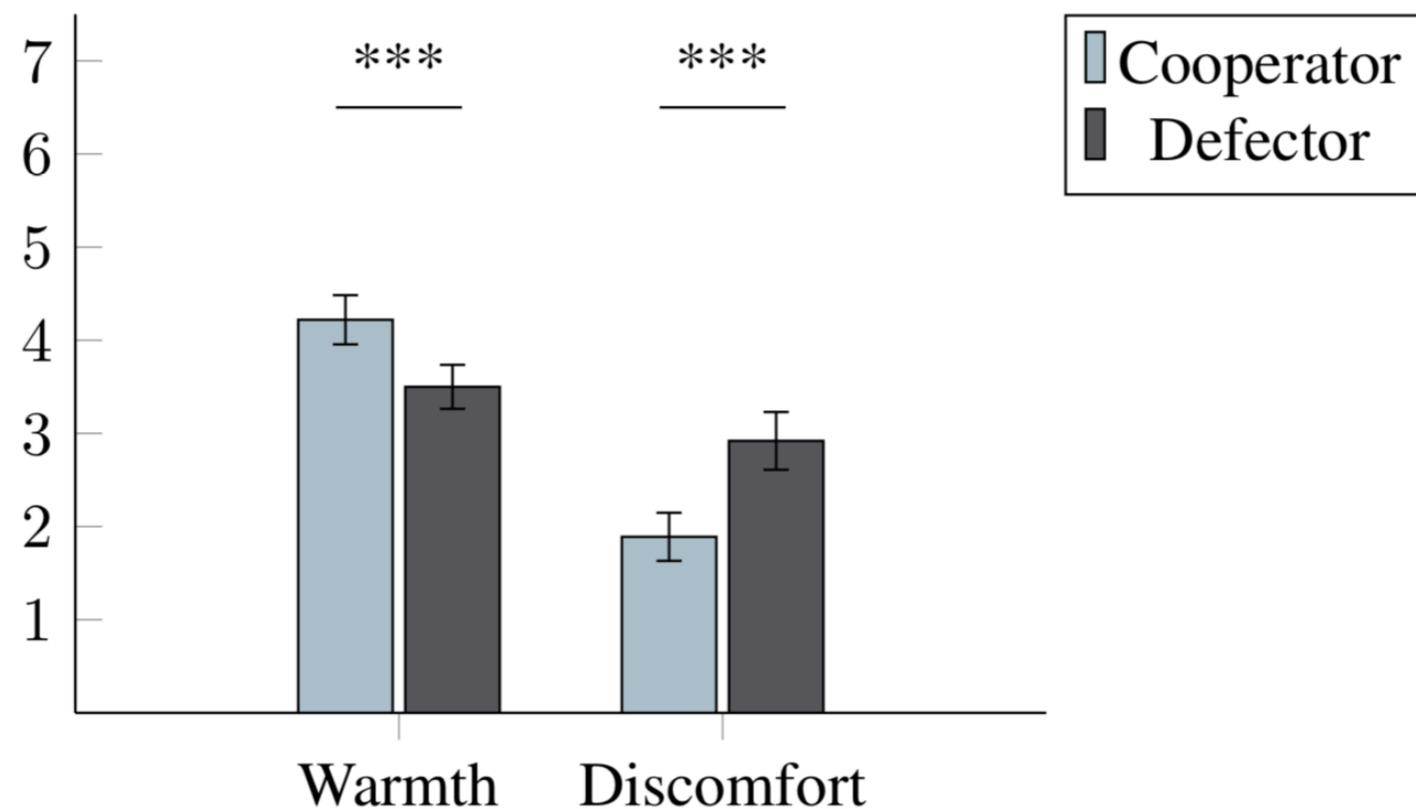
- Choice of a robotic partner for a hypothetical future game
  - Prosocial
  - Selfish

# Results

## Results - Social Attributes

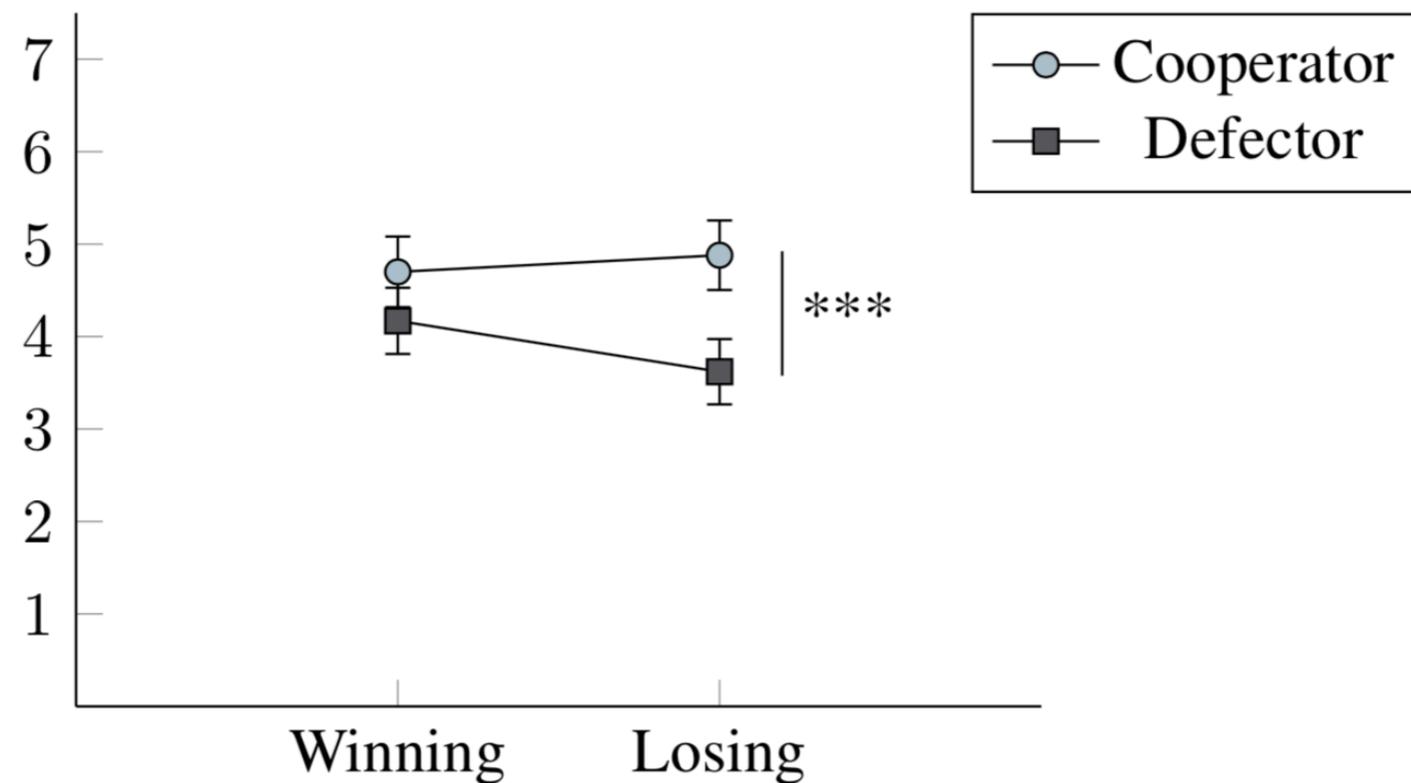
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- We found a statistically **significant main effect** of the **robotic partner** on the perceptions of **warmth** ( $p < 0.001$ ) and **discomfort** ( $p < 0.001$ ).



## Results - Social Attributes

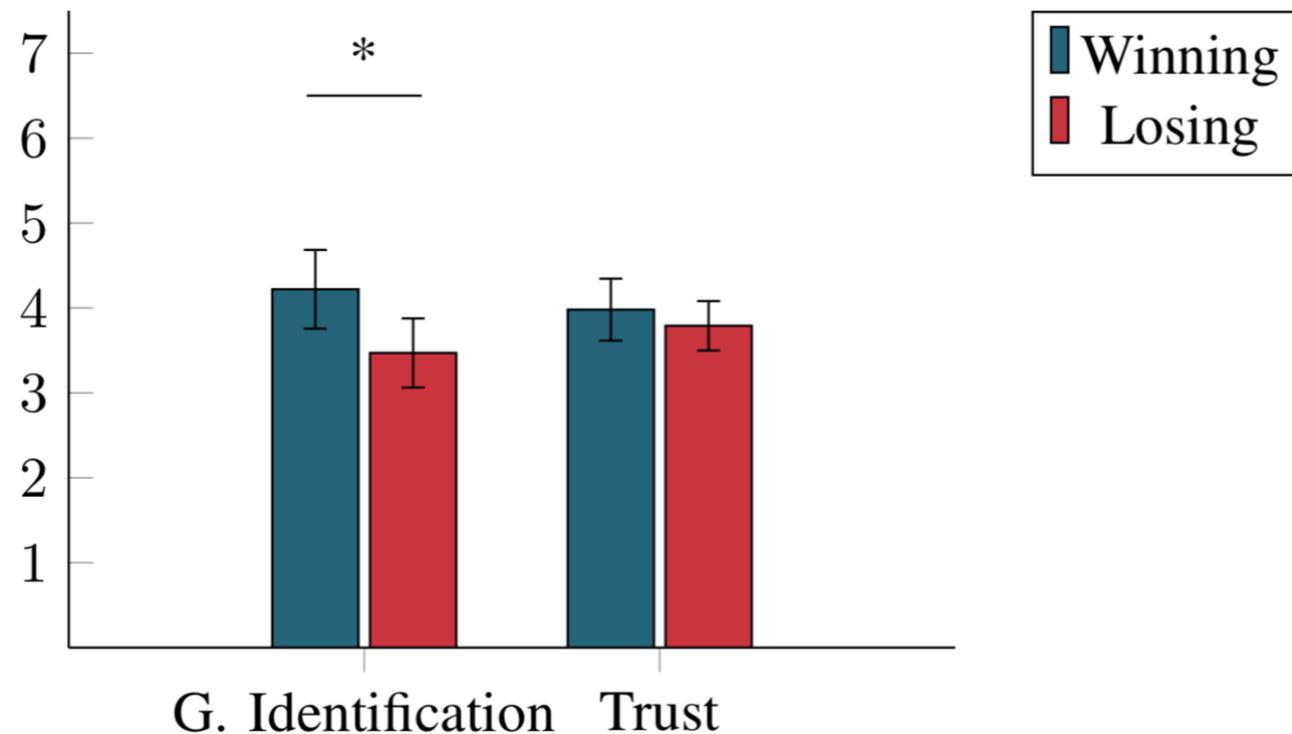
- We found a statistically **significant interaction effect** between the **robotic partner** and the **game result** on the perception of **competence** ( $p = 0.047$ ).



## Results - Group Measures

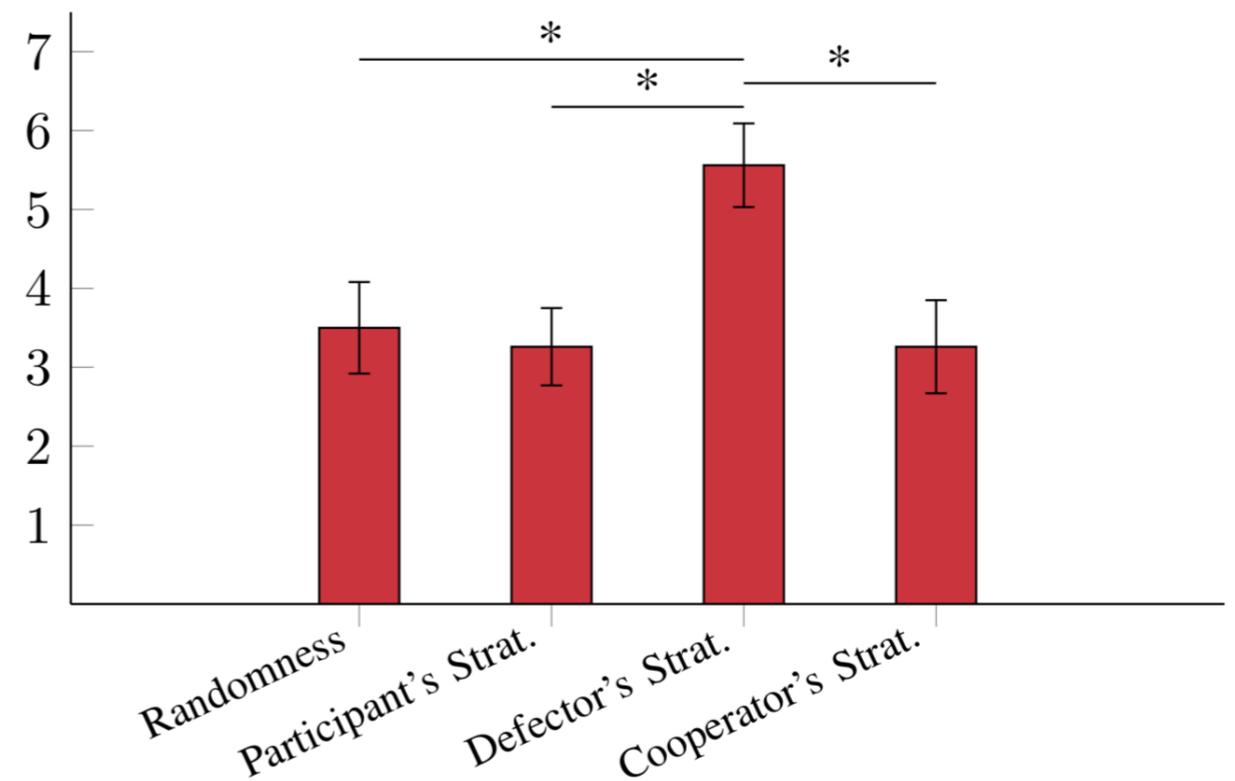
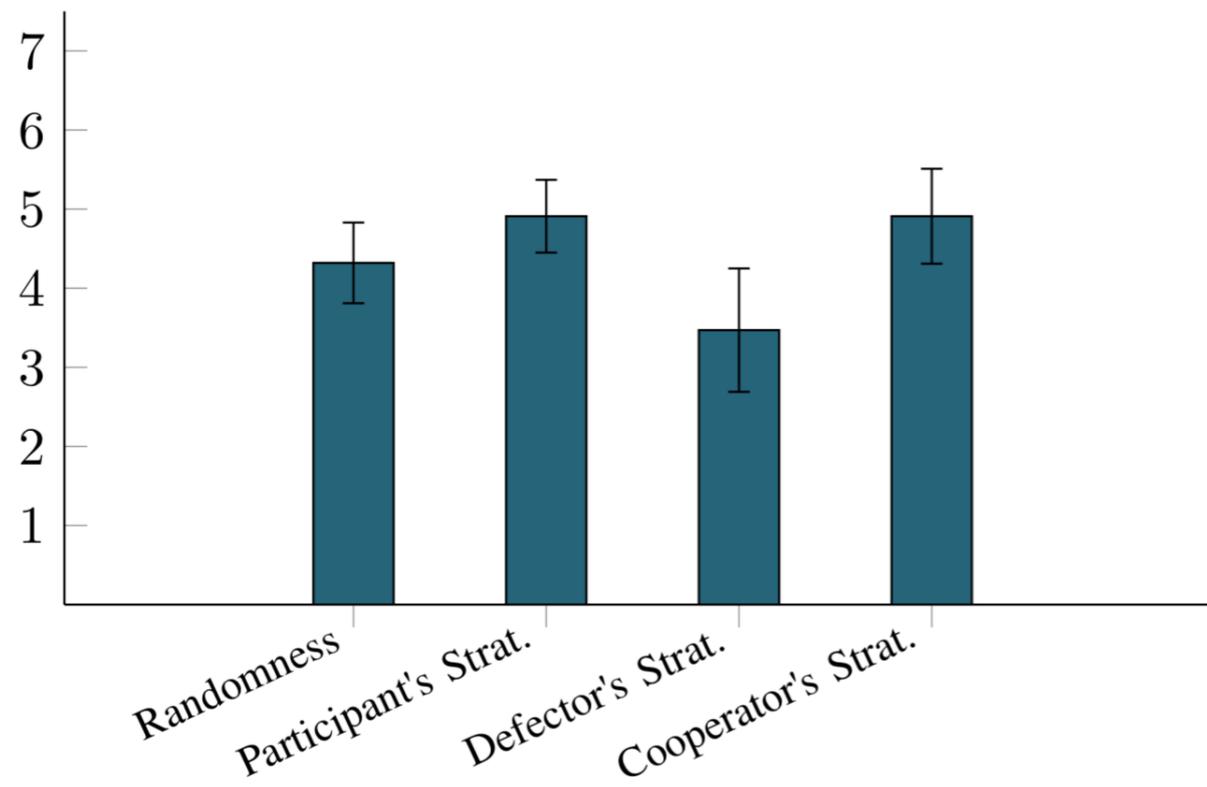
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- We found a statistically **significant effect** of the **game result** on the level of **group identification** ( $p = 0.014$ ).
- We found **no statistically significant** effect of the **game result** on the level of **group trust** ( $p = 0.474$ ).



# Results - Responsibility Attribution

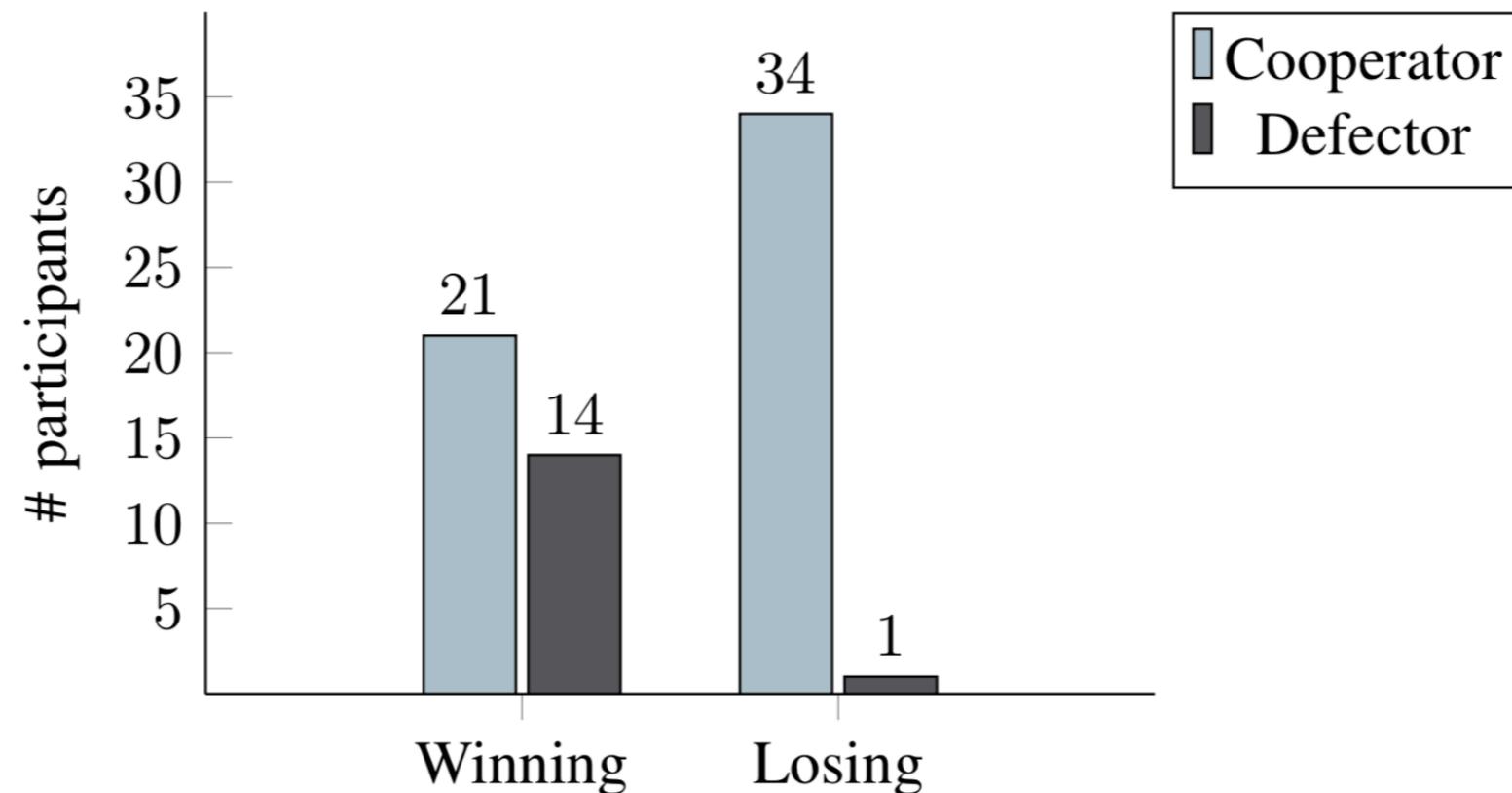
- We found **no significant differences** on the **credit** attribution to the four factors ( $p = 0.067$ ).
- We found a **significant difference** on the **blame** attribution to the four factors ( $p < 0.001$ ).



## Results - Partner Selection

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- We found a **significant association** between the **partner selection** and the **game result** ( $p < 0.001$ ).



# Discussion

# Discussion - Social Attributes

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✓ **H1** - The **prosocial robot** will be perceived **more positively** in its social attributes **than** the **selfish robot**.

✗ **H2** - The **prosocial robot** will be perceived as **less competent than** the **selfish robot**.



# Discussion - Group Measures

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**H3** - Group **trust** and group **identity** will be **positively associated** with the team **performance**.



# Discussion - Group Measures

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**H3** - Group **identity** will be **positively** related with the team **performance**.



Check out on the paper the regression analysis!

# Discussion - Responsibility Attribution

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**H4** - When the team **wins**, people will attribute higher **credit** to the **prosocial robot**.



**H5** - When the team **loses**, people will **blame** more the **selfish robot**.

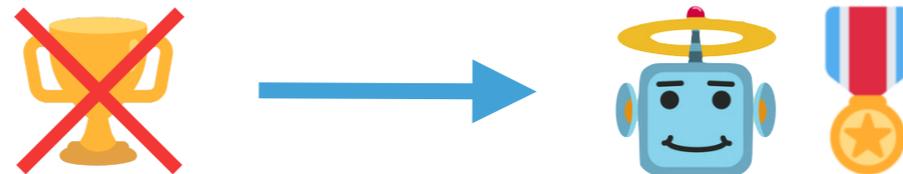


# Discussion - Partner Selection

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**H6** - The **prosocial robot** will be **preferred** as a **future partner**.



# Conclusions

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- A **prosocial robotic partner** can be perceived more **positively regardless of the game result.**
- **Poor performance** of the team **increased** the **awareness** of the **selfish behaviour**. In the losing condition, the selfish robot was **identified as**:
  - **Less competent;**
  - **Blamed more** for the result;
  - **Preferred less** as a partner.

# Conclusions

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- Regression analysis on the measures of group trust and group identify.
- Study outside the lab in large corporation with little or no exposure to robots.

# Conclusions

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Participants that won the game reported a significantly higher agreement with the sentence

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compared to participants that lost the game.

# Conclusions

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Participants that won the game reported a significantly higher agreement with the sentence “Social robots will be relevant to the society”, compared to participants that lost the game.

# Thank you!

We will have a **live demo** at **AAMAS'19**  
(Montreal, Canada 13-17 May)

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