

Exploring Prosociality in Human-Robot Teams

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What is Prosociality?



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THE DUKW

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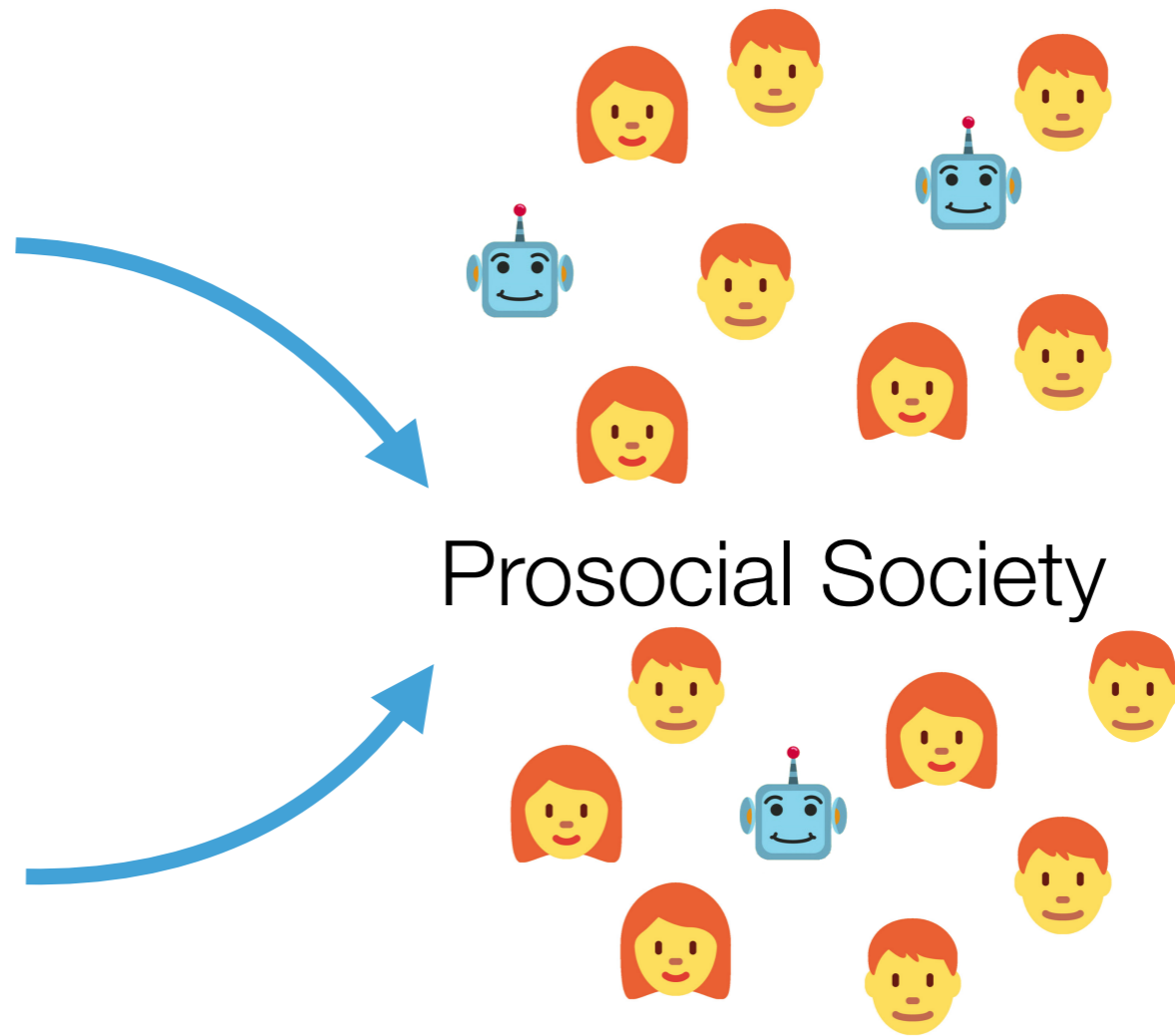
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TOILETRIES DRIVE

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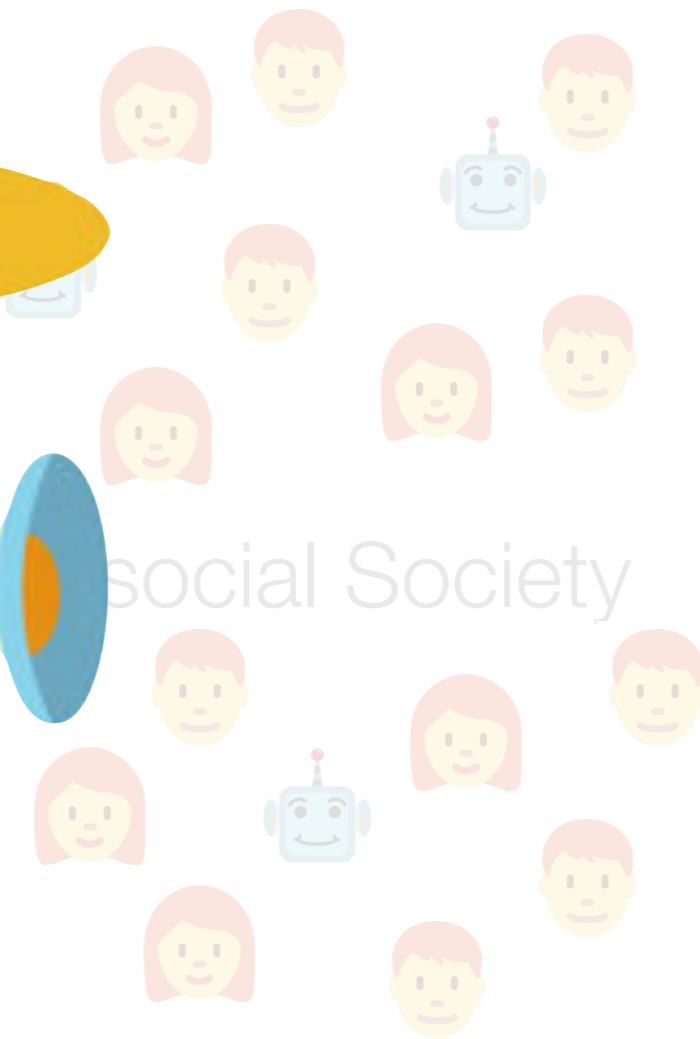
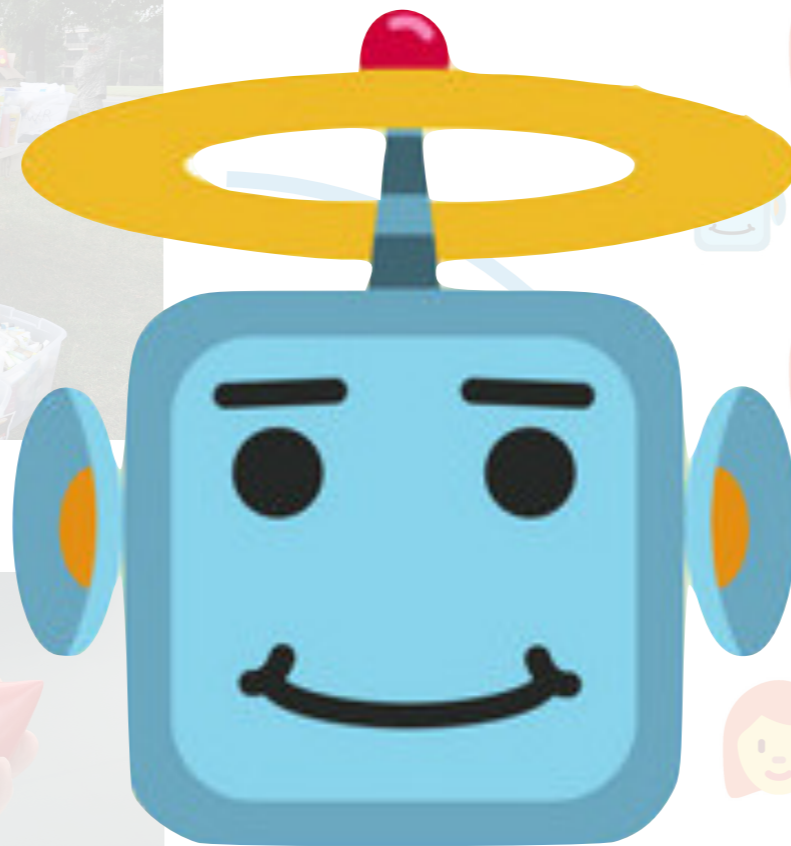


ARUP
BLOOD SERVICES

Motivation



Motivation

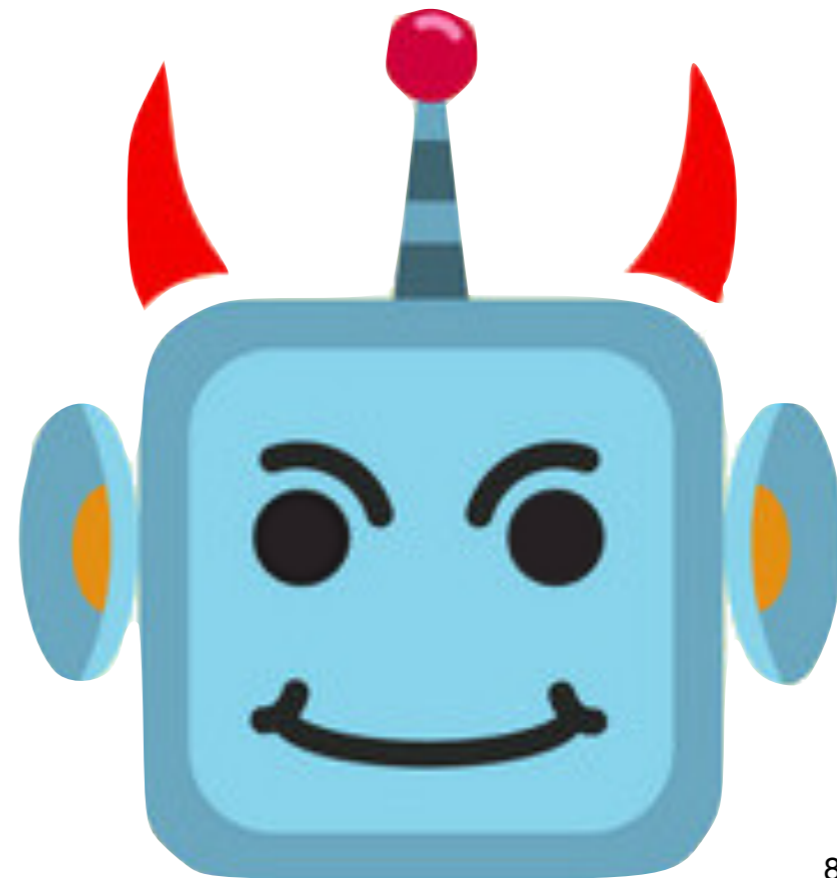


Why wouldn't
we create
prosocial robots?

Motivation

Robots will always somehow reflect the interests of...

- Developer
- Owner
- Company
- Government



Research Questions

Research Questions

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

- “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

Threshold game with **uncertain returns**



digital dice

control the outcome (win/lose)

Scenario

3 players

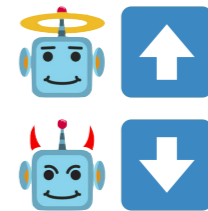
- 1 person
- 2 autonomous robots



Hypotheses

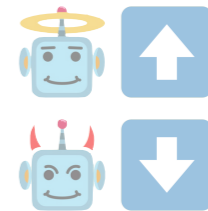
Hypotheses

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

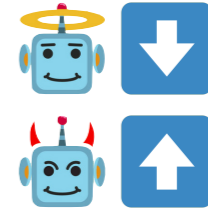


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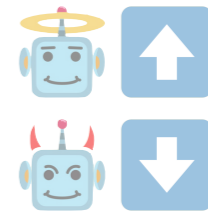


H2 - The **prosocial robot** will be perceived as **less competent than** the **selfish robot**.

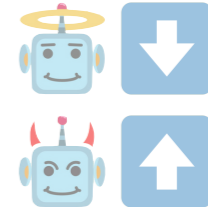


Hypotheses

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

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

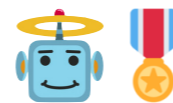
H4 - When the team **wins**, people will attribute higher **credit** to the **prosocial robot**.



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



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



User Study

Experimental Design

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

Cooperator/Prosocial

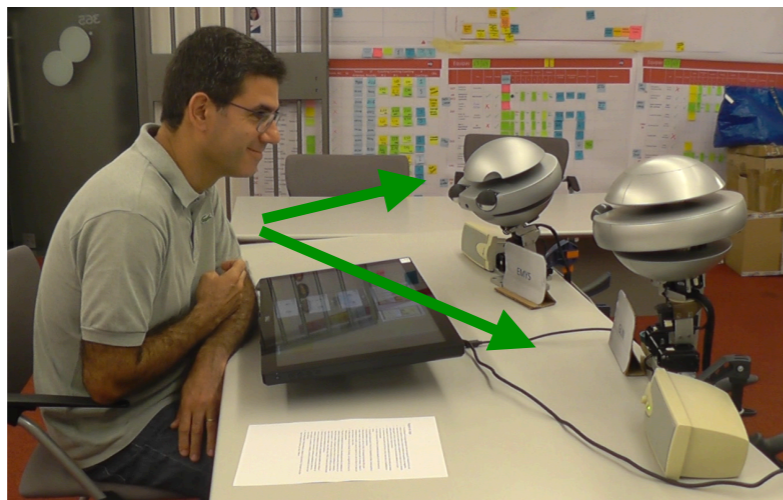
Defector/Selfish



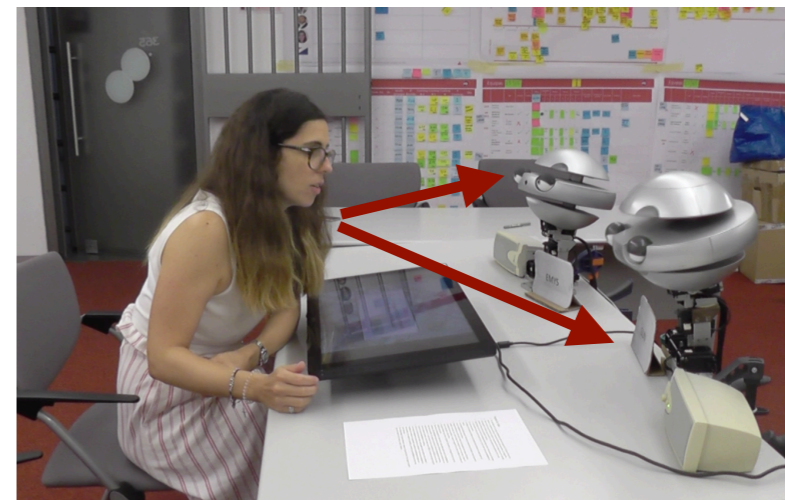
Experimental Design

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

Winning



Losing





Participation

- 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

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

- 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

Credit / Blame attribution to...

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

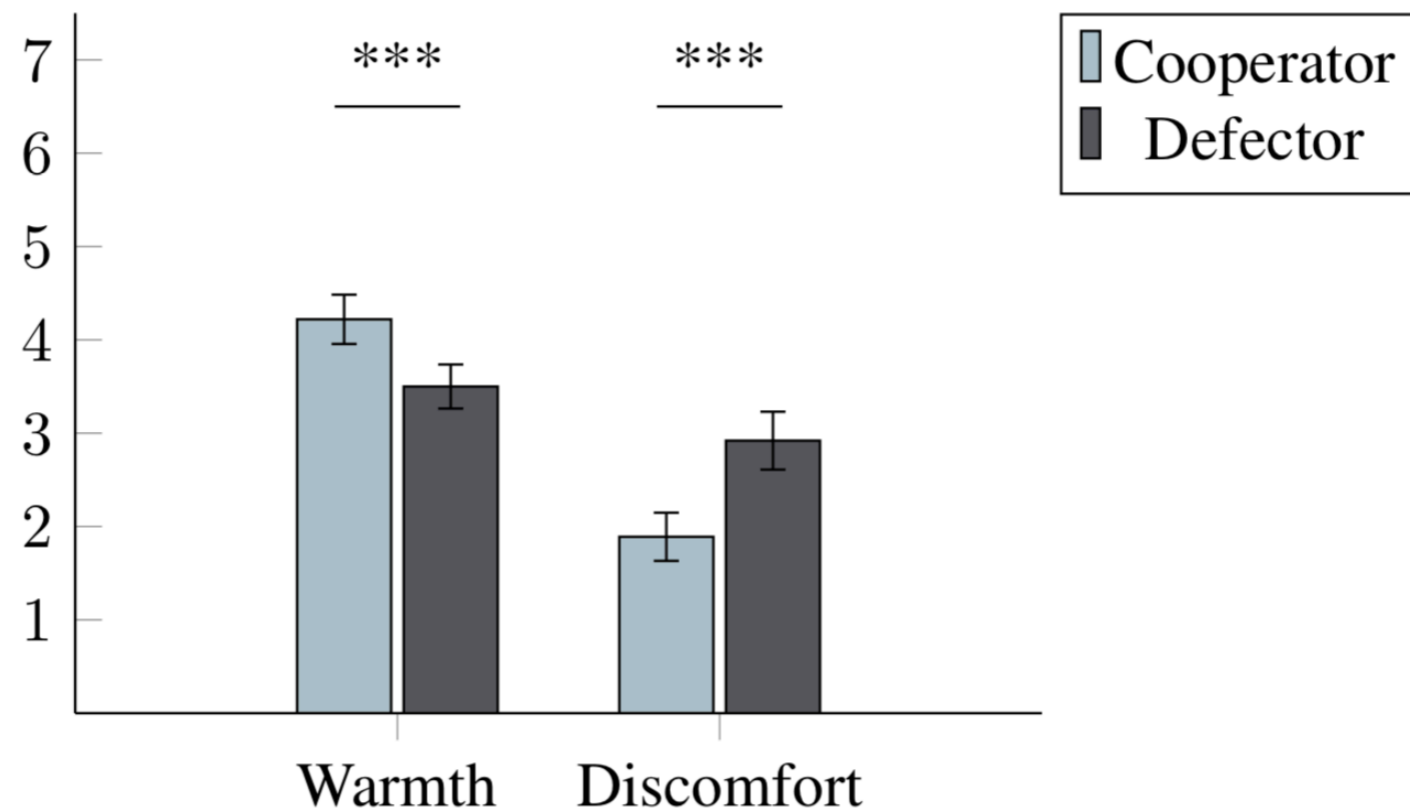
Measures - Partner selection

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

Results

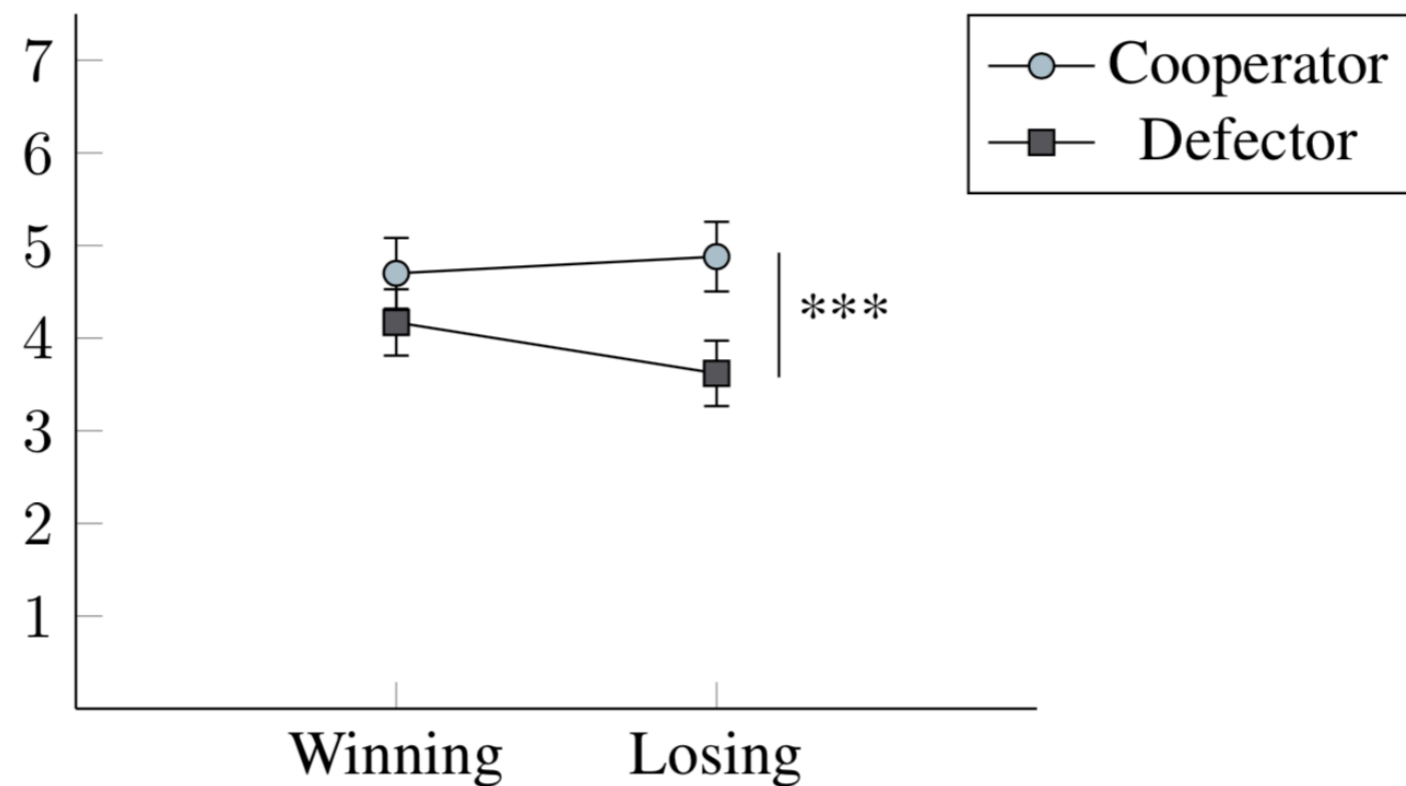
Results - Social Attributes

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



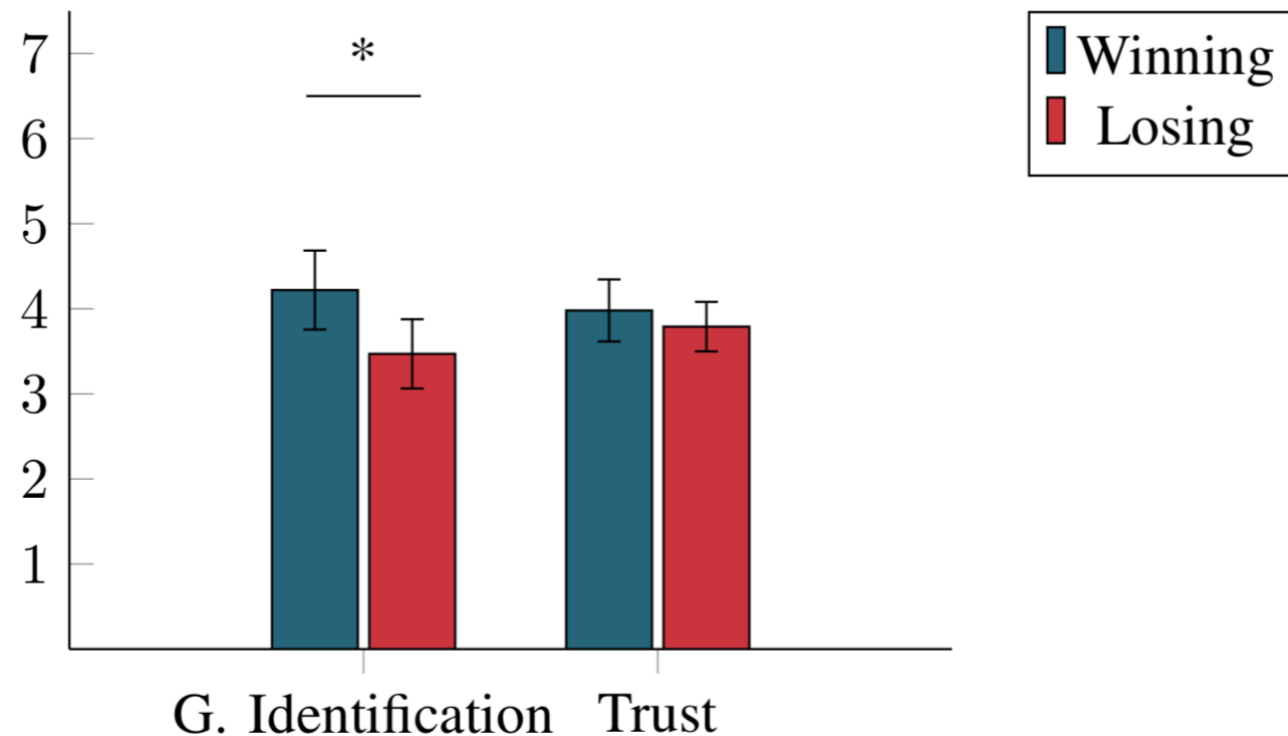
Results - Social Attributes

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



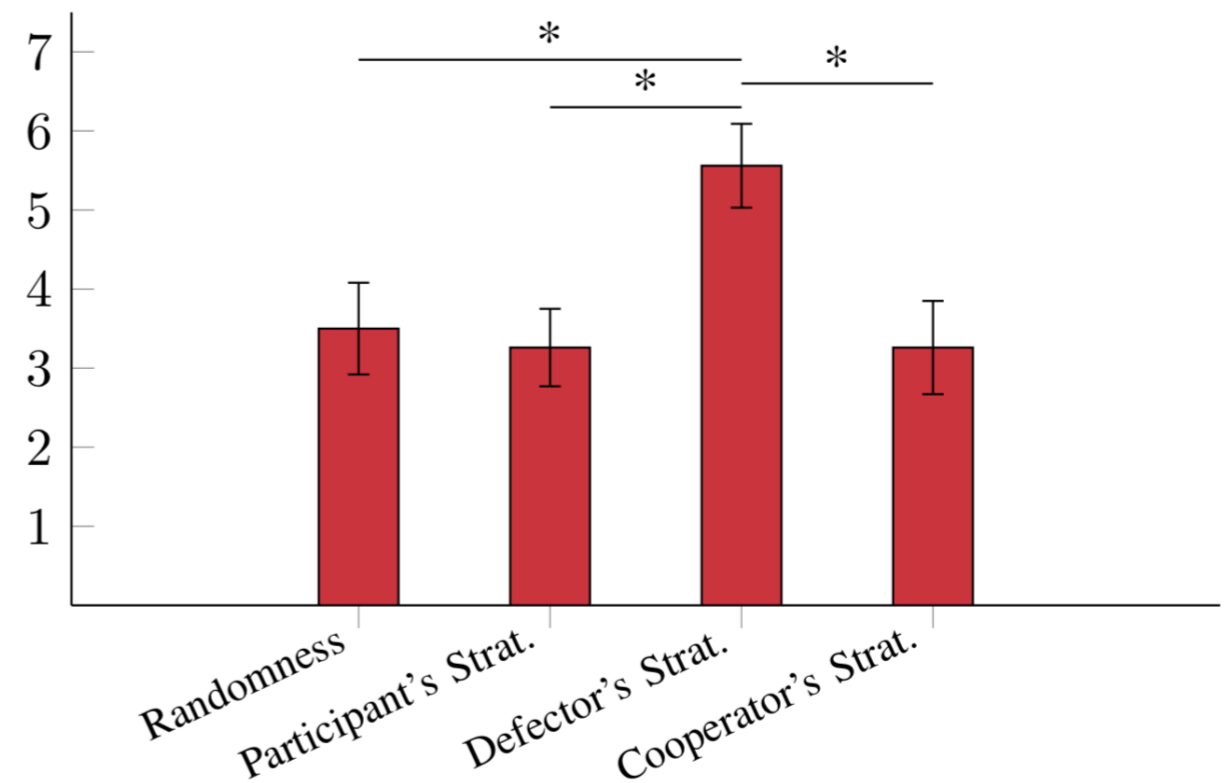
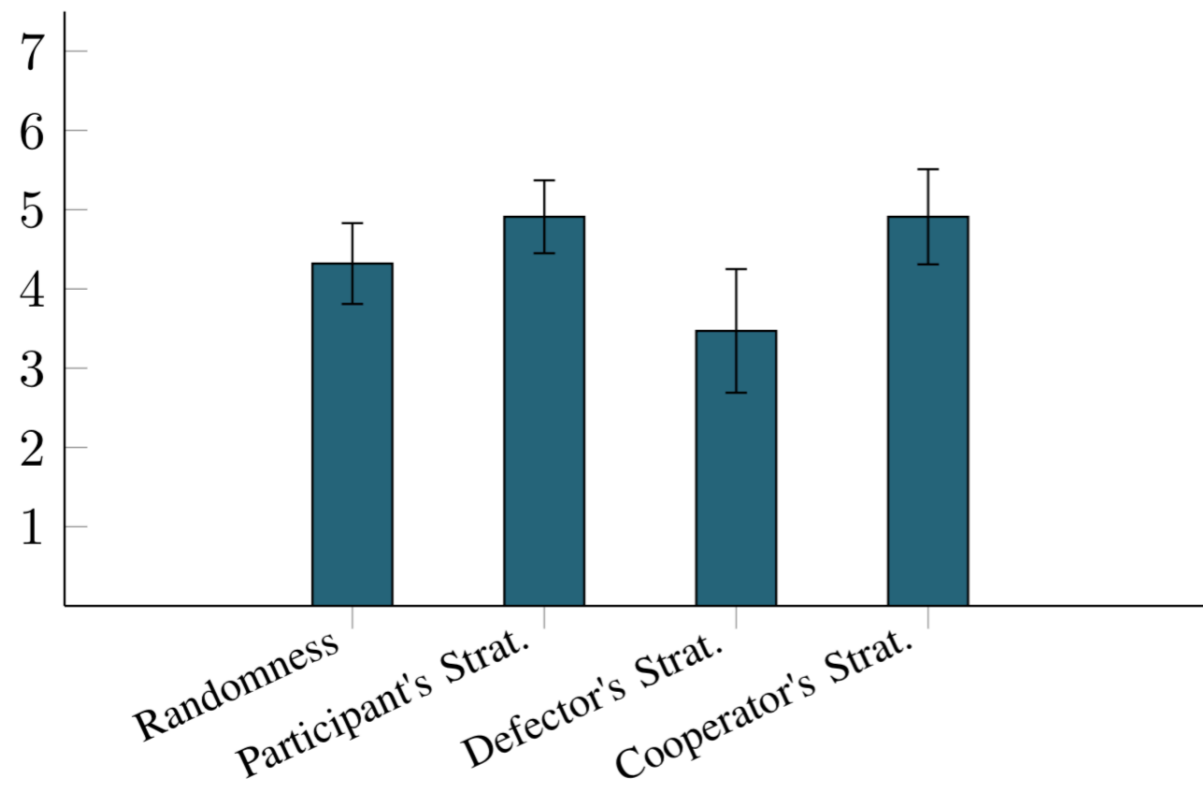
Results - Group Measures

- 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** ($p = 0.474$).



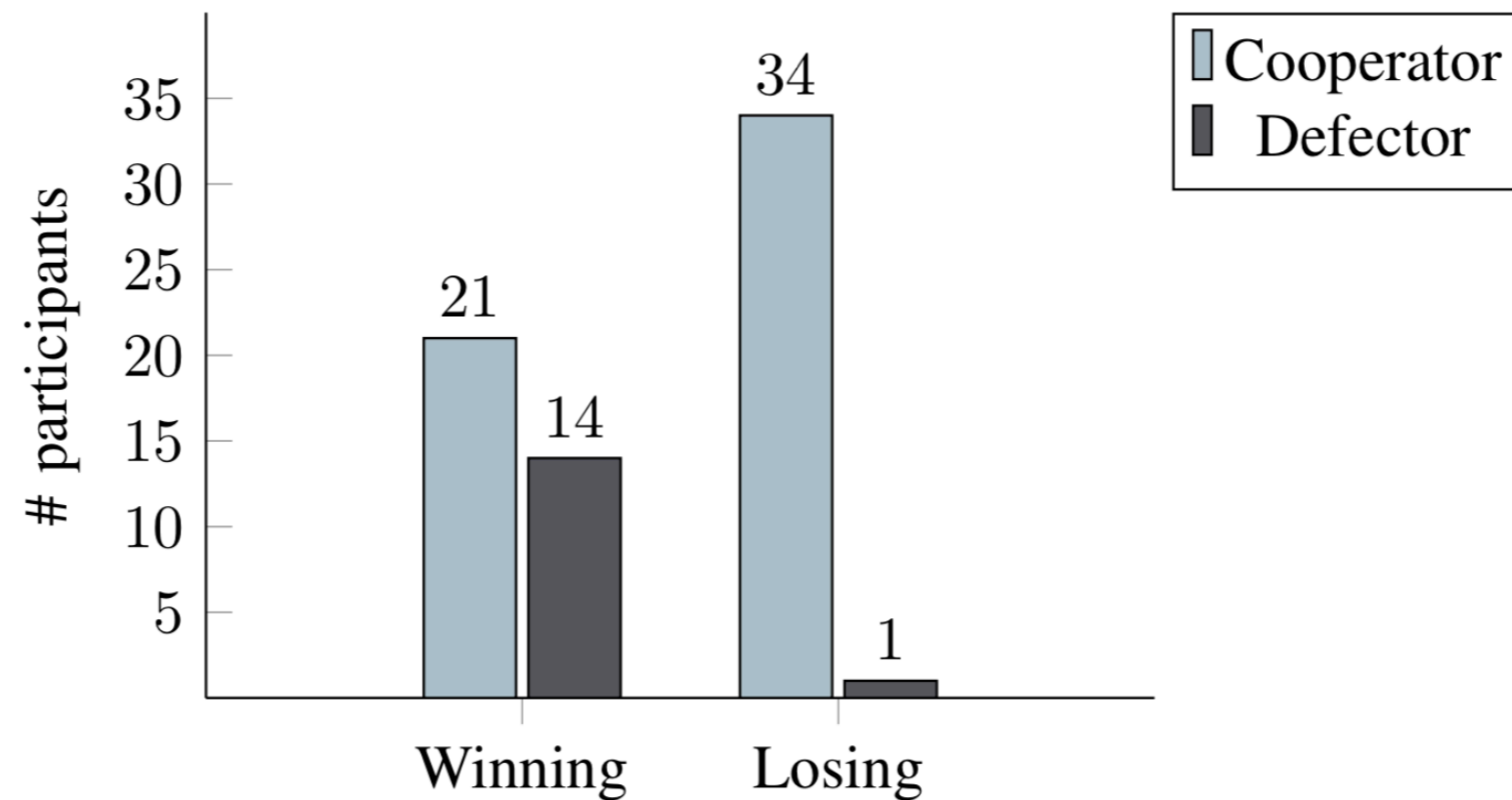
Results - Responsibility Attribution

- 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

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



Discussion

Discussion - Social Attributes

✓ **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



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



Discussion - Group Measures



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



Check out on the paper the regression analysis!

Discussion - Responsibility Attribution



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



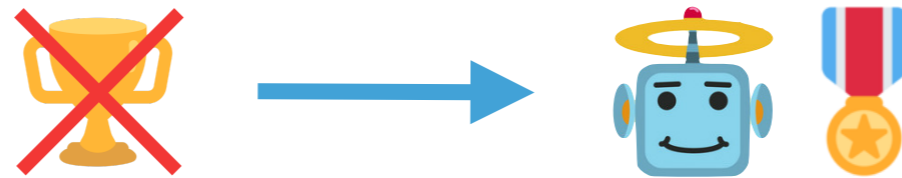
H5 - When the team **loses**, people will **blame** more the **selfish robot**.



Discussion - Partner Selection



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



Conclusions

Conclusions

- 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

- 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

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

...

compared to participants that lost the game.

Conclusions

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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