The Hidden Influence of Robots:

How Robot Interaction Strategies Shape Human-Human Interaction and Perception in Creative Ideation

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1. Introduction

Creative work often happens in small groups, where ideas are built through conversation. As social robots enter classrooms, workplace discussions, and problem-solving teams, they may change not only how people relate to the robot, but also how they relate to each other.

CORE IDEA
Interaction-Shaping Robotics (ISR) studies robots that influence the behaviours and attitudes exchanged between humans [1].

- Prior ISR studies isolate a single robot behaviour in one condition, making cross-strategy comparison impossible. We test what happens when you change the strategy itself.
- Existing work measures participation quantity (speaking time, turn counts) but not collaborative talk quality. However, in creative ideation, how people talk matters as much as who talks.
- Robots can produce unintended effects on human-human relating, beyond their designed role [2, 3].

2. Research Question

How do different robot interaction strategies shape human-human interaction and perception in creative ideation?

Sub-questions:

1. How does the inequality of word counts among human partners vary across different robot interaction strategies?
2. How does the proportion of human utterances (disputational, cumulative and exploratory) vary across robot interaction strategies?
3. How does the robot's interaction strategy influence participants' reported group cohesion and ingroup identification with their human partner?
4. What shaping effects emerge across conditions, and do they differ between strategies?

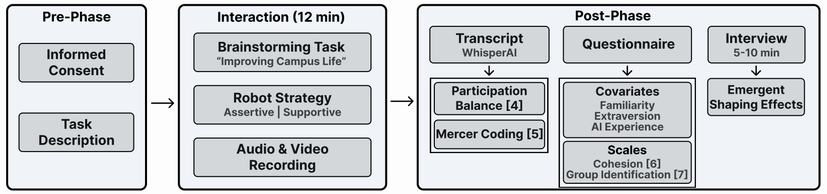
3. Methodology

Participants & Setting

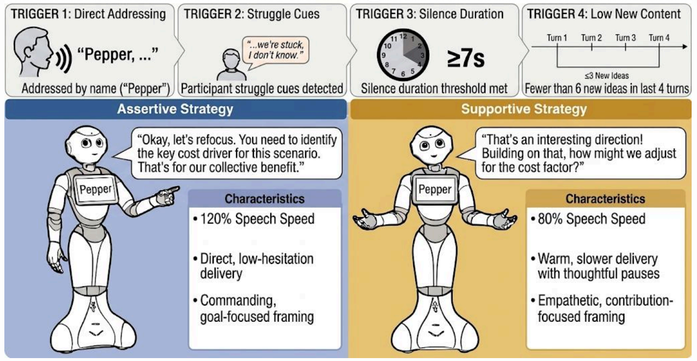
Groups of 2 humans + 1 Pepper robot were brainstorming on "Improving campus life"
N = 40 participants (33 male, 7 female; 26 Bachelor's students, 13 Master's students, and 1 PhD, M age = 22.8 (SD = 2.4).

Responses were generated at runtime using Phi-3.5-mini (3.8B) LLM according to the assigned strategy (assertive or supportive).

10 sessions per condition (20 total)



4. Robot Interaction Strategies



5. Results

Participation Balance (SQ1)

Table 1: Mann-Whitney U test results for the adjusted Gini index by robot strategy.

	Mann-Whitney U	p
Strategy	37.00	.353

FINDING
Robot interaction strategy did not change how evenly partners shared speaking time. Normality assumptions were violated, so a Mann-Whitney U test was used. No significant difference between conditions (U = 37.00, p = .353).

Quality of Collaborative Talk (SQ2)

Table 2: One-way ANOVA results for Mercer talk types by robot strategy.

	F (1, 18)	p	η^2p	ω^2
Disputational	1.54	.230	0.079	0.026
Cumulative	0.13	.719	0.007	-0.045
Exploratory	6.16	.023	0.255	0.205

FINDING
Robot strategy significantly shaped the quality of collaboration. ANOVA showed a significant effect for exploratory talk (F(1,18) = 6.16, p = .023, η^2p = .255). Disputational and cumulative talk did not differ significantly between conditions.

Group Cohesion & Group Identification (SQ3)

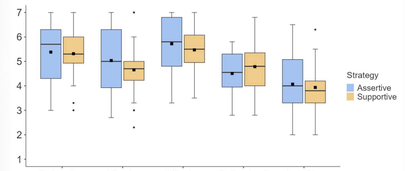


Figure 1: Group cohesion and group identification results per strategy.

Table 3: AI experience had significant effect on group belonging.

	F (1, 35)	p	η^2p	ω^2
Strategy	0.32	.575	0.009	-0.016
Familiarity	0.87	.356	0.024	-0.003
Extraversion	0.47	.499	0.013	-0.013
AI Experience	4.26	.046	0.109	0.078

Table 4: Familiarity had significant effect on cognitive identification.

	F (1, 35)	p	η^2p	ω^2
Strategy	1.03	.316	0.029	0.001
Familiarity	6.80	.013	0.163	0.131
Extraversion	0.05	.830	0.001	-0.022
AI Experience	0.31	.579	0.009	-0.016

FINDING
Robot strategy did not affect how participants evaluated their group experience. No significant effects were found for belonging, morale, affective identification, behavioral identification, or cognitive identification (all p > .31). Prior AI experience predicted stronger group belonging. Pre-existing familiarity predicted stronger cognitive identification with the group.

Shaping Effects (SQ4)

INTENDED SHAPING EFFECTS

Assertive Strategy	Supportive Strategy
Creative steering Robot pushed subjects toward unexplored territory expanding creative output.	**Ideational scaffolding** Robot extended ideational reach beyond what subjects generated independently.
Directed attention Subjects oriented conversational focus toward the robot's proposals.	**Topical anchoring** Robot kept dyads on task by preventing tangential drift.

UNINTENDED SHAPING EFFECTS

Present in Both Conditions

Attention Redistribution
Focus moved to the robot reducing attention given to the human partner.

Partner Solidarity
Managing the robot prompted unscripted alignment between partners.

Speech formalisation
Partners adopted more structured speech directed at each other.

Emotional Suppression
Personal content was withheld that would have been shared otherwise.

Assertive Strategy	Supportive Strategy
Role Negotiation Directive robot was recast as a passive oracle by subjects.	**Expert Deference** Warm register was misread as a signal of expertise by subjects.
Creative Suppression Topic steering narrowed the generative range of subjects	

6. Limitations

- Speech processing and generation constrained interaction quality. Participants reported fast speech rate, occasional lack of clarity, and difficulty understanding context-specific references. These issues likely reduced perceived competence and trust [8, 9]. This may reflect platform constraints rather than the facilitation strategies themselves.
- The study is based on a single-session interaction, meaning results may be influenced by novelty effects and may not generalise to longer-term use or repeated exposure.
- The participant sample was heavily male dominated (33 male, 7 female) due to convenience sampling at TU Delft. This limits the generalisability of the findings, as responses to robot interaction strategies and collaborative communication may differ across more diverse populations.

7. Future Work

- Future work should explore richer non-verbal behaviour in robot facilitators. Participants noted that nodding, gaze, and emotional expression could significantly improve perceived engagement. A controlled comparison between minimal and gesture-enriched behaviour could isolate this effect.
- Long-term studies are needed to understand interaction-shaping effects over time. It remains unclear whether behaviours such as over-attending to the robot persist beyond initial novelty or stabilise with repeated exposure.

8. Conclusion

MAIN CONTRIBUTION
A robot's presence restructures human conversation, even when its strategy does not.

Takeaway 1: For creative ideation settings, a supportive verbal register is the better design choice. It sustains the exploratory dialogue that idea generation requires, while an assertive strategy introduces rhythm disruption and narrows participants' own generative range.

Takeaway 2: Four unintended shaping effects emerged identically across both conditions, proving that robot presence alone is a structural force on human communication. Designers cannot fully anticipate or contain these effects through strategy alone.

Takeaway 3: Strategy shapes conversation but not connection. Group cohesion and identification did not differ between conditions, suggesting that relational outcomes within a single session are not sensitive to how a robot chooses to speak.

References

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