

1. Background

- Creative group ideation is widely used to generate ideas [1]
- Social robots can now contribute ideas during brainstorming [2]
- Proactive robot interventions may influence participant autonomy
- Autonomy supports intrinsic motivation and creativity [3]
- This work investigates whether proactive robot interventions reduce perceived autonomy compared to a reactive robot

2. Methodology

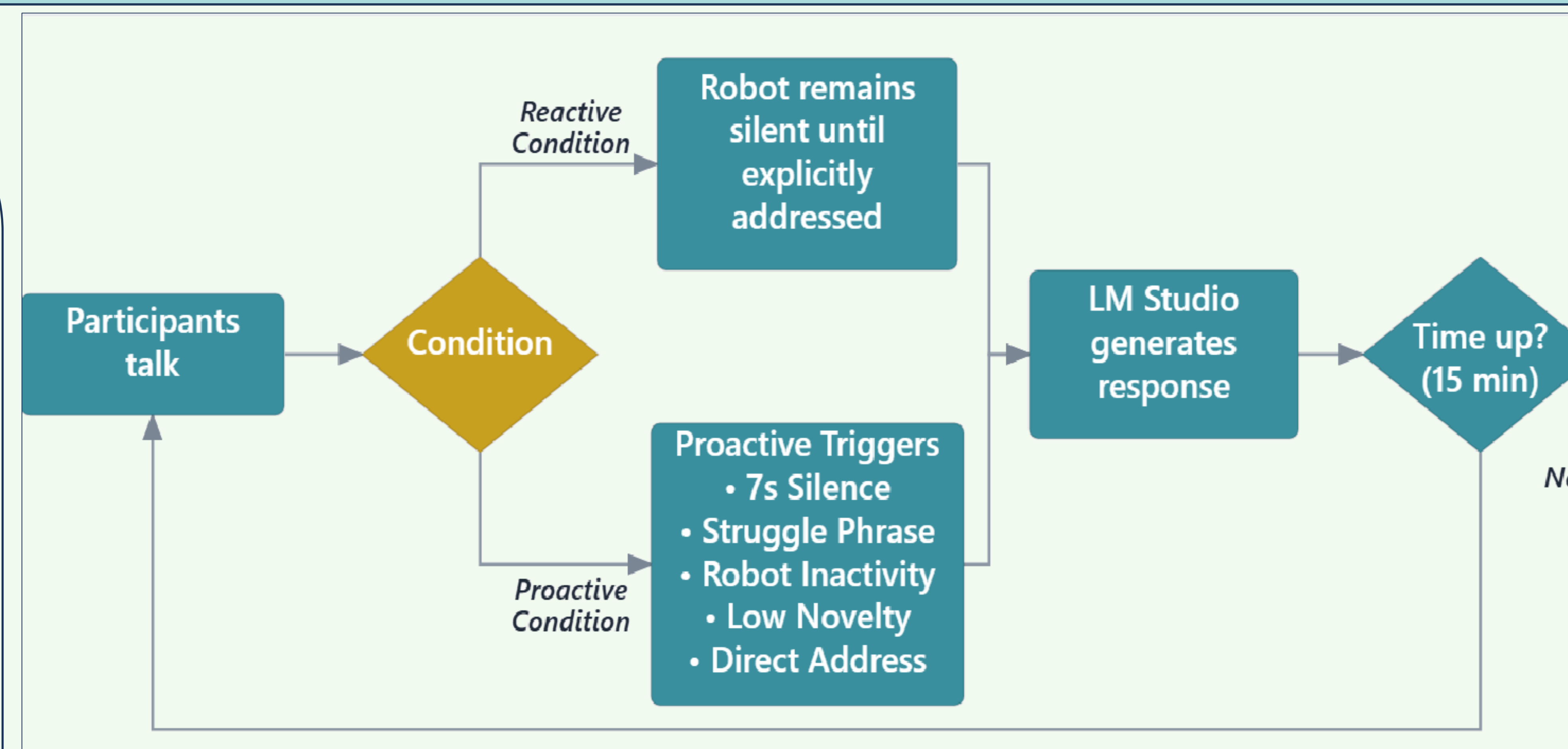
- Between-subjects study with
 - Reactive condition
 - Proactive condition
- Study used a Pepper robot and involved 40 participants
- Perceived autonomy measured through post-task questionnaire
- Task: Improving Campus Life
- Robot only gives solutions
- Responses generated using a local large language model

3. Intervention Strategies

Proactive interventions were triggered by:

- 7 seconds of silence
- Struggle phrases (e.g., "I don't know", "We need help", "This is hard")
- Robot inactivity
- Low novelty
- Direct address

Reactive interventions were triggered by saying "Pepper" or "Robot"



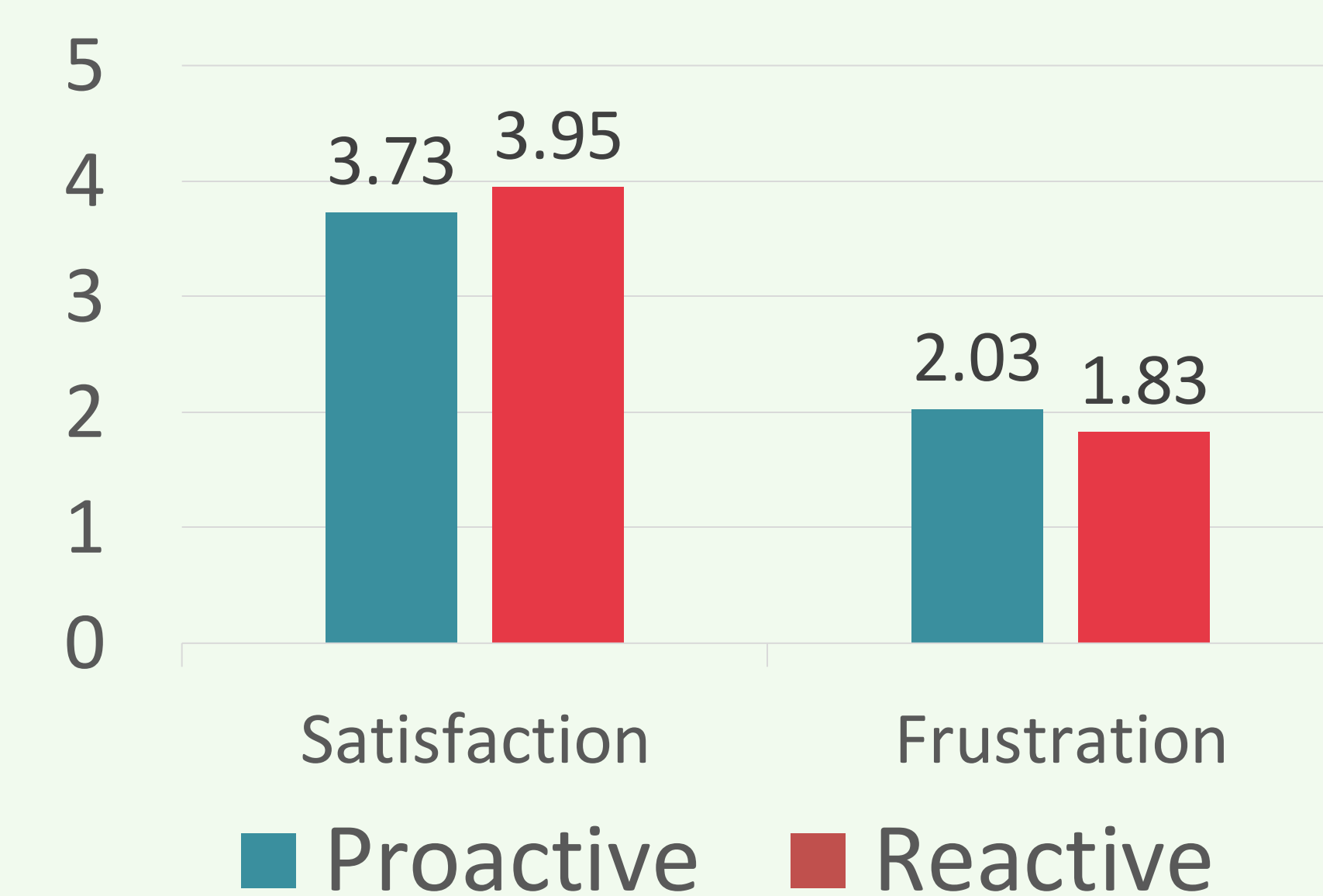
5. Discussion

- May have been viewed as supportive facilitator
- Most frequent trigger was silence, followed by struggle phrases
- Proactive groups discussed ideas in less depth
- Interactions dropped when robot responses were less useful
- Participants frequently forgot to explicitly say "Pepper"

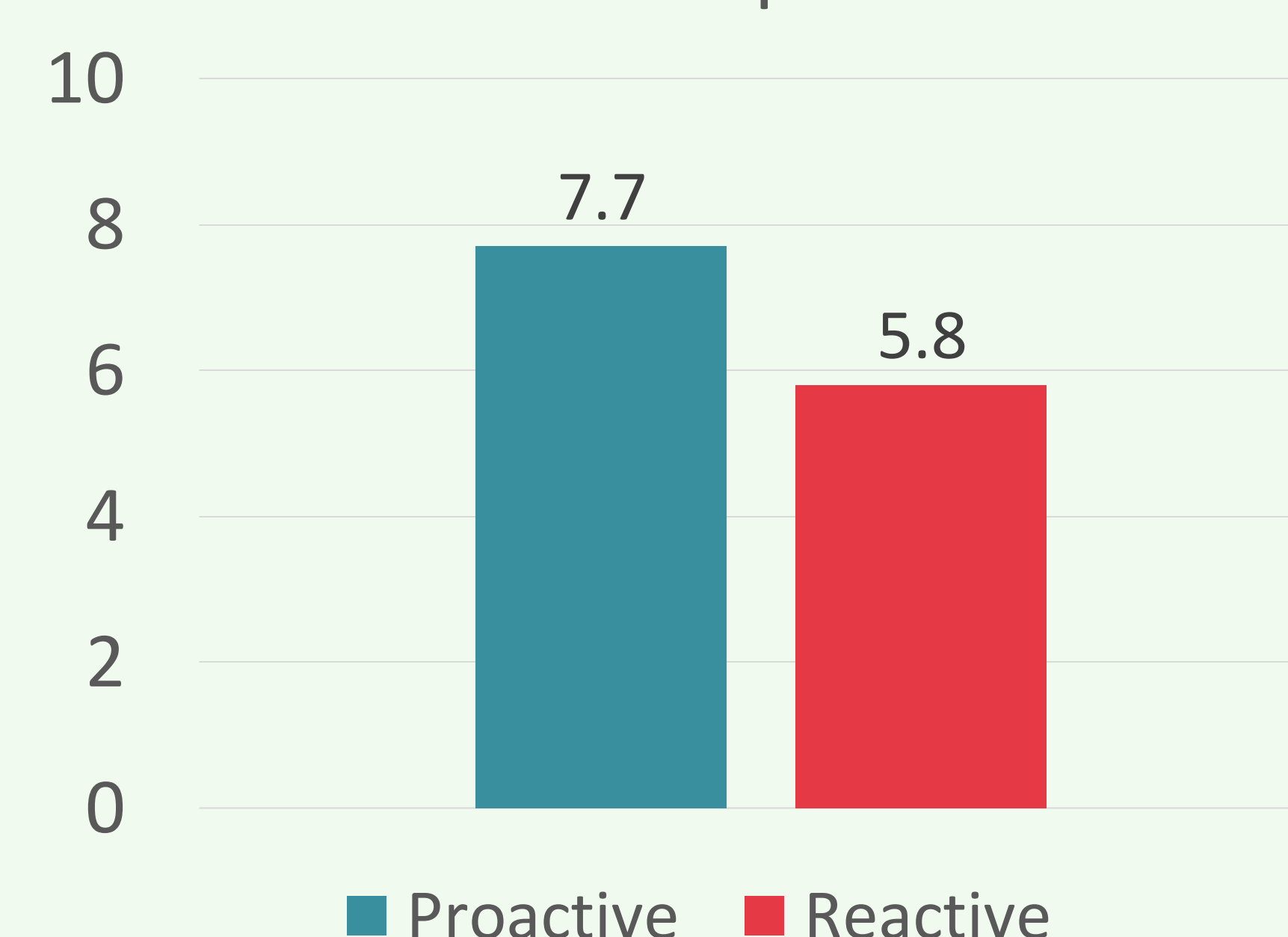
4. Results

- No statistically significant difference in autonomy satisfaction or frustration between conditions
- Mean proactive replies – 10.6
- Mean reactive replies – 7.2

Perceived Autonomy by Intervention Strategy



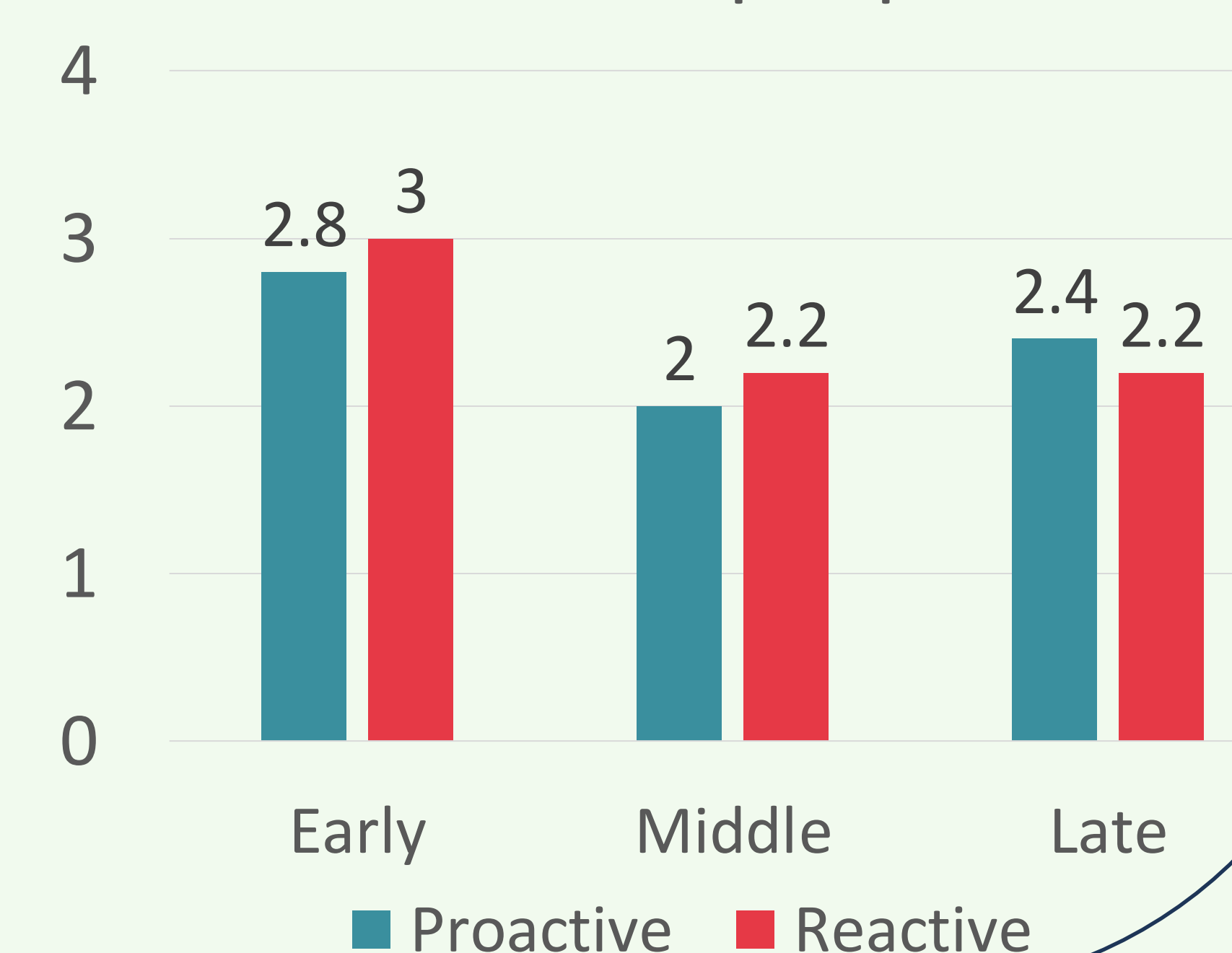
Average Ideas Generated per Group



- Proactive groups generated more ideas on average, although the difference was not strictly significant

- Both conditions showed more engagement in the first phase
- Average times robot was addressed:
 - Proactive – 7.2
 - Reactive – 7.4

Participant initiated interactions per phase



6. Limitations

- Delay in robot responses due to computational constraints
- Small sample size
- Idea count is partially subjective
- Study focused on a single interaction context

7. Conclusion

- No significant autonomy difference
- Proactive groups generated more ideas
- Participants interacted with Pepper equally often
- More robot utterances weakly associated with lower autonomy
- Future work: Examine different forms of proactivity (e.g., reflective questions)
- Future work: Define when support becomes unwanted interference

References

- [1] Osborn, A. F. (1953). *Applied Imagination*.
- [2] Geerts, J., et al. (2021). *Frontiers in Robotics and AI*.
- [3] Deci, E. L., & Ryan, R. M. (2000). *Psychological Inquiry*.