Individual Differences in Social and Emotional Responses to Robotic Dining Companions

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Commensality and Social Connection

Commensality Benefits

- mental health
- mood
- dietary habits
- group cohesion
- social identity development

Eating Alone

- binge eating
- poor nutrition
- social isolation
- *illness, old age, or epidemic-related restrictions*
- *commensality with human not always satisfying*

Our Prior Work (1) on Robotic Commensality

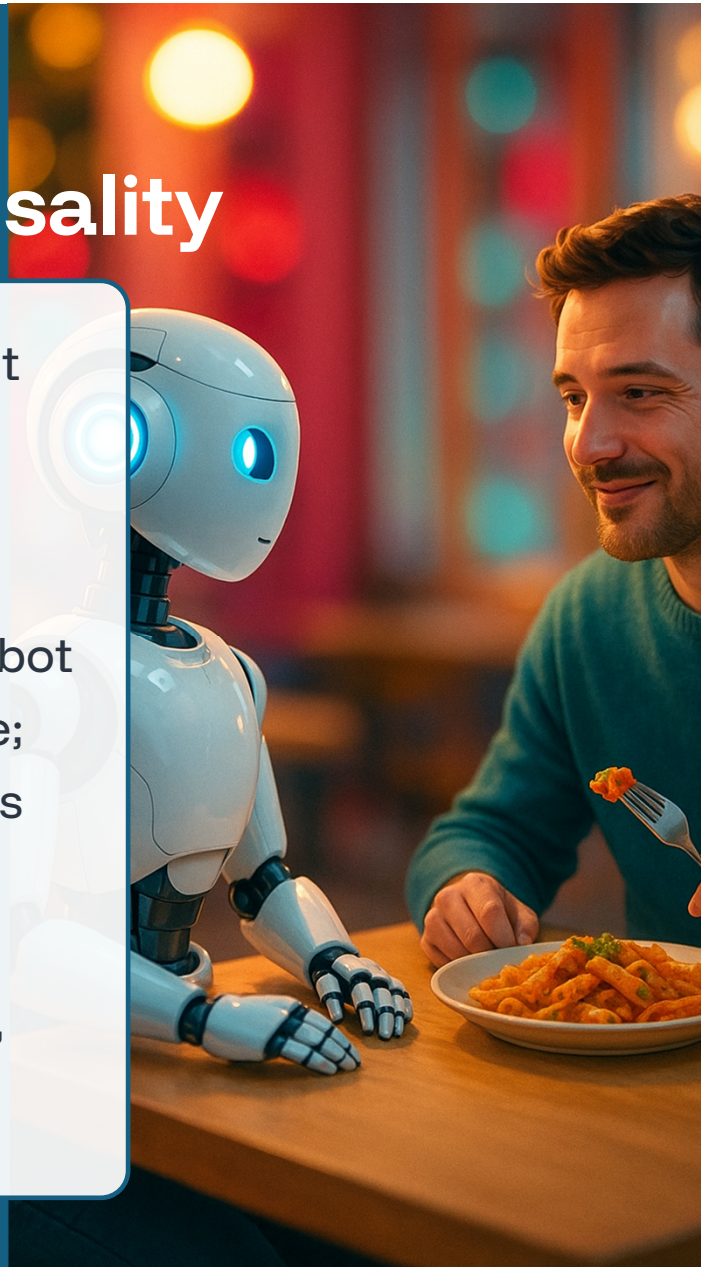
Social robots as eating companions

- MyKeepon robot + Kinect sensor;
- Track human commensal's activity (i.e., food picking and intake) ;
- Gaze model + emotional model;
- Predefined nonverbal emotional response.

- The interactive and social robot is preferred over eating alone;
- Subjects would like to have a robot displaying more active social behaviors;
- People benefit the most: the elderly and people who live alone;

Related Work on Robotic Commensality

- Robotic agents can effectively support social engagement without fully mimicking human interaction (Duffy et al.);
- FoBo Robotic Dining Companion (Khot et al.): create entertaining interactions during meals;
- Mixed reality co-eating system (Fujii et al.): a humanoid robot simulating food consumption improves dining experience;
- Multi-robot dining companions (Fujii et al.): ate-alone users preferred dining with 2 robots > 1;
- Socially assistive robot (McColl and Nejat): cognitively stimulating and engaging elderly users through gestures, greetings, and humor.



Related Work on Individual Differences in HRI

Individual difference: influential in shaping engagement.

- Tailoring robot demeanor to user sociability in assistive and pedagogical contexts to improve engagement and effectiveness (Tapus et al.)
- Healthcare agents have shown variable outcomes depending on users' baseline affect and emotional needs (H. N. Io and C. B. Lee.)

- Personality traits like openness, agreeableness, and extraversion predict users' acceptance of and trust in domestic and assistive robots (Tay et al.)
- Affective tendencies (anxiety, trust propensity, loneliness) are linked to perceived supportiveness and social bonding in HRI (Broadbent et al.)

Related Work on Individual Differences in HRI

Emotional states, disclosure tendencies, and long-term interaction trajectories affect subjective well-being and relationship formation with social robots (Laban et al.)

- Emotional distress and the desire to cope predict increased self-disclosure to robots;
- Emotional expression during interaction lead to improved affective outcomes;
- These effects vary over time and are shaped by user perceptions of trust, understanding, and social presence;

- **Requirement of trait-sensitive robot design;**
- **Personality and affect influence users' responses to robotic companions in social;**

Motivation

- As eating alone becomes increasingly common due to aging, lifestyle, or social isolation, socially assistive robots offer a potential source of emotional and interpersonal support. Artificial Commensal Companions (ACCs) could be an alternative to human dining companions.
- Little attention has been paid to how **individual differences** shape social and emotional outcomes in robotic commensality contexts.
- We aim to identify how individual traits predict reactions to and perceptions of the robot and the interaction to inform future personalization strategies.

Research Questions

1 Emotional Responses

How do personality and affective traits influence emotional responses (e.g., enjoyment and situational affect) during an ACC interaction?

2 Social Connection

How do these traits shape perceived social connection and enjoyment?

Hypotheses

H1 Emotional Responses

a) High Trait **negative affect** / **loneliness** will report greater enjoyment;

b) High **openness** will report higher enjoyment and situational positivity;

c) High **neuroticism** / **conscientiousness** will report lower enjoyment.

H2 Social Connection

a) High trait **negative affect** / **loneliness** will report stronger connection;

b) High **extraversion** / **agreeableness** will report lower perceived connection;

c) High Frequency of eating with others / technology use during meals will predict higher perceived connection.

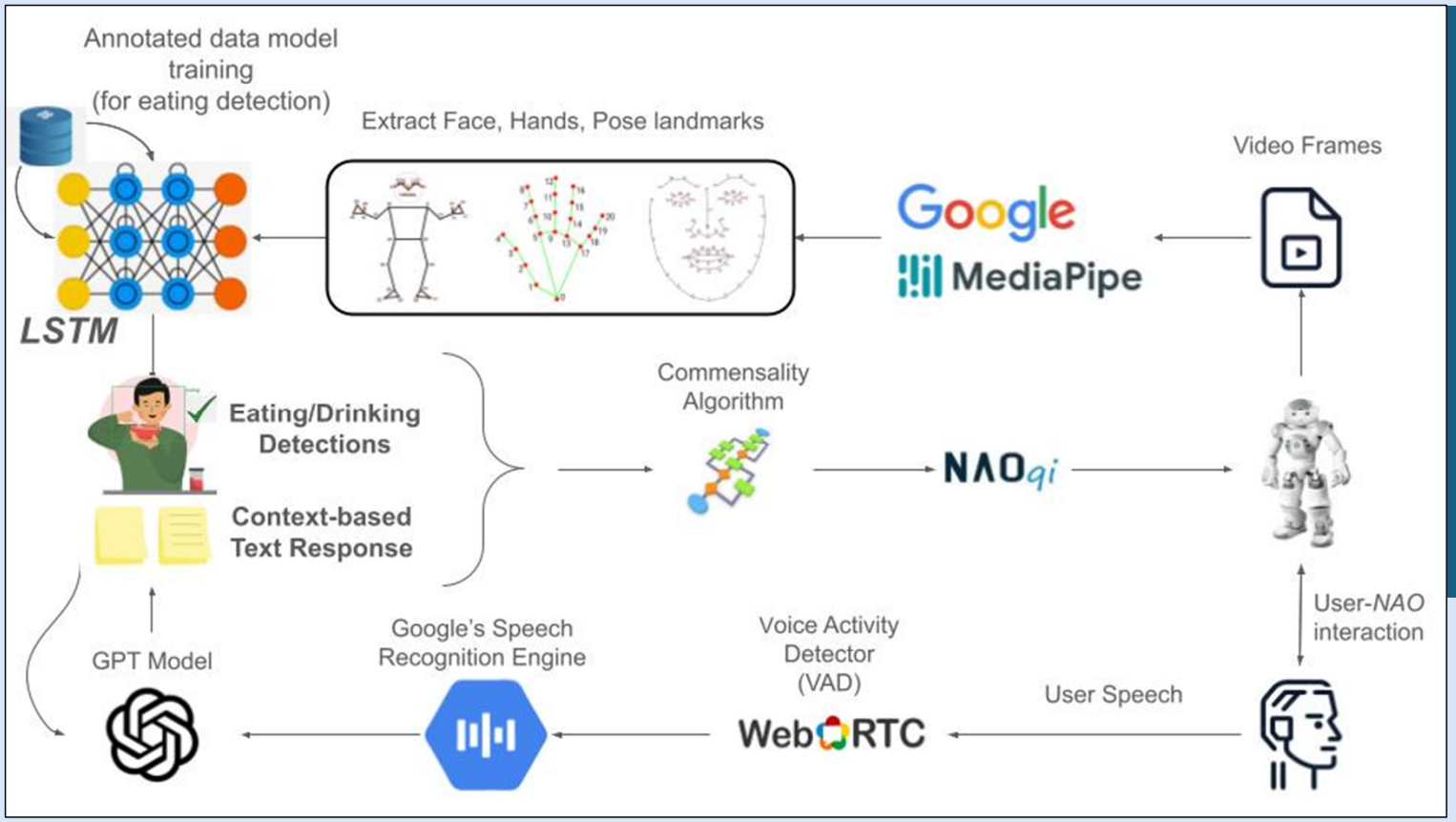
Our Prior Work (2) on Robotic Commensality

A Social Robot Companion for Individuals Eating Alone：

- The first implementation of a social robot acting as a companion for individuals eating alone;
- Develop a commensality algorithm to make the user enjoy their meal seamlessly while interacting with a digital companion;
- NAO + human activity recognition modules (Vision) + speech recognition module + dialog system (LLM) + Movement Module;
- Interaction Flow: look for the user + greet + start conversation + Silence Reaction (idle state, detect eating activities, ask questions initiatively);

System Overview

The robot uses head gaze, arm gestures, and idle motions to simulate attentiveness and presence during mealtime interaction.



Multimodal interaction pipeline:

- Eating detection
- GPT-based generation
- Rule-based engagement triggers

Methodology

1

Pre-Interaction Measures

- Demographics
- Big Five Personality (BFI-S)
- Commensality Questionnaire
- Positive/Negative Affect (PANAS-GEN)
- Short Loneliness Scale (LON)

2

Interaction Procedure

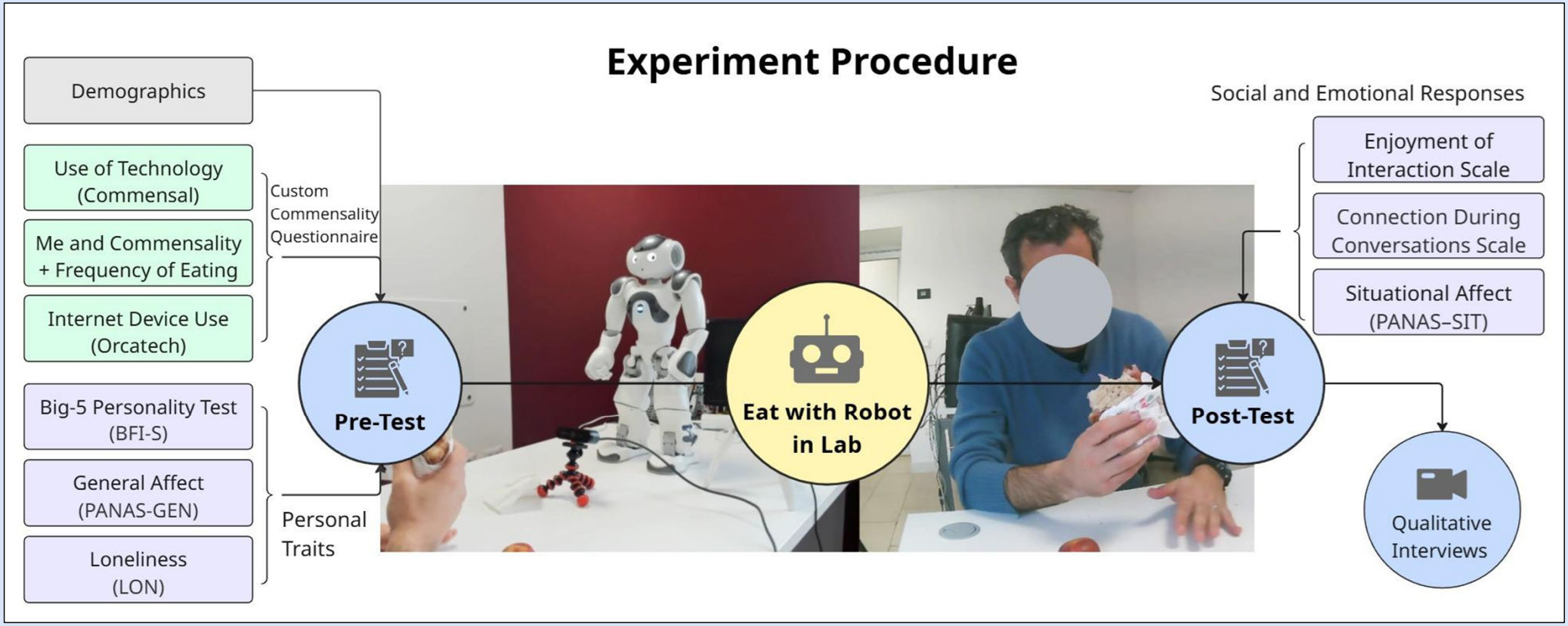
- 22 participants (18 male; ages 19-62)
- Brought own food, Sat at table facing NAO robot
- Robot initiated conversation
- Dialogue partially GPT-generated

3

Post-Interaction Measures

- Enjoyment of Interaction scale
- Situational affect (PANAS-SIT)
- Connection During Conversations Scale (CDCS)

Study Procedure Overview



H1. Emotional Response - Enjoyment

Significant predictors of enjoyment:

65%

Variance Explained

The regression model explained 65% of the variance in enjoyment (Adj. R^2 = .50)

60%

Correlation

Openness to Experience was positively correlated with **enjoyment** (r = .60, p = .014)

54%

Correlation

Trait negative affect was positively correlated with **enjoyment** (r = .54, p = .010)

Trait negative affect remained significant even when controlling for situational negative affect, suggesting participants high in negative affect may derive value from the interaction even if they experience momentary discomfort.

H2. Social Responses

Perceived Connection

Five predictors explained 61% of the variance in connection (Adj. R^2 = .41):

- Trait negative affect (β = .81, p = .012)
- Frequency of commensality (β = .89, p = .061)
- Technology use during meals (β = 1.72, p = .099)
- Extraversion (β = -.53, p = .071) - negative trend
- Agreeableness (β = -.38, p = .224) – slight negative trend

Emotional sensitivity and routine digital commensality may foster stronger social responses.

Perceived Partner Responsiveness

Partner Responsiveness (CDCS_PR) was not significantly predicted by any individual difference variables.

Perceptions of the robot's responsiveness may be driven more by robot behavior than user traits.

Who Enjoys ACCs?

Structured, low-pressure interaction works well for:

- Emotionally sensitive (negative affect) users
- Openness to new experiences
- People who use technology while eating more regularly

Less appeal for:

- Users high in extraversion or agreeableness

Who Enjoys Eating with Robots?

Openness
Felt more positive during the meal → Enjoyed it more

Negative Affect
Usually low mood but still liked the structure

Partner Responsiveness
An attentive robot = a more enjoyable experience

Extraversion
More social folks enjoyed the robot less

What Didn't Matter
- Conscientiousness
- Loneliness
- Positive Affect

Who Feels Connected to Robots?

Negative Affect
Even without feeling great generally, they valued the interaction

Frequency of Eating with Others
More used to social meals → Felt more connected

Tech Use During Meals
Used to tech at the table → Adjusted easily

Extraversion
Wanted more human-like sparkle → Felt less connection

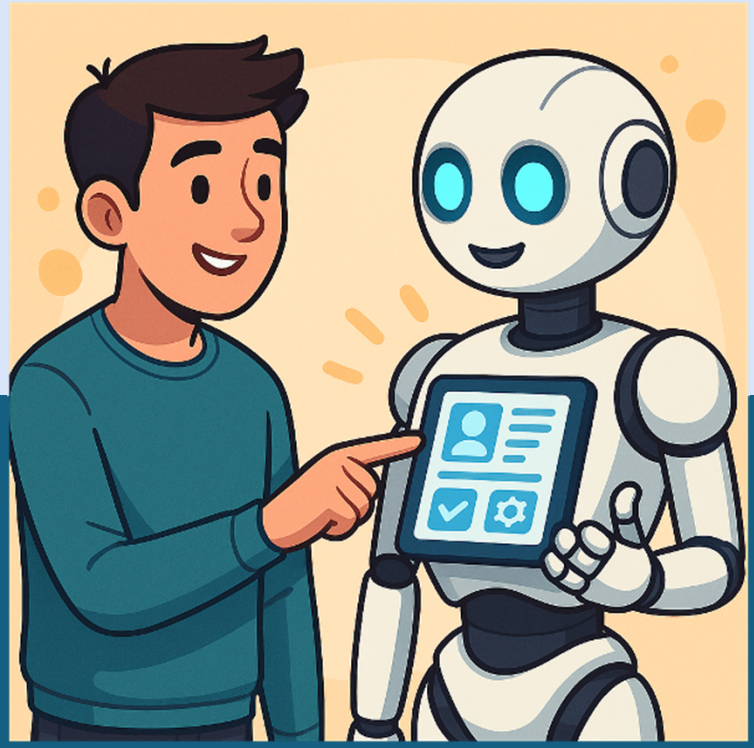
What Didn't Matter

Limitations

- Less diverse sample sizes.
- Lab setting.
- Several trait-based hypotheses not supported (loneliness, conscientiousness, neuroticism).
- Short-term, single-session.
- Further research could build upon our understanding of these traits, such as how prior work linked loneliness to increased receptivity towards social robots.

Future Work Toward Personalization

- Longitudinal repeated studies
- Diverse contexts (group meals, home)
- Elderly, adolescent, disabled user groups
- Real-time affect sensing (eating pace, gaze, vocal prosody)
- More expressive robot behavior

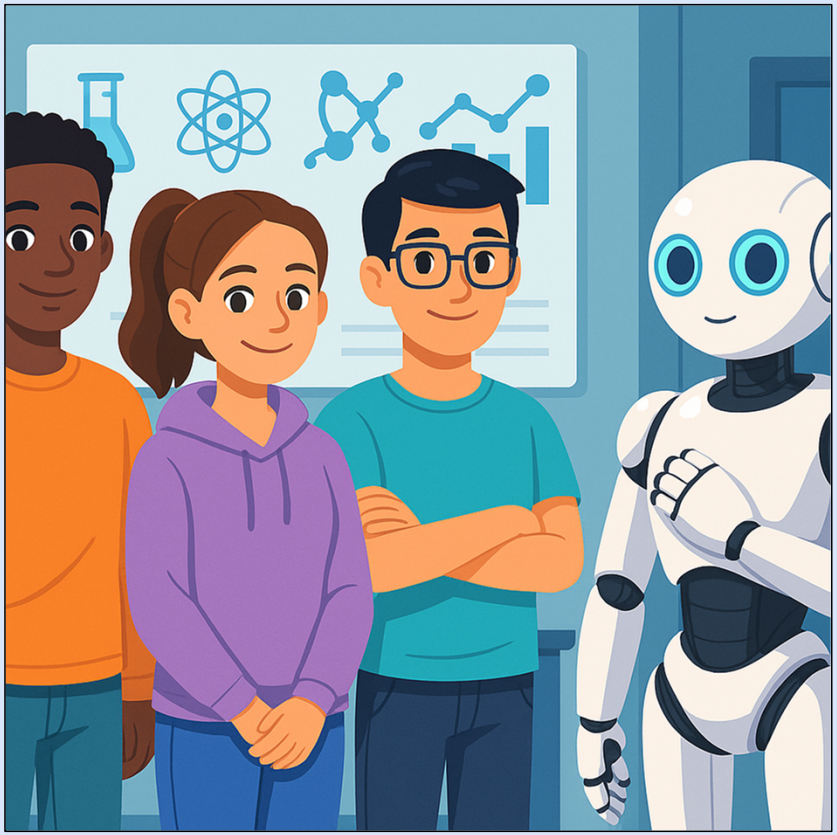


Future ACCs should adapt:

- Dialogue tone
- Interaction pacing
- Topics of interest
- Use pre-survey traits to guide system behavior.

Thank You!

Questions/Comments?



Demo Video