Customizing Robot Personality: How Personality Control and Form Factor Shape Perceptions of a Robot as a Social Agent

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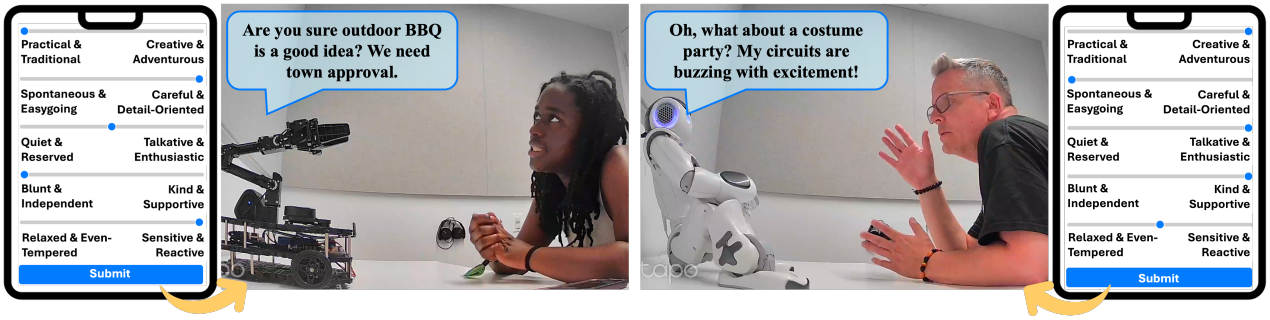


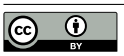
Figure 1: We conducted a user study where participants interacted with either (a) a non-humanoid robot or (b) a humanoid robot and could either customize the robot's personality using a web-based user interface (a & b) or could not customize the robot's personality. Each robot's dialogue reflects the individual personality profiles customized by their respective participants.

Abstract

A robot's personality can shape user experience and acceptance in many social robot applications. Allowing users to customize robot personality could help them tailor robot products to their preferences, but it remains unclear whether this customization diminishes perceptions of the robot as a social agent and whether robot form factor influences these effects. We conducted a 2×2 between-subjects study (N = 79) examining robot form factor (humanoid NAO vs. non-humanoid TurtleBot) and personality customizability (customizable vs. non-customizable) during a collaborative event-planning task. Our results reveal that while customization reduced perceived social agency for both robot types, this reduction was particularly evident for humanoid robots. Conversely, personality customization significantly improved human-robot rapport, with this improvement driven primarily by non-humanoid robots. These findings reveal form factor-dependent effects in personality customization, indicating that robot form and customization capabilities yield differential impacts on perceived social agency and human-robot rapport in human-robot interaction design.

CCS Concepts

• **Human-centered computing** → **Empirical studies in HCI**; • **Computer systems organization** → **Robotics**.



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Keywords

Human-Robot Interaction, Robot Personality, End-User Programming, Customizing Personality, Robot Form Factor

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1 Introduction

As robots increasingly enter social contexts across diverse applications, their personality characteristics become critical determinants of user experience and acceptance. From companionship for older adults [15, 52] to education [12, 18] and home assistance [7, 27], robot personalities strongly influence how people perceive and relate to robotic systems [16, 22, 37, 39]. As with human interactions, preferences for robot personality vary: some users prefer robots whose personalities match their own [59], while others favor complementary traits [37, 47]. Getting robot personality right is therefore essential for long-term success, as personality characteristics substantially shape interaction outcomes.

Given this challenge, the ability to customize robot personality characteristics represents a compelling option for creating more satisfying interactions. Just as users benefit from customizing robot movement speed or speech patterns, personality customization could allow users to tailor robot social behaviors to their specific interaction styles. Customization has been shown to improve user

acceptance across diverse robotic applications [17, 57], with tailored interactions feeling more intuitive and aligned with individual needs [28, 34]. End-user programming approaches that allow non-technical users to modify robot characteristics can increase attachment, perceived ownership, and overall satisfaction with robotic systems [31, 58, 66].

However, personality customization capabilities may come with significant trade-offs in how users perceive robots as social agents. Perceived social agency–encompassing perceptions of autonomy, authenticity, and social intelligence–is crucial for robots to be viewed as genuine social entities rather than mere tools [35, 61, 66]. Robots perceived as socially intelligent and autonomous tend to elicit greater engagement and acceptance [11, 13], supporting more meaningful interactions [24, 40]. Recent work shows that extensive user control over robot behavior can undermine these perceptions by shifting mental models from "autonomous agent" to "controllable tool" [66], raising the question of whether personality customization may produce similar effects.

Robot form factor may further shape this trade-off. Humanoid robots naturally evoke stronger anthropomorphic responses and social expectations than non-humanoid platforms [16, 25], leading to more robust initial personality expectations [53, 60]. As a result, explicit personality customization may be more disruptive for humanoid robots, while non-humanoid robots may benefit from customization as a means of enhancing social presence without comparable costs to perceived autonomy.

Despite its importance, the interaction between personality customization and robot form factor remains unexplored. While prior research has examined the effects of general robot behavior programming on social agency [66], the specific impact of personality has not been systematically investigated. Understanding how robot physical form influences users' responses to personality customization is just as critical for designing effective social robot systems, particularly as new robot products must decide between humanoid [1–3] or non-humanoid designs [4, 7].

To address this gap, we conducted a 2×2 between-subjects study (N = 79) examining how robot form factor (humanoid vs. non-humanoid) and personality customizability (customizable vs. non-customizable) affect perceived social agency, rapport development, and overall user experience during a collaborative event planning interaction.

2 Background

This section reviews prior work on robot customization, personality implementation, and form factor effects on social perception.

2.1 Robot Customization and Social Agency

Robot customization enables non-technical users to modify robot behavior to meet individual needs [5, 50], often increasing engagement, satisfaction [41, 51, 63], and perceived utility [10, 33, 42]. End-user programming (EUP) approaches supporting customization include Learning-from-Demonstration [9, 14], augmented reality interfaces [30, 54], speech and natural language programming [6, 19], and visual tools ranging from block-based environments [32, 56, 63] to lightweight slider- and form-based interfaces [41, 42, 55].

However, this customization may come with trade-offs in the robot's perceived social agency [66]. We use the term "perceived social agency" to describe people's perceptions of a robot as a "social other," encompassing qualities like autonomy, agency, authenticity, and social intelligence [21, 35, 61, 66]. Perceived social agency is crucial for robots to be seen as social entities rather than mere tools [13, 23, 35], often leading to more enjoyable interactions [11, 24, 38]. Recent work has demonstrated that adopting EUP interfaces can diminish perceived social agency by shifting user perception from autonomous social agent to controllable tool [66]. While this work examined general robot behavior programming, no research has investigated how personality customization specifically affects social agency perceptions. Unlike other forms of customization (e.g,. movement speed, "no go" zones), modifying a robot's personality may have particularly significant effects on social agency because personality represents the core of social identity–altering it may feel like fundamentally changing the agent itself rather than merely adjusting its behaviors.

2.2 Robot Personality Customization

Robot personality significantly influences user experience and acceptance, with different personality traits producing varied interaction outcomes across contexts and user types [37, 47, 59, 60]. Prior work has examined non-customizable robot personalities, demonstrating that specific personality characteristics can affect user engagement, task performance, and long-term acceptance [8, 16, 39]. However, most studies focus on researcher-designed personalities rather than user-driven customization approaches.

In recent years, robot personality implementation has evolved from rule-based and handcrafted dialogue systems [44, 47] to sophisticated LLM-based approaches that generate personality-consistent behavior using structured trait definitions and style prompts [49, 64]. This evolution enables more scalable personality generation, making user customization of robot personalities technically feasible. However, the effects of allowing users to customize these AI-driven personalities–rather than interacting with non-customizable designs–on social agency perceptions and user experience remain unexplored, representing a critical gap as robots transition toward more personalized social interactions.

2.3 Robot Form Factor and Anthropomorphism

Anthropomorphism research in human-robot interaction has established that robot form factor significantly influences social perceptions and interaction dynamics [25, 29, 67]. Humanoid robots activate social cognition mechanisms more readily than non-humanoid platforms, leading users to attribute more personality traits and social capabilities to them [16, 53]. This enhanced anthropomorphism creates stronger initial personality expectations and stereotypical attributions that align with cultural assumptions about human-like entities [26, 60].

These form factor-based differences in social perception may critically influence how users respond to personality customization opportunities. Groom et al. [31] demonstrated that robot form affects user relationships and willingness to customize robot characteristics, suggesting that the customization-social agency trade-off identified in prior work [66] may operate differently across robot

form factors. Understanding these form factor-dependent effects is essential for designing effective personality customization systems that preserve social agency while enabling user control.

3 Methods

To investigate how robot form factor and personality customizability influence perceived social agency and user experience, we conducted a 2×2 between-subjects study varying Robot Form Factor (Humanoid vs. Non-humanoid) and Robot Personality Customizability (Customizable vs. Non-customizable). This study was approved by the University of Chicago's SBS Institutional Review Board (Protocol IRB25-1064), preregistered on AsPredicted (#239295)[1], and materials including questionnaires, LLM prompts, robot code, human-robot transcripts, and anonymized data are available in the accompanying supplemental materials and our OSF Repository[2].

3.1 Hypotheses

Prior work has demonstrated that granular end-user programming of robot behaviors (e.g., movement speed, vocal profile) significantly reduces perceived social agency compared to high-level adjustments, suggesting that excessive user control shifts perception from autonomous social agent to controllable tool [66]. As personality represents a core element of social identity, even high-level personality trait adjustments may be particularly prone to diminishing perceived social agency compared to interacting with non-customizable robots. We hypothesized:

- **H_1 (Effect of Personality Customizability)** – Participants who customize a robot's personality will perceive the robot as having **lower social agency** (including reduced authenticity, agency, and social anthropomorphism) compared to participants who cannot customize a robot's personality.

The relationship between customization and social agency may also be influenced by a robot's form factor. Users more readily attribute personality traits and social capabilities to humanoid robots, with their human-like physical features, than non-humanoid robots [25, 29], creating stronger initial expectations for humanoid robot personality [16, 37, 53]. When users customize a humanoid robot's personality, they may feel they are altering an already-established social entity, creating a greater sense of inauthenticity compared to customizing a non-humanoid robot that lacks such strong social expectations. As such, we hypothesized that:

- **H_2 (Influence of Robot Embodiment)** – The effect of personality customization on perceived social agency will be moderated by robot form factor, such that **humanoid** robots will experience a greater reduction in perceived social agency from customization than **non-humanoid** robots.

Humanoid robots often evoke stereotypical expectations based on their human-like appearance [26, 36, 60, 62], potentially leading to more convergent personality customization choices, clustering around stereotypical personality traits, as users align with social schemas for human-like entities. In contrast, non-humanoid robots may permit greater diversity in user-selected personality traits. Therefore, we hypothesized:

- **H_3 (Personality Customization Patterns)** – There will be **greater consistency** in how participants customize personalities for humanoid robots compared to a wider distribution for non-humanoid robots.

While perceived social agency represents a fundamental aspect of human-robot interaction, the success of robot systems also depends on broader experiential outcomes including relationship quality and user satisfaction. We therefore examined how robot form factor and personality customizability influence **human-robot rapport** and **overall interaction experience**, as the mechanisms affecting these relational and experiential outcomes may differ from those impacting social agency perceptions.

3.2 Experimental Conditions

Our 2×2 between-subjects design crossed robot form factor and personality customizability. To manipulate form factor (see Figure 1), we used two platforms: SoftBank Robotics NAO robot (**humanoid**) and TurtleBot3 + OpenMANIPULATOR-X arm (**non-humanoid**). Both robots were positioned at eye level and equipped with speech and arm hardware to support natural conversational interaction.

To ensure parity across form factors, both robots executed the same set of pre-scripted gestures—waves, pointing motions, a greeting sequence, and periodic ambient arm movements. Because the two platforms differ mechanically, each gesture was kinematically adapted to produce the closest feasible equivalent movement. Gesture behavior was identical across conditions and did not vary with personality customization.

Both robots used the same speech model (OpenAI gpt-4o-mini-tts) and a fixed voice identity ("alloy") played back on-device. Voice characteristics were constant across conditions. In customizable conditions, participants' Big Five slider selections additionally modulated prosody cues (e.g., higher extraversion produced a more energetic cadence) while retaining the same base voice. The prompt template used to generate these prosody adjustments is included in the supplementary materials.

For the personality customizability manipulation, participants in the **customizable** condition adjusted the robot's personality using a web interface (see Figure 1) with five Big Five trait sliders (Low, Mid, High) with descriptive labels (e.g., Extraversion: "Quiet & Reserved" to "Talkative & Enthusiastic"). In the **non-customizable** condition, the robot's personality remained fixed at the "Mid" level for all traits, and participants were never shown the customization interface. Participants were given the opportunity to adjust the robot's personality traits using the customization interface but were not required to make any changes.

3.3 Event-Planning Task

We selected collaborative event planning as a relatable, everyday scenario that supports multi-turn, embodied interaction and provides ample opportunities for personality expression through dialogue, suggestions, and decision-making. The task comprised three segments (Figure 2):

Phase 1: Introduction (2–3 minutes). The robot introduced itself as Nova, a home assistant capable of helping plan gatherings. It learned the participant's name and interests and explained

[1] https://aspredicted.org/t6b3-83jc.pdf
[2] https://osf.io/dm5wp/?view_only=1b656666d08c4fcb97e939edac7082c1

Figure 2: Participants completed a 3-phase event-planning task with a robot. Before Phases 2 and 3, participants in the customizable condition were given the option to modify the robot's personality.

communication protocols (e.g., visual listening cues), establishing baseline interaction mechanics and personality.

Phase 2: High-Level Planning (8–10 minutes). Participants and the robot defined core event parameters—occasion, guest list size, timing, food options, and activity categories. The robot asked clarifying questions and offered suggestions aligned with its personality configuration.

Phase 3: Detailed Logistics (8–10 minutes). Participants collaborated with the robot on specific planning details, including food and beverage selections, activities, contingency planning, and the robot's potential day-of assistance. This phase provided more opportunity for nuanced personality-driven dialogue.

Representative full interaction transcripts are provided in the supplemental materials.

3.4 Implementation of Robot Dialogue

We implemented the robot's dialogue using a large language model (Gemini 2.5 Flash) prompted with Big Five personality trait characteristics [46]. Each trait level (Low, Mid, High) was associated with specific behavioral descriptions and linguistic patterns derived from personality psychology research [45, 64]. For example, high extraversion was characterized by "enthusiastic, talkative dialogue with frequent questions and exclamations", while low extraversion featured "reserved, concise responses." Prior work [64] has shown that LLMs can reliably convey distinct robot personalities through linguistic style, supporting our use of system-prompt conditioning. The default personality for the "Introduction" phase in the customizable conditions and the entire interaction in the non-customizable conditions were set to "Mid" for all five traits.

To ensure consistent task progression, our system prompts constrained the LLM to guide participants through the event planning interactions in sequence. If conversations strayed from the planning agenda, the robot was programmed to naturally redirect participants back to the current interaction objectives (e.g., "That's interesting! Now, what kind of food are you thinking about for the gathering?"). For reproducibility, the exact system prompts used in the interaction are included in the supplement. Each session consisted of at least six dialogue turns per phase. Responses were limited to 50 words, and the LLM temperature was fixed at 0 to minimize randomness.

3.5 Experimental Protocol

The experiment (displayed in Figure 2) was conducted across two rooms: an interaction room containing the robot and a separate survey room. Participants first completed a consent form and pre-interaction survey in the survey room. They were then brought to the interaction room where a research assistant explained the event-planning task and observed while the robot introduced itself during Phase 1 (Introduction), after which, they left the room.

Then, participants in the customizable personality condition returned to the survey room and were given the option to adjust the robot's personality settings using the interface pictured in Figure 1. Customization logs revealed that 1 participant chose not to modify personality settings for Phase 2 and keep the default ("Medium" for all traits). Afterwards, they returned to the interaction room to proceed with Phase 2. Participants in the non-customizable personality condition proceeded directly to Phase 2.

Participants then engaged in high-level event planning (Phase 2) for approximately 8-10 minutes. After Phase 2, all participants returned to the survey room to complete a mid-interaction survey and only participants in the customizable robot condition were given a second opportunity to adjust the robot's personality settings. 11 out of 39 participants chose to keep the same settings for Phase 3.

After returning to the interaction room, all participants worked with the robot to complete detailed planning (Phase 3) for approximately 8-10 minutes. Finally, participants completed a post-interaction survey in the survey room and were debriefed about the study's purpose. The entire session lasted approximately 30 minutes, and participants were compensated 600 points (equivalent to $6 USD) redeemable for museum prizes.

3.6 Measures

Participants completed questionnaires assessing their interaction with the robot; full instruments are provided in the supplementary materials. All items used 7-point Likert scales unless otherwise noted. All participants were included in analyses regardless of whether they modified personality settings, as the manipulation targeted the availability of customization rather than the magnitude of change.

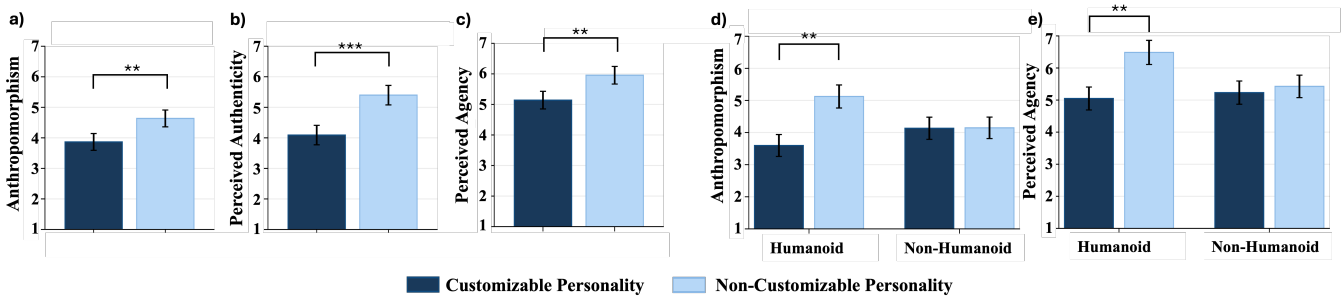

Figure 3: Participants who customized the robot's personality perceived the robot as having less (a) anthropomorphism, (b) agency and (c) authenticity than those who did not customize the robot's personality. Interaction effects (d, e) suggest that this effect was driven by the lower perceptions of humanoid robot social agency when participants were able to customize its personality. (**) and (***) denote $p < 0.01$ and $p < 0.001$, respectively. Error bars show one standard error from the mean.

3.6.1 Perceived Social Agency. We assessed perceived social agency using several related constructs. From the Scale of Social Robot Anthropomorphism (SSRA) [21], we used the Human-like Appearance subscale as a manipulation check, and combined the Self Understanding, Social Intelligence, and Emotional Capability subscales into a composite dependent measure (Cronbach's $\alpha = 0.940$). We measured perceived authenticity with a 4-item scale we developed (e.g., "the robot's personality felt genuine"; $\alpha = 0.892$), and administered Trafton et al.'s 5-item Perception of Agency scale [61].

3.6.2 Social Relationship Quality. We measured interpersonal closeness using the IOS Scale for Multiparty Interactions (IIMI) [65] and human–robot rapport via a shortened version of the Connection-Coordination Rapport (CCR) scale [43] (Cronbach's $\alpha = 0.913$).

3.6.3 Overall User Experience. Overall user experience included interaction enjoyability, warmth and competence using the RoSAS scale [20], attachment and ownership toward the robot, and long-term use intentions adapted from Moon and Kim [48].

3.6.4 Customization-Specific Measures. Customization-specific items included perceived awkwardness in adjusting personality traits and logged personality selections across interactions.

3.6.5 Manipulation Checks. We employed three manipulation checks: (1) the Human-like Appearance subscale of the SSRA to verify perceived form factor differences and (2) a perceived personality change item to confirm noticeable effects of customization.

3.6.6 Demographic and Free Response Measures. Participants reported demographic information, prior AI experience, and open-ended reflections on the interaction.

3.7 Participants

An a priori power analysis using a medium-large effect size (f = 0.35) from prior work on perceived agency [66], with $\alpha = 0.05$, power = 0.80, and 3 covariates, suggested a sample size of 68, therefore, we aimed to recruit 80 participants to maintain balanced cells and account for potential exclusions. We successfully recruited 82 participants visiting Mindworkds, a behavioral science museum in Chicago. Three participants were excluded due to technical failures or protocol breaches (e.g., incomplete questionnaire), resulting in a final sample of 79 participants (19 in the Customizable Humanoid condition and 20 in each of the other three conditions).

Participants' age ranged from 18 to 70 ($M = 33.96$, $SD = 12.86$). 48 participants self-identified as female, 26 as male, and 5 as other. 44 participants identified as White, 18 as Hispanic, 12 as East Asian, 8 as South Asian, 6 as Black or African American, 6 as South East Asian, 3 as Middle Eastern, 1 as Native American / Alaska Native, 1 as Pacific Islander, and 1 as other, with 2 declining to respond. Those who identified with multiple ethnicities were double counted in those ethnicities.

4 Results

To evaluate the impact of robot form factor and personality customization on user perceptions, we conducted two-way Analysis of Covariance (ANCOVA) tests for each dependent variable. We included the covariates of participant age, gender, and AI familiarity in all models and removed them if they did not have a statistically significant effect. We report effect sizes as partial eta squared (η_p^2). Post-hoc decompositions were performed using simple effects analysis using covariate-adjusted Estimated Marginal Means (EMMs)[3]. Non-significant measures are reported in the supplemental document.

4.1 Manipulation Checks

4.1.1 Perceived Change in Robot Personality. Participant customization logs revealed that 1 participant chose not to modify personality settings for Phase 2 and 11 chose not to modify personality settings for Phase 3. Our analysis of participants' ratings of perceived personality change revealed a significant main effect of customizability ($F(1, 75) = 8.55, p = 0.005, \eta_p^2 = 0.102$). Participants in customizable conditions reported greater perceived change ($M = 43.44, SD = 34.18$) than those in non-customizable conditions ($M = 23.60, SD = 24.91$). No effects of form factor or interactions were observed. These findings indicate that participants who customized the robot reliably perceived corresponding personality changes, suggesting discernable expression.

[3]This approach is more statistically appropriate for decomposing interactions in factorial ANCOVA designs than TukeyHSD, which we initially stated that we would use in our Pre-Registration (AsPredicted #239295: https://aspredicted.org/t6b3-83jc.pdf).

4.1.2 Perceived Human-Likeness. Our analysis of participants' responses to the Human-like Appearance subscale of the SSRA revealed a significant main effect of robot form factor ($F(1, 75) = 48.11, p < 0.001, \eta_p^2 = 0.391$). The humanoid NAO robot was perceived as significantly more human-like ($M = 3.86, SD = 1.60$) than the non-humanoid TurtleBot3 ($M = 1.81, SD = 0.92$). No significant effects of customization condition nor interactions were found, confirming that participants viewed the humanoid robot as more human-like than the non-humanoid robot.

4.2 Perceived Social Agency

4.2.1 Social Robot Anthropomorphism. As our first measure of social agency, we combined three of the four subscales (Social Understanding, Social Intelligence, and Emotional Connection) of the Scale of Social Robot Anthropomorphism (SSRA [21]) into one dependent measure (Cronbach's $\alpha = 0.940$). We found a significant main effect of robot personality customizability ($F(1, 67) = 7.17, p = 0.009, \eta_p^2 = 0.097$). As shown in Figure 3(a), participants perceived the robots with customizable personalities as less anthropomorphic ($EMM = 3.87, SE = 0.34$) than those with non-customizable personalities ($EMM = 4.64, SE = 0.35$). This main effect supports H_1 (Effect of Personality Customizability).

We also found a significant interaction between robot form factor and personality customizability ($F(1, 67) = 6.33, p = 0.014, \eta_p^2 = 0.086$). Simple effects revealed that the customization effect was driven primarily by humanoid robots, where customization significantly reduced perceived anthropomorphism (customizable: $EMM = 3.60, SE = 0.34$; non-customizable: $EMM = 5.13, SE = 0.36$; $F(1, 29) = 9.03, p = 0.005, \eta_p^2 = 0.237$), see Figure 3(d). No significant customization effect was found for non-humanoid robots. This interaction effect provides support for H_2 (Influence of Robot Form Factor), suggesting that humanoid robots are more susceptible to the diminishing effects of personality customization on perceived social agency.

4.2.2 Perceived Authenticity. Examining perceived authenticity, or the degree in which the robot is seen as a genuine social agent, (Cronbach's $\alpha = 0.892$) we found a main effect of robot personality customizability ($F(1, 67) = 15.84, p < 0.001, \eta_p^2 = 0.191$). As shown in Figure 3(b), participants perceived robots with customizable personalities as less authentic ($EMM = 4.09, SE = 0.40$) than non-customizable personalities ($EMM = 5.40, SE = 0.40$). This main effect provides support for H_1 (Effect of Personality Customizability), demonstrating that personality customization substantially reduces perceptions of robot authenticity as a genuine social agent.

Neither robot form factor nor the interaction between factors reached significance for authenticity.

4.2.3 Perceived Agency. Our analysis of participant responses to the Perceived Agency scale [61] revealed a significant main effect of robot personality customizability ($F(1, 67) = 7.39, p = 0.008, \eta_p^2 = 0.099$). Participants perceived robots with customizable personalities with lower perceived agency ($EMM = 5.14, SE = 0.36$) than non-customizable personalities ($EMM = 5.96, SE = 0.36$), see Figure 3(c). This main effect supports H_1 (Effect of Personality Customizability), providing additional evidence that users perceive a robot with less social agency if they customize its personality. Robot form factor did not reach statistical significance.

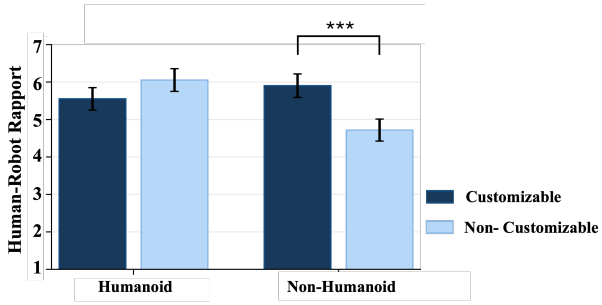

Figure 4: Participants that interacted with the customizable non-humanoid robot reported higher rapport than those interacting with the non-customizable non-humanoid robot. (***) denotes $p < 0.001$. Error bars show one standard error from the mean.

We also found a marginally significant interaction effect ($F(1, 67) = 3.89, p = 0.053, \eta_p^2 = 0.055$). Simple effects analysis revealed that customization significantly reduced perceived agency for humanoid robots (customizable: $EMM = 5.05, SE = 0.36$; $non - customizable$: $EMM = 6.49, SE = 0.38$; $F(1, 29) = 10.52, p = 0.003, \eta_p^2 = 0.266$), see Figure 3(e). This pattern echoes the interaction effect observed with the SSRA social agency measures, providing additional support for H_2 (Influence of Robot Embodiment), though it should be interpreted with caution given the marginal interaction effect.

4.3 Social Relationship Quality

4.3.1 Human-Robot Rapport. Analysis of participant responses to the shortened Connection-Coordiation Rapport (CCR) [43] scale revealed a significant main effect of robot personality customizability ($F(1, 67) = 4.21, p = 0.044, \eta_p^2 = 0.059$) on perceived human-robot rapport. Participants interacting with robots with customizable personalities reported higher rapport ($EMM = 5.80, SE = 0.30$) compared to those interacting with robots with non-customizable personalities ($EMM = 5.31, SE = 0.30$). Robot form factor did not reach statistical significance.

We also found a significant interaction between robot form factor and personality customizability ($F(1, 67) = 10.23, p = 0.002, \eta_p^2 = 0.132$) on perceptions of human-robot rapport. Interestingly, simple effects revealed that customization significantly enhanced rapport for non-humanoid robots (customizable: $EMM = 6.05, SE = 0.30$; non-customizable: $EMM = 4.72, SE = 0.29$; $F(1, 31) = 14.28, p < 0.001, \eta_p^2 = 0.315$), but had no significant effect for humanoid robots (see Figure 4). This interaction effect reveals distinct patterns where personality customization may diminish perceived social agency (particularly for humanoid robots) while enhancing rapport, especially with non-humanoid robots.

4.3.2 Interpersonal Closeness. We found no significant differences between conditions on the IIMI [65] interpersonal closeness measure.

4.4 Overall User Experience

4.4.1 Interaction Enjoyability and Party Planning Experience Quality. Across all conditions, participants reported generally high levels of enjoyment of the interaction ($M = 5.62, SD = 1.30$) and evaluations of their event-planning experience ($M = 5.74, SD = 1.22$). However, we found no significant differences due to the robot's form factor, customizability, nor interactions between them on these measures.

4.4.2 Future Use Intentions, Attachment, Perceived warmth and competence. We found no significant differences between conditions on our measures of future use intentions, attachment, and perceptions of the robot's robot warmth and competence (RoSAS [20]).

4.5 Personality Customization Patterns and Clustering Analysis

To test H_3 (Personality Customization Patterns), we examined whether robot form factor influenced how participants customized robot personalities in the customizable conditions. Across all analyses–within-group variance, multivariate dispersion, Shannon entropy, and k-means clustering–we found no evidence that humanoid robots elicited more consistent or convergent personality configurations than non-humanoid robots, indicating that form factor did not shape aggregate customization patterns.

Although overall personality selection structure did not differ by form factor, participants systematically adapted personality settings over time. Comparing selections between Phases 2 and 3 using one-sample t-tests, we observed significant decreases in extraversion ($M_\Delta = -0.26, p = 0.016$) and agreeableness ($M_\Delta = -0.38, p = 0.045$), alongside a significant increase in neuroticism ($M_\Delta = 0.36, p = 0.018$). Openness showed a marginal decrease ($M_\Delta = -0.31, p = 0.070$), while conscientiousness did not change significantly. These adaptation patterns were consistent across robot form factors (Figure 5).

Independent-samples t-tests on change scores revealed one form-factor difference: participants interacting with humanoid robots increased neuroticism more strongly ($M = +0.68, SD = 1.00$) than those interacting with non-humanoid robots ($M = +0.05, SD = 0.71$), $t(36) = 2.25$, $p = 0.031$, Cohen's $d = 0.73$.

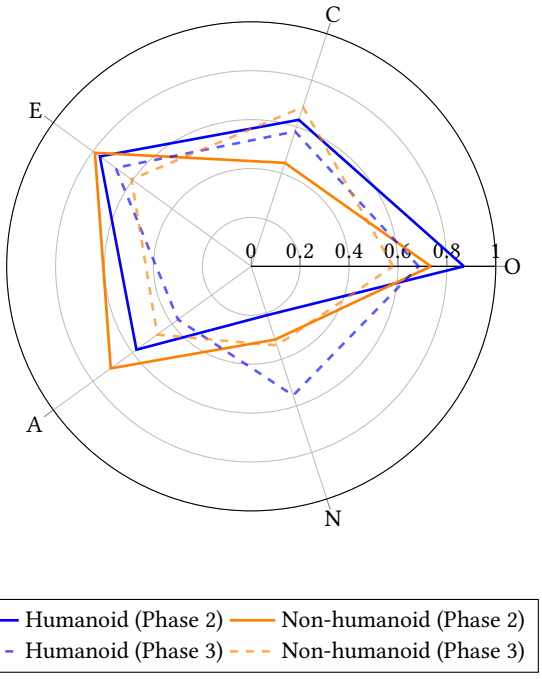

Figure 5: Participants' normalized [0–1] personality trait selections for (O)peness, (C)onscientiousness, (E)xtraversion, (A)greeableness, (N)euroticism by form factor across interaction Phase 2 (solid) and Phase 3 (dotted).

5 Discussion

We interpret how personality customization alters perceptions of social agency and how these effects depend on robot form factor. We further discuss the contrasting effects on human–robot rapport and their implications for designing customizable social robots.

5.1 Personality Customization Reduces Perceived Social Agency

Personality represents a fundamental element of any social agent, whether embodied robots or AI chatbots, serving as the core foundation of social identity and interaction patterns. Our study isolates *personality* as a fundamental component of social agents, demonstrating that when users are given the ability to customize their robot's personality, their view of the robot as a social agent significantly decreases across multiple survey measures. This suggests that the trade-off between user control and social agency extends beyond general robot behavioral customization (e.g., movement speed) to the core aspects that define a social agent's identity.

The discomfort some participants expressed about customizing their robot's personality further illustrates this tension. As one participant noted in the post-experiment survey: *"I think finding an optimal balance of outgoing/reserved is important. Although, I'm not sure that I like the idea that I can customize a personality..."* (p43, Hum. Cust.). Another described feeling *"Uncomfortable, it felt odd deciding how the robot would interact with me"* (p45, Hum. Cust.). These reactions suggest that even when customization is technically simple, manually configuring personality traits can feel unnatural and compromise the robot's perceived genuineness as a social agent.

These findings have important implications for robot system design. Prior research has shown that granular, complex customization aligns robot behavior with user preferences but significantly reduces perceived social agency [66]. In contrast, higher-level customization achieves preference alignment with less impact on social agency [66]. Our work extends these findings by demonstrating that even simple personality customization can diminish perceived social agency. Product designers should consider this trade-off based on their design goals: systems intended to function as social companions may benefit from limiting customization or implementing higher-level adjustments [66], while systems designed as functional tools may prioritize comprehensive customization to maximize preference alignment. Additional mitigation strategies include selecting appropriate robot form factors or introducing temporal separation between customization and interaction phases. Understanding

these trade-offs enables designers to make informed choices that align customization capabilities with their intended user experience, whether prioritizing social engagement, functional control, or a balanced approach.

5.2 Robot Form Factor Moderates Customization Effects on Social Agency

Our findings reveal that robot form factor significantly moderates the impact of personality customization on perceived social agency. The interaction effects across social agency measures showed that customization's impact was concentrated in participant perceptions of the humanoid robot, while the non-humanoid robot showed no significant reduction in perceived social agency from customization.

This differential susceptibility may stem from the distinct social expectations users bring to different robot forms. Several participants interacting with humanoid robots commented on their human-like qualities, interpreting this both positively and negatively. One participant noted: *"The robot was realistic and exhibited empathy and understanding. If I didn't see him, it would have been easy to imaging this interaction as one with a human, rather than a robot"* (p17, Hum. Non-Cust.). Others expressed concern about this human-likeness: *"It gives me the impression that scientists are trying to make robots sentient to replace humans"* (p9, Hum. Non-Cust.).

These responses suggest that humanoid robots can achieve high levels of perceived social agency–to the extent that some participants expressed concern about potential human replacement, a sentiment absent among non-humanoid robot participants. When users customize an already human-like agent's personality, this may create a stronger sense of artificiality or manipulation compared to customizing a mechanical platform. The act of manually configuring what appears to be an established social entity may feel more intrusive than personalizing a tool-like robot.

5.3 Personality Customization Shows Complex Effects on Human-Robot Rapport

While personality customization reduced perceived social agency specifically for humanoid robots, its effects on human-robot rapport showed a different pattern. We observed both a main effect of customization (generally enhancing rapport) and a significant interaction with robot form factor. The interaction revealed that customization significantly enhanced rapport specifically with non-humanoid robots while having no significant impact on rapport with humanoid robots.

For non-humanoid robots, personality customization appears to possibly fulfill participants' desire to transform mechanical platforms into more human-like entities. Several participants explicitly described this motivation: *"I liked the customize feature, and would customize the robot to be more human like with a personality rather than just a tool"* (p71, Non-Hum. Cust.) and *"I wanted the robot to feel as human as possible"* (p29, Non-Hum. Cust.). Others framed customization in relational terms: *"It was very interesting experience. It was like thinking of the traits your partner should have"* (p6, Non-Hum. Cust.) and *"I was basically giving it traits I'd want in a person/robot that I was interacting with"* (p66, Non-Hum. Cust.).

This transformation process may occur without the discomfort that some participants expressed when customizing humanoid robots' personalities. The absence of awkwardness associated with manipulating an already human-like entity may allow participants to focus on the benefits of improved robot behavior preference alignment [66]. Additionally, other prior work suggests that customizing robot tools (i.e., Roomba) can increase user attachment and sense of ownership [58], which may explain how personality customization enhanced rapport specifically with non-humanoid robots.

5.4 Experience-Driven Adaptation and Design Implications

Participants made experience-driven personality adjustments after their initial interaction, decreasing extraversion and agreeableness while increasing neuroticism. These changes suggest users may seek more emotionally complex and relatable personalities following direct experience, aligning with prior work showing that neurotic robot personalities can enhance user relatability [64].

Despite significant differences in perceived social agency and rapport, interaction enjoyment remained consistently high across all conditions during the party planning task. This reveals an important distinction between task-level satisfaction and deeper perceptual outcomes: while participants found collaborative event planning equally engaging regardless of customization or form factor, the underlying mechanisms of how they perceived and related to their robots differed substantially. This indicates that perceived social agency and rapport represent meaningful dimensions of human-robot interaction beyond immediate task performance.

6 Conclusion

This work examined how robot form factor and personality customization jointly shape perceived social agency and human–robot rapport. Through a between-subjects study comparing humanoid and non-humanoid robots with customizable versus non- customizable personalities, we found that personality customization significantly reduced perceived social agency, with this effect concentrated in humanoid robots. In contrast, customization enhanced rapport primarily for non-humanoid robots, revealing that identical personalization mechanisms can produce divergent social and relational outcomes depending on embodiment. Together, these findings highlight that personalization in social robots is not universally beneficial, but instead involves a trade-off between user control and perceived social agency that is strongly moderated by robot form factor. From a design perspective, humanoid robots may benefit from limiting explicit personality customization to preserve their status as autonomous social agents, whereas non-humanoid platforms can leverage personality customization to enhance rapport with comparatively lower costs to perceived agency. As consumer robots move from novelty interactions toward long-term, everyday use, understanding and accounting for these embodiment-dependent effects will be essential for designing systems that support both immediate usability and sustained social relationships.

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