

Sriya R Kasumarthi. Robotics Augmented Web Conferencing. A Master's Paper Proposal for the M.S. in I.S degree. December, 2024. 37 pages. Advisor: William Payne

This study investigates the impact of different robotic greeting gestures —such as a handshake, wave, fist bump, or high five— on interactions in virtual meeting environments, such as Zoom. Building on prior research demonstrating the positive emotional effects of robotic gestures in face-to-face interactions, this study extends the inquiry to online scenarios. Participants will experience robotic gestures paired with vocal and visual greetings during virtual meetings, and their responses will be analyzed to determine intuitive reactions to each greeting type. Mixed methods data collection will include observational and survey methods, analyzed qualitatively and quantitatively to identify trends in emotional and social responses. The primary objective is to understand how participants intuitively respond to each type of greeting. The findings aim to understand how combining robotic gestures with online meetings can impact feelings of connection and presence with potential applications for improving user experience in commercial business and social contexts.

Headings:

Technological Innovations

Inventions

Computer Conferencing

Videoconferencing

Robotics Augmented Web Conferencing

by
Sriya R Kasumarthi

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Approved by:

William Payne

Table of Contents

Introduction.....	2
Literature Review.....	3
Enhancing Web Conferencing Interactions.....	3
Social Gestures in Robotic Interactions.....	4
Bridging the Gap between Virtual and Physical Interactions.....	5
Conclusion.....	5
Research Questions.....	6
Methodology.....	8
Positionality / Researcher Role.....	8
Sample / Research Participants.....	9
Data Collection Methods.....	10
Data Analysis Methods.....	12
Research Quality and Ethical Considerations.....	15
Timetable, Resources, and Budget.....	17
Impact, Limitations, and Conclusions.....	19
References.....	22

Appendix A. Consent Form.....	25
Appendix B. Recruitment Email.....	29
Appendix C. Recruitment Flyer.....	30
Appendix D. Survey.....	31
Appendix E. Participant Script.....	34

Introduction

As virtual meetings increasingly replace face-to-face interactions, establishing a sense of connection and presence in online environments remains a significant challenge. Video conferencing platforms like Zoom have become staples in professional, commercial, and social settings, yet they can lack the interpersonal warmth and engagement of in-person encounters. Emerging technologies, such as social robotics, offer potential solutions to bridge this gap. Robotic systems equipped with social and gestural capabilities have been shown to foster positive emotional responses in face-to-face contexts, suggesting their promise for enhancing online interactions.

This study explores the integration of robotic gestures into virtual meeting environments, focusing on how greetings like waves, handshakes, fist bumps, and high fives impact participants' emotional and social experiences. By pairing robotic gestures with vocal and visual greetings, we aim to understand how these interactions influence perceptions of connection and engagement in online spaces.

The research builds on prior studies demonstrating the emotional and social benefits of robotic gestures in physical settings, extending the inquiry to online scenarios. Through mixed methods, including surveys and observational analysis, we seek to capture participants' intuitive reactions to various robotic greetings. Data will be analyzed both qualitatively and quantitatively to identify trends in emotional responses, social rapport, and perceived presence.

The findings of this research could have significant implications for improving user experiences in virtual meetings. By leveraging robotic gestures, we aim to provide insights into how these technologies can enhance feelings of connection and engagement, with applications in professional, commercial, and social contexts. This work contributes to a growing body of research on human-robot interaction, particularly in adapting these technologies to online environments.

Literature Review

Robotics plays a crucial role in enhancing human interaction by bridging gaps between virtual and physical environments. The success of these interactions is shaped by factors such as context, familiarity and robot design. As robots are integrated into everyday scenarios like remote work and social interactions, they must effectively replicate human gestures to facilitate engagement, trust, and collaboration. The goal of this study is to explore two key areas: how robots in web conferencing can enhance virtual interactions and how performing social gestures impacts human reactions.

Enhancing Web Conferencing Interactions

The growing use of robots in web conferencing environments has the potential to enhance virtual interactions, especially by addressing the inherent lack of social presence in remote communication. Research has shown that adding embodied gestures and improving the virtual presence of robotic avatars can increase telepresence and collaboration. For instance, Sirkin and Ju (2012) found that consistent physical actions between robotic avatars and their virtual counterparts improved participants' perception of telepresence. Similarly, Tanaka et al. (2014) and Hsu and Chen (2022) observed that when robots greet participants or assist with tasks during virtual meetings, social presence and engagement significantly increased.

Additionally, Kuzuoka et al. (2018) explored how telepresence robots, through salutations and greetings, fostered informal communication among remote workers,

further facilitating collaboration. Stahl et al. (2018) highlighted the positive impact of robotic gestures in virtual meetings, noting that simulating human-like interactions enhanced collaboration. These studies collectively emphasize the value of incorporating robotic gestures into web conferencing and remote collaboration settings to bridge the social gaps present in these virtual environments.

Social Gestures in Robotic Interactions

Robots have also been shown to positively influence human reactions through social gestures. Research has demonstrated that cooperative gestures, such as handshakes and waves, significantly enhance collaboration and social acceptance. Riek and Rabinowitch (2010) found that robotic handshakes and other gestures improved social bonding and cooperation, while advances in robotic handshaking technology (Avelino Moreno, 2018) have made these interactions feel more natural. Studies have shown that haptic feedback during these gestures increases user engagement and satisfaction (Fitter & Kuchenbecker, 2014), emphasizing the importance of physical cues in fostering positive human-robot interactions.

Further research by Heenan and Greenberg (2014) has demonstrated that the design of robotic gestures—such as waves and handshakes—plays a critical role in improving perceptions of warmth, trust, and approachability. Anderson et al. (2018) explored how even abstract robotic gestures can effectively initiate social interactions, demonstrating the wide-reaching potential of gestures in shaping human-robot relationships. These findings suggest that robotic gestures, when thoughtfully designed and executed naturally, can promote trust and engagement across various social contexts.

Bridging the Gap between Virtual and Physical Interactions

Although much of the existing research has focused on robots in physical spaces or one-on-one interactions, the current study aims to extend this research to virtual environments. With the increasing integration of robots in business, commercial, and social settings, the impact of robotic gestures on virtual interactions has become an important area of study. Understanding how robots can replicate human-like behaviors such as greetings in virtual meetings is crucial for improving the user experience in virtual workspaces and digital consultations. This research builds on prior studies by investigating how robotic greeting gestures—such as handshakes, waves, fist bumps, or high fives—affect user responses during virtual meetings, particularly in settings like Zoom or people-less commercial environments such as robotic-assisted bank branches or stores.

Conclusion

The integration of robotic gestures into both physical and virtual settings plays a critical role in shaping human-robot interactions. As robots increasingly take on roles that involve direct human contact, it becomes essential to design interactions that are socially appropriate, emotionally engaging, and contextually relevant. By extending research into virtual spaces, this study seeks to expand our understanding of how robots can foster engagement, trust, and positive user experiences in digital environments.

Research Questions

The purpose of this study is to explore how participants respond to robotic gestures—such as handshakes, waves, fist bumps, and high fives—paired with vocal and visual greetings during augmented web conferencing. Building on research showing the positive impact of robotic gestures on user perceptions, this study aims to identify which gestures are most intuitive and how they are perceived in virtual settings. The findings will inform the use of robots in virtual meetings, retail, and business environments, enhancing human-robot interactions in increasingly common scenarios.

My research questions are:

1. How do participants respond to and perceive robotic gestures (handshake, wave, fist bump, high five) when accompanied by a vocal and visual greeting during augmented web conferencing?
2. Which gesture type leads to the highest levels of perceived positivity, comfort, and friendliness during interactions with a robotic arm in an augmented web conferencing setting?
3. How do participants intuitively respond to different robotic gestures when paired with a vocal and visual greeting during augmented web conferencing?

Key terms in this study are:

1. Co-bot (Collaborative Robot): A co-bot is designed to work alongside humans in shared environments, enhancing productivity and safety by performing tasks in collaboration with people. In this study, the co-bot will initiate social gestures that complement virtual interactions (Dautenhahn, 2007; De Santis et al., 2008).
2. Web Conferencing: Web conferencing is an online platform that allows individuals to communicate and collaborate remotely through audio, video, and screen sharing. This study investigates how participants interact with robotic gestures within the context of virtual meetings (Tang & Isaacs, 1993).
3. Greeting Gestures: Greeting gestures, such as handshakes, waves, fist bumps, and high fives, are social cues that help initiate friendly or respectful interactions. In this study, these gestures are performed by a robotic arm to evaluate their impact on participant reactions (Kendon, 2004; Sato & Yonekura, 2007).

Methodology

This study will use a mixed methods approach, combining quantitative and qualitative data to provide a comprehensive understanding of how participants respond to robotic gestures. The quantitative component will measure reaction times and response patterns, identifying trends in participants' engagement levels. The qualitative component, through a follow-up survey, will capture participants' thoughts and reasoning behind their responses, providing context to explain observed patterns. This approach leverages the strengths of both methods, offering both objective measurements and deeper insights into participants' experiences and comfort with robotic gestures.

Positionality / Researcher Role

I bring both personal and academic investment to this research project, stemming from my enthusiasm for exploring how robotics can enhance human interaction. This interest has shaped my decision to focus on robotic gestures in virtual environments, driven by the belief that robotics can positively influence social engagement. However, I recognize that this enthusiasm could unintentionally bias my research design or interpretation, potentially leading me to favor positive outcomes.

To mitigate this risk and ensure balanced and credible findings, I will take deliberate steps to consider alternative interpretations, particularly if the data indicates neutral or negative effects on social engagement. This will involve peer debriefing, where an unbiased reviewer can critique my design and analysis, as well as maintaining an audit

trail to document my decisions and interpretations throughout the research process. By disclosing my values and assumptions and taking these measures, I aim to minimize the influence of personal bias on the study's outcomes and uphold its validity and reliability.

Sample / Research Participants

The population for this study will consist of individuals aged 18–35, specifically college students and faculty on the UNC campus. Participants will be recruited through university listservs, which provide an efficient and practical means to reach a broad group of college students who are accessible and likely interested in participating. The sampling unit includes both students and faculty members, leveraging convenience sampling to gather participants quickly within the university setting. This approach allows for a range of perspectives from individuals with varying academic and personal backgrounds.

Despite its practicality, convenience sampling introduces limitations. One key limitation is limited generalizability, as the findings may not fully apply to professional contexts such as business or commercial environments, where robotic interactions in virtual settings are more likely to occur. Professionals in these fields often use robots for tasks like client assistance and customer support, which may lead to different responses compared to those of college students.

Another limitation is self-selection bias, as participants may have a higher interest in technology, potentially skewing results toward more favorable attitudes toward robotic interactions. Additionally, the method lacks diverse characteristics, as it does not guarantee diversity in familiarity with technology or cultural background, which could significantly influence participants' responses. These limitations are justified in the

context of this study. Recruiting within a university allows for efficient and cost-effective participant gathering, aligning with the study's constraints. Moreover, while the results may not fully generalize, studying college students provides valuable initial insights into robotic greetings, which can inform future research targeting broader and more diverse populations. By addressing these limitations transparently, this research lays the groundwork for subsequent studies that explore robotic interactions in varied professional and cultural contexts.

Data Collection Methods

This study will employ two primary data collection methods: post-study questionnaire/survey and observation. These two methods will allow for the collection of both quantitative and qualitative data, providing a comprehensive approach to addressing the research question.

The post-study questionnaire will include a combination of Likert-scale items and open-ended questions to assess participants' perceptions of robotic gestures, their comfort levels, and their feelings of hesitation or uncertainty during the interactions. For credibility, the survey will adapt items from the Godspeed Questionnaire, a widely recognized tool in human-robot interaction research. While not explicitly designed to measure confusion, the Godspeed Questionnaire includes scales that evaluate perceived friendliness and safety, which can be modified to align with the objectives of this study. The use of this tool provides a structured means of gathering participants' subjective perceptions while also adding credibility to the study by leveraging a previously validated instrument.

The post-study questionnaire offers several benefits. It combines structured quantitative data from the Likert scales with qualitative insights gathered through open-ended responses. This mixed approach enables the identification of patterns and trends in participants' attitudes toward robotic gestures while providing opportunities for participants to express their personal experiences and thoughts in more depth. However, this method is not without its limitations. Self-reported responses are inherently subject to bias, such as social desirability or personal interpretation, and the depth of open-ended responses may vary between individuals, potentially limiting the richness of the qualitative findings.

The observation method will involve video recording participants as they interact with the robotic arm performing a greeting gesture. The recording will capture participants' non-verbal responses, such as facial expressions, hesitation, excitement, or surprise. Additionally, reaction times will be measured from the initiation of the robotic gesture to the participant's visible response. This will provide an objective behavioral measure of hesitation or comfort during the interaction. Video recordings allow for the capture of real-time reactions while offering the opportunity for later review and coding.

Observation has its benefits, as it offers an objective, behavioral measure of participants' reactions. Faster responses may indicate a sense of comfort and engagement, while slower responses may suggest hesitation or unease. It will also allow the research team to analyze non-verbal cues, such as facial expressions, to gain insights into participants' emotional states during the interaction. Nonetheless, the method has its limitations. Coding non-verbal reactions can introduce subjectivity into the analysis, and

the presence of a recording device may lead participants to alter their behavior due to self-consciousness, which could potentially affect the study's findings.

Participants will also be asked to complete reaction time measurements to determine how quickly they respond to the robotic gesture. This will offer an additional, objective behavioral indicator of their comfort and engagement with the robotic interaction. While this approach provides meaningful data, it should be noted that individual differences (e.g., cognitive processing speeds or familiarity with virtual settings) could influence reaction times independently of participants' comfort with the robotic gesture.

Each participant session will last approximately 10 minutes, which includes the consent process, the interaction with the robotic arm during the Zoom call, survey completion, and brief debriefing. The post-study survey will take about 2–3 minutes, and the observational data will be coded after the conclusion of the individual sessions. By combining these two methods—video observations and surveys—this study will gather both objective and subjective data. This mixed-methods approach will strengthen the study's ability to examine participants' responses to robotic gestures and provide a more nuanced understanding of the emotional and behavioral impacts of these interactions.

Data Analysis Methods

The data analysis procedures for this study will involve a systematic and multi-faceted approach to ensure comprehensive insights into participants' responses to robotic gestures. The analysis will focus on three types of data: video data, survey data, and reaction time data, with each analyzed using methods appropriate to its nature.

For video data, key segments showing participants' emotional and physical reactions will be isolated and coded into predefined categories, such as surprise, hesitation, and correct/incorrect responses to robotic gestures. This categorical coding will provide structured and consistent insights into participants' immediate emotional responses and nonverbal cues during the robotic interactions. This method is grounded in qualitative coding techniques, offering a systematic way to analyze facial expressions and physical behaviors indicative of participants' reactions to robotic gestures. The rationale for this approach is to focus on observable, non-verbal responses as objective measures of comfort, confusion, or engagement.

Survey data will be analyzed in two complementary ways. The Likert-scale responses will be analyzed quantitatively by compiling the responses in a spreadsheet. This will provide numerical insights into participants' general attitudes, levels of comfort, and perceptions of the robotic gestures. Open-ended responses from the survey will be transcribed and coded thematically to identify patterns, recurring thoughts, and deeper qualitative insights into participants' subjective experiences. This dual approach allows the study to combine the objectivity of quantitative analysis with the richness of qualitative reasoning.

Reaction time data will involve extracting response times from video timestamps and recording these times in a data sheet. Statistical analysis will then be performed on these times to identify average response speeds. Faster response times suggest participants are more comfortable or familiar with the robotic gestures, while slower response times may indicate hesitation or confusion. This analysis will quantify

participants' intuitive responses, providing objective evidence of how robotic gestures impact engagement and comfort.

To ensure the credibility and reliability of the analysis, coding categories from the Godspeed Questionnaire will be adapted for use in video coding. This instrument is a well-established tool in human-robot interaction research, and its categories related to perceived likeability and safety will be repurposed to examine participants' facial expressions and physical responses (e.g., surprise, excitement, hesitation) during the robotic gesture interactions. Adapting these pre-existing categories provides consistency and credibility to the coding process by grounding it in established research methods.

Statistical software may be employed to analyze the reaction time data, while qualitative coding will be performed manually or with qualitative analysis software (e.g., NVivo or ATLAS.ti) to manage survey and video data coding. This combination of statistical and thematic analysis methods ensures that the study examines both objective measures (reaction times and numerical trends) and subjective responses (thematic patterns in video and survey data). This systematic, multi-method approach allows for a nuanced understanding of participants' experiences and responses during the study, addressing the research question from multiple angles.

Research Quality and Ethical Considerations

To ensure the trustworthiness of this mixed-methods study, I will employ strategies tailored to both its qualitative and quantitative elements, using appropriate terms for each component. For validity and credibility, I will include raw data examples, such as participant quotes, to support conclusions and interpretations. Peer debriefing will involve reviewing project design and data analysis with an unbiased reviewer to ensure objectivity. Additionally, randomized assignment and pilot testing will minimize threats to internal validity by refining methods and identifying potential challenges before full implementation.

To address reliability and dependability for the findings, I will document any challenges and solutions encountered during the study. A pilot test will refine the protocols, and diverse data sources, including video recordings, surveys, and reaction times, will enhance the robustness of the findings. Collaborative coding with a second researcher on a subset of data will ensure consistency in qualitative analysis, with discussions on codes and themes improving alignment in interpretations.

For generalizability of quantitative results and transferability of qualitative insights, I will calculate an appropriate sample size using a sample size calculator and report margins of error and confidence intervals to provide context for the findings. Detailed descriptions of the study's context, participants, and methods will allow readers to assess the applicability of the results to other environments. Although the study

focuses on college students, the findings will provide valuable initial insights to guide future research in broader populations, such as business professionals or other groups interacting with robots.

To ensure objectivity in quantitative data and confirmability of qualitative findings, I will maintain a comprehensive audit trail of research instruments, data, codes, and interpretations. This record will allow for future verification or reanalysis of the study. Additionally, I will disclose my personal biases, values, and assumptions (positionality) as well as any potential conflicts of interest. For example, my familiarity with the robotic technology requires me to take extra steps to educate participants on safe interaction and emphasize their autonomy in stopping the experiment if they feel uncomfortable.

Ethical considerations are also central to the study, as it involves inherent risks related to robotic interactions, such as brief physical contact, unexpected movements, or technical malfunctions. To mitigate these risks, I will closely monitor participants throughout the study, providing immediate assistance if needed, and clearly instruct them on how to signal their desire to stop the experiment. The robot features built-in safety measures, such as low-speed operation and collision avoidance systems, and researchers will have remote shutoff capabilities to prevent harm. Interaction with the robot will be limited to brief and teleoperated movements to further ensure safety. By addressing these ethical concerns and employing comprehensive strategies for trustworthiness, this study aims to produce credible, reliable, and impactful findings that advance research and practice in human-robot interactions.

Timetable, Resources, and Budget

The studies will be conducted over a two-week period in mid to late February. Data analysis and writing the first draft of the paper will take place throughout March, utilizing freely available software such as Taguette provided by UNC. During this time, the first draft of the research paper will be written. Revisions and the final submission will be made in April.

Deliverables and schedule of completion:

1. November 15: Turn in my first submission to the IRB.
2. January 11th: IRB approved- start recruiting and start drafting the methods section.
3. Feb 14th: Have a strongly written methods section and start running studies.
4. Feb 28th: Wrap-up studies.
5. March 14th: Have an outline of the findings and discussion sessions.
6. March 31st: Submit a first draft of the thesis for advisor's review.
7. April 9th: Submit the final draft of the thesis for advisor's review.
8. April 16: The final graduate school submission date.

The materials required for the study include a robotic arm and hand to perform the gestures, one computer to control the robot and facilitate participants' post-study surveys, a second computer to host and run the Zoom calls, and a camera to record participants'

responses during the interactions. All these materials are available at no extra cost. The total budget for this study is \$200, which will be split into five \$40 gift cards and used to compensate participants via a raffle.

Impact, Limitations, and Conclusions

This study investigates how participants respond to robotic gestures, such as handshakes, waves, and fist bumps, in virtual meeting settings. Its potential impact spans multiple stakeholder groups, offering theoretical, practical, and innovative implications.

Findings could reinforce theories suggesting that human-like social cues, such as gestures, enhance engagement, trust, and social presence in human-robot interaction (HRI). This aligns with frameworks advocating for embodied interactions as a means of fostering rapport, even in virtual or hybrid environments. Alternatively, if participants react with confusion or hesitation, this might highlight gaps in current HRI theories, indicating that gesture-based interactions may require additional context, customization, or participant familiarity to achieve their intended impact.

For practitioners in professional settings, the study offers insights into how robotic gestures can improve user experience. For example, business professionals might leverage robotic handshakes in virtual meetings to simulate personal connection, while healthcare providers could use intuitive gestures to ease virtual patient interactions, fostering comfort and trust. Customer service settings could also benefit, with robotic gestures creating a welcoming atmosphere for clients. These applications have the potential to enhance engagement and operational efficiency across industries.

The study's findings could inform the development of customizable gesture libraries for robots, allowing for adaptation to specific environments or cultural contexts.

Virtual meeting platforms might integrate robotic gestures to enhance social presence and engagement. Additionally, insights into participant preferences could inspire future designs for robotic assistants tailored to professional and social contexts.

The study's focus on college students limits the generalizability of results to other demographics, such as business professionals or healthcare workers, who may interact differently with robotic gestures. The controlled lab setting provides consistency but does not fully capture the complexity and unpredictability of real-world environments, potentially influencing participants' responses. Convenience sampling introduces self-selection bias, as participants with an interest in robotics may skew results toward more favorable responses. Furthermore, the study's short-term interactions do not account for the sustained effects of robotic gestures over extended periods, limiting its ability to explore long-term user comfort and engagement.

The study deliberately focuses on a specific participant group—college students—due to practical accessibility, excluding broader demographics like professionals. It is conducted in a controlled lab setting to ensure safety and consistency, omitting real-world scenarios. Short-term interactions are assessed to keep the study feasible within its time constraints, leaving long-term effects unexplored. Cross-cultural analysis, while valuable, is beyond the study's scope due to the need for a larger and more diverse sample.

Future research could build upon this study by exploring robotic gestures in professional environments such as healthcare or customer service, analyzing how context and prior briefing influence participant responses. Longitudinal studies could examine the

sustained impact of repeated robotic interactions, while cross-cultural studies could assess how gestures resonate across different cultural contexts. These extensions would deepen understanding and broaden the applications of robotic gestures in diverse settings.

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Appendix A. Consent Form

University of North Carolina at Chapel Hill

Research Information Sheet

IRB Study #: 242410

Study Title: Robotics Augmented Web Conferencing

Principal Investigator: Sriya Kasumarthi

This study aims to explore how different robotic greeting gestures affect virtual meeting interactions in a web conference setting such as Zoom. This observation will build on existing research that shows how robotic gestures can induce more positive emotions in users within a physical space; the purpose of this mixed methods study is to expand upon this physically limited prior research and move it to an online sphere. Specifically, the study will observe how people respond to different robotic greeting gestures when these gestures are accompanied by a vocal and visual greeting in a virtual meeting. The primary objective is to understand how participants intuitively respond to each type of greeting.

Being in a research study is completely voluntary. You can choose not to be in this research study. You can also say yes now and change your mind later.

If you agree to take part in this research, you will be asked to join a brief Zoom call with a researcher, observe a greeting gesture from a robotic arm, and complete a short survey about your experience. Your participation in this study will take about 10 minutes. We expect that approximately 50 people will take part in this research study.

You can choose not to answer any question you do not wish to answer. You can also choose to stop taking the survey at any time. You must be at least 18 years old to participate. If you are younger than 18 years old, please stop now.

The possible risks to you in taking part in this research are:

This study involves inherent risks related to interacting with a robotic device, including potential discomfort or concerns about privacy. Brief physical contact may result in minor impacts, such as accidental pressure from the robot's components. Unexpected movements, even if smooth, might startle participants due to unfamiliarity. Additionally, rare technical malfunctions could lead to unintended robot operation. However, to our knowledge, there has never been an incident of the Factory X-arm

(<https://www.ufactory.us/>) causing harm to a person. While all collected data will be de-identified and securely stored, there is a minimal risk of loss of confidentiality. Steps will be taken to minimize these risks, including monitoring interactions and ensuring the robot operates within safe parameters.

To protect your identity as a research subject, no identifiable information will be collected, the research data will not be stored with your name, the researcher(s) will not share your information with anyone. In any publication about this research, your name or other private information will not be used.

The study team would like to message you by email, however you may say “no” to receiving these messages and still participate in this study. If you say “yes”, messages may contain personal information about you and may be sent or received by the study team’s personal electronic devices or in a method that is not able to be encrypted (protected) and there is the risk your information could be shared beyond you and the study team. This information may include information such as reminders and notifications to contact the study team.

If you wish to stop receiving unprotected communication from the study team or have lost access to your device, please notify the study team using the study contact information on the first page of this consent form. After the study is complete and all research activities finished, or you withdraw from the study or request to stop receiving unprotected communication, you will no longer receive un-encrypted (un-protected) messages specific to this study.

_____ Yes, I consent to the study team utilizing the following email address to send communication: _____

_____ No, I do not consent to receive un-protected communication from the study team.

The study team may use the following email address to send communication:

kasri@unc.edu

If you have any questions about this research, please contact the Investigator named at the top of this form by calling 3109860475 or emailing kasri@unc.edu. If you have questions or concerns about your rights as a research subject, you may contact the UNC Institutional Review Board at 919-966-3113 or by email to IRB_subjects@unc.edu.

Appendix B. Recruitment Email

Subject: Join a 10-Min Study & Enter to Win a \$40 Gift Card!

Dear [Listserv],

We're looking for participants to join a study on human-robot interaction in virtual meeting settings. Your participation will help advance research in human-robot interaction, providing valuable insights into how robots can enhance virtual experiences.

Participation Details:

- The study will take place at Manning Hall Rm. TBD
- Your participation will involve joining a virtual call and interacting with a robot, followed by a brief survey.
- The entire study will take approximately 10 minutes to complete.

Compensation:

Your participation will take about 10 minutes, and as a thank-you, you'll be entered into a raffle to win one of five \$40 gift cards.

If you're interested, schedule a time that works for you by using this link [insert sign-up link here].

Best regards,

Sriya Kasumarthi

Appendix C. Recruitment Flyer

JOIN OUR STUDY

Human-Robot Interaction

Your participation will involve joining a virtual call and interacting briefly with a robot.

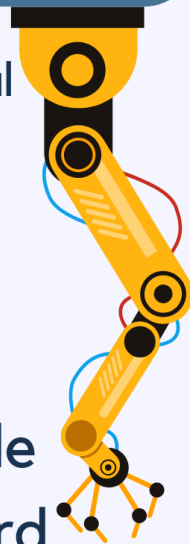
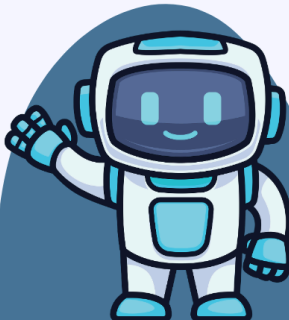
Location: Manning Hall Rm.

Length: Study takes about 10 minutes.

Compensation:

You will be entered in a raffle for a \$40 gift card

Email us or scan the QR code to sign up!
kasri@unc.edu



Appendix D. Survey

Robotic Gesture Interaction Survey

Part 1: General Thoughts

1. I would feel uneasy if robots really had emotions.

(1 = Strongly Disagree, 5 = Strongly Agree)

0. Robots could be good companions for humans.

(1 = Strongly Disagree, 5 = Strongly Agree)

0. The increasing use of robots would lead to unemployment.

(1 = Strongly Disagree, 5 = Strongly Agree)

0. Which of the following robots have you interacted with? (Check all that apply)

☐ None

☐ Roomba or other robotic vacuum

☐ Telepresence robot

☐ Industrial robot

☐ Social robot (e.g., Pepper, NAO)

☐ Other (please specify): _____

Part 2: Study Impressions

Please rate your overall experience with the robotic arm during the web conference:

0. I felt comfortable interacting with the robotic arm.

(Strongly Disagree) 1 2 3 4 5 (Strongly Agree)

0. The robotic arm's gestures seemed natural.
(Strongly Disagree) 1 2 3 4 5 (Strongly Agree)
0. I found the robotic arm's behavior to be friendly.
(Strongly Disagree) 1 2 3 4 5 (Strongly Agree)
0. This gesture was appropriate for a web conferencing setting.
(Strongly Disagree) 1 2 3 4 5 (Strongly Agree)
0. I would like to see this gesture used in future web conferences.
(Strongly Disagree) 1 2 3 4 5 (Strongly Agree)

Part 3: Interaction and Response

1. What greeting gesture do you think the robot was trying to communicate? How clear was this intention?
[Short answer]
2. Did you experience any confusion during the interaction?
(Strongly Disagree) 1 2 3 4 5 (Strongly Agree)
If so, briefly explain: _____
3. Did you respond to the robot's greeting?
- Yes – Please describe how you responded
briefly explain: _____
 - No – Please explain why you chose not to respond
briefly explain: _____

Part 4: Vocal and Visual Greeting

1. The combination of gesture, vocal, and visual greetings was:
(Ineffective) 1 2 3 4 5 (Highly effective)
2. Which elements enhanced the interaction? (Check all that apply)
☐ Robotic gesture
☐ Vocal greeting
☐ Visual greeting on screen

Part 5: Overall Experience

1. What concerns, if any, do you have about interacting with robots?
2. What potential benefits do you see in human-robot interaction?
3. When would you want to use a robot in web conferencing?

Appendix E. Participant Script

Hello, and thank you for agreeing to participate in this study. Before we begin, I will briefly explain the purpose and process of this study. We are examining how people respond to robotic gestures during virtual interactions. Your participation will involve a short interaction with a robotic arm that will perform a simple greeting gesture.

First, I'll ask you to review and sign the consent form. This ensures you understand the purpose of the study, the procedures involved, and your rights as a participant, including the right to withdraw at any time without penalty.

Once you've signed the consent form, we'll proceed with the study. You'll join a Zoom call, observe the robotic arm's greeting gesture, and your reactions will be recorded. We'll also measure your reaction time from when the gesture begins until you respond. After this, you'll complete a short survey and share your thoughts.

The entire process should take about 10 minutes. Please let me know if you feel uncomfortable at any point, and you may stop the study at any time. Do you have any questions before we begin?

[Participant signs consent Form]

Do you have any questions about the study or the process?

[Pause for questions]

When you're ready, please join the Zoom call on the laptop I will direct you to.

[Once the robotic interaction is complete]

Thank you so much for participating. You are now finished with the study. I will now ask you to complete a short post-study survey. This survey will include a few questions about your experience and thoughts related to the robotic gesture interaction.

[Participant completes the survey.]

Once you have finished the survey, please let me know. That concludes the study. Thank you again for your time and participation. Have a great day!