

1. Authorship Information

Dataset Report for: Community Embedded Robotics: A Dataset to Study Perceived Social Intelligence and Safety During Unexpected Encounters with Quadrupedal Robots

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2. Research Areas

Keywords: Human Robot Encounters, Crossing strategies, Human-aware navigation, Community Embedded Robotics, Perceived Social Intelligence, Perceived Safety

Disciplines: Social Science, Robotics / Autonomy, Engineering

Field of Study: Human Robot Encounters, Crossing strategies, Human-aware navigation, Human Computer Interaction

Theme of Study: Community Embedded Robotics, Perceived Social Intelligence, Perceived Safety

3. Dataset Description

This dataset derives from an interdisciplinary experiment designed to investigate perceived social intelligence (PSI) and perceived safety (PS) in the context of human-robot unexpected encounters in three scenarios motivated from the literature; (1) stop and back off: when the robot sees the person, it stops where it is before backing off and moving out of the participant's way; (2) stop: when the robot sees the person it stops in place; and (3) efficiency: this behavior

reflects many social navigation techniques that continues uninterrupted while treating the person as a dynamic obstacle to be avoided.

The research questions that were investigated in this work were:

- How are PSI and PS related? Are higher levels of PSI associated with higher feelings of safety?
- Are the statistical evaluations of PSI and PS representative of participants' feelings about these concepts during interview discussions?
- How does the back-off behavior compare to the stop and efficiency behaviors with respect to PSI and PS during unanticipated crossings? (e.g. around corners, doorways, stairs).

The experiments investigated the three aforementioned human robot encounter scenarios and manipulated the autonomous robot behavior at the moment of those crossings. The experiments were performed in a wizard of oz manner, wherein a study member controls the robot from afar while the participant believes the robot is behaving autonomously. The study was run in two parts. First, we performed a (N=286) *between-subject* online video study, in which participants see a first person view video of a person in all three scenarios under one of the three behavior conditions. Along with demographic and personality characteristics, participants took a post-video survey of four Perceived Social Intelligence (PSI) Scales [cite] and Perceived Safety, taken from the Godspeed Questionnaire [cite]. The four PSI scales used are Social Competence, Identifies Humans, Rudeness, and Trustworthiness.

The second part of the study involved a (N=24) *within-subject* laboratory experiment where participants cross the robot in all three scenarios under each of the three robot behavior conditions. After encountering each behavior, the participants take the same survey used in the online video study. The purpose of this was to validate the low ecological validity, but high statistical power online video study results using a lower power, higher ecological validity laboratory study of crossings. In the laboratory study, participants were also interviewed to learn about their in depth perceptions and experiences during the robot encounters. Specifically, we interviewed them for 30-45 minutes following the experimental encounters and discussed PSI and PS and how they related to the robot's behaviors. Particularly, the goal was to augment the statistical relationship between PSI and PS with a qualitative model that connects these two key factors used to evaluate perceptions of mobile robots.

The impact of this work and dataset is in the novelty of the human robot crossing scenarios investigated. Particularly, existing works in crossings in hallways, elevators or doorways are not designed to investigate *unexpected crossings* as studied here. Furthermore, this study utilizes a quadrupedal robot (Boston Dynamics Spot robot), which differs from many existing studies using various wheeled robots, including the Pepper robot or various autonomous robots.

This dataset provides all of the information necessary to enable the replication of the experiment. The dataset can be used to study unexpected crossing scenarios between humans and robots at blind corners, blind doorways, and corners on stairwells. Particularly, the videos

can be used to analyze path behavior and body language behavior from the participants in the experiments, which may offer valuable insights beyond the statistical and interview results presented in the accompanying paper.

4. Dataset Contents

- Research Instruments
 - Pre Experiment Questionnaire [PDF - 21KB]. This set of questions include Ten Item Personality Index and Demographic information about the participants and is taken before any robot stimulus.
 - Post Stimulus Questionnaire [PDF - 87KB]. This set of questions was taken after encountering the robot in each of the three experimental scenarios, under one of the three robot behaviors. Thus, it was taken one time by each participant in the online video study and three times by each participant in the real world laboratory experiment
 - Semi Structured Interview Protocol [PDF - 104KB]. This was a list of questions that the research members used in interviews with participants in the real world laboratory study. They enabled the investigation into the perceptions and feelings of safety and social intelligence during the experimental encounters.
- Online Video Study Dataset
 - Raw Survey Data [CSV - 100KB]. Contains the responses to the pre-experiment questionnaire and post-stimulus questionnaire in the online video study. Participant responses to the pre-experiment questionnaire are given in rows A-N for all participants. Participant responses to the post-stimulus questionnaire are given in columns O-Z or AA-AL or AM-AX, depending on which robot behavior was seen.
 - Robot Videos: Back-off robot behavior [MP4 - 8.6MB], Efficiency robot behavior [MP4 - 6.4MB], Stop robot behavior [MP4 - 7.4MB]. These are the video stimuli used in the online study. Each video shows the Boston Dynamics Spot performing one of the three behaviors in each of the scenarios.
- Lab Experiment Study Dataset
 - Raw Survey Data [CSV - 13.5KB]. Contains the responses to the pre-experiment questionnaire and post-stimulus questionnaire in the online video study. Participant responses to the pre-experiment questionnaire are given in rows A-N for all participants. Notably, Column C of the document shows the order of behaviors seen by participants while Row 30, Columns B-D explain the meaning of the values in Column C for each participant. Columns Q-AB were the responses to the first behavior stimulus; Columns AC-AN were the responses to the second behavior; Columns AQ-AZ were the responses to the final behavior.
 - Human Robot Videos. This folder contains a sub-folder for each of the 24 participants. Under each participant are 9 videos, which are de-identified videos of each of the 9 crossing scenarios between the human and the Boston Dynamics Spot.

5. Robot

Below is a list of information elements required to describe a robot.

- Robot type: Quadrupedal Robot
- Model: Boston Dynamics Spot
- <https://bostondynamics.com/products/spot/>
- Hardware instrumentation: Remote Control
- Software instrumentation: N/A
- Indicate if adaptations were made: N/A
- Implementation: Wizard of Oz

6. Research Method/s

Research method type/s:

- Laboratory Experiment
- Semi-Structured Interview
- Deductive Thematic Analysis
- Participant Questionnaires
- Observation
- Statistical Evaluation (ANOVA, Post-Hoc Tukey)

Research Method Description:

- **Experiment Settings:**

- **Online and In-person**
- **Geographical location:** Room 2.202 Anna Hiss Gymnasium, University of Texas at Austin, Texas, USA
- **Environment description:** The experiments take place in three different locations, all within the same room. The first environment is a blind corner set in a realistic apartment setting between the kitchen and living room. The participant walks to pick up a folder in the living room before returning to the door. The second environment is a narrow stairway with a 90 degree bend, which connects the area next to the realistic apartment setting to an office environment where graduate students have desks and some faculty have offices. The third environment is in an automatic doorway entrance to the room. The door does not have glass, therefore the participant and the robot cannot see each other. Large privacy shields were used to cover the windows near the door to ensure this occlusion.
- **Tasks:**
 - Online: First the participant responded to the pre-experiment questionnaire of demographics and personality. Then they watched a roughly 30 second video of a first person view of a person crossing the robot in the three scenarios under one of the robot behaviors. Then they answered the post-stimulus questionnaire.
 - In-person: First they took the pre-experiment questionnaire. Then they completed 9 total trials (3 environments, 3 behaviors) wherein they picked up a red folder across the respective environment and returned to their starting point. The robot was moving in the opposite direction in both their approach to the folder and their return with it. In the apartment blind corner scenario participants went to the living room before returning to the doorway. In the stairs scenario, participants started at the top and had to go to a chair near the bottom before returning up the stairs. In the doorway scenario, participants began in the hallway, entered the doorway and went roughly 8 meters to the left to get the folder before exiting back into the hallway. After encountering each behavior in all three environments, they took the post-stimulus questionnaire. Afterwards, they participated in a semi-structured interview that lasted 30-45 minutes
- **Study conditions:** The three environments described were tested. The manipulated variable was the robot's behavior: Back off, Stop and Efficiency. The dependent variables were the four Perceived Social Intelligence Scales and Perceived Safety.
- **Sessions:** One per participant.
- **Number of sessions:** Online Video Study N=286. In person lab study N=24.
- **Trials per session:** Online Video Study 3 (i.e. one behavior seen in each of the three experimental scenarios). In person lab study 9 (i.e. each behavior in each environment).

- **Duration of trials:** Online: 5 minutes. In-person: 60 minutes
- **Subjects per session:** 1
- **Research Instrument/s:**
 - **Survey:** Pre-experiment questionnaire collecting demographics and personality information. Post-Stimulus Questionnaire used to gauge perceptions of the individual robot behaviors with respect to perceived social intelligence and perceived safety
 - **Interview protocol:** Semi-structured interview protocol used for interviews with participants in the real world lab study. Will be added to version 2 of the dataset.
 - **Code book:** Will be added to the version 2 of the dataset.

Data Collection Description:

The data collected and published in this dataset comes in four forms. First, using Qualtrics we collected the survey data for pre and post experiment questionnaires in both the online and lab studies. This is the data saved as CSV files. The next data type is .MOV files, which display 3rd person videos of the human robot encounters in all three scenarios under all three behaviors in the lab study. Next is three .mp4 files, which are the videos that were used in the online video study. The final format is PDF, which includes the research instruments (i.e. the surveys and the semi structured interview protocol).

As aforementioned, participants in both the online and in-person portions took the pre-experiment questionnaire. This data is presented alongside the post-stimulus questionnaire. Notably, in the online portion they completed the post-stimulus questionnaire once, versus three times (once per behavior) in the in-person portion. In the in-person study, participants also participated in semi-structured interviews, which were recorded using mp3 files. Those data were transcribed to text via Amazon Web Services Transcription services.

7. **Data Dictionary:** (Include a dictionary for variables, labels, or any other consideration in your data)

8. Human Subjects:

- Age: Included in CSV files
- Gender: Included in CSV files
- Ethnicity: Included in CSV files
- How many participants are included: online study: 286. in-person: 24
- Regional Distribution: Online study: USA. in-person: University of Texas at Austin Students and Staff
- Recruitment mode: Convenience Sample of USA using Prolific (online study). Convenience sample of University of Texas at Austin Students and Staff
- IRB Number and resolution: Raw interview data is not included and videos of experiments are de-identified.
- Protected Data: None of the data contains direct identifiers and there are up to three indirect identifiers in the online survey data. Videos do not show the participant's faces.

To protect participants from possible identification, the raw interview data will not be released. Instead, version 2 will contain coded responses and a codebook. But they are not currently published in the dataset

9. Dataset/s:

Dataset Organization:

The dataset is organized by whether the item is part of the Online Video study or the In-person lab study. The only naming convention used is the lab experiment videos. For each participant, there are 9 total videos. One for each behavior in each environment. They are named as [Participant #]-[Behavior]-[Scenario #].mov

- [Participant #]: p1 - p24
- [Behavior]: bo (back off), st (stop), or eff (efficiency)
- [Scenario #]: s1 (blind corner), s2 (blind corner on stairs), s3 (Blind doorway)

10. Quality Control Statement

- **Research Validation** – Rigorous methodologies ensured experimental reliability, with controlled conditions and standardized protocols. We performed a separate manipulation check to ensure the independent variables were perceived as intended.
- **Data Integrity** – Automated and manual validation processes detected inconsistencies, ensuring accuracy and completeness.
- **Ethical Compliance** – Data collection followed ethical guidelines, with anonymization and consent procedures in place. We followed the IRB protocol that we submitted for independent review by the IRB office at UT Austin.