Homework 4: Study Design
Undergrad Human-Robot Interaction
Out March 25; Due April 8; Presentations April 6 and 8

This is the last homework assignment before you run your HRI experiment, and is probably the most critical – designing the study itself. A carefully designed study can lead to significant results; a poorly designed study will have little or no scientific value. The goal of this homework assignment is to make sure your experiment is well designed and will be able to demonstrate the effects you are interested in observing.

The study design consists of 5 sections. Each section is listed below, along with the information that we expect to be present in each section (the numbers in parentheses following each section title indicate the minimum number of single-spaced pages that you need to write for each section). Make use of the lecture notes from March 25 and outside reading on study design methodology to make your report scientifically valid.

1. **Problem statement and research question (0.5)**
   - Summarize the experiment, including what you hope it will tell you about HRI
   - For motivation, provide real-world applications where the results of your experiment may be useful
   - Present a carefully crafted and valid research question. Be sure to make clear what type of question you are asking (difference vs. relationship)

2. **Literature Review (1)**
   - Provide a citation to, and discuss, a study from the psychological or social sciences literature that is relevant to the problem your experiment is addressing (e.g., if you are looking at how expression can effect trust in robots, find an experiment that talks about expression effecting trust in humans). In particular, discuss the methods used in that study. This should be a study from which you will take inspiration in terms of study design or strategy.
   - Provide a citation to, and discuss, a study from the HRI literature that is relevant to your research question (e.g., if yours is a relationship question, find a published HRI study that also poses a relationship question). In particular, discuss the analyses used in that study. Again, this should be a study that inspires your approach, and you should explain this relationship to your plans.

3. **Method (4)**
   - Describe the conditions in your study (the independent and dependent variables)
   - Describe, in detail, the procedure to be used, including the script that will be used to introduce the study (if any), and what precisely the robot will say, or do, in response to the stimuli (e.g., vocalizations, expressions, movements) provided by the human subjects, and how those stimuli will be detected, either autonomously by the robot or by the experimenters. Remember that your script, in the case of a remote-controlled robot,
includes not just what the robot says, but how you will control any actuators on the robot, as well. For instance, you should seriously consider creating a limited number of software “buttons” that launch specifically coded behaviors you wish your robot to have, in order to maximize consistency between test runs. Describe all such plans.

- Describe the subjects you expect to obtain, including the numbers of subjects needed, the pool from which they will be selected, and the method that will be used to select them from that pool.
- Describe the measurements/observations you will make during the study, including both qualitative and quantitative ones. Discuss how you will collect the data (e.g., what instruments you will use make the measurements, how you will make observations, how you will code any qualitative observations you make). Remember that sometimes a well-designed paper form is perfectly suitable for quick entry of data during real-time observation. Think through the simplest, most accurate way you can ensure that you get the right data saved.
- If you intend to provide a questionnaire, list the various questions to be asked (e.g., semantic differential questions, Likert-scale questions, open-ended questions).
- Present your timeline for the experiment, including how long you expect it to take you to ready the experiment, when you intend to pilot it, and how much time it will take to run the subjects (and over how many days you will be running the experiment). If your experiment is multi-day, think about which times and days of week you will target, and explain your thinking about this. Review the CMU calendar- some days are really poor options.

4. **Results** (1)

- Obviously, you will not have any results by the time this homework is due. That part will be filled in for your final report. Here, we want you to present the statistics and analyses that you will be doing on the data collected. Describe, in detail, how you will aggregate the data, the statistical tests that you will perform, and why your approaches are valid for the types of data collected (note: different types of data may need different analyses).

5. **Discussion** (0.5)

- In your final report, this section will include discussion of the results with respect to your research question. Here, we want you to discuss the issues in your study design that may effect internal and external validity (see lecture notes for definitions of study validity).

We have allocated two class sessions to present Homework 4. You will present in a format similar to the previous homework presentations, although you will have nearly twice the amount of time (15 minutes to present, 10 minutes for questions). Present each of the first four sections (you do not have to present the discussion section in class) in enough detail that we can determine whether the study is well designed and is able to answer your research question adequately. Note that teams that present on the first day (April 6) will have the advantage of being able to incorporate our feedback into the written report.