

# What Untrained People Do When Asked “Make The Robot Come To You”

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Fig. 1: Participants gesturing to attract or maintain the robot’s attention. From left: clapping, waving, beckoning, reaching and no gestures

**Abstract**—We report the actions of untrained users when instructed to “make the robot come to you”. The robot is a generic wheeled mobile robot located 8m away and is driven by the experimenter without the knowledge of the participant. The results show a variety of calls and gestures made to the robot, that changed over time. We observed two distinct behaviour phases: (i) getting the robot’s attention; (ii) maintaining the robot’s behaviour as it approaches. This data could aid the design of future mobile-robot HRI.

## I. INTRODUCTION

We seek to understand what untrained people do when placed in a room with a mobile robot 8m away, and instructed only to “make the robot come to you”. This is towards our goal of designing an HRI system that allows uninstrumented users to achieve this task with no control device, training or specific instructions. Such a system needs to automatically recognize potential interaction partners from their appearance and/or behaviour.

Most HRI is done face-to-face. In contrast, we seek HRI systems to achieve this situation. Previous studies of human-mobile-robot attention, like the “Mechanical Ottoman” [3], have focused on close ranges where the robot and human are already co-located and primed for interaction, but medium-range (3-20m) environments pose additional challenges for initiating interaction and approaching an interested party.

Prototype robots and systems are regularly built according to observations and then tested to generate more observations, as with the Snackbot [2] which underwent three such phases.

This paper reports on a Wizard of Oz experiment where participants are invited to act freely in bringing a robot over to them. The results show a variety of calls and gestures made

to the robot, that changed over time. This data could aid the design of future mobile-robot HRI.

## II. STUDY DESIGN

### A. Participants

We studied 25 participants, 9 males and 16 females, ranging in age from 18 to 73, with the majority being 18 to 27 years old, from around our university. None had experience with robots.

### B. Experiment Setup

The goal of the study is for the participant to bring a robot to them from across an 8x5m room without leaving a fixed spot, with other humans nearby as bystanders. The user is not given any description of the robot’s capabilities or instructions on how to behave. This setup is similar to the “Cocktail party robot” [1].

A Clearpath Robotics “Husky” robot is set in one corner of the room (Fig. 2). The participant and three lab assistants



(a) Attract Attention Phase

(b) Maintain Attention Phase

Fig. 2: Study Setup

TABLE I: Sound and Gestures Frequencies in *Attract Attention* Phase

Gesture Sound	Beckoning	Waving	Clapping	Reaching	No Gesture
Deictic	4	3	-	-	6
Directive	-	-	-	-	1
Addressing	2	1	-	-	5
Clapping	-	-	5	-	-
Other	-	-	-	-	2
No Sound	1	4	-	-	-

stand at the far end of the room, with the participant and one assistant facing the robot and two other assistants facing each other and conversing. Whatever the participant does to attract attention, the test conductor secretly teleoperates the robot toward them.

### III. RESULTS

#### A. Sound Signals and Gestural Cues

The means by which participants tried to communicate to the robot can be classified into either sound signals or gestural cues. Voice commands were the dominant sound signal, and we classified them as one of **deictic** (referenced to the user, e.g. *come here*), **directive** (referenced to the robot, e.g. *go forward*) or **addressed** to the robot (e.g. *hello, robot!*). **Clapping** (which is also counted as a gesture) was the most common non-verbal sound, with one case of finger-snapping and two of thigh-slapping. Gestures were grouped into **waving**, **beckoning**, **clapping**, **reaching** or **null** (i.e. no gesture). Examples of each gesture are given in Figure 1. All but reaching incorporate periodic motion. Waving and reaching significantly change the user’s outline seen from the robot, while beckoning and reaching modify the depth seen by the robot. Beckoning included extending hands toward the robot and moving all or part of the forearm back and forth in an inviting motion.

Participants appeared to perceive two different phases to their interaction: they changed their behaviour distinctly at one point in the experiment, so we have presented the results in two phases. In the first phase, the robot is facing away from the participant, who tries to *attract* its attention (Figure 2a). Once the robot turns toward the participant and begins to approach, they shift focus to *maintain* (Figure 2b) the attention. Despite being told in advance that robot would stop automatically, 44% of participants tried signalling the robot to stop, which might constitute a third phase but was not analyzed here.

For sound signals, deictic and addressing were most common during the *attract attention* phase, while the *maintain attention* phase saw addressing drop off in favour of directives, particularly affirmations. For example, at the start of a trial, when the robot is not facing toward the user, the participant would say “Hey robot! Come here!”. When the robot turns towards them, the user switches to “Yes. This way. Good job.”. The frequency of participants making no sound was low during *attract attention* but spiked during *maintain attention*, for example clapping participants stopping once they have the robot’s attention.

TABLE II: Sound and Gestures Frequencies in *Maintain Attention* Phase

Gesture Sound	Beckoning	Waving	Clapping	Reaching	No Gesture
Deictic	7	3	-	-	4
Directive	1	1	-	-	5
Addressing	-	-	-	-	1
Clapping	-	-	3	-	-
Other	-	-	-	-	3
No Sound	3	4	-	2	3

Tables I and II give the frequency of each pairing of a gesture and a sound during each observed phase. Note that the totals for each Table do not sum to the number of participants, as some participants would exhibit multiple behaviours over the course of the trial such as switching between waving and clapping.

Making no gesture was common in both phases, although *maintain attention* also sees participants doing nothing but watch the robot. Waving stayed mostly constant in both phases, but beckoning increased significantly once the robot began approaching, and both were most popular combined with deictic commands or silence. Reaching was only observed during the *maintain attention* phase, and then only rarely and silently.

#### B. Continuous vs. Corrective

Another way to analyze participant behaviour is whether they continued to signal to the robot throughout the interaction or stopped once they believed they had the robot’s attention, only signalling again to correct perceived errors.

Since the robot was teleoperated, robot behaviours requiring correction were rare, so after appearing to engage the robot’s attention participants behaving correctively would signal infrequently or stop altogether. The proportions of participants engaged in each behaviour are given in Table III.

TABLE III: Continuous vs. Corrective

Interaction Phase	Continuous Gesture	Continuous Sound	Both Continuous	Purely Corrective
Maintain Attention	20%	4%	24%	52%

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