# Personality Type Implementation in Autonomous Robots

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## 1. Abstract

Social robots are becoming a prevalent part of modern society. They aid in research of diseases, take care of the elderly and perform calculations faster than the human mind. A significant barrier preventing robots from frequent use is human acceptance and perception. One way to improve this relationship is to implement more human-like characteristics in robots to make them less intimidating to users. The main objective of this research is to test how robots exhibiting different personality types contribute to an individual's willingness to interact with and help a robot. Two robots with two different personas were used (cute and un-cute,) and ultimately participants assisted the cute robot more frequently, suggesting humans can interpret personality type in robots, and this positively impacts their degree of interaction.

## 2. Background

Humans interact with entities they feel a connection with. It is not common for them to walk up to inanimate objects and expect an interaction. However, it is common for most people to address a pet by their name or talk to them and expect an answer. This is because humans can recognize when another entity *intends* to evoke a reaction from them. In other words, humans are equipped with skills allowing them to interpret social information.

Why then is it common for humans to form connections, emotional or otherwise, to their computers, phones, televisions, cars, etc. as though they were interacting with a living entity? These people feel the agent is participating in some type of interaction [1]. Humans are predisposed to treating complicated technologies in a social way [2]. The greater the connection an individual feels to a device they are using, the more likely they are to continue to use or recommend it to someone who would also enjoy it.

Software should efficiently perform the service a user is expecting. It must be designed to cater to many different types of users: users with low technological literacy, users with disabilities, users of different ethnicities, etc. The more diverse the software, the larger the customer base it reaches, and the higher the chances the technology will be successful. Different products are more appealing to different types of people. Users are drawn to technologies fulfilling their individual preferences and needs, and no two people will have the same interaction with an object.

This notion of interaction is applied to the field of robotics. Humans associate with robots similarly to the way they respond to humans. They will engage in different levels of interaction based on what the robot is doing and how it appeals to their individual interests [1]. But, while this general tendency toward social interaction has been empirically demonstrated, it is still not clear how deeply it runs or to which of the broad spectrum of social behaviors it applies.

As the technology age advances, robots are becoming more prominent in daily life. They are used in various areas such as the home, entertainment and healthcare. Although many of these robots are able to perform tasks with a much higher accuracy than humans, many individuals are not comfortable with the idea of machines playing an active role in society. Since some of this technology is still relatively new, it has the tendency to appear intimidating and not appeal to many users. If robots in these fields were more approachable to users, perhaps these robots would be more widely used in society.

Commonly in the field of human-robot interaction, individuals “respond to systems with an unconscious similarity to similar interpersonal human situations, including a tendency to anthropomorphize or attribute human qualities" [2]. The aim of human robot interaction is not to "force humans to adapt to [a] system, but to design a system with which humans can interact naturally" [3]. The closer the interaction to a level of human-human communication, the more successful an interaction could be. Therefore, designing systems similarly to humans could eliminate this uneasiness associated with robots.

As with humans, appearance is what helps a user form an initial opinion of an object. "Liking can even compensate in the absence of similarity" [3] meaning as long as the robot appeals to the human, even if it lacks some human-like qualities, a person may still be inclined to interact with it. The extent to which a robot appeals to a person visually plays a large role in the level of acceptance a person has with the robot.

Appearance is what initially captures the human's attention; however, personality type is what ultimately keeps the human engaged. Since they associate robot appearances, movements, and reactions with those of humans (much like with other objects) and respond to them in a similar manner [1], humans may also be inclined to label robots with a personality type. Personality, good or bad, is what will ultimately keep the human interested and encourage responses. Could this increase the quality of human-robot interactions?

Interaction can be defined as many things. Whether it is simply watching or physically engaging with another object, both actions require certain levels of interest [4]. Another commonality in human-human interaction is helping [5]. This is a higher level of interaction because it requires a person to feel interested *and* connected so they are willing to exert the effort to help. A main motivator for helping behavior is empathy [5]. Empathy can be defined as "a motivational state with the ultimate goal of increasing another's welfare" [5]. So in order for an individual to help, they should feel empathy toward the object.

There are a set of guidelines which outline why people help others in certain situations. Psychologist Daniel C. Batson has done extensive research in this area, leading a research program suggesting a strong relationship between helping, empathy, and his proposed the Empathy Altruism Theory. This theory rejects that humans are only willing to act altruistically if the benefits of helping someone outweigh the costs resulting from it [5]. Batson demonstrates humans will willingly assist others, even if they would not directly benefit from the situation, as long as they genuinely feel empathy for a person. If one can sympathize with an individual, chances are they will be willing to help them [6].

Batson states the main motivation for acting empathetically toward individuals is a result of *empathetic concern.* Batson describes empathetic concern as “another-oriented emotional response elicited by and congruent with the perceived welfare of someone in need” [5]. This is what happens when an individual identifies with an object and in return feels compassion or sympathy for it. It is this feeling that encourages a person to assist another without seeking compensation for their actions. They feel compelled to assist this person with a task in order to increase their welfare, not their own.

A question arises in this situation; can someone feel empathy for an autonomous robot since it is not alive? Personality perception may fill this void. If someone is able to identify a personality type, it could allow them to form a personal connection to the robot. This could cause them to feel empathy toward the object. This is an important concept to consider in relation to human willingness to help a robot. A human cannot feel empathy for anything they do not sympathize with. People are more willing to sympathize and help others if they can relate to them. Depending on the way a human perceives the robots personality, it could either persuade or dissuade the human to interact with the robot, which in return effects whether or not the person chooses to assist it.

Here is where we might see a link between personality and helping behavior. When people help each other, they do so because they care about improving someone else's welfare, and they typically accept the person they are helping. Humans are usually less likely to help people they do not like. Therefore if you are helping someone, you most likely accept that person and empathize with his or her situation enough to help improve it.

Comparatively, in human-robot interaction, one could use helping behavior to gauge how invested a person is in interacting with a robot. A similar methodology was used in a demonstration called "The Tweenbot Project" performed by Kacie Kinzer [7], where a simple robot equipped with the flag "Help me get to MOMA!" was placed in Central Park NYC with the goal of reaching the Museum of Modern Art. People would bump into it as they were walking, but ultimately steer it in the direction of its goal [7]. Kinzer used only one sample of robot "personalities"—very cute. One might expect different results using different robot personalities.

## 3. Objectives

This is a comparative study which matches participants' interactions with two robots (cute vs un-cute) moving about the same room at the same time. The objective of this research is to determine whether personality type and preference increase interaction between a robot and its user. The initial hypothesis is that the more a personality appeals to the user the more likely the user is to be engaged in the interaction. It was also theorized that the robot with the personality appealing most to participants should receive the most helping behaviors and achieve its goal first.

## 4. Materials and Methods

Participants were initially asked to complete a survey on phone preference. This survey posed as a distraction, where the real motive of the study was to measure helping behaviors directed at two robots hidden in the room. This study tested if participants will stop what they are doing to help the robots (as in the Tweenbot project), and if they respond to two differently designed and programmed robots (cute vs. un-cute) with two distinct personalities.

Two Scribbler S2 robots were used in this experiment. Each robot was created using principles outlined in *The Effects of Overall Robot Shape* [8].


*Figure 1: Robbie (left), Eibbor (right)*

Robbie (Figure 1: left) was designed to be more appealing, given a "cute" exterior with smooth lines and cartoon-like eyes. It was programmed to be spunky and outgoing, moving quickly, making smooth turns and minimal noise. Eibbor (Figure 1: right) was designed to be "un-cute," given a machine like exterior with wires and plugs exposed. Eibbor was programmed to move mechanically, making sharp turns, and loud beeping noises.

Prior to the trials for this experiment, five sample runs were executed to ensure both robots moved about the room at the same rate. This is to guarantee one robot would not be helped over the other because it reached the participants first. After running these tests it was determined that robot location after 5 minutes was random in each run, and there was no noticeable correlation between the robot's motion and end location.

Twenty-two students from Monmouth University (9 males, 13 females) were recruited for this study, none of which had prior knowledge of the goals of the experiment. Four separate trials were held with about 5 students participating in each trial.

On the day of the experiment, students arrived at the testing facility illustrated in Figure 2. They were under the assumption their

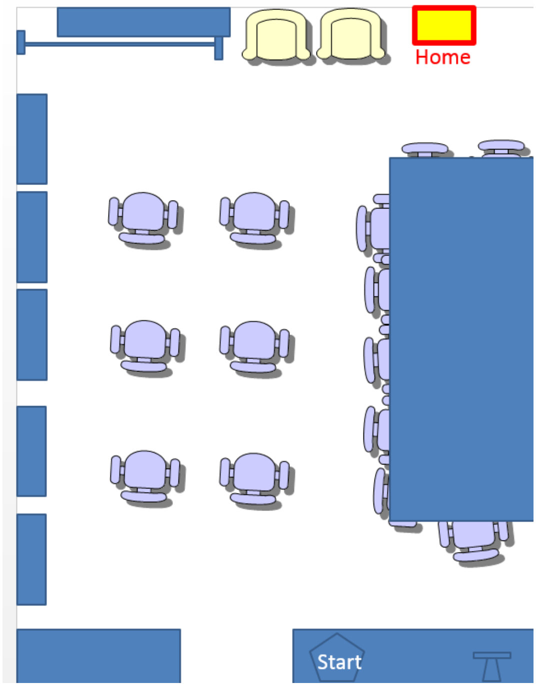


*Figure 2: Testing Facility*

task was filling out a survey on cellphone preference. The survey was distributed and completed, however the data collected were not used in the scoring of this experiment. While participants took the survey, the proctor turned the robots on in the rear of the room, and exited. Both robots would begin moving after two minutes and surprise the students while they were completing their surveys.

Each robot was equipped with a flag stating "help me get home." The study measured whether the participants would stop taking the survey and help the robots get to a box labeled "home" placed near the front of the room. There was only room in the box for one robot. It was hypothesized the robot whose personality appeals to the participants the most should attract the most attention, exhibit the most helping behaviors and be able to return home first.

Interactions were recorded by two cameras hidden in the room. One camera was above the "home" position (see Figure 2) and the other was near the start position and could be controlled from outside the room. In most cases, these camera positions provided a view of most of the room.

After 10 minutes, the proctor returned to the testing room, explained the real intention of the experiment, and handed out a post experiment survey. This served as a manipulation check to measure the degree to which participants differentiated the robots.

## 5. Results

After reviewing the videos, participants in trial 3 misunderstood and thought "home" for the robots was not in the front of the room in their box as intended, but back at their starting position. When asked at the end of the trial why this was the case, they responded it was because they did not see the box in the front of the room, so they assumed “home” was back where they came from. Because of this, data for trial three were analyzed with home at the start position in the back of the room illustrated above in Figure 2, since this is where the participants perceived home to be.

After all trials were completed, it was determined that Robbie reached home first for two out of four trials. Eibbor reached home once before Robbie, and in the fourth trial both robots reached home at the same time illustrated in Figure 3.

*Figure 3: Final Position, Trial 4*

Reactions to the robots were separated into seven categories:

a. Stand up but don’t touch robot
b. Move Chair
c. Look at robot
d. Move object out of path
e. Steer robot with foot
f. Steer robot with hand
g. Pick up robot

Some of the most common helping actions performed were moving objects out of the path of the robots, moving the robots themselves, and using feet to manipulate sensors to steer the robots. The tapes were scored according to these categories (see results in Table 2 in the appendix). This was done by having one researcher organize behaviors into the

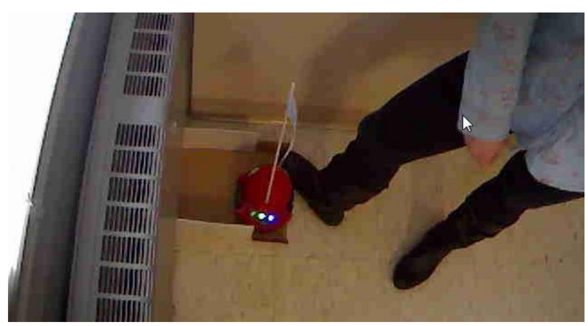

*Figure 4: Steering with foot, Trial 1*

categories above. A second researcher also viewed the tapes, guided by this categorization as a way of verifying the tallies. Interobserver reliability was 94%. These behaviors were counted for each robot from the videos recorded for each trial --this difference failed to reach significance with a Binomial test.

Statistically speaking, there were about the same number of helping behaviors for both robots. However, there was a marginally significant difference when these behaviors were separated into contact and non-contact categories.

| Contact | Non-Contact |
|---|---|
| • Steer robot with foot<br>• Steer robot with hand<br>• Pick up robot | • Stand up but don't touch robot<br>• Move chair<br>• Look at Robot |

*Table 1: Helping behavior categorization*

Figure 5 shows the number of behaviors for each category for Robbie and Eibbor. Both robots received about the same number of non-contact behaviors, however Robbie received many more contact ones. This difference was marginally significant, (p=.06), so

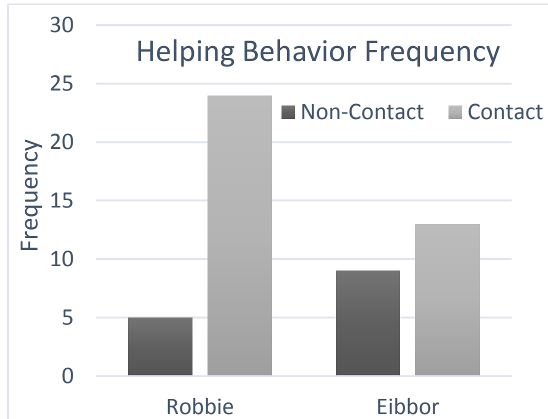


*Figure 5: Helping behavior frequencies from videos*

we can't make a lot of it, although it is definitely interesting.

Data recorded in the manipulation check yielded very different data. Overall there was about 28% more interest in Robbie opposed to Eibbor shown in Figure 6.

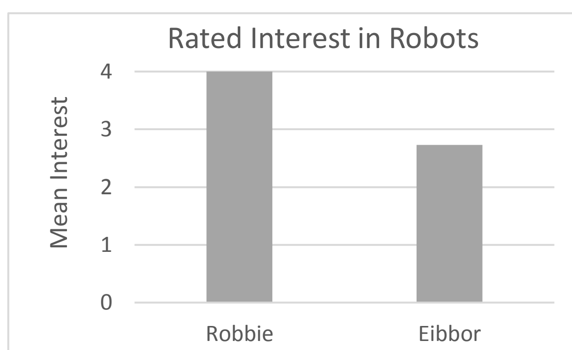


*Figure 6: Rated interest from manipulation check*

This data used the 21 participants who guessed the robots correctly. The difference between Robbie and Eibbor was significant (t(21)=1.27, p< .01)), showing more participants were significantly more interested in Robbie. Additionally, when asked to identify each Robot by name, 21 of 22 participants responded correctly, naming the cute robot Robbie and the un-cute robot Eibbor.

The survey asked participants to what extent the Robots' appearance was felt to determine their helping behavior, and 58% of participants responded the appearance and actions of the robots influenced which one they chose to help. Participants were also asked if they cared if the robots reached their goal, and their responses were 62% in favor of the robots

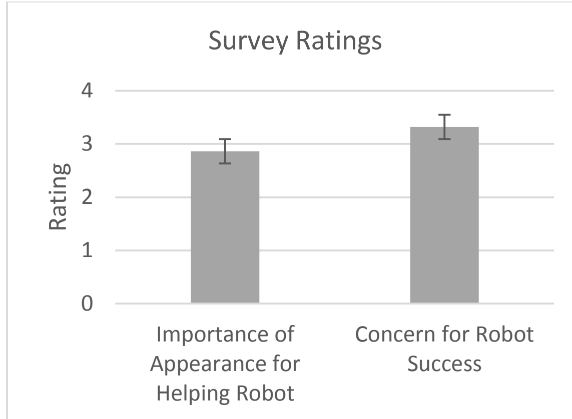


*Figure 7: Confidence interval*

accomplishing their tasks. These data, which are shown in Figure 7 along with confidence intervals, suggest a significant amount of support for the robots as well as a belief that their appearance affected helping.

## 6. Discussion

The quantitative measures of behavior demonstrate a high level of helping behaviors for robots in that participants in every trial helped. Two interesting scenarios took place showing participants made connections with the robots. In trial three, participants determined how to turn Eibbor off because they were agitated by its beeping. They then sat in a circle and continued to play with Robbie, referring to him as “Clifford" and continued to call the robot by name until they decided to turn it off and place it where they perceived home to be, in the start position next to Eibbor. In trial four, one of the participants picked both robots up, placed them on a long table in the room, and appeared to make them race each other as seen in Figure 8 below. The rest of the participants watched and engaged as this took place.

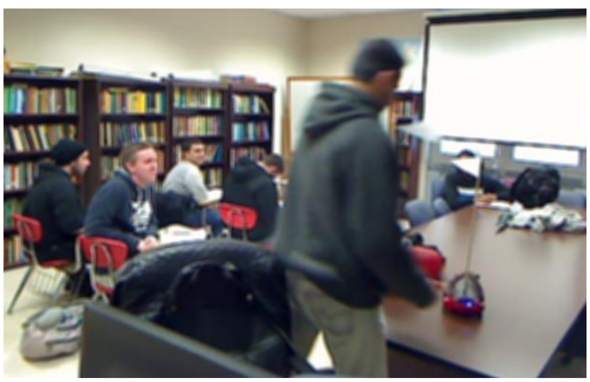

*Figure 8: Racing, trial 4*

These types of social interactions are not influenced by any particular aids built into this study, but they occurred simply because the participants wanted to interact with the robots. "People respond to systems with an unconscious similarity to similar interpersonal human situations, including a tendency to anthropomorphize or attribute human qualities" [2]. This can be seen in both of these situations. In one case, participants played a game with the robots, something typically seen in human-human interaction. One group of

*Figure 9: Helping behavior*

participants named one of the robots, an attribute used to identify individuals from one another. It is clear the participants made connections with the robots, and this is most likely what influenced their decision to help achieve their goals.

Having said this, it is clear that overall Robbie was more popular among participants than Eibbor. Possible explanations for Eibbor reaching home first in trial three may be due to placement in the room at the time the participant decided to help the robots.

Additionally it could have been due to the higher interest level in Robbie in that particular round, as participants named him and wanted to continue playing with him. In this trial however, both robots did eventually reach "home" wherever the participants believed it to be. Additionally, in one trial both robots returned home at the same time.

While participants claimed that appearance had a big effect on helping (in the manipulation check), the actual behavior didn't show that very clearly (i.e. marginal significance at best). Evidence is less clear but suggestive. While statistically insignificant, there were nominally more helping behaviors for Robbie, especially behaviors involving contact. It could be that participants were hesitant to touch Eibbor since he was covered in wires. Participants may also have felt awkward helping the robots in this setting, not knowing any other participants or being afraid of judgement. However, qualitative observations of the videos suggest that participants may have connected with Robbie more.

One way this experiment could have been improved is to have an equal number of male and female participants. There was no calculation made based on participant sex and helping behavior, however it is possible this may have had some effect on the data. Additionally, different age groups (i.e. small children and elderly) could be observed to see if there are differences in attitudes toward the robots, having been born in two different technological ages. Additional research and data sampling could further clarify data since there was variability between statistical and behavioral data.

## 7. Conclusion

This experiment observed how robots exhibiting different personality types contribute to an individual's willingness to interact with and help a robot. It was determined in this experiment that people will help robots, which suggests empathy. This is an important finding consistent with other "humanizing" studies but extending it to helping. As for personality differences, the results are less clear but suggestive. More study is required to clarify the results. Human acceptance and perception continues to be a challenge in the field of Human-Robot Interaction. However if this model is followed, perhaps it would lead to more socially accepted robots, and more frequent usage of robots in society.

## 8. References


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## 9. Appendix

| | non-contact | | | | | contact | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | SU | MC | MO | LR | AC | FS | HS | PU | | total |
| Robbie | 0 | 1 | 2 | 2 | 0 | 8 | 7 | 9 | | 29 |
| Eibbor | 1 | 5 | 1 | 2 | 0 | 1 | 4 | 8 | | 22 |
| total | 1 | 6 | 3 | 4 | 0 | 9 | 11 | 17 | | 51 |

*Table 2 Total helping behaviors with key*

**Key**

SU: Stand up but don't touch robot

MC: Move Chair

LR: Look at robot

MO: Move object from path

FS: Steer robot with foot

HS: Steer robot with hand

PU: Pick up robot