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Do People Change their Behavior when the Handler is next to the Robot?

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By

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It is increasingly common for people to work alongside robots in a variety of situations. When a robot is completing a task, the handler of the robot may be present. It is important to know how people interact with the robot when the handler is next to the robot. Our study focuses on whether the handler's presence affects human's behavior in response to the robot. Our experiment targets two different scenarios (handler present and handler absent) in order to find out human's change in behavior toward the robot. Results show that in the handler present scenario, people are less willing to interact with the robot. However, when people do interact with the robot, they tend to interact with both the handler and the robot. This suggests that researchers should consider the presence of a handler when designing for human-robot interactions.

DEDICATION

I would like to dedicate my thesis to my beloved friends, Mr. Harrison, Mr. Akula, and Mr. Chowdhury.

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CHAPTER I

INTRODUCTION

The market for robotics is thriving, especially when total global sales, which surpassed $8 billion (USD) in 2015 (IFR, 2016), are considered. With the huge potential presented by this growing market, the field of robotics merits significantly more study in order to better understand interactions between people and robots. Robots are designed in countless styles and for a multitude of functions, both of which can be tailored to the user's purpose. The International Federation of Robotics (IFR) defines and categorizes robots as:

> (1) A robot is an actuated mechanism programmable in two or more axes with a degree of autonomy, moving within its environment, to perform intended tasks. Autonomy in this context means the ability to perform intended tasks based on current state and sensing, without human intervention.
>
> (2) A service robot is a robot that performs useful tasks for humans or equipment excluding industrial automation application. Note: The classification of a robot into industrial robot or service robot is done according to its intended application.
>
> (3) A personal service robot or a service robot for personal use is a service robot used for a non-commercial task, usually by lay persons. Examples are domestic servant robot, automated wheelchair, and personal mobility assist robot.

(4) A professional service robot or a service robot for professional use is a service robot used for a commercial task, usually operated by a properly trained operator. Examples are cleaning robot for public places, delivery robot in offices or hospitals, fire-fighting robot, rehabilitation robot and surgery robot in hospitals. In this context, an operator is a person designated to start, monitor and stop the intended operation of a robot or a robot system.

(5) A robot system is a system comprising robot(s), end-effector(s) and any machinery, equipment, devices, or sensors supporting the robot performing its task. (IFR, n.d.)

According to the IFR's definition, professional service robots (PSRs) are the most likely to interact with multiple humans. Therefore, this this study will focus its attention on PSRs in its examination of human-robot interaction (HRI).

One of the most interesting topics in the field of robotics, HRI focuses on how humans' feelings and behaviors change toward robots and how robots affect humans' perspectives. Many previous studies have examined HRI from varying perspectives. For example, some have focused on robot trust (Robinette, Li, Allen, Howard, &Wagner, 2016), while others have investigated robots' effect on human perception (Bartneck, 2008; Lee & Sabanović, 2014; May et al., 2017). Additionally, several have concentrated on robot design and movement (Kidokoro, Kanda, Bršĉić, & Shiomi, 2013; Kim et al., 2010; Kim, Moon, Choi, & Kwak, 2014). In order to study HRI, researchers have often used surveys and experiments. Furthermore, a number of researchers have designed studies by using an actual robot to discover the factors which can affect HRI (Weiss et al., 2008).

Research in this field has concentrated on three main variables (human, environment, and robot), which researchers have manipulated to better understand their influence on HRI. For example, when studying the human variable, researchers have focused on how the human's background, culture, and demographics affect his or her perception of the robot (May et al., 2017; Nomura & Sasa, 2009; Robinette et al., 2016). Additionally, researchers have exposed robots to different surroundings to determine how environmental factors affect HRI (Stricker, Muller, & Einhorn, 2012). Some researchers have even created a simulated scenes using Virtual Reality (VR) or Augmented Reality (AR) to discover the HRI (Robinette et al., 2016). In contrast, experiments that test the robot variable are relatively easy to change and control: Researchers can easily alter a robot's appearance, action, voice, and even size to better study this aspect of HRI.

However, none of the researchers cited above have examined the presence or lack thereof of robots' handlers. According to the Oxford English Dictionary, the word *handler* refers to "A person who touches, holds, or physically manipulates something" (handler, n.d., n.1); however, for the purposes of this study, the word is defined as the person who controls the robot via remote control. We believe that the presence of the robots' handlers must be considered in HRI research because, in the future, the robot's owner may walk beside and control it. For example, the robot could be equipped to carry heavy objects for the handler. The increasing popularity of PSRs likely foreshadows their increased presence in everyday activities. We therefore believe that the presence of robots' handlers should be considered an additional variable in the study of HRI.

This study attempts to determine whether the presence of a robot's handler also affects others' feelings and behaviors. Several previous studies have found that pet ownership can affect an individual's social life, relationships, and perception by others (Guéguen & Ciccotti, 2008; Mueller, 2014). In other words, the presence of a pet can alter an individual's feelings and behaviors. Following this logic, we will evaluate the effect the presence of a robot's handler has on others. Do people act differently toward a robot when its handler is present? If so, how does this affect HRI? In attempting to answer these questions, this study will introduce the presence of robots' handlers to the list of variables considered in HRI research.

CHAPTER II

LITERATURE REVIEW

2.1 People's behavior or feeling change in HRI

Researchers have done many studies to unveil feelings, behaviors, attitudes, and perceptions toward robots; however, very few of them mention behavior changes in the subjects. In order to study behavior change, two or more variables must be compared. The small number of behavioral studies have found mainly compared environment, robot, and demographic variables to analyze behavior change (R. H. Kim et al., 2014). Other researchers in the field have concluded that the length of time spent with a robot can also affect behavior change (Kheng, Syrdal, Walters, & Dautenhahn, 2007; Kidd & Breazeal, 2008).

In contrast to interactions with pet or other humans, people behave differently toward robots. Bartneck, C., & Hu, J. (2008) showed that people who abused robots had fewer concerns than when they abused people. Other researchers report that people acted differently toward a puppy than a robot dog (AIBO). When they played with an AIBO, they spent more time moving a toy closer to the AIBO in order to allow the AIBO to detect the toy and catch it (Kerepesi, Kubinyi, Jonsson, Magnusson, &Miklósi, 2006).

When a robot is present, behaviors and feelings tend to change. Some scholars studied people taking an exam and discovered they were as dishonest with a robot as when other people were present in the test room, but the test-takers felt less guilty about cheating when robots were present in the room (Hoffman et al., 2015).

Other researchers revealed that people tend to forgive or ignore an error made by a robot (Robinette et al., 2016). Some studies have also made the point that behaviors do change when people interact with robots. A five-week experiment found that preferences change over time (Kheng et al., 2007). Kheng reported participants wanted a robot to get closer due to the desired of more interaction with the robot to complete tasks. When considering time as a factor in the study, they also discovered participants wanted more verbal interaction than physical interaction (Kheng et al., 2007). Kidd and Breazeal's research reported similar results. They found that participants tried to create new relationships with robots over time. They also reported that many participants were reluctant to give up the relationship when the experiment was over (Kidd & Breazeal, 2008).

Cultural context and demography also play a role in HRI. In 2008, researchers studied the difference in robot preference between Japanese and Americans. They concluded that Americans had more positive thoughts at the time toward robots than Japanese, but they believed the result might change in the future (Bartneck, 2008). This paper supports that culture does affect perception of robots. In 2014, a group of scholars used surveys to compare Korean, Turkish, and American participants' thoughts about robots. Compared to the other two countries, Americans had more negative thoughts about robots. They thought robots were scary and dangerous and should not appear in their daily lives (H. R. Lee &Sabanović, 2014).

The body of literature also supports that cultural context changes over time. In 2015, after an experiment using a trash can robot in university cafeterias both in Japan and America, Fraune et al. reported that Americans were less interested in robots than Japanese (Fraune, Kawakami, Sabanovic, deSilva, & Okada, 2015). Researchers showed that education background and age can be a factor affecting HRI (Nomura et al., 2007; Nomura & Sasa, 2009; Nomura & Takagi, 2011). Elderly people tend to react more positively toward robots than younger people (Nomura et al., 2007; Nomura & Sasa, 2009).

Table 2.1 shows an analysis of selected past experiments, categorized according to method of experimentation. It is noted whether the studies compared demographics, environments, robot design or behavior, type of interaction (human-creature interaction or human-robot interaction), and other factors. Perceptions, feelings, and behaviors changes are also documented. The table is ranked chronologically by study date. Many early studies compared only a single variable, and later studies compared two or three variables. Many studies focus on the robot’s outlook or behavior, others focus on demographics, while others focus on environment, HRI, or other factors.

Table 2.1 Literature review table: Relevant studies, including which items were included in study comparisons (list in chronological order

Authors	Title	Environment	Robot's outlook or behavior	Demographics	HRI	Other factors	Feeling /Perception change	Behavior change
Bartneck, Rosalia, Menges, & Deckers, 2005	Robot Abuse–A Limitation of the Media Equation				Y		Y	Y
Kerepesi, Kubinyi, Jonsson, Magnusson, & Miklósi, 2006	Behavioral comparison of human-animal (dog) and human-robot (AIBO) interactions				Y			Y
Bartneck, van derHoek, Mubin, & AlMahmud, 2007	"Daisy, Daisy, give me your answer do!"		Y				Y	Y
Kheng, Syrdal, Walters, & Dautenhahn, 2007	Living with robots: Investigating the habituation effect in participants' preferences during a longitudinal human-robot interaction study					Duration with robot	Y	Y
Nomura et al., 2007	Questionnaire-based social research on opinions of Japanese visitors for communication robots at an exhibition			Y			Y	
Bartneck & Hue, 2008	Exploring the abuse of robots		Y	Y			Y	Y
Kidd & Breazeal, 2008	Robots at home: Understanding long-term human-robot interaction					Duration with robot	Y	Y
Lohse, Rohlfing, Wrede, & Sagerer, 2008	"Try something else!" When users change their discursive behavior in human-robot interaction		Y				Y	

Table 2.1 (continued)

Authors	Title	Environment	Robot's outlook or behavior	Demographics	HRI	Other factors	Feeling /Perception change	Behavior change
Walters et al., 2011	Evaluating the robot personality and verbal behavior of domestic robots using video-based studies		Y				Y	
Nomura & Takagi, 2011	Exploring effects of educational backgrounds and gender in human-robot interaction			Y			Y	
Groom et al., 2011	Responses to robot social roles and social role framing		Y				Y	
M. K. Lee, Kiesler, Forlizzi, & Rybski, 2012	Ripple effects of an embedded social agent: A field study of a social robot in the workplace					Duration with robot	Y	Y
Chidambaram, Chiang, & Mutlu, 2012	Designing persuasive robots: How robots might persuade people using vocal and nonverbal cues		Y				Y	
KayakoNakagawa et al., 2013	Effect of Robot's Whispering Behavior on People's Motivation		Y					Y
Rosenthal-von der Pütten, Krämer, Hoffmann, Sobieraj, & Eimler, 2013	An Experimental Study on Emotional Reactions Towards a Robot					friendly versus aggressive interaction	Y	
Giuliani et al., 2013	Comparing task-based and socially intelligent behavior in a robot bartender		Y	Y			Y	

Table 2.1 (continued)

Authors	Title	Environment	Robot's outlook or behavior	Demographics	HRI	Other factors	Feeling /Perception change	Behavior change
DeGraaf & BenAllouch, 2013	The Relation between People's Attitude and Anxiety towards Robots in Human-Robot Interaction		Y	Y			Y	
R. H. Kim, Moon, Choi, & Kwak, 2014	The effect of robot appearance types on motivating donation		Y					Y
Salem, Ziadee, & Sakr, 2014	Marhaba, how may I help you? Effects of politeness and culture on robot acceptance and anthropomorphization	Y		Y			Y	
Vouloutsi, Grechuta, Lallée, & Verschure, 2014	The influence of behavioral complexity on robot perception		Y				Y	
H. R. Lee &Sabanović, 2014	Culturally variable preferences for robot design and use in South Korea, Turkey, and the United States	Y		Y			Y	
Hoffman et al., 2015	Robot Presence and Human Honesty: Experimental Evidence					presence of robot versus human	Y	Y
Fraune, Kawakami, Sabanovic, de Silva, & Okada, 2015	Three's company, or a crowd?: The effects of robot number and behavior on HRI in Japan and the USA	Y	Y	Y		single versus multiple	Y	Y
Wills, Baxter, Kennedy, Senft, & Belpaeme, 2016	Socially contingent humanoid robot head behavior results in increased charity donations					facial feature		Y

Table 2.1 (continued)

Authors	Title	Environment	Robot's outlook or behavior	Demographics	HRI	Other factors	Feeling /Perception change	Behavior change
Birnbaum et al., 2016	Machines as a source of consolation: Robot responsiveness increases human approach behavior and desire for companionship		Y				Y	Y
Sandoval, Brandstetter, & Bartneck, 2016)	Can a robot bribe a human? The measurement of the negative side of reciprocity in human robot interaction		Y				Y	
Robinette, Li, Allen, Howard, & Wagner, 2016	Overtrust of robots in emergency evacuation scenarios		Y				Y	
Hirano et al., 2016	Communication cues in human-robot touch interaction		Y				Y	
MShiomi & Hagita, 2016	Do synchronized multiple robots exert peer pressure?					multiple robots	Y	
MasahiroShiomi et al., 2017	Does A Robot's Touch Encourage Human Effort?		Y					Y
Rea, Muratore, & Sciutti, 2017	13-year-olds approach human-robot interaction like adults			Y			Y	Y

2.2 The gap in the literature

According to Table 2.1, it is not difficult to find out that so far, no research was found related to the handler's presence next to the robot. Some may say that the handler's presence is has no effect and is unnecessary to study, but we think that is a gap in the HRI studies. The present of handler may affect the HRI experiment results. We cannot find any direct evidence to prove that the presence of handler is a gap in the literature but, we have some indirect evidence to state that the presence of handler may be a gap of HRI studies.

Some research suggests that the presence of a dog can be a catalyst for pet owner's social interaction (Guéguen & Ciccotti, 2008; McNicholas & Collis, 2000; Wells, 2004; Westgarth, Christley, & Christian, 2014) However, a dog and a robot are extremely different. One is, no doubt, a living creature and the other is a machine or tool. Some experimental studies have already shown that when in the presence of a dog, people's behaviors tend to change (Guéguen &Ciccotti, 2008; McNicholas &Collis, 2000; Wells, 2004). McNicholas and Collis's study (2000) found that when the owner appeared with their dog, the number of social non-verbal and verbal interactions increased.

Furthermore, they discovered that when a dog is present as a catalyst, it will still be effective even when the appearance of the dog or the owner is less attractive. They show that once a human walks a dog, the dog will become a catalyst of the owner's social interaction, regardless of the dog's or the owner's appearance. In the research of Guéguen & Ciccotti (2008), they found that the presence of the dog can cause the owner to receive more help than when the dog is absent. Some research revealed that even generously speaking to a dog can be a “social lubricant” for the master. Research also show that the age, breed, and color of the dog does matter (Wells, 2004). After reviewing multiple articles, Westgarth (2014) concludes that current evidence states that walking a dog may be the most effective catalyst for pet-owner’s social relationship. While pet interaction resources are not directly related to this study, they can still be used to hypothesize experimentation results.

CHAPTER III

OBJECTIVE AND HYPOTHESIS

3.1 Objective

The objective of this study is to determine whether the presence of a robot handler will affect people's behavior near a robot. The use of robots in day to day tasks is increasing. It is important to understand how people's behavior may change under different conditions. This will allow systems designers to set conditions in such a way to elicit the desired behavior from those around the robot.

3.2 Hypothesis

According to the McNicholas and Collis's study (2000), the presence of a dog can make their owner more attractive to others. As such, it is possible that a robot may have the same effect. That is, the robot may make their handler more attractive to people passing by. This leads to the hypotheses for this study:

Hypothesis 1: There will be more interaction with the robot when the handler is present compared to when there is no handler next to the robot.

Hypothesis 2: People will interact with both the robot and the handler when the handler is present.

CHAPTER IV

METHOD

4.1 Experiment design

4.1.1 Independent variable

The study has one independent variable: handler presence. The variable has two levels: present and absent. In the handler present condition, a human handler will be standing next to the robot during the experimental procedure. In the handler absent condition, there will be no handler next to the robot.

4.1.2 Dependent variable

The study has one dependent variable: participant behavior. Behavior will be measured by classifying the person's behavior when they are close to the robot and/or handler. Behavior will be classified into one of five categories: ignore (I), curious (C), interact with robot only (R), interact with handler only (H), or interact with robot and handler (RH). The behavior of each participant will be classified into only one category. If a participant begins the scenario by only observing the robot, but then approaches and interacts with the robot, the behavior will be classified as interact with robot only (R). The highest level of interaction during the entire exposure time will be the behavior that is classified. The behavior categories are defined as follows:

- Ignore (I): The participant doesn't approach or observe the robot.

- Curious (C): The participant approaches the robot only to observe it and then move away. Observing the robot from a distance is also categorized here.
- Interact with Robot only (R): Participant interacts with the robot by taking the candy offered by the robot.
- Interact with Handler only (H): The participant talks to the handler but does not interact with the robot. Only possible in handler-present condition.
- Interact with Robot and Handler (RH): The participant interacts with the robot and talks to the handler. Only possible in handler-present condition.

4.2 Procedure

In this study, we used the Jaguar V4 robot, which is a semi-anthropomorphic robot. A picture of the robot in the experimental environment is shown in Figure 4.1.

Figure 4.1 Robot outlook

The experiment was conducted on the 2nd floor of Mississippi State University's Mitchell Memorial library. The area of interest, where participant behavior was recorded, is shown as Figure 4.2. Data was collected for one hour each on two weekday afternoons. The robot held a plate that contained a bowl filled with candy and information cards. The information cards provided information about the experiment and contact information for the researcher. During data collection, the robot began by being stationary, holding the plate with candy bowl and cards, at location 1 (see Figure 4.2). After five minutes, it moved to location 2, where it was stationary again. After another five minutes, it moved to location 3. After another five minutes, it moved to location 2, where it stay for another five minutes then it move to location 1 as a cycle.

Figure 4.2 Robot moving pattern

Robot will start from location 1 then move to location 2 then move to location 3 then move back to location 2 then location 1.

4.3 Participants

A total of 459 participants (221 male, 225 female, 13 unknown gender) were recorded in our area of interest during the experiment running time. Of the 459 participants, 395 were in the area of interest individually, whereas 64 were in groups of two or larger.

CHAPTER V

RESULT

5.1 Descriptive Statistics

In the handler absent scenario, there were 257 participants. Regarding behavior, 135 (52.5%) of them ignored the robot, 58 (22.6%) of them were curious about the robot, and 64 (24.9%) of them interacted with the robot.

In the handler present scenario, there were 202 participants. Regarding behavior, 116 (57.4%) of them ignored the robot, 59 (29.2%) of them were curious about the robot, 9 (4.5%) of them interacted with the robot, 3 (1.5%) of them interacted with the handler only, and 15 (7.4%) of them interacted with both the robot and the handler.

5.2 Result: Human Behavior

Handler presence had an overall significant effect on participant behavior, χ^2 (4, N = 459) = 55.086, $p < .001$. A larger percent of participants interacted with the robot in the handler absent scenario. See figure 5.1 below:

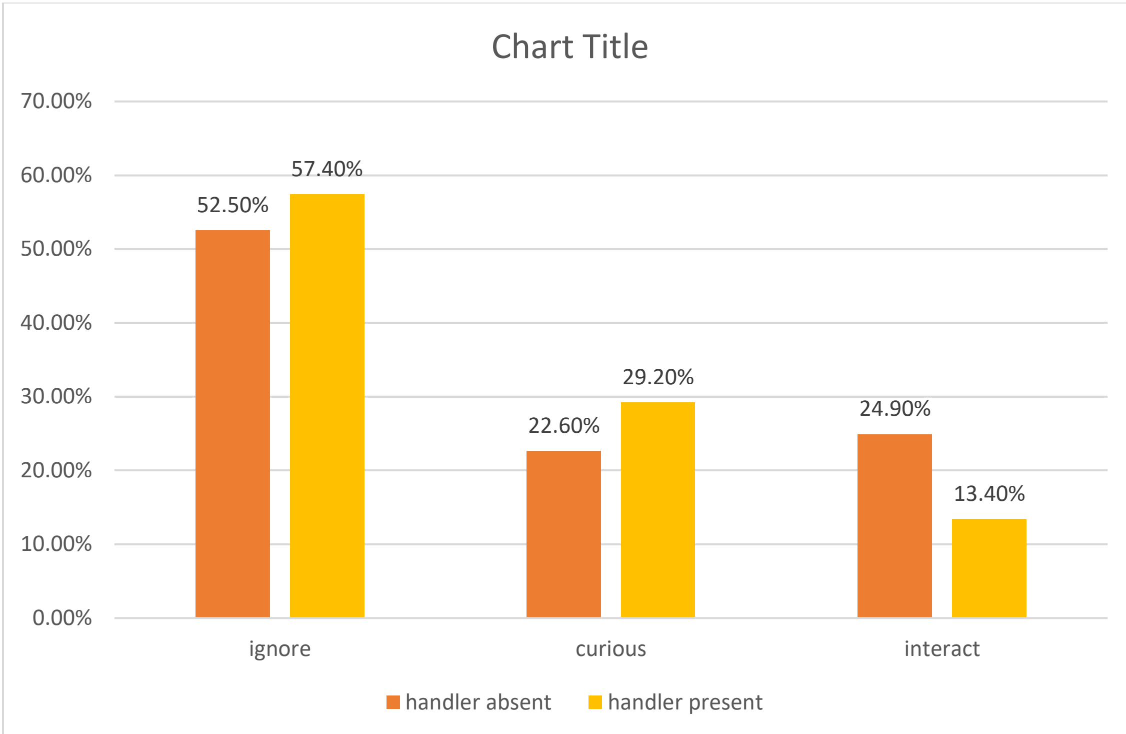

Figure 5.1 Bar chart of human behavior

In the handler absent scenario, there were 257 participants. In the handler present scenario, there were 202 participants.

5.3 Difference of demographic

Table 5.1 details the count of participants by gender and group size for the handler absent scenario. Gender had no overall significant effect on interaction with robot, $\chi^2(4, N = 257) = 2.764,\ p = .598$. There was a significant effect of group size on behavior, $\chi^2(2, N = 257) = 22.737,\ p < .01$. A larger percent of participants interacted with robot in the group in handler absent scenario.

Table 5.1 Handler Absent Demographic Table

Behavior	Overall (N=257)	Gender Male (N=112)	Gender Female (N=134)	Gender Unknown (N=11)	Size Individual (N=214)	Size Group (N=43)
Ignore (I)	52.5%	49.1%	53.7%	72.7%	57%	30.2%
Curious (C)	22.6%	23.2%	22.4%	18.2%	23.8%	16.3%
Interact (R)	24.9%	27.7%	23.9%	9.1%	19.2%	53.5%

Table 5.2 details the behavior counts by gender and group size for the handler present scenario. Gender had no overall significant effect on interact with robot, $\chi^2(8, N = 202) = 9.536,\ p = .299$. There was a significant effect of group size on behavior, $\chi^2(4, N = 202) = 19.421,\ p < .01$. A larger percent of participants interacted with robot in the group in handler present scenario.

Table 5.2 Handler Present Demographic Table

Behavior	Over all (N=202)	Gender Male (N=107)	Gender Female (N=92)	Gender Unknown (N=3)	Size Individual (N=182)	Size Group (N=20)
Ignore (I)	57.4%	59.8%	56.5%	0.0%	61.0%	25.0%
Curious (C)	29.2%	27.1%	29.3%	100%	28.6%	35.0%
Interact (R)	4.5%	2.8%	6.5%	0.0%	3.3%	15.0%
Interact with Handler only (H)	1.5%	1.9%	1.1%	0.0%	1.6%	0.0%
Interact with Robot and Handler (RH)	7.4%	8.4%	6.5%	0.0%	5.5%	25.0%

CHAPTER VI

DISCUSSION

Our first hypothesis, there will be more interaction with the robot when handler is present compared to when there is no handler next to the robot, was not proven. Our result has shown that when handler is absent, individuals tend to interact with the robot more. The difference in the interaction rates was noticeable: 24.9% of participants interacted with the robot with no handler present, compared to a 13.4% interaction rate when the handler was present.

In the handler present scenario, people may feel that they are being watched, making the individual more hesitant about interacting with the robot. The handler's appearance and actions may also have reduced the likelihood of interaction with the robot. In our experiment, the handler had very limited interaction with both with robot and participants. This limited human-to-human interaction may have been viewed by participants as threatening of uninviting, which may have led to people losing their interest toward the robot.

In the handler present scenario, some participants approached the handler to ask questions such as "Is it a robot?" or "Are you controlling the robot?" In future studies, more interaction between the handler and the robot should be included to incorporate people's natural inquisitiveness in a better manner. By better identifying the handler as belonging to the robot, the results of the study may change. Consider, for example, the case of a pet and their owner. When a person is walking their dog, people can easily tell who is the dog's owner is by observing the interaction between the owner and the pet. However, when a person is controlling the robot, there may not be a clear indication of who is acting as a handler for that robot. The case of identifying the robot handler is likely situation dependent, but should be explored further.

Our second hypothesis, that people will interact with both the robot and handler when the handler is present, was supported with the results. Of all participants in the handler-present scenario, 7.4% interacted with both the robot and handler. In the handler present scenario, people tend to ask the handler questions such as: "Can I have candy?" or saying thank you to the handler after they interacted with robot.

Our experiment has shown that the presence of handler can affect human's behavior. When the handler was present and next to the robot, people tended to ignore the robot. This explains that the presence of handler can be a factor in HRI experiments. We still do not know why people loss their interest when the handler is next to the robot, it may be due to comfort, expectations, or uncertainty on the part of the passer-by. When a handler is next to the robot, people tended to interact with both the handler and the robot. We do not have direct answers as to why this occurred. However, consider again the case of pet ownership. When pet-owners walk their pet, people will interact with both the pet-owner and the pet. This expectation and behavior may carryover to robots and handlers.

Our result also shows that people are more likely to interact with the robot in groups, rather than individually. This matches results previously reported in literature, showing that groups are more interactive with a robot compared to individual people

(Fraune, Kawakami, Sabanovic, de Silva, & Okada, 2015). Their study (Fraune, et al., 2015) also reported that Americans are less likely to interact with a robot compared to Japanese. While we did not measure ethnicity or nation of origin, we did find that over 50% of participants ignored the robot, providing support for the prior research that shows Americans are disinterested in robots. .

The majority of published studies in human-robotic interaction report results from laboratory studies. The results from a closed environment may not be the same as from an open or 'real-world' environment. Our experiment is naturalistic, which means that we conducted our study in an open environment and with the minimized intervention.

CHAPTER VII

CONCLUSION

In this research, we discovered the effect of robot handler presence on participant response to a robot. We designed two experiments to determine this effect. Results suggest that the presence of a robot's handler impacts human behavior. When a handler stands next to a robot, people tend to avoid interacting with it. Although our experiment has several limitations, our results suggest that when robots appear in public spaces, their handlers should be hidden or absent.

Our experiment only included one type of robot and handler, so we cannot determine whether other types of robots and handlers would show the same effect of handler presence. We also only studied one type of environment (the university library), so we cannot conclude that the effect would apply in all environments. A further limitation of our study is that the robot in our experiment did not move a lot and engaged in only one type of interaction (taking candy).

Future work needs to examine different combinations of handler and robot and consider handler outlook, race, and action to reveal why the presence of a handler may affect people's behavior toward a robot. Future work should also consider different types of interaction between robot and participant in handler-present scenarios.

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