Love at First Sight: Mere Exposure to Robot Appearance Leaves Impressions Similar to Interactions with Physical Robots

S. Maryam Fakhr Hosseini, Samantha Hilliger, Jaclyn Barnes, Myounghoon Jeon, Chung Hyuk Park, Ayanna M. Howard

Abstract— **As the technology needed to make robots robust and affordable draws ever nearer, human-robot interaction (HRI) research to make robots more useful and accessible to the general population becomes more crucial. In this study, 59 college students filled out an online survey soliciting their judgments regarding seven social robots based solely on appearance. Results suggest that participants prefer robots that resemble animals or humans over those that are intended to represent an imaginary creature or do not resemble a creature at all. Results are discussed based on social robot application and design features.**

I. INTRODUCTION

As robots become more common and interact regularly with users that lack specialized training, social robotics, which deals with robots that behave according to human social norms, can provide crucial insights needed to create natural interactions. In particular, efforts are underway to utilize robots with vulnerable populations (i.e., the elderly, children, and individuals with special needs) and in dynamic situations, including schools and hospitals. In these circumstances, quick judgments from uninformed users about the functions and intentions of a robot are unavoidable.

Previous research has shown that the appearance of the robot influences non-verbal aspects of interaction [1]. For example, children's perceptions and attitudes towards three different types of robots in terms of robot appearance, physical attributes, personality features and emotional characteristics [2] showed that children attribute feelings and cognitive understanding significantly less to the machine-like robots.

There are other variables to influence people's impressions on the robots. For example, people's beliefs regarding autonomy and emotional capacity of robots were explored in cross-cultural research [3]. Students in Japan, Korea, and the USA commonly did not assume autonomy and emotional capacity for the robots except for small humanoids, human-size humanoids, and pet-type robots. Nomura et al. in a different study [4] showed that under the contexts of "assistive robots at home" and "service robots in public places" only negative attitudes toward emotional interaction with robots affected the respondents' acceptance of robots. Emotions associated with humans, robots, and their interaction is still a concern in HRI. Further considerations of hedonic and utilitarian variables [5] is needed under interaction scenarios.

Studies with a humanoid robot showed participants reacted best to robots that appeared and acted in a manner that suited the situation in which they operated. So, a serious robot elicited better compliance in a serious task than a playful robot, but a playful robot was better for a playful task [6]. However, this information does not help design the appearance of a general purpose robot that will need to be useful in a variety of situations. In [7], researchers attempted to design such a general purpose humanoid, but the doll-like robot created was not experimentally validated with users. During the design process, existing social robots were categorized based on appearance as mecha, human clones, spaceman/appliance, soft skin, beefcake, and femme fatale, toybot, and friendly doll. As is evident from the categories a variety of characteristics were used and the sample of social robot used leaned heavily toward humanoid robots.

In the present study, we both expand the variety of robots evaluated and restrict the characteristics considered to focus just on physical form or shape of the robot.

We first classify robots as mechanistic and biomimetic. For our purposes, mechanistic robots are considered a single control group. While fully acknowledging there are a myriad of subdivisions possible, we leave determining what influence different types of mechanistic robots may have on social interaction to future work as mechanistic robots are less common in social robotics than biomimetic robots. We further subdivide biomimetic robots into humanoid, zoomorphic, fantastical, and plantlike. For the current work, we do not consider plantlike robots, but focus instead on the more common humanoid, zoomorphic, and fantastical robots that present greater opportunities for social interactions.

In a previous study [8] in which our participants interacted with actual robots, we found that Pleo, Robosapien, and Zoomer (dinosaur, humanoid, and canine robots respectively) were participants' top three choices for most interesting robot. Participants liked interacting with Zoomer the most and mentioned that they preferred Zoomer for long-term interaction. Given the preference, comments on realism, and praise for physical form in the open questions, it would seem that having a physical form similar to an existing creature, be it human or animal, increases initial preference in undirected interactions. Other than the physical form of robots, comments of participants show the importance of sensation modalities, such as touch and speech. The results we obtained do suggest that the form of the robot has an impact on people's impressions of it. However, it is difficult to isolate appearance from functionality since participants interacted with the robots.

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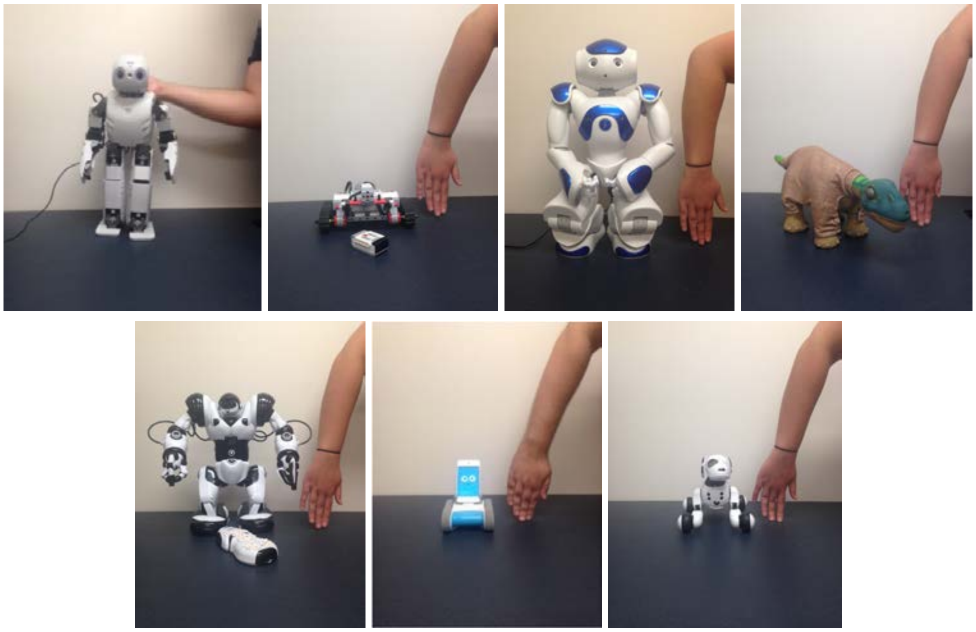
Figure 1. Row by row, from the upper left: Darwin (Robotis OP2), Mindstorm EV3, Nao, Pleo, Robosapien, Romo, Zoomer



The present study expands on the previous work by measuring opinions based on the pictures of the robot in an online survey without being biased by any physical interactions and robots' functions.

II. METHODS

College students completed an online survey that included pictures of the robots, but no descriptions of their functionality.

A. Participants

Fifty-eight undergraduate students (40 male, 18 female; between the ages of 18-30; mean age = 20.47) were recruited for participation in this study via the Michigan Technological University online-recruitment system. Participants received partial course credit for participation.

B. Robots

We used seven different robots in this study: Darwin, a humanoid robot; Mindstorm EV3, a Lego robot; Nao, another humanoid robot; Pleo, a dinosaur robot; Robosapien, a simpler humanoid robot; Romo, an animated face on an iPod Touch with a tracked base; and Zoomer, a toy dog robot. Darwin has exposed wiring and motors, giving it a slightly more mechanistic appearance than Nao. Robosapien has more exaggerated proportions than either of the other humanoid robots. Including three humanoid robots with differing appearances allows us to examine the influence of form somewhat independently from styling and helps identify important details that influence preference beyond simply the type of robot. See Figure 1 for images of all the robots.

C. Questionnaires

1) Modified PHIT-40

Kamide, Kawabe, Shigemi, and Arai developed and validated a psychological scale, the PHIT-40, to evaluate humanoid robots. The scale based around nine psychological acceptance factors they had identified while working with the Japanese general population: Agency, Familiarity, Humanness, Motion, Performance, Repulsion, Sound, Utility, and Voice. The perceived autonomy of the robot is represented by the Agency factor. Friendliness and comfort are included in Familiarity. Humanness measures the resemblance of the robot to a real person. Motion captures the smoothness of the robot's movement. Performance measures cognitive and technological functions. Repulsion captures the respondents' fear and possibly hatred of robots. Usefulness and function are Utility. Voice and Sound both deal with sound, but divide it into use of language and operating noise respectively [9]. In this study we used some of the questions and variables of PHIT-40 and removed those that question about sound and functions of robots since the participants did not have the opportunity to observe those characteristics. Questions related to humanness were adapted to suit the form of the robot, e.g., participants were asked how much Zoomer seemed like a dog, not how much the dog robot seemed like a human.

2) Experimenter-developed questionnaire

We also added an investigator-designed questionnaire for an emotional perspective on the results. This was to help us see how much attributing emotional characteristics to robots led to cognitive reasoning about usefulness, intelligence, and so on [5].

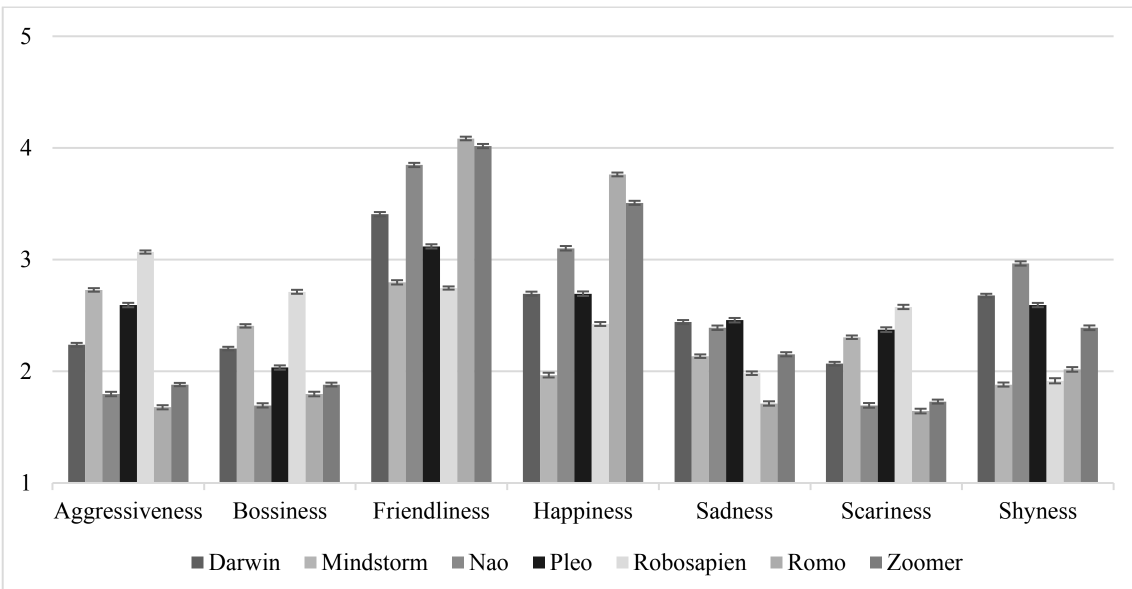
D. Design and Procedure

The survey was conducted online using Google Forms and had nine sections which included yes/no questions, Likert-type questions, and free response questions. The first section

TABLE I. MEAN AND STANDARD DEVIATION FOR ITEMS ON EXPERIMENTER DESIGNED QUESTIONNAIRE

	Aggressiveness		**Bossiness**		**Friendliness**		**Happiness**		**Sadness**		**Scariness**		**Shyness**	
	Mean	***StdDv***	***Mean***	***StdDv***	***Mean***	***StdDv***	***Mean***	***StdDv***	***Mean***	***StdDv***	***Mean***	***StdDv***	***Mean***	***StdDv***
Darwin	2.24	1.01	2.20	1.23	3.41	0.87	2.69	1.07	2.44	1.09	2.07	1.05	2.68	1.11
Mindstorm	2.73	1.20	2.41	1.22	2.80	1.10	1.97	1.00	2.14	1.15	2.31	1.24	1.88	0.95
Nao	1.80	0.94	1.69	0.95	3.85	1.01	3.10	1.08	2.39	1.08	1.69	0.99	2.97	1.14
Pleo	2.59	1.13	2.03	1.13	3.12	1.16	2.69	1.19	2.46	1.18	2.37	1.24	2.59	1.12
Robosapien	3.07	1.05	2.71	1.35	2.75	0.84	2.42	1.04	1.98	0.94	2.58	1.13	1.92	0.84
Romo	1.68	0.90	1.80	1.08	4.08	0.93	3.76	1.25	1.71	0.93	1.64	0.92	2.02	1.14
Zoomer	1.88	1.04	1.88	1.08	4.02	0.84	3.51	1.07	2.15	1.05	1.73	0.93	2.39	1.05

Figure 2. Means of items on experimenter designed questionnaire



gathered informed consent and the second section contained general demographics questions. The remaining seven sections each contained a picture of a robot alongside an adult female's hand for scale and a series of questions about the participant's perception of the robot. The robots included in this study were Zoomer, Pleo, Darwin (Robotis OP 2), Nao, Robosapien, Romo, and Mindstorm. Information about the functionality and operation of the robots was not provided. Robots were not named in the study. To control for order effects, there were four versions of the survey which counterbalanced the order of the robots so that a humanoid robot, an zoomorphic robot, a fantastical robot, and a mechanistic robot appeared first in the survey for 20, 14, 11, and 14 participants respectively.

There were a few new questions and modifications to the questionnaire from our previous robot interaction study [8], but most of the questions were based off of the previous questions so that we could directly and indirectly compare the results. As in that previous study, a significant portion of the questionnaire used Likert-type questions with a seven-point scale modeled after the questions of the PHIT-40 scale for evaluating humanoid robots.

III. RESULTS

A. Researcher Created Questionnaire

All the pairwise comparisons were assessed using paired-samples t-tests with an adjusted alpha level of .0024 (.05/21).

1) *Aggressiveness.*

Repeated-measures ANOVA results indicated some robots were perceived as more aggressive than others, $F(1,58) = 699$, $p < 0.01$, $\eta_p^2 = .923$ (Fig. 2). Two-tailed paired-samples t-tests showed respondents thought Pleo was more aggressive than Nao, $t(58) = -4.54$, $p < 0.001$. Robosapien, $t(58) = -7.60$, $p < 0.001$, Mindstorm, $t(58) = -5.89$, $p < 0.001$, and Darwin, $t(58) = -3.491$, $p = 0.001$, were all rated as more aggressive than Nao. Respondents rated Romo as less aggressive than Pleo $t(58) = -5.63$, $p < 0.001$, Robosapien, $t(58) = -8.38$, $p < 0.001$, Mindstorm, $t(58) = -5.64$, $p < 0.001$, and Darwin $t(58) = -3.79$, $p < 0.001$. Pleo was rated as more aggressive than Zoomer, $t(58) = 3.97$, $p <$

0.001. Zoomer was rated less aggressive than Robosapien, $t(58) = -6.91$, $p < 0.001$, and Mindstorm $t(58) = -5.30$, $p < 0.001$. Robosapien was rated as more aggressive than Darwin $t(58) = 4.85$, $p < 0.001$.

2) Bossiness

ANOVA results indicated some robots were perceived as more bossy than others, $F(1, 58) = 395$, $p < 0.001$, $\eta_p^2 = .872$. Nao was rated as less bossy than Robosapien, $t(58) = -5.36$, $p < 0.001$, Mindstorm, $t(58) = -4.60$, $p < 0.001$, and Darwin, $t(58) = -3.88$, $p < 0.001$. Romo was rated less bossy than Robosapien $t(58) = -4.52$, $p < 0.001$ and Mindstorm $t(58) = -3.23$, $p = 0.002$. Pleo was rated as less bossy than Robosapien $t(58) = -3.99$, $p < 0.001$. Zoomer rated less bossy than Robosapien $t(58) = -4.43$, $p < 0.001$ and Mindstorm $t(58) = -3.20$, $p = 0.002$.

3) Friendliness

ANOVA results indicated some robots were perceived as more friendly than others, $F(1,58) = 1777$, $p < 0.001$, $\eta_p^2 = .968$. Paired comparisons showed that Nao was rated as friendlier than Pleo, $t(58) = 4.90$, $p < 0.001$, Robosapien, $t(58) = 7.85$, $p < 0.001$, Mindstorm, $t(58) = 6.67$, $p < 0.001$, and Darwin, $t(58) = 3.33$, $p = 0.002$. Romo was perceived as friendlier than Pleo, $t(58) = 6.24$, $p < 0.001$, Robosapien, $t(58) = 8.80$, $p < 0.001$, Mindstorm, $t(58) = 7.32$, $p < 0.001$, and Darwin, $t(58) = 4.65$, $p < 0.001$. Pleo was viewed as less friendly compared to Zoomer, $t(58) = -5.38$, $p < 0.001$. Zoomer was perceived as friendlier than Robosapien $t(58) = 9.97$, $p < 0.001$, Mindstorm $t(58) = 8.08$, $p < 0.001$, and Darwin $t(58) = 4.95$, $p < 0.001$. Robosapien was viewed as less friendly compared to Darwin $t(58) = -4.79$, $p < 0.001$. Mindstorm was viewed as less friendly than Darwin $t(58) = -3.80$, $p < 0.001$.

4) Happiness

ANOVA results indicated some robots were perceived as happier than others, $F(1,58) = 1007$, $p < 0.001$, $\eta_p^2 = .946$. Paired comparisons showed that respondents perceived Nao as less happy compared to Romo, $t(58) = -3.67$, $p = 0.001$. However, Nao was rated as happier than Robosapien, $t(58) = 4.36$, $p < 0.001$, and Mindstorm, $t(58) = 6.55$, $p < 0.001$. Romo was perceived as happier than Pleo, $t(58) = 5.21$, $p < 0.001$, Robosapien, $t(58) = 6.69$, $p < 0.001$, Mindstorm, $t(58) = 7.53$, $p < 0.001$, and Darwin, $t(58) = 5.53$, $p < 0.001$. Pleo was considered less happy compared to Zoomer, $t(58)$ -4.36, $p < 0.001$, but was rated happier than Mindstorm, $t(58) = 4.84$, $p < 0.001$. Zoomer was rated as happier than Robosapien, $t(58) = 6.82$, $p < 0.001$, Mindstorm, $t(58) = 8.21$, $p < 0.001$, and Darwin, $t(58) = 5.16$, $p < 0.001$. Mindstorm was rated as less happy than Darwin, $t(58) = -4.72$, $p < 0.001$.

5) Sadness

ANOVA results indicated some robots were perceived as sadder than others, $F(1,58) = 519$, $p < 0.001$, $\eta_p^2 = .899$. Paired comparisons showed that respondents perceived Nao as sadder than Romo, $t(58) = 3.83$, $p < 0.001$. Romo was also rated as less sad than Pleo, $t(58) = -4.47$, $p < 0.001$, Zoomer, $t(58) = -3.26$, $p = .002$, and Darwin, $t(58) = -5.18$, $p < 0.001$. Robosapien was also considered less sad than Darwin, $t(58) = -3.28$, $p = 0.002$.

6) Scariness

ANOVA results indicated some robots were perceived as scarier than others, $F(1,58) = 490$, $p < 0.001$, $\eta_p^2 = .894$. Paired comparisons showed that respondents perceived Nao as less scary than Pleo, $t(58) = -3.95$, $p < 0.001$, Robosapien, $t(58) = -5.20$, $p < 0.001$, and Mindstorm, $t(58) = -3.61$, $p = 0.001$. Romo was viewed as less scary than Pleo, $t(58) = -4.41$, $p < 0.001$, Robosapien $t(58) = -5.52$, $p < 0.001$, and Mindstorm, $t(58) = -3.30$, $p = 0.002$. Pleo was also viewed as scarier than Zoomer, $t(58) = 4.52$, $p < 0.001$. Zoomer was perceived as less scary than Robosapien $t(58) = -5.63$, $p < 0.001$, and Mindstorm, $t(58) = -3.86$, $p < 0.001$. Robosapien was also viewed as scarier than Darwin, $t(58) = 3.76$, $p < 0.001$.

7) Shyness

ANOVA results indicated that some robots were perceived as shyer than others, $F(1, 57) = 848$, $p < 0.001$, $\eta_p^2 = .937$. Paired comparisons showed that Nao was perceived as shyer than Romo, $t(57) = 4.33$, $p < 0.001$, Zoomer, $t(57) = 3.34$, $p = 0.002$, Robosapien, $t(57) = 5.96$, $p < 0.001$, and Mindstorm, $t(57) = 5.71$, $p < 0.001$. Romo was perceived as less shy than Darwin, $t(58) = -3.28$, $p = 0.002$. Pleo was perceived as shyer than Robosapien $t(58) = 4.26$, $p < 0.001$, and Mindstorm, $t(58) = 5.46$, $p < 0.001$. Robosapien, $t(58) = -4.54$, $p < 0.001$, and Mindstorm, $t(58) = -5.22$, $p < 0.001$, were perceived to be less shy than Darwin .

B. Adapted PHIT-40

The average scores for the modified PHIT-40 for each robot is shown in Fig. 3. The result of the one-way MANOVA showed a statistically significant difference in effect of different types of robots $F(36, 1763.675) = 8.34$, $\eta_p^2 = .1$, $p < 0.01$. Therefore, for each factor, we conducted a one-way repeated measures ANOVA.

1) Agency

Agency reflects the extent to which the robot has its own dependent mind or intention. ANOVA results indicated that agency was perceived differently among the robots, $F(1,58) = 384.657$, $p < 0.001$, $\eta_p^2 = .869$. Paired samples t-test shows that the participants rated Mindstorm, the mechanical robot, significantly lowest which is less than Pleo $t(58) = -3.61$, $p < 0.001$, Robosapien, $t(58) = -5.74$, $p < 0.001$, Romo, $t(58) = -5.07$, $p < 0.001$, Zoomer, $t(58) = -5.01$, $p < 0.001$, Nao, $t(58) = -6.12$, $p < 0.001$, and Darwin, $t(58) = -4.62$, $p < 0.001$. Moreover, Pleo was significantly rated lower than Nao, $t(58) = -2.87$, $p < 0.001$.

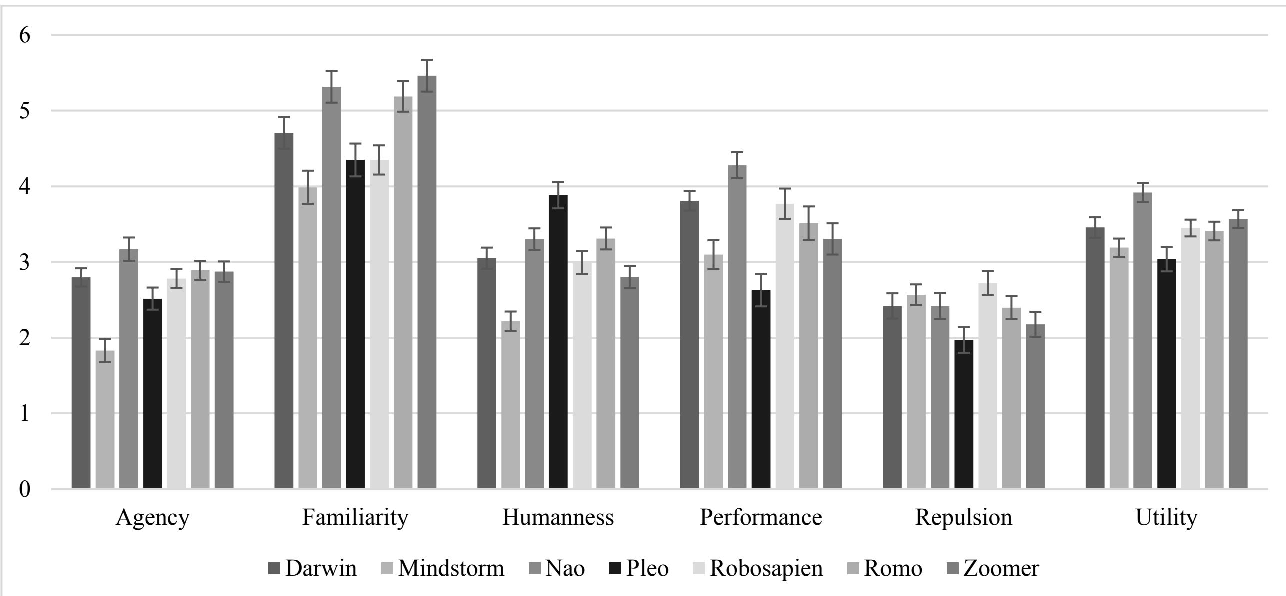
2) Familiarity.

ANOVA results indicated familiarity is different among the robots, $F(1,58) = 3364.379$, $p < 0.001$, $\eta_p^2 = .983$. Pairwise comparisons showed that opinions on the likability of Mindstorm, motion, and design are significantly less than Romo, $t(58) = -6.76$, $p < 0.001$, Zoomer, $t(58) = -9.56$, $p < 0.001$, Nao, $t(58) = -8.66$, $p < 0.001$ and Darwin, $t(58) = -4.94$, $p < 0.001$. These three robots have also been rated significantly higher than Pleo and Robosapien for this factor. Also, Darwin was rated on the familiarity scale significantly less than Zoomer $t(58) = 5.51$, $p < 0.001$ and Nao $t(58) = 5.07$, $p < 0.001$.

TABLE II. MEAN AND STANDARD DEVIATION OF ADOPTED PHIT-40 ITEMS

	Agency		**Familiarity**		**Humanness**		**Performance**		**Repulsion**		**Utility**	
	Mean	***StdDv***	***Mean***	***StdDv***	***Mean***	***StdDv***	***Mean***	***StdDv***	***Mean***	***StdDv***	***Mean***	***StdDv***
Darwin	2.80	1.58	4.70	1.04	3.05	0.91	3.81	1.13	2.42	1.27	3.46	1.61
Mindstorm	1.83	0.99	3.99	0.93	2.22	1.04	3.10	1.08	2.57	1.28	3.19	1.61
Nao	3.17	1.70	5.32	0.96	3.30	0.95	4.28	1.11	2.42	1.17	3.92	1.54
Pleo	2.52	1.46	4.35	1.19	3.88	0.93	2.63	0.98	1.97	1.05	3.04	1.69
Robosapien	2.78	1.31	4.35	1.19	2.99	0.96	3.77	1.09	2.72	1.31	3.45	1.61
Romo	2.89	1.63	5.19	1.12	3.31	1.24	3.51	1.33	2.40	1.30	3.41	1.67
Zoomer	2.87	1.53	5.46	0.97	2.80	0.85	3.31	1.16	2.18	1.22	3.57	1.48

Figure 3. Means of adapted PHIT-40 items



3) Humanness

ANOVA results indicated that humanness was perceived differently among the three humanoid robots (Darwin, Nao, and Robosapien), $F(1,58) = 880.029$, $p < 0.001$, $\eta_p^2 = .938$. General humanness was attributed to Nao ($M = 3.3$, $SD = .94$) more than Robosapien ($M = 2.99$, $SD = .96$), $t(58) = -3.08$, $p = 0.003$, but this did not reach a statistically different level with a corrected alpha level.

4) Performance

ANOVA results indicated that performance was perceived differently among the robots, $F(1,58) = 1287.064$, $p < 0.001$, $\eta_p^2 = .957$. General evaluations of performance including interactions, sensations, and intelligence, were rated significantly the lowest for Pleo in comparison to Robosapien, $t(58) = -7.69$, $p < 0.001$, Mindstorm, $t(58) = 3.25$, $p = 0.002$, Romo, $t(58) = -4.82$, $p < 0.001$, Zoomer, $t(58) = -4.08$, $p < 0.001$, Nao, $t(58) = -9.61$, $p < 0.001$, and Darwin, $t(58) = -5.71$, $p < 0.001$. Nao was significantly rated higher than Romo, $t(58) = -4.28$, $p < 0.001$, Zoomer, $t(58) = -5.94$, $p < 0.001$, Mindstorm,), $t(58) = -6.77$, $p < 0.001$, Robosapien, $t(58) = -3.46$, $p < 0.002$, and Darwin, $t(58) = 4.05$, $p < 0.001$. Moreover, Mindstorm is scored lower than Robosapien, $t(58) = -4.37$, $p < 0.001$ and Darwin, $t(58) = -3.71$, $p < 0.001$. Zoomer is scored significantly higher than Darwin, $t(58) = -3.18$, $p < 0.001$ and Robosapien, $t(58) = 3.25$, $p = 0.002$.

5) Repulsion

This factor is related to anxiety or sense of aversion about humans being replaced by robots in terms of work or existence itself. ANOVA results indicated that repulsion was perceived differently among the robots, $F(1,58) = 318.218$, $p < 0.001$, $\eta_p^2 = .846$. Participants opinion on this factor shows the least hatred or anxiety for Pleo in comparison to Mindstorm, $t(58) = 4.41$, $p < 0.001$, Robosapien, $t(58) = -6.1$, $p < 0.001$, Romo, $t(58) = -3.2$, $p < 0.001$, Nao, $t(58) = -3.38$, $p < 0.001$, and Darwin, $t(58) = -3.31$, $p < 0.001$. Robosapien was rated significantly less than Zoomer, $t(58) = 4.32$, $p < 0.001$.

6) Utility

ANOVA results indicated that utility was perceived differently among the robots, $F(1,58) = 477.152$, $p < 0.001$, $\eta_p^2 = .892$. Respondents found clearer aims and greater usefulness for Nao than Mindstorm $t(58) = -3.86$, $p < 0.001$ and Pleo, $t(58) = -3.82$, $p < 0.001$.

IV. Discussion

The results of this study showed that Romo was rated as the least aggressive and least sad. It was also considered friendlier than most of the other robots. This might be related to Romo being pictured with a smile, its default expression. One of our humanoid robots, Nao was also considered non-aggressive and friendly. Nao, Romo, and Zoomer were perceived as the happiest robots. Nao, Romo, and Zoomer were the least scary and bossy. We speculate that participants are attributing positive emotions to the pet-like robots and those with a cartoon-like style.

In [10], researchers examined emotional characteristics of single and small groups of anthropomorphic, zoomorphic, and mechanomorphic robots. Their findings showed significant interaction between the number of robots and the type of robots in influencing humans emotional appraisal of robots in general. However, the valence of that interaction varied among the types of robots featured. In light of this, it is possible our results would differ if we included groups of robots.

The results of adapted PHIT-40 showed that Nao, Romo, and Zoomer were considered the most amiable robots and people felt more intimacy with them. This finding is similar to our previous result [8], in which Zoomer rated highest in familiarity. The mechanistic robot, Mindstorm, and the dinosaur, Pleo, had lower utility ratings than all of the other robots indicating that they did not seem useful or have a clear purpose. We found the same pattern for Pleo in the first study as well as Romo. This result suggests that people's mental models and expectations of robots are based on their experience in real life [11], which again supports the idea of matching a robot's function with its appearance [6]. Nao was considered more human-like in appearance than Darwin and Robosapien, which were both rated equally. Agency, which shows that the robot appears to have an independent mind or intention, was not attributed to the mechanical robot (Mindstorm), but was equivalent among all other robots except Pleo, which was rated significantly lower than Nao. It is interesting that participants' opinions on this factor were the same among pet-like and humanoid robots. In regard to high cognitive or technological functions, humanoid robots were rated highest. Again we can see how people attribute some elements just by looking at the pictures of the robots. These first impressions of robots highlight human expectations about robot characteristics and behavior. Developers of future robots should consider these expectations in the design of their robots if they aim to facilitate easy human-robot interaction.

V. Conclusion

In summary, participants estimated the characteristics for the robot based on what they experienced with similar forms and shapes in the real life. People use these social cues automatically and apply stereotypes, heuristics, and social habits to novel robots. These rules are important if the robot is to be used by people with special needs [12], [13], children, or in a specific environment. Finding the factors that influence people's impressions of robots helps designers to apply specific criteria that can represent particular personality [14] in robots and create emotional and goal-oriented interactions between humans and robots.

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