Measurement of Moral Concern for Robots

Tatsuya Nomura[1,4]
[1] Ryukoku University
Otsu, Shiga 520-2194, Japan
[4] ATR Intelligent Robotics and Communication Laboratories
Keihanna, Kyoto 619-0288, Japan
nomura@rins.ryukoku.ac.jp

Takayuki Kanda[2,4]
[2] Department of Social Informatics, Kyoto University
Yoshida-honmachi, Kyoto 606-8501, Japan
kanda@i.kyoto-u.ac.jp

Sachie Yamada[3,4]
[4] Department of Psychological and Sociological Studies, Tokai University
Hiratsuka, Kanagawa 259-1292, Japan
s-yamada@tokai-u.jp

***Abstract*— We developed a self-report measurement, Moral Concern for Robots Scale (MCRS), which measures whether people believe that a robot has moral standing, deserves moral care, and merits protection. The results of an online survey (*N* = 200) confirmed the concurrent validity and predictive validity of the scale in the sense that the scale scores are successfully used to predict people's intentions for prosocial behaviors.**

Keywords— moral concern, self-report scale

I. INTRODUCTION

Morality is one intrinsic human characteristic. People have an innate motivation to help others even if such action/decisions decrease their own benefit. Although such moral cognition is usually applied to human beings, people sometimes expand it to include such non-human entities as animals and nature, e.g., extending basic human right to the great apes [1]. Individual differences exist in moral expansiveness. A less morally expansive person restricts her moral concern to those entities she deems "close" (e.g., family), and a more morally expansive person extends her moral concern beyond more "distant" entities like animals.

However, opposite situations also occur. Sometimes people avoid expanding their moral concern to include pets and robots, and mistreat them (e.g., [2]). Imagine a future scenario where robots serve various roles in our daily lives. Robot abuse might be a serious societal problem. In a store, robot clerks might be abused and fail to maintain the stores; robot workers might be cheated by their human co-workers and fail to receive appropriate work efforts from their employees; when a robot asks a human for help, it might receive scorn or abuse. For such future scenarios, we expect people to offer a minimal level of prosocial behaviors, not necessarily a great level of morality, instead of harm.

We expect diverse moral relationships between individuals and robots, depending on such factors as personality, robot appearance and behaviors, and interaction contexts. In some contexts, we want to elicit more moral concerns to improve a robot's treatment. In other contexts, we might want to decrease our moral concern so that users can easily manipulate robots as tools without being bothered by their well-being.

Here the fundamental research question is how to measure moral concern for robots. Our research establishes a self-report measurement for this concept, i.e., moral concern for robots. HRI empirical studies commonly use scales (self-report questionnaires). This paper reports the development of a scale for the moral concern for a robot called Moral Concern for Robots Scale (MCRS).

The research was supported by JST CREST, Japan.

II. SCALE DEVELOPMENT

To collect item pool for MCRS, we adopted nine items from the interview protocol in Kahn et al. [3] which asks about moral concern for the disposal/destruction and forced labor of robots, two items from the Feelings toward Nature Scale [4] which asks whether people feel negative emotions if nature is destroyed, and five items from the Thoughtfulness toward Friends Scale [5] which asks about prosocial behaviors toward friends. Moreover, we created four items that mention humans' moral treatment and account for robots based on the language in the instructions and definitions of the Moral Expansiveness Scale [6], and eight items based on scenes of possible robot abuse. Finally, we prepared 28 candidate items for our prototype MCRS version.

Then, we conducted a questionnaire-based survey with 121 Japanese university students (males: 66; females: 55; mean age: 20.1 (*SD* = 1.6)). In the survey, to provide a context for the answer targets, we first presented a scene where a robot worked in a city. Then we administrated a questionnaire, i.e., a prototype version of MCRS that consists of the above 28 questionnaire items. Each item was evaluated by a 7-point Likert scale (1: strongly disagree, to 7: strongly agree).

We analyzed the collected data by conducting an exploratory factor analysis using principal component analysis and Promax rotation. A two-factor structure was decided based on a scree-plot and item consistency. Two subscales (factors), consisting of 21 items (first factor: 12 items; second factor: 9 items), were extracted based on factor loadings, the contents of the items, and the item analysis results in each subscale, which consisted of I-T correlation coefficients and α-coefficients. The cumulative contribution ratio of these two factors on the data was 47.3%, which is enough coverage. The Cronbach's α-coefficients for each subscale were .912 and .876, which indicate good internal consistency.

The first subscale, which is called the basic moral concern, consists of items that ask whether people have general moral concerns for robots (e.g., when they should be destroyed or suffer physical harm) and whether people spend their resources to provide better welfare for them (e.g., helping them and

TABLE I. PEARSON'S CORRELATION COEFFICIENTS BETWEEN MCRS AND OTHER SCALES

	Moral expansiveness	Altruism	Egoism	Sadism	Negative attitudes toward robots	Mental state	Social partner
Subscale I Basic moral concern	.229**	.207**	-.109	-.139*	-.147*	.707**	.742**
Subscale II Concern for psychological harm	.134	-.029	-.358**	-.375**	-.276**	.361**	.256**

(*p < .05, **p < .01)

TABLE II. RESULTS OF LINEAR REGRESSION ANALYSIS FOR PROSOCIAL BEHAVIORS TOWARD THE ROBOT IN THE HYPOTHESIZED SITUATION (R^2 = .375)

Independent variable	β	p
Perception as a social partner	.270	< .001
Egoism	-.163	.008
Altruism	.202	.001
Negative attitudes toward robots	-.107	.072
Moral concern for the robot	.277	< .001

providing better treatment). The second subscale, which is called concern for psychological harm, specifically asks about scenarios where the robot suffers from such possible psychological harm as uncomfortable situations, neglect, and coercion.

III. SCALE VALIDATION

We conducted a survey in which two hundred Japanese participants (20 males and 20 females each from 20's, 30's, 40's, 50's, and 60's) filled out questionnaires about their personal traits (moral expansiveness [1], altruism [7], egoism [8], sadism [9], and negative attitudes toward robots [10]). In the survey, robots were presented with a scenario in which the robots were selling a cup of coffee on the street, a customer threw a cup of coffee at it and left without paying. Finally, for the specific robot that was described to them, participants filled out questionnaires about MCRS. Moreover, we measured their intention to conduct prosocial behavior by asking about different levels of prosocial behaviors using 3 questions (e.g., "I will approach the robot to see how it is doing,") on a seven-point scale (1: very low possibility, 7: very high possibility). In addition, we measured whether participants attributed mental states to the robot (3 items) and whether participants treated this robot as a social partner (5 items) from Kahn et al. [3].

Cronbach's α-coefficients of the MCRS subscales were .921 and .873 for the basic moral concern and concern for psychological harm, respectively. As shown Table 1, the first subscale, basic moral concern, has a significant correlation with moral expansiveness and altruism and is negatively correlated with sadism. The second subscale, concern for psychological harm, has significant negative correlations with egoism and sadism. Table 2 shows the result of a linear regression analysis of which dependent variable was prosocial behavior and independent variables were the total score of MCRS, personal traits, and perception of the robot (mental state and social partner). The result showed that the score of MCRS predicted prosocial behavior in larger level than other variables.

IV. DISCUSSION

We only developed and validated the scale with Japanese participants and just tested with a limited variety of robots. Moreover, we expect to uncover considerable cultural differences about the degree to which people expand their moral concern for robots. Such cultural differences are a critical open question, and we believe that MCRS is a useful research tool to understand such cultural differences.

REFERENCES

[1] P. Singer, The Expanding Circle: Ethics and Sociobiology, Oxford: Oxford University Press, 1983.

[2] T. Nomura, T. Kanda, H. Kidokoro, Y. Suehiro and S. Yamada, Why Do Children Abuse Robots?, Interaction Studies, vol. 17, pp. 347-369, 2016.

[3] P. H. Kahn Jr, et al., "Robovie, You'll Have to Go into the Closet Now": Children's Social and Moral Relationships with a Humanoid Robot, Developmental Psychology, vol. 48, p. 303, 2012..

[4] S. Shibata, Development of the Feelings toward Nature Scale and Relationship between Feelings toward Nature and Proximity to Nature, Shinrigaku kenkyu: The Japanese journal of psychology, vol. 87, pp. 50-59, 2016..

[5] F. Mitsuno, Concerns in University Students' Friendships: Determinants and Influences Regarding Prosocial and Inhibitory Concerns, Kazama-Shobo, 2015.

[6] D. Crimston, P. G. Bain, M. J. Hornsey and B. Bastian, Moral Expansiveness: Examining Variability in the Extension of the Moral World, Journal of Personality and Social Psychology, vol. 111, p. 636, 2016.

[7] J. P. Rushton, R. D. Chrisjohn and G. C. Fekken, The Altruistic Personality and the Self-Report Altruism Scale, Personality and individual differences, vol. 2, pp. 293-302, 1981.

[8] R. H. Weigel, D. J. Hessing and H. Elffers, Egoism: Concept, Measurement and Implications for Deviance, Psychology, Crime and Law, vol. 5, pp. 349-378, 1999.

[9] R. A. Plouffe, D. H. Saklofske and M. M. Smith, The Assessment of Sadistic Personality: Preliminary Psychometric Evidence for a New Measure, Personality and individual differences, vol. 104, pp. 166-171, 2017.

[10] T. Nomura, T. Suzuki, T. Kanda and K. Kato, Measurement of Negative Attitudes toward Robots, Interaction Studies, vol. 7, pp. 437-454, 2006.