Examining the Frankenstein Syndrome

An Open-ended Cross-Cultural Survery

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Abstract. This paper reports findings from an open-ended survey on attitudes towards humanoid robots collected from samples in the United Kingdom and Japan. 335 participants were asked how they felt about humanoid robots becoming widespread in society and what tasks they wanted humanoid robots to perform. While the UK sample was overall less negative towards humanoid robots than their Japanese counterparts, the UK sample did not want robots to perform tasks that required capabilities deemed as human qualities, such as empathy, caring, or independent decision making.

Keywords. Survey, Humanoid Robots, Attitudes

1 Introduction

1.1 Kaplan and the Frankenstein Syndrome

The differences between Western and Japanese attitudes and responses towards technologies have been a subject of fascination across different fields of research. Kaplan [1] argues that much of the work considering such differences have taken as the base-line that the Japanese have a greater fascination with these technologies, than their western counterparts. Kaplan, however, makes the argument that this is not necessarily the case. According to Kaplan, acts of technological creation and the use of technological creations are seen as very important in defining the identity of both creator and user in Western Cultures. As such, the role of technology in the West is fraught with many taboos. One of these taboos can be described as a Frankenstein Syndrome, wherein the creation of an artifact that is a convergence between humanity and technology is an act of potential transgression in and of itself. Many Western narratives deal with the implications of such transgressions. Mary Shelley's novel [2], may be the most iconic, but this narrative is repeated in almost every single narrative that deals with robots. From Blade Runner [3] to the recent children's movie Wall-E [4], the creation of artificial beings is seen as problematic, with potentially disastrous consequences. Japan, however, Kaplan goes on to argue, has no such strong taboos

regarding such technologies, they do not occupy a special position and thus their creation and use are only subject to the same rules governing general conduct within society. An example of this line of thinking would be Masahiro Mori's argument in the Buddha in the Robot [5] that the robot and its operator are both acting within the same moral framework.

1.2 Cross-Cultural Differences in HRI

That differences exist between Japan and the West has, of course, been considered within the field of HRI. Attempts at exploring and quantifying these differences have been numerous [6-9]. Overall, these studies have challenged the popular belief that the Japanese are more positive towards robots than people in the West. A series of studies using the Negative Attitudes towards Robots Scale (NARS [10]) as a measure for attitudes towards robots, were performed by Bartneck et al. [6-7]. The NARS was a scale developed using a method derived from Allport's Lexical Hypothesis [11], where open-ended responses from surveys where categorized and turned into questionnaire items, responses to which were then subjected to factor analysis within large Japanese samples. When this test, along with translations, was administered to samples of different cultures, Japanese samples did not score significantly more positively than Dutch or American samples, and in fact scored more negatively than Western samples on some dimensions. Syrdal et al. [12] drew attention to the possibility of cultural specificity of the NARS and similar scales constructed using this method, suggesting that even if appropriately translated, the NARS may still rely on culturally specific constructs, leading to results not being comparable across cultures. A similar issue was highlighted by MacDorman [9], who found that different measures for attitudes and responses to robots yield different results in terms of cultural differences.

1.3 Towards a tool for Cross-cultural investigation of the Frankenstein Syndrome

Due to these factors, it is reasonable to suggest that tools to study the specific interactions of culture on attitudes towards humanoid robots, need to be developed cross-culturally, from their inception to their deployment. Using the lexical hypothesis as base, this paper describes the initial stage of data-collection from open-ended questionnaires to a large number of participants in both the United Kingdom and Japan.

2 Methodology

2.1 **Questionnaire Design**.

A questionnaire was created for this study, consisting of 3 questions apart from demographics. The questions were open-ended in order to get as wide a range of res-

ponses as possible from the participants. Apart from demographic details, the questions were as follows:

Q1. How do you feel about humanoid robots becoming widespread in society?
Q2. What sort of activities do you think humanoid robots should perform in society, what sort activities do you think they should not perform?
Q3. Where do your impressions of humanoid robots come from?

2.2 Data Collection

The Japanese student sample was collected through students voluntarily participating in the survey conducted at the end of their lectures. The non-student sample was collected using postal mailings to request responses from the employees of different companies. The UK sample was collected via snowball-sampling where participants who participated in other HRI experiments and filled out the survey, volunteered to give out the questionnaires to their acquaintances, colleagues, affinity groups and classmates, allowing for exposure to a more diverse population than direct recruitment would have.

2.3 Coding Scheme

A data-driven coding scheme was created and is presented below with two examples from each class for Q1 and Q2.

Q1 Positive

0 – No Positive Sentiment

1 – Expectation of specific benefits, future possibilities

"I think that they can be quite useful."

"I think I would like to have a robot to help me in the home. It could be fun to talk to."

2 – Other positive, including general positive sentiment

"It sounds promising."

"I would be happy to see it happen."

Q1 Negative

0 – No Negative Sentiment

1 – Negative changes to human mental and social processes (laziness, unemployment, meaning of humanity).

"I am afraid that their presence will encourage less human interaction and make our world more technical - less natural."

"We have managed ok so far, - it would just make us more lazy."

2 – Other negative, including physical risks and maintenance costs and simple negative expression

"Scares the life out of me!"

"Would want assurances about controllers/ maintenance people being on hand at all times to fix any problems."

Q2 – Tasks to perform

1 – Substitution for tasks that humans currently perform, assistive tasks.

"Caring for the disabled, housework."

"Factories, Menial Jobs."

2 – Tasks that are difficult for humans to perform such as space exploration, or to hazardous for humans.

"Aid in more dangerous tasks such as firefighting, bomb disposal, or even representing a human in hostile conditions (humans being behind scenes)"

"Military"

Q2 – Tasks not to perform

1 – Tasks requiring humanity – caring, emotional support, decision making, education, medicine.

"Anything requiring empathy, compassion, thoughtfulness, discretion, lateral thinking, 'people skills'"

"Responsible jobs, decision making,"

2 – Other, including anti-social behavior and military robotics.

"Murder, crime"

"War, weapons"

Q3 – Sources

1 – Fictional Sources: TV-dramas, Films, Comics, Science Fiction Books

2 – Actual Source: Documentaries, Science Magazines, Academic Publications, News media

3 – Both Fictional and Actual Sources

4 – Non-classifiable.

The coding scheme was tested for reliability using inter-coder reliability measures. The results are presented in Table 1 and suggest that the scheme was reliable for this data.

Table 1. Coding Scheme

Questions	Code	Cohen's Kappa
Q1	**Positive**	**.859(36)**
0	No Positive	
1	Expectation of specific benefits, future possibilities	
2	Other, including general positive sentiment	
Q1	**Negative**	**.734(44)**
0	No negative sentiment	
1	Negative changes to human mental and social processes (laziness, unemployment, meaning of humanity)	
2	Others, including physical risks and maintenance costs	
Q2-Tasks	**Positive**	**.860(45)**
1	Substitution for human tasks, including assistive roles	
2	Others, including tasks that are hazardous for humans	
Q2 –Tasks	**Negative**	**.670(36)**
1	Tasks requiring human-like qualities, decision making, caring, education, medicine.	

	2 Others, including anti-social, criminal and military tasks.	
Q3	**Sources**	**.816(39)**
	1 Fictional sources, films, magazines, TV dramas	
	2 Real sources, science books, TV news, actual experiences of robots	
	3 Both 1 and 2	
	4 Non-classifiable, eg just 'TV'	

3 Results

3.1 Demographics:

The two samples were compared for systematic differences in terms of demographic characteristics. There were no significant differences between the two samples in terms of gender ($\chi^2(1)=.908, p>.34$). Examination of Table 2 suggests that there were no salient residuals, implying that the samples were equivalent in terms of gender.

Table 2. Gender Distribution

Sample	**Measure**	**Gender**		**Total**
UK		**Female**	**Male**	
	Count	77	53	130
	% Within Sample	59.2	40.8	100
	Std. Residual	.5	-.6	
Japan		**Male**	**Female**	
	Count	110	94	204
	%Within Sample	53.9	46.1	100
	Std. Residual	-.4	.4	
Total		**1**	**2**	
	Count	187	147	334
	%Within Sample	56.1	44	100

As for age, the mean age in the UK sample was 29.5 years while it was 24.1 in the Japanese sample. This difference was significant ($t(331)=4.77$, $p<.001$), and as such, one could not discount age as a systematic difference between the samples. Also, there were significant deviations from expected counts between the samples ($\chi^2(1)=7.07$, $p<.01$) in terms of number of students. The salient residuals presented in Table 3 suggest that the UK sample had more non-students than the Japanese sample.

3.2 Independence Measures.

Due to systematic differences between the samples in terms of age and student proportion, tests between the relationships between population characteristics and responses were run. The relationship between age and responses were assessed using

a series of one-way ANOVAs, the results are presented in Table 4. Age and Responses. The results suggest that age did not have a systematic effect on the responses across the two samples.

Table 3. Proportion of Students within the Samples

Sample	**Measure**			**Total**
UK		**Non-students**	**Students**	
	Count	53	77	130
	% Within Sample	40.8	59.2	100
	Std. Residual	1.7	-1.2	
Japan		**Non-students**	**Students**	
	Count	55	150	205
	% Within Sample	26.8	73.2	100
	Std. Residual	-1.4	.9	
Total		**1**	**2**	
	Count	108	227	335
	% Within Sample	32.2	67.8	100

Table 4. Age and Responses

Sample	**Measure**				
UK		**F**	**df**	**P**	η^2
	Positive Sentiment	.329	2(126)	.72	.005
	Negative Sentiment	.643	2(126)	.53	.010
	Task to perform	.801	1(120)	.37	.007
	Task not to perform	.299	1(104)	.59	.003
Japan		**F**	**df**	**P**	η^2
	Positive Sent	.076	2(197)	.93	.001
	Negative	.969	2(197)	.38	.010
	Task to perform	.208	1(184)	.65	.001
	Task not to perform	.098	1(96)	.76	.001

A series of cross-tabulation analyses were performed in order to examine the impact of students within each sample. The results are presented in Table 5 and suggest that systematic variation between the samples would not be caused by the different proportions of students in the samples.

3.3 Cultural Comparisons

General Sentiments

There was significant deviation from expected counts between the samples ($\chi^2(2)=19.54, p<.001$) in terms of positive sentiments. Examination of residuals in

Table 6 suggest that participants in the UK referenced specific benefits (Code 1) to a lesser degree, and tended to reference more general feelings than the Japanese sample.

Table 5. Students vs non-students in responses

Sample	Measure				
UK		χ^2	**df**	**P**	**φ**
	Positive Sent	1.22	2	.54	.097
	Negative	1.41	2	.49	.104
	Task to perform	.084	1	.72	.026
	Task not to perform	2.59	1	.11	.156
Japan		χ^2	**df**	**P**	**φ**
	Positive Sent	1.61	2	.45	.089
	Negative	3.34	2	.19	.129
	Task to perform	.52	1	.47	.052
	Task not to perform	.15	1	.7	.039

Table 6. Positive Sentiments Towards Humanoid Robots according to Sample.

Sample	Measure	Code			Total
UK		**0**	**1**	**2**	
	Count	60	35	35	130
	% Within Sample	46.2	26.9	22.8	100
	Std. Residual	.5	-2.2	2.6	
Japan		**0**	**1**	**2**	
	Count	83	95	23	201
	% Within Sample	41.3	47.3	11.4	100
	Std. Residual	-.4	1.8	-2.1	
Total		**0**	**1**	**2**	
	Count	143	130	58	331
	% Within Sample	43.2	39.3	17.5	100

There was significant deviation from expected counts between the samples ($\chi^2(2)=27.55, p<.001$) for negative sentiments. Examination of the residuals in Table 7 suggest that participants from the UK sample were more likely to not reference negative sentiments (Code 0) than participants from the Japan sample at all. Also, participants from the UK sample were less likely to reference emotional and social issues (Code 1) than participants from the Japanese sample.

Tasks Envisaged for the robot.

There was no significant deviation between the samples in terms of what type of tasks the robot should perform ($\chi^2(1)=2.37, p>.1$). There were, however, significant deviations from expected counts between the samples($\chi^2(2)=18.56, p<.001$) in terms of tasks not to perform. Examination of the residuals in Table 8 suggest that participants from the UK referenced tasks requiring human-like qualities (Code 1) to a much larger extent than participants from the Japanese sample, while participants from the Jap-

anese sample were more concerned with other aspects such as anti-social activities (Code 2).

Table 7. Negative Sentiments towards Humanoid Robots

Sample	Measure		Code		Total
UK		**0**	**1**	**2**	
	Count	67	17	46	130
	%Within Sample	51.5	13.1	35.4	100
	Std. Residual	2.5	-3.2	.3	
Japan		**0**	**1**	**2**	
	Count	59	76	66	201
	%Within Sample	29.4	37.8	32.8	100
	Std. Residual	-2.0	2.6	-.3	
Total		**0**	**1**	**2**	
	Count	126	93	112	331
	%Within Sample	38.1	28.1	33.8	100

Table 8. Activities not to perform

Sample	Measure	Code		Total
UK		**1**	**2**	
	Count	75	31	106
	%Within Sample	70.8	29.2	100
	Std. Residual	2.0	-2.2	
Japan		**1**	**2**	
	Count	40	58	98
	%Within Sample	40.8	59.2	100
	Std. Residual	-2.1	2.3	
Total		**1**	**2**	
	Count	115	89	331
	%Within Sample	56.4	43.6	100

Sources of information.

There was significant deviation from expected counts between the samples ($\chi^2(3)=16.98, p<.001$). Examination of the residuals in Table 9 suggest that participants from the UK referenced getting information from both virtual and real sources (Code 3) to a much larger extent than participants from the Japanese sample.

3.4 Summary of results

The general sentiment shows that participants from the UK sample were less likely to volunteer negative sentiment towards humanoid robots than in the Japanese sample. In terms of positive statements, the Japanese sample contained more statements regarding specific benefits that adoption of humanoids robots could provide. In terms

of tasks that robots should not perform, the UK sample focuses on tasks that require "human-like" qualities, while the Japanese sample is more concerned with other things such as crime or war.

Table 9. Sources of information

Sample	Measure	Code				Total
UK		**1**	**2**	**3**	**4**	
	Count	71	8	38	8	
	%Within Sample	56.8	6.4	30.4	6.4	100
	Std. Residual	-.9	-1.0	2.8	-.6	
Japan		**1**	**2**	**3**	**4**	
	Count	121	20	21	16	178
	% Within Sample	68	11.2	11.8	9	100
	Std. Residual	.8	.9	-2.3	.5	
Total		**1**	**2**	**3**	**4**	
	Count	192	28	59	24	303
	% Within Sample	63.4	9.2	19.5	7.9	100

4 Discussion

The above results suggest that cultural differences do exist between a UK and a Japanese sample in terms of attitudes towards humanoid robots. Interestingly, these findings suggest that the Japanese sample was more likely to volunteer negative sentiments towards humanoid robots than the UK sample. The focus on emotional and social issues in the Japanese sample when expressing such negative sentiments is at odds with what one would expect from Kaplan's thesis on the Frankenstein Syndrome as a primarily Western concept.

This is in contrast to the results for tasks that participants would not want the robot to perform, where the UK sample's preferences suggested this population either believed that humanoid robots could, or should, not perform tasks that required characteristics considered exclusive to humans; while the Japanese sample considered the role of humanoid robots as an extension of the general rules of society and warned against them being used in crimes or for violence.

5 Conclusions and Future Work

While there are clear cultural differences between the samples in terms of attitudes towards humanoid robots, these differences are complex and not clear-cut along a single dimension. We are currently preparing a new questionnaire, drawing on responses from both the UK and Japanese sample, which will allow for a rigorous quantitative exploration of these differences along several dimensions. The end result of this work will be a valuable tool for researchers investigating responses to robots across cultures.

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7 References

[1] F. Kaplan, "Who is afraid of the humanoid? Investigating cultural differences in the acceptance of robots," *International Journal of Humanoid Robotics*, vol. 2004, p. 1–16, 2004.

[2] M. Shelley, *Frankenstein, or, The modern Prometheus*, Rev. ed. London ;;New York: Penguin Books, 2003.

[3] R. Scott, *Blade Runner*. Warner Bros, 1982.

[4] A. Stanton, *Wall-E*. Pixar-Disney, 2008.

[5] M. Mori, *The Buddha in the robot*, 1st ed. Tokyo: Kosei Pub. Co., 1981.

[6] C. (Christoph) Bartneck, T. Nomura, T. (Takayuki) Kanda, T. Suzuki, and K. Kensuke, "Cultural differences in attitudes towards robots," in *Proceedings of the AISB convention : symposium on robot companions : hard problems and open challenges in human-robot interaction, April, 2005, University of Hertfordshire, Hatfield*, 2005.

[7] C. Bartneck, T. Nomura, T. Kanda, T. Suzuki, and K. Kennsuke, "A cross-cultural study on attitudes towards robots.," *Proceedings of the HCI International 2005, Las Vegas.*, 2005.

[8] C. Bartneck, T. Suzuki, T. Kanda, and T. Nomura, "The influence of people's culture and prior experiences with Aibo on their attitude towards robots," *AI & SOCIETY*, vol. 21, no. 1-2, pp. 217-230, 2006.

[9] K. F. MacDorman, S. K. Vasudevan, and C.-C. Ho, "Does Japan really have robot mania? Comparing attitudes by implicit and explicit measures," *AI & SOCIETY*, vol. 23, no. 4, pp. 485-510, 2008.

[10] T. Nomura, T. Kanda, T. Suzuki, and K. Kato, "Psychology in Human-Robot Communication: An Attempt through Investigation of Negative Attitudes and Anxiety toward Robots," *Proc. 2004 IEEE International Workshop on Robot and Human Interactive Interactive Communication, Kurashiki, Okayama Japan, September 20-22, 2004*, pp. 35-40, 2004.

[11] G. W. Allport, "Traits revisited.," *American Psychologist*, vol. 21, no. 1, pp. 1-10, 1966.

[12] D. S. Syrdal, K. Dautenhahn, K. L. Koay, and M. L. Walters, "The negative attitudes towards robots scale andreactions to robot behaviour in a live human-robotinteraction study.," in *Proc. of the AISB Symposium on New Frontiers in Human-Robot Interaction.*, 2009.