Furhat Travelling the World: How Cultural Background Predicts Preference of Receiving Feedback from Social Robots

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ABSTRACT
This aim of this research paper is to investigate in what instances people prefer feedback provided by social robots considering different cultural backgrounds. This study examines the role of Hofstede's cultural dimensions in receiving feedback from social robots as there is a lot of potential in effective time-utilization. The social robot that was used for this study is Furhat from Furhat Robotics provided by the BMS Lab of the University of Twente. Data was collected from surveys after participants (N=64) received feedback from the social robot on a task they had performed in front of Furhat. The aim of this study was to investigate in what instances people prefer feedback provided by social robots considering two of Hofstede's cultural dimensions, Uncertainty Avoidance Index (UAI) and Long-Term Orientation (LTO). This study shows a significant positive relation between both UAI and LTO on people's attitude towards receiving feedback from the social robot Furhat. This observatory research delivered some interesting findings and can be used as a starting point for future research on attitudes towards receiving feedback from social robots. Future research will likely hold important implications on what factors are important in the acceptance of feedback from social robots.

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Human-Robot Interaction (HRI), feedback, social robots, cultural dimensions, attitudes

1. INTRODUCTION

We live in a time in which we are continuously moving to a more technology-based world. People who have access to a mobile phone are usually also dependent on their mobile phone to work, entertain and/or be entertained and communicate with others. Technology is playing a more significant and crucial role in our lives every day and we can only imagine what the future holds as the possibilities seem endless. In today's world we use artificial intelligence (AI) to perform surgeries (Vatandoost & Litkouhi, 2019), to tutor children in primary schools (Kanero, et al., 2018) and to develop social robots to deliver various kinds of services (Talvitie-Lamberg, Silvennoinen, Tyrväinen, Ala-Kitula, & Kuoremäki, 2018).

Duffy et al. (1999) describe a social robot as 'a physical entity embodied in a complex, dynamic, and social environment sufficiently empowered to behave in a manner conducive to its own goals and those of its community' (Duffy, Rooney, O'Hare, & O'Donoghue, 1999, p. 1) In other words, a social robot is an autonomous robot that can interact and communicate with humans and aid them in what it is designed to aid them with. Social robots have been on the rise and are increasingly implemented in different contexts. One of the most popular social robots is Furhat, the social robot that is 'as intuitive to interact with as interacting with another human' (Furhat Robotics, 2022). Furhat takes much pride in the ability of its product to impersonate many different characters and is able to be create life-like expressive characters like any other human. Social robots with their abilities to listen, speak and express emotions, are able to understand and respond to humans based on the circumstances and are able to adapt by experiencing real-life situations (Shourmasti, Colormo-Palacios, Holone, & Demi, 2021). Therefore, I believe that social robots, like Furhat, could be able to provide feedback to humans. The delivery of feedback plays a significant role in the feedback process (Pelgrim, Kramer, Mokkink, & van der Vleuten, 2012). Thus it is important to understand the effect of feedback delivered from a social robot. One aspect of effective feedback communication is cultural barriers. Communication requires a receiver and giver. Regarding this, it is important to understand and accept another person's cultural norms and values when communicating in order for the receiver to accept and utilizes the feedback optimally. Today, it is questionable whether a social robot is capable of these considerations.

This aim of this research paper is to investigate in what instances people prefer feedback provided by social robots considering different cultural backgrounds. This paper will consider Hofstede's cultural dimensions because Hofstede has developed a model that provides information on differences between countries' cultural norms and values and how to manage these differences. This paper will consider two of five of Hofstede's cultural dimensions: the Uncertainty Avoidance Index (from here on referred to as UAI) and Long-Term Orientation versus Short Term Orientation (from here on referred to as LTO). For this research, the UAI was used based on the assumption that societies that score high on UAI are less likely to be open to deal with unknown situations and have lower tolerance for risk-taking. This could mean that they would be less open to receive feedback from social robots. This will be elaborated in the theory section. Furthermore, the choice for LTO assumes that societies that score low on LTO will be less open to unknown experiences with social robots as these societies tend honour traditional norms and values which could mean that they are less willing to receive feedback from social robots as well.

Therefore, the research questions the paper will answer is: *'To what extent does cultural background influence the preference of people to receive feedback from social robots?*' In this case, 'prefer' will refer to the willingness/attitude to accept the feedback provided by social robots and function as the dependent variable. In this study we will examine in what way the cultural background of a person will influence the willingness to accept the feedback by social robots by using Hofstede's cultural dimensions. In order to do so, we will analyse the individual scores on these dimensions considering the personality of the participant as well.

2. THEORETICAL BACKGROUND

2.1 Social robots

Key concepts: Human- robot interaction (HRI)

Before we investigate in what cases people accept feedback from social robots, we have to establish an understanding of what a social robot is. Breazeal et al. (2016) describe a social robot as a robot that is designed to engage with humans in an interpersonal manner and act in human environments as partners rather than a tool that assists the human. A characteristic of social robots is that they communicate and coordinate their behaviour based on the behaviour of the human interacting with them verbally and non-verbally. Breazeal et al. (2016) state that people tend to anthropomorphize the robot to their own mental state (thoughts, desires, beliefs). This facilitates interaction and most importantly acceptance from the human (Breazeal, Dautenhahn, & Kanda, 2016). Simple characteristics of conversations between humans in daily life is difficult to implement in a social robot. Noticing non-verbal cues like poses, facial expressions and gestures is done effortlessly by most people and are aims for social robots to be able to replicate. Furhat Robotics has been able to develop a social robot that fulfils these needs. It allows for Furhat to imitate human behaviours and movement like blinking, raising an eyebrow or looking at another person in the room (Furhat Robotics, 2022).

Not only being able to imitate human behaviour, Furhat is also designed to react to users' facial expressions and engage in rapid turn-taking conversation to create a human-like setting (Furhat Robotics, 2022). Considering these capabilities, this social robot could have great practical potentials in regard of feedback giving. Furhat is not yet able to 'think' and generate answers that are not already programmed in, but this does not have to limit Furhat's capacity to give feedback. Pre-defining and designing a set of practicalities for Furhat should allow it to give effective feedback based on speech recognition. This could result in time-effective and cost-effective outcomes as one social robot could replace several simpler tasks of humans that can be programmed which would allow humans to focus on other tasks that are considered more complex. Tasks that require providing information performed by a secretary could be performed by Furhat. For example, giving directions in a building and give information on whether certain people or rooms are available are tasks that Furhat could take over. These functionalities of Furhat allow human personnel to focus their attention on more difficult tasks that require problem-solving thinking which Furhat is not capable of doing yet.

2.2 Attitude towards social robots

Before discussing how cultural backgrounds can influence once's preference of receiving feedback by social robots, we also need a common definition of what a preference entails. In the Cambridge dictionary, a preference is defined as "a greater interest in or desire for someone or something than someone or something else." If a person has a preference of something, that person has a certain predisposition to something. Attitudes are *"(a) a mental state—conscious or unconscious; (b) a value,*

belief, or feeling; and (c) a predisposition to behaviour or action." (Altmann, 2008) Therefore, a preference can be described as a person's attitude towards something or someone. A person's values and believes are heavily dependent on a person's cultural norms and values which influences a person's inherent preferences or, in other words, their attitudes towards something. The technology acceptance model(TAM) suggests that the success of the adoption of new technology is based on positive attitudes towards two factors: perceived usefulness and perceived ease of use. (Agarwal & Prasad, 1999) Positive attitudes towards a situation are more likely to result in a successful outcome than when approached with a negative attitude. (Achor, 2010) Based on this, we can assume that cultural backgrounds that approach innovative technologies like social robots more positively, will likely be more positive about the experience with the social robot and show more effort.

2.3 Giving feedback

Due to Furhat's limitations in assessing the performance and giving feedback based on the performance, the assessment of the performance of the experiment and the corresponding feedback will be predefined and programmed in the Furhat programming tool 'Blockly' beforehand. The score of the performance will be based on predefined criteria and the corresponding feedback will be delivered by Furhat. There are many verified models regarding feedback giving. In this paper, the Situation-Behaviour-Impact (SBI) model is used in order to develop the feedback (Weitzel, 2000). The choice for this model is mainly based on Furhat's limitations in generating feedback of choice for this feedback model is due to the lack of thinking skills Furhat has. Also, many other models require a discussion with the feedback provider and receiver to determine what the next course of action is. The aim for Furhat is to deliver the feedback and what possible actions could improve the participant's performance. Other models, like the Pendleton model, would require Furhat to engage in a discussion to develop a plan for improvement (Pendleton, 1984).

The SBI model requires the feedback to consist of three elements (Weitzel, 2000):

- *Situation*, the situation is explained so that the participant is aware of the context in which the situation occurred.

- *Behaviour*, the behaviour of the participant that you want to address is specified to the participant.

- *Impact*, the impact of the behaviour on you is explained to the participant.

Furhat will deliver the feedback in the structure mentioned above. Furhat will give a description of what the context and expectation of the experiment was, following with the behaviour the participant displayed and tell the participant how they did performing the experiment. This can be complemented with suggested alternative actions they could have done to improve their performance.

2.4 Hofstede's cultural dimensions

Geert Hofstede studied differences in culture across modern nations and identified five dimensions of cultural values (Hofstede, 1980)**.** As mentioned above, this paper is focussing on two of Hofstede's cultural dimensions, UAI and LTO. To get an understanding of these dimensions they are described below. The UAI and LTO cultural dimensions consist of the following:

- Uncertainty Avoidance Index (UAI), the UAI describes the extent that people are able to cope with uncertainty and anxiety from uncertainty. Societies that score high on UAI tend to be less open to open-ended decision making and require focus but not too much structure. On the contrary, societies that have a low UAI tend to favour having a sense of control and predictability to give an ease of mind. (Hofstede, 1980) (Patterson, Cowley, & Prasongsukarn, 2006)
- Long-term Orientation versus Short-term Orientation (LTO), societies that have a long-term perspective tend to value flexibility and persistence, while short-term societies value tradition and immediate gratification rather than long-term satisfaction. This is important to know for, e.g., managers when dealing with employees to strategize motivating incentives for their employees that align best with an employee's orientation. (Hofstede, 1980)

We will focus on these two dimensions because these dimensions are more coherent with the topic that is discussed, namely social robots. The first variable UAI will be researched because a social robot like Furhat is a relatively new concept and receiving feedback from a social robot is a new experience for many people and thus perceive uncertainty in this situation. Therefore, it is fair to say that there comes a lot of uncertainty when a person approaches a new situation with a social robot and engages in Human-Robot Interaction(HRI). Based on this knowledge, I want to test the following hypothesis:

H1: If a person is from a society that scores low on the Uncertainty Avoidance Index, that person is more likely to prefer feedback from a social robot.

The same thought process can be applied to the LTO dimension. Societies that score high on short term orientation and low on long term orientation tend to value traditional practices and the focus lies on the past to serve as a moral compass (Hofstede, 1980). This focus on old values and traditions might result in a hesitant attitude towards new experiences. On other hand, one could argue that societies that score high on LTO place emphasis on perseverance, persistence, and adaptability. Therefore, it would be fair to say that person from a high LTO scoring society is less hesitant to the new experiences which translates to a more positive attitude towards. Therefore, the second hypothesis that is tested is the following:

H2: If a person is from a society that scores low on the Long-Term Orientation, that person is more likely to prefer feedback from a social robot.

There could be cases in which the cultural background does not relate to an individual's preference. This could, for example, be caused by people's individual experiences. (Norman, 1963) Individual experiences could result in a person having a completely different score on the UAI and LTO dimensions than the society that person is originally from. For example, at home, a person can receive a very traditional upbringing while living in a society that is very modern. The upbringing may be significantly inspired by a low UAI scoring society while living in a high UAI society. Combined with an individual's personality, the relation can be affected to be made stronger, weaker, or non-existent.
Therefore, in order to provide more reliable research, the survey the participants will be filling in will consist of items to measure their individual level on UAI and LTO rather than scores of the participant's native country's level. This will be further explained in the 'method' section.

3. METHOD

3.1 Design

In order to determine how a person's cultural background influences their willingness to accept feedback from a social robot, an experiment was designed to allow for an interaction between a person and a social robot. A survey was constructed to measure the scores on the cultural dimensions UAI and LTO, the score on openness and the attitude towards receiving the feedback from the social robot. The reason of choice for experiments is to show whether there is a correlation between cultural background and the attitude. Cultural background is a nonmanipulable variable which means that an observational study is most appropriate for this research (Campbell, Cook, & Shadish, 2001).

The social robot used for the experiment was Furhat. Participants perform a task in front of Furhat after a short interaction with the robot. Participants either have to name all the ingredients from a lasagne recipe or give a one-minute pitch selling a red dish brush. After the performed task, the participant would receive feedback from Furhat based on their performance. Immediately after the interaction was finished, participants were asked to fill in the survey. The interaction was created with the built-in programming language 'Blockly.'

Due to some limitations, it was not possible to create an algorithm to such an extent that Furhat could assess the performance and generate the feedback. Therefore, the feedback was predetermined and coded in the Blockly environment with different pathways, so that the feedback was personalized for each participant. Prior to the experiment, the participant would be told that Furhat would be assessing the performance and give the feedback to simulate a genuine believe from the participant that the social robot was the one assessing the performance and giving the feedback. It would only be told that the feedback was pre-coded after the survey was filled in.

3.2 Sample

The study includes a single sample consisting of 64 participants. People were approached and invited to participate amongst friend groups, after lectures, and people available in the building of the experiment. As the main interest was the cultural background of the participants, other demographic factors like age, sex and occupation were not documented. However, due to the location of the experiment, most of the participants were students at the University of Twente aging from 17 to 28 years old. The experiments took place in the BMS Lab of the University of Twente.

Additionally, the BMS Lab of the University of Twente invited us to set up our experiment at the 'Stoervoer' food festival due to the nature of one of the tasks included in our experiment.

3.3 Measures

3.3.1 Variables for Cultural dimensions

The independent variables that are used in this research refer to the score on the cultural dimensions LTO and UAI that will be collected from surveys. In order to measure a participant's individual score on these dimensions, survey items from the CVSCALE survey will be used. (Donthu & Yoo, 1998) This scale has been determined to be adequately "reliable, valid and across-sample and across-national generalizable." (Kale, 2011) This scale has been successfully used to measure Hofstede's cultural dimensions on the individual level. (Donthu & Yoo, 1998) The choice for individual measurement of the cultural dimensions can be argued to increase external validity. Like mentioned before, one's attitude can be influenced my several factors including personal experiences which could influence an individual's score on the cultural dimensions. Therefore, the choice for an individual assessment seems more appropriate than the score of the society the participant has lived most of its life.

11 items have been used of the original CVSCALE. The cultural dimensions UAI and LTO were tested based on the 5 and 6 items, respectively. These items have been subjected to both a regression analysis and correlation analysis. Refer to appendix A for the exact wording of the items.

3.3.2 Variable for attitude

The dependent variable for attitude (in analysis referred to as preference) will be measured based on the survey items constructed by Agarwal and Prasad. (Agarwal & Prasad, 1999) In their efforts, they constructed a four-item scale to measure attitude based on conditions set by Azjen and Fishbein. (Ajzen & Fishbein, 1980) This article was used due to extensive testing of their model for goodness of fit including only items that satisfied their conditions. (Agarwal & Prasad, 1999) There are other models as well like the Negative Attitude Towards Robots Scale (NARS) (Syrdal, Dautenhan, Koay, & Walters, 2009) and General Attitude Towards Robots Scale (GAToRS). (Koverola M. , Kunnari, Laakasuo, & Sundvall, 2021)

The NARS model seems to be a reliable and valid model to measure attitudes towards social robots because it shows strong relationships with significant variance explained by the model. However, the article does suggest that it has pitfalls as "the number of participants was quite low due to resource constraints." (Syrdal, Dautenhan, Koay, & Walters, 2009)

The GAToRS model does have relatively large sample size which would make it more representable and score higher on validity. However, also this study shows potential risks due to the recency of this article. The model shows less significance that the model presented by Agarwal and Prasad. Furthermore, the study suggests that there still needs to be more peer-reviews before the model can deem to be a viable options to measure attitudes towards social robots. Therefore, this study also scores lower than the model presented by Agarwal and Prasad.

3.3.3 Openness to Experience

There could be cases in which the negative UAI-preference relation becomes weaker due to, e.g., a person's personality. Holzman describes a personality as *'a characteristic way of thinking, feeling, and behaving. Personality embraces moods, attitudes, and opinions and is most clearly expressed in interactions with other people.'* Therefore, certain personality traits can cause the relation to be weaker or stronger because these traits influence a person's attitude towards something.
The big five describe 5 personality traits that make up the overall personality of a person (John & Srivastava, 1995) (Norman, 1963). 'Openness to Experience' is a personality trait that indicates the open-mindedness of an individual (Norman, 1963). A person that scores high on 'openness to experience'(from here on referred to as openness) could make this relation weaker, while a person that scores low on openness will make the relation stronger. Thus, in order to conduct more reliable research, we will control for the effect of the personality trait 'openness' on relations described in H1 and H2.

3.3.4 Reliability

The data from the surveys was collected in Google Forms, exported to Microsoft Excel, and transferred to SPSS 26. The complete survey consisted of 25 5-point Likert items which was intended to measure the four variables. Before investigation the data, a reliability analysis was performed testing the items to their related variable, see table 3.1.

Table 3.1 Reliability Analysis

	Cronbach's Alpha	Cronbach's Alpha on standardized items	N
Long-Term Orientation (LTO)	0.571	0.577	6
Uncertainty Avoidance Index (UAI)	0.665	0.676	5
Preference	0.858	0.860	4
Openness-to-Experience (Openness)	0.570	0.644	10

Pallant (2002) states that Cronbach's Alpha values higher than 0.60 is considered as high reliability while anything below 0.60 is considered low. As seen in table 3.1, the values for the three variables are around 0.60 or slightly higher or lower with the value for the preference being the highest at 0.736. The reliability of variables 'Preference' and 'UAI' are therefore sufficiently reliable while the reliability of 'LTO' could be regarded as questionable.

3.4 External Validity

External validity is considered in the sense that personality traits can play a significant role in the relation of cultural background and preference like explained in the theory section. Therefore, each participant is required to fill in personality test in order to measure the influence of the 'openness' variable on this relationship. To measure this variable, survey items will be used from the 'Big Five Inventory'(BFI). The BFI is believed to be a valid and reliable 44-item survey to measure the big five personality traits due to consistent high alpha scores averaging above 0.80 as well as with peer ratings. (John & Srivastava, 1995)

4. RESULTS

The collected data from the survey was evaluated using SPSS 26. To see whether the cultural dimensions had any effect on the participant's attitude towards receiving feedback, each cultural dimensions was tested with a linear regression analysis. The items concerning each dimension was combined into a single independent variable.

4.1 Regression analysis

A regression analysis was performed for each of the variables in *H1* and *H2*, while controlling for openness, type of task performed, and the type of feedback received to investigate the causality. For the dependent variable, a table was produced containing the coefficients and p-values of the controlling variables for each of the independent variables, UAI and LTO.

4.1.1 Uncertainty Avoidance Index

Hypothesis 1 states that there is a negative relationship between the UAI variable and the preference variable. The regression analysis shows that there is a significant relationship between UAI and preference as the p-value (0.011) is smaller than alpha (0.05) However, unlike stated in hypothesis 1, the relationship appears to be a positive one ($\beta = 0.316$) as the coefficient for this regression is positive. Thus, hypothesis 1 is not supported.

Table 4.1 Regression Analysis UAI

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	3,575	,458		7,812	,000
	UncertaintyAvoidanceIndex	,316	,121	,315	2,609	,011

a. Dependent Variable: Preference

We control this relationship for openness to see whether the personality trait has a significant effect on the relationship. By doing a bivariate correlation analysis, we see that there is no significant correlation between UAI and openness (p=0.186), see table 4.2 Therefore, this model does not provide enough evidence to state that openness has a significant effect on the relationship described in hypothesis 3 and therefore not supporting hypothesis 3.

Table 4.2 Correlation Analysis UAI and 'openness'

Correlations

		Preference	OpennessToExperience	UncertaintyAvoidanceIndex
Preference	Pearson Correlation	1	,298*	,315*
	Sig. (2-tailed)		,017	,011
	N	64	64	64
OpennessToExperience	Pearson Correlation	,298*	1	,168
	Sig. (2-tailed)	,017		,186
	N	64	64	64
UncertaintyAvoidanceIndex	Pearson Correlation	,315*	,168	1
	Sig. (2-tailed)	,011	,186	
	N	64	64	64

*. Correlation is significant at the 0.05 level (2-tailed).

4.1.2 Long-Term Orientation

Hypothesis 2 states there is a positive relationship between the LTO variable and the preference variable. Again, a linear regression analysis was used to test this hypothesis. The results support the hypothesis as the p-value is smaller than alpha (p=0.045). The coefficient for LTO is positive ($\beta = 0.275$) which means that this model shows enough evidence to state that there is a positive relationship between LTO and preference.

Table 4.3 Regression Analysis LTO

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	3,735	,504		7,409	,000
	LongTermOrientation	,275	,135	,251	2,043	,045

a. Dependent Variable: Preference

Also, for this relationship we controlled for the personality trait openness. To do this, we again performed a bivariate correlation analysis in which we found that preference, LTO and openness all significantly correlated with each other, see table 4.4. We test LTO on openness and openness on preference and in both cases found a significant relationship, see tables 4.5 and 4.6, respectively. To evaluate whether openness is a confounding variable, a multiple regression analysis was performed. The results show that the relationship between LTO and preference becomes insignificant (p=0.165), see table 4.7. Therefore, there

is enough evidence to state that openness is a confounding variable. Hypothesis 4 states that a higher score on openness to experience would make the relation described in hypothesis 2 stronger. The data shows enough evidence to state that openness does have a significant impact on the relationship, but the relation becomes weaker rather than stronger.

Table 4.4 Correlation Analysis LTO and 'openness'

Correlations

		Preference	Openness ToExperience	LongTerm Orientation
Preference	Pearson Correlation	1	,298*	,251*
	Sig. (2-tailed)		,017	,045
	N	64	64	64
OpennessToExperience	Pearson Correlation	,298*	1	,303*
	Sig. (2-tailed)	,017		,015
	N	64	64	64
LongTermOrientation	Pearson Correlation	,251*	,303*	1
	Sig. (2-tailed)	,045	,015	
	N	64	64	64

*. Correlation is significant at the 0.05 level (2-tailed).

Table 4.5a Regression control variable 'openness' LTO

Coefficients[a]

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.
1	(Constant)	2,964	,358		8,269	,000
	LongTermOrientation	,239	,096	,303	2,500	,015

a. Dependent Variable: OpennessToExperience

Table 4.5b Regression control variable 'openness' on LTO

Coefficients[a]

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.
1	(Constant)	3,166	,650		4,870	,000
	OpennessToExperience	,413	,168	,298	2,457	,017

a. Dependent Variable: Preference

Table 4.5c Regression control variable 'openness' on LTO

Coefficients[a]

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.
1	(Constant)	2,732	,715		3,819	,000
	LongTermOrientation	,194	,138	,177	1,404	,165
	OpennessToExperience	,338	,175	,244	1,936	,058

a. Dependent Variable: Preference

4.2 Degree of positivity

Lastly, to see whether the degree of positivity of feedback enhances the preference, we test the 'type of feedback' (bad, good, very good) on preference. A linear regression analysis shows that this relationship is very insignificant as the p-value is 0.942, **see table 4.8**. Therefore, we can state there is not enough evidence to suggest that the degree of positivity affects the preference a person has towards receiving feedback from the social robot.

Table 4.8 Regression for control variable 'type of feedback'

Coefficients[a]

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.
1	(Constant)	4,738	,257		18,447	,000
	What was the feedback you received from Furhat?	,008	,103	,009	,074	,942

a. Dependent Variable: Preference

5. DISCUSSION, LIMITATIONS AND FUTURE RESEARCH

5.1 Discussion

In order to test the hypotheses and examine the relationships between once cultural background, based on the two dimensions Uncertainty Avoidance Index and Long-Term Orientation, and once's attitude towards receiving feedback from social robots, this study used observatory research where survey data was analysed. After the experiments, 64 participants filled in a survey which measured their score on the cultural dimensions, their score on openness to experience, and their attitude towards the received feedback from the Furhat robot. Correlation analyses have been conducted to test whether there is a relation between the variables while the regression analyses have been used to analyse possible relationships in more detail. With the use of the tools, we were able to test the abovementioned hypotheses.

Firstly, we found that a person's score on the uncertainty avoidance index has a statistically significant impact on the degree a person is willing to accept feedback from a social robot. However, our hypothesis (H1) states that this relationship would be negative as the concept of receiving feedback from a social robot is still relatively new ($\beta = .316$, $p = 0.011 < .05$, one-tailed). Due to these new situations created, a lot of uncertainty is bound to be present as this field still needs to be explored and developed. The analysis shows however that people that score rather high on UAI tend to prefer feedback from the social robot, and the higher a person scores on UAI, the more likely this person is willing to accept feedback from social robots.

The positive relationship could be explained by the potential reduction of uncertainty a social robot can offer. People may perceive the social robot to be a future instrument of delivering more consistent and reliable feedback once the social robots are more developed and capable of doing so. If the early stage of this instrument already allows it to do so much now, then who knows what capabilities the social robot will have in 10 years.

We controlled for 'openness to experience' for this relationship to see whether this could play a dominating role in the relationship, but the model shows that there is no significant correlation between UAI and OTE, and therefore this claim cannot be made. The adjusted R^2 of this relationship is approximately 8.5% which means that there are probably a lot of other factors explaining the positive relationship.

Secondly, the analysis did show support for the second hypothesis. Again, we found that a person's score on the 'long-term orientation' variable has a statistically significant impact on the degree a person is willing to accept feedback from a social robot. Our hypothesis was there would be a positive relationship between LTO and the attitude towards receiving feedback from the social robot and analysis supports this ($\beta = .275$, $p = 0.045 < .05$, one-tailed). The relationship is on the verge of not being

significant, but this can be explained by the relatively small number of participants that is advised for this kind of research.

Furthermore, also for this relationship we controlled for openness to experience. Surprisingly, the analysis showed that the relationship between LTO and preference becomes insignificant when the control variable is implemented in the regression. In this case, Openness appears to be a confounding variable showing a possible distorted relationship between LTO and preference. By performing a correlation analysis, we see a moderate correlation between openness and LTO and a weak correlation between openness and preference. This correlation between openness and LTO can potentially be explained by some overlapping characteristics of both entities. A characteristics of people who score high on LTO are willing and able to adapt. (Hofstede, 1980) People who score high on openness tend to be creative, adventurous, and open to unusual ideas. (Hofstede, 1980) These characteristics may complement and overlap each other and could therefore explain the correlation between the two variables. For future research, it would be wise to account for this confounding effect and try to minimise it.

5.2 Limitations and Future Research

This study has shown some interesting findings in the field of feedback-giving. Therefore, this study can be used as a base for future research.

Firstly, some of the limitations are the sample and sample size. A bigger sample size would improve the reliability of the study and in turn improve the chance of obtaining significant results. The time in which the experiments could be conducted was rather limited as the Furhat was also reserved by other students or reserved for conferences, events, etc.. The preferred sample size could not be attained and therefore results in a less reliable analysis. The process of data collection was planned across three weeks. Due to the small number of participants, we were able to make a final effort to increase this number by attending the Stoervoer festival with Furhat to conduct more experiments. Unfortunately, we experienced several internet connection difficulties which made it impossible to conduct our experiments, so we were not able to increase the sample size. Like mentioned before, most people that participated were students attending the University of Twente. This means that, even though the University of Twente has a broad and diverse set of students, most students that participated were people that spend most of their life in either the Netherlands or Germany which could prove to be a limitation of the generalizability of this study's findings. We considered this by using the CVSCALE to measure individual scores on the cultural dimensions because a lot of students have mixed backgrounds and some have spent most of their childhood abroad. However, a majority will have will have lived a considerable amount in Western Europe which leaves an opportunity for future research to broaden the sample to not only Western-European countries, but also involving people that have spent most of their life in different continents. On top of that, the age group of this study is around 17 to 30 years old which also leaves an opportunity for future research to see whether different age groups also yield the same results as found in this study.

Secondly, the result for hypothesis 1 allows for further exploration to discover why the relationship between UAI and the preference is actually positive rather than negative as was first believed. The adjusted R^2 suggests that there are more factors explaining the relationship which allows future research to use this study as a starting point.

Thirdly, due to the time period, we were unable to create an algorithm within Blockly to make the Furhat robot able to assess the performance of the participants and give personalized feedback based on the performance. Therefore, we programmed the interaction simulating a genuine feeling with the participant to ensure a more authentic answer when filling in the survey. We asked every participant after filling in the survey to what extent they felt the robot was actually the one giving the feedback. There were differences in the degree they felt the feedback was personalized for them, but every participant was surprised to hear that the feedback was actually predefined, and that the robot was actually used as an instrument to deliver the feedback rather than thinking of the feedback. This leaves room for future research to create an algorithm to an extent that the social robot is completely independent in the interaction. The structure of the algorithm in Blockly can be found in appendix C.

Finally, the evidence found the analysis to support hypothesis 2 has shown to have flaws due to the moderate correlation between LTO and OTE. Therefore, future research could focus on this relationship and investigate why this correlation exists and how each variable individually affects the attitude people have towards receiving feedback from social robots.

6. CONCLUSIONS

The aim of this study was to investigate in what instances people prefer feedback provided by social robots considering different cultural backgrounds. During this study, we did not particularly focus on a specific target group, but due to the logistical factors, mostly students from age group 17 to 30 years old participated in this study. This was done in order to answer the following research question: *'To what extent does cultural background influence the preference of people to receive feedback from social robots?*' This observatory research delivered some interesting findings and can be used as a starting point for future research on attitudes towards receiving feedback from social robots. This study encourages further exploration of this topic as social robots take an increasingly significant role in day-to-day life which will have to accommodate for the continuous globalization of the world.

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9. APPENDICES

9.1 Appendix A – Survey Items

Openness to Experience

1. Is original, comes up with new ideas
2. Is curious about many different things
3. Is ingenious, a deep thinker
4. Is inventive
5. Has an active imagination
6. Values artistic, aesthetic experiences
7. Prefers work that is routine
8. Likes to reflect, play with ideas
9. Has few artistic interests
10. Is sophisticated in art, music, or literature

Uncertainty Avoidance Index

1. It is important to have instructions spelled out in detail so that I always know what I'm expected to do.
2. It is important to closely follow instructions and procedures.
3. Rules and regulations are important because they inform me of what is expected of me.
4. Standardised work procedures are helpful.
5. Instructions for operations are important.

Long Term Orientation

1. Careful management of money
2. Going on resolutely in spite of opposition
3. How important is personal steadiness and stability in your life?
4. I plan for the long-term
5. Giving up today's fun for success in the future
6. Working hard for success in the future

Preference

1. I like using Furhat.
2. Furhat is fun to use.
3. I dislike using Furhat.
4. Furhat provides an attractive feedback.

9.2 Appendix B – SPSS OUTPUT

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation	Variance
UncertaintyAvoidanceIndex	64	2,40	5,00	3,7344	,54981	,302
LongTermOrientation	64	2,33	5,00	3,7135	,50524	,255
Preference	64	3,63	5,50	4,7559	,55296	,306
OpennessToExperience	64	3,10	5,00	3,8516	,39920	,159
What was the feedback you received from Furhat?	64	1	3	2,41	,684	,467
Valid N (listwise)	64					

9.2.1 Regression Analyses

9.2.1.1 Uncertainty Avoidance Index on attitude (Preference)

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	,315[a]	,099	,084	,52911	,099	6,808	1	62	,011

a. Predictors: (Constant), UncertaintyAvoidanceIndex

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1,906	1	1,906	6,808	,011[b]
	Residual	17,358	62	,280		
	Total	19,263	63			

a. Dependent Variable: Preference

b. Predictors: (Constant), UncertaintyAvoidanceIndex

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	3,575	,458		7,812	,000
	UncertaintyAvoidanceIndex	,316	,121	,315	2,609	,011

a. Dependent Variable: Preference

9.2.1.2 Long Term Orientation on Preference

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	,251[a]	,063	,048	,53954	,063	4,173	1	62	,045

a. Predictors: (Constant), LongTermOrientation

b. Dependent Variable: Preference

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1,215	1	1,215	4,173	,045[b]
	Residual	18,049	62	,291		
	Total	19,263	63			

a. Dependent Variable: Preference

b. Predictors: (Constant), LongTermOrientation

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	3,735	,504		7,409	,000
	LongTermOrientation	,275	,135	,251	2,043	,045

a. Dependent Variable: Preference

9.2.1.3 Type of feedback on preference

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	,009[a]	,000	-,016	,55738	,000	,005	1	62	,942

a. Predictors: (Constant), What was the feedback you received from Furhat?

b. Dependent Variable: Preference

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	,002	1	,002	,005	,942[b]
	Residual	19,262	62	,311		
	Total	19,263	63			

a. Dependent Variable: Preference

b. Predictors: (Constant), What was the feedback you received from Furhat?

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	4,738	,257		18,447	,000
	What was the feedback you received from Furhat?	,008	,103	,009	,074	,942

a. Dependent Variable: Preference

9.2.1.4 Regression Controlling for Openness to Experience

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	,342[a]	,117	,088	,52798	,117	4,052	2	61	,022

a. Predictors: (Constant), OpennessToExperience, LongTermOrientation

b. Dependent Variable: Preference

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	2,259	2	1,130	4,052	,022[b]
	Residual	17,004	61	,279		
	Total	19,263	63			

a. Dependent Variable: Preference

b. Predictors: (Constant), OpennessToExperience, LongTermOrientation

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	2,732	,715		3,819	,000
	LongTermOrientation	,194	,138	,177	1,404	,165
	OpennessToExperience	,338	,175	,244	1,936	,058

a. Dependent Variable: Preference

9.2.2 Correlation Analysis

Correlations

		Preference	OpennessToExperience	UncertaintyAvoidanceIndex
Preference	Pearson Correlation	1	,298*	,315*
	Sig. (2-tailed)		,017	,011
	N	64	64	64
OpennessToExperience	Pearson Correlation	,298*	1	,168
	Sig. (2-tailed)	,017		,186
	N	64	64	64
UncertaintyAvoidanceIndex	Pearson Correlation	,315*	,168	1
	Sig. (2-tailed)	,011	,186	
	N	64	64	64

*. Correlation is significant at the 0.05 level (2-tailed).

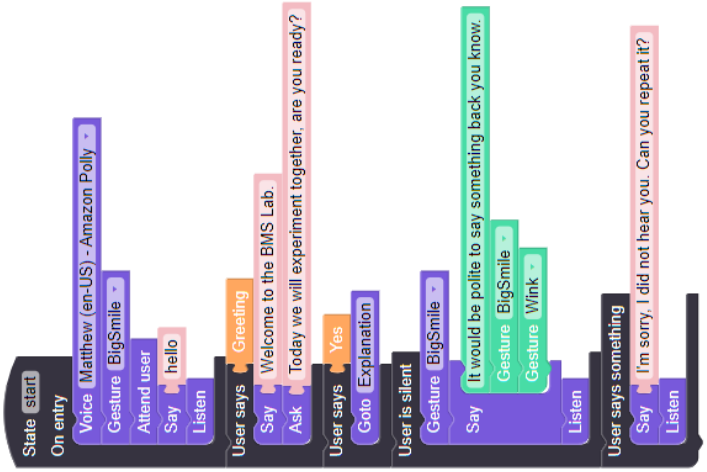
Correlations

		Preference	LongTermOrientation	OpennessToExperience
Preference	Pearson Correlation	1	,251*	,298*
	Sig. (2-tailed)		,045	,017
	N	64	64	64
LongTermOrientation	Pearson Correlation	,251*	1	,303*
	Sig. (2-tailed)	,045		,015
	N	64	64	64
OpennessToExperience	Pearson Correlation	,298*	,303*	1
	Sig. (2-tailed)	,017	,015	
	N	64	64	64

*. Correlation is significant at the 0.05 level (2-tailed).

9.3 Appendix C – Blockly Algorithm

9.3.1 Introduction



9.3.2 Task 1 – Identifying ingredients

9.3.3 *Task 2 – one-minute pitch*