

# **My Dear Robot – Anthropomorphism and Loneliness**



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## **Abstract**

Over the last years a more refined picture over the concept of anthropomorphism develop. Where before the focus lay primarily on the questions of where and to what extent anthropomorphism occurs, now a theory on the how emerged. The Three-Factor theory (Epley, Waytz, & Cacioppo, 2007) gives an underlying mechanism that could explain how anthropomorphism forms. In the context of the more and more relevant topic of human-robot interaction this study tries to shed more light onto how sociality motivation influences the anthropomorphisation of robots.

To answer this research questions it was tested if chronic loneliness and/or situational loneliness positively influence the anthropomorphisation of robots. Al 27 respondents had to rate 20 videos of different robots on a 'Perceived Humanness'. To assess the dispositional loneliness they were asked to fill out the 'UCLA Loneliness' scale. For the situational loneliness an experimental condition was implemented. The results were analysed through a correlation analysis and a Linear Mixed Model regression.

The results of this research could only partly support previous findings and the Three-Factor theory, as only the situational factor revealed a significant influence on the anthropomorphisation of robots. More research is needed to further confirm and evaluate this findings.

## **Samenvatting**

Over de laatste jaren is een steeds nauwkeurigere beeld over antropomorfisme ontstaan. Waar tevoren de focus op de vraag laag waar en hoe vaak antropomorfisme voorkomt, is nu een nieuw theorie over het hoe ontstaan. De Three-Factor theorie (Epley, Waytz, & Cacioppo, 2007) stelt een mechanisme die zou kunnen verklaren hoe zich antropomorfisme ontwikkeld. In de context of de actueel relevante onderwerp van human-robot interactie verzoekt dit onderzoek meer uit te vinden over hoe sociality motivation de antropomorfisme van robots beïnvloed.

Om de onderzoeksvraag te beantwoorden het word getest of chronic loneliness en/of situational loneliness een positieven invloed op de antropomorfisme van robots hebben. Alle 27 respondenten worden gevraagd 20 verschillende video's van robots op een 'Percived Humanness' scala te beoordelen. Om de dispositional loneliness te meten nemen wij de 'UCLA Loneliness' scala af. Om de situational loneliness te creëren was een experimentele conditie implementeert. De resultaten worden met een correlatie analyse en a Linear Mixed Model regressie analyseert.

De resultaten van dit onderzoek konden de uitvindingen van eerdere onderzoek en de Three-Factor theorie maar gedeeltelijk bevestigen. Alleen de situationele factor bleekt een significante invloed op de antropomorfisme van robots te hebben. Meer onderzoek is nodig om dit resultaten verder te bevestigen en te evalueren

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## **1. Introduction**

People have an affectionate relation to their mobiles and technical devices. The more we use mobiles laptops and the internet the more we depend on it and on our communication with it. To deal with all the technology that is around us we unconsciously tend to give those lifeless devices human features. This humanisation helps us to better predict, connect and handle agents around us. This process is not only limited on technical devices. People see pets as a member of the family, give hurricanes names and sexes, talk of Mother Nature or believe that gods look and act like humans. All those things are results of people attributing human features to non-human agents. This common phenomenon is called anthropomorphism.

To quote the Oxford Dictionary (Soanes & Stevenson, 2005) anthropomorphism is the “attribution of human characteristics or behaviour to a god, animal, or object”. The extent to which this very common phenomenon is occurring is well researched. Epley, Waytz, & Cacioppo, (2007) think that most of the existing research however do not see the underlying psychological mechanisms. They explain that mechanism by a Three-Factor theory. In the following we will have a look at the concept of anthropomorphism and investigate if this concept can be explained by the Three-Factor theory.

### **1.1. Anthropomorphism**

The word Anthropomorphism is derived from the greece word anthropos (άνθρωπος), which means human, and morphe (μορφή), which means shape. The word was first used by the Greek philosopher Xenophanes, who said that if lions and horses could paint they would show their gods as lions and horses, just as humans show their gods as humans. (Quoted from Guthrie, 93) This example is meant to lay out the egocentric representation we have from the world. We see things from our own point of view and interpret them only from that point. The use of the word interpretation here is an important one. Anthropomorphism means not only that we give something a human like shape – as the literal meaning of the word suggests-, but also attribute human properties to non-human agents. “The essence of anthropomorphism is therefore attributing capacities that people tend to think of as distinctly human to nonhuman agents”. (Waytz, Cacioppo, & Epley, 2010)

The phenomenon of anthropomorphism is widely researched. The existing literature goes from researches of anthropomorphisation of pets to cope with stress (Duvall Antonacopoulos & Pychyl, 2008), over theories on gods and religion (e.g. Barrett & Keil, 1996, Guthrie, 1993) to the implication of anthropomorphism on robotics (e.g. Sims et al., 2005; Złotowski, Strasser, & Bartneck, 2014). Especially the latter one arose more and more the interest of the scientific community over the last years. With the constant increase in technological gadgets that support the human existence, simultaneous the interest on how to perfect the interaction with them has risen. As for example Sims

et al. (2005) state, there are many beneficial aspects, if robots or other technological agents show affectionate behaviour. This behaviour has to be as natural as possible (Lester et al., 1997). It can even be improved if the technical agents are moving. As movement is generally perceived as a sign of life, people seem to feel more familiarity with a non-animated agent if it is moving. (Mori, 1970) All this research focuses on the “what” and the implications of anthropomorphism. It has been described as a common and chronic tendency of judging nonhuman agents that is taking place automatically (i.e.: Guthrie, 1993 and Mitchell, Thompson and Miles, 1997; cited in Epley et al. 2007). Epley et al (2007) tried to close that gap in the scientific canon by introducing a Three-Factor theory of anthropomorphism. This theory is meant to give further insight in the workings of anthropomorphism and explain also why we differ in the extent to which we anthropomorphise.

## 1.2. Three-Factor Theory

Epley et al (2007) presumed that “Anthropomorphism represents a process of inductive inference about nonhuman agents”. They established three psychological key determinants that should influence anthropomorphism. Those factors are *elicitation of agent knowledge*, *effectance motivation* and *sociality motivation*. They further determine important categories of independent variables that influence those determinants in everyday life. This categories are dispositional, situational, developmental, and cultural. For each of the determinants operational variables are proposed.

The determinant *elicitation of agent knowledge* describes the accessibility of knowledge over humans and the specific non-human agent. The more knowledge about the non-human agent is accessible the smaller the chance that human characteristics are applied. Epley et al. (2007) call this “a central feature of our theoretical account of anthropomorphism”. The other two determinants are not cognitive but motivational. The first one mentioned here is the *effectance motivation*. The idea is that people account a huge variety of non-human agents. To secure a successful and efficient interaction with them, people instinctively propose that those non-human agents act, think and feel like human ones. The last determinant is the *sociality motivation*. People are social beings. Social pain can even feel like actual physical pain. (MacDonald & Leary, 2005) Social deprivation can lead to a variety of negative effects from reduced wellbeing to serious mental and physical illness. (Baumeister & Leary, 1995) Thus are people highly motivated to ease feelings of social disconnection may they be temporarily or not. In the absence of other human, people establish connections with non-human agents to fulfil the need for social relation. This way they are using anthropomorphism as a coping strategy. The lonelier people get, the harder they try to solve this dissonance. Epley et al. (2007) state in their theory that this *sociality motivation* influences anthropomorphism in two different ways. First, people that are lonelier tend to have an easier access to social cues. As Pickett (2004) for example found out in a study consisting of 3 experiments that social disconnection heightens the sensitivities for social cues. Secondly sociality motivation has an indirect influence on anthropomorphism. Lonely people try actively to fill this gap in their needs. In a series of experiments Maner, DeWall,

Baumeister, & Schaller (2007) could prove that socially excluded people not only have a higher motivation to reconnect with people, but also search for new possible bonds. Thus, by creating a social connection to a non-human agent, where no human agent is available they try to compensate. The determinant *sociality motivation* is constructed out of the dispositional aspect chronic loneliness and the situational factor social disconnection. The theory says that people who are chronically lonely seek more intensely for social cues and connection and are thus more likely to use anthropomorphic representations. The effect of the situational variable is explained as “to anthropomorphize nonhuman agents, essentially creating humans out of nonhumans” (Epley et al, 2007; p.876) This phenomenon which manifests itself in for instance substituting human connection with connection to pets or religious agents is well documented.

### 1.3. Recent Studies

Different studies have shown the relevance of the theory. The creators of the Three-Factor theory conducted different studies on this topic. They could show that the sociability as well as the *effactance motivation* determinant can have influence on the extent to which people use anthropomorphic thinking (Epley, Akalis, Waytz, & Cacioppo, 2008; Epley, Waytz, et al., 2008). Another study transferred this findings to the fields of robotics. Eyssel & Reich (2013) could also show that *sociality motivation* is connected to anthropomorphism. In this experiment, people in the manipulative condition were asked to think back at a time where they felt lonely and write a letter about it. The control condition people were ask to describe their day. After that they had to asses a human-like robot called FloBi. The results of this study showed that people in the loneliness condition tended to a stronger anthropomorphisation of the robot than respondents in the control group. A research conducted at the University of Twente also took up the Three-Factor theory and tried to show the relation between “geekism” and anthropomorphism. They used two explanatory paths to create that connection. First the cognitive determinant of the Three-Factor theory and secondly the *effectance motivation* determinant. To test the degree of anthropomorphism, the respondents were shown 20 different videos that they had to rate through explicit measurement as well as implicit. In this research no proof for the Three-Factor theory could be found. (Schmettow & Echelmeyer, 2014) Creating a follow up research for this study with the focus at the sociality motivation has several intriguing aspects. For one, this way the previous research can be validated. Through using the method for testing another domain and variable we can make inferences about those. Moreover the context of adding further proof that Epley’s et al (2007) theory works in the fields of robotics give a broad variety of possible implication. The field of robotics and human-robot interaction has gotten more and more attention over the last few years. Anthropomorphism can be a key component to govern this relation.

*Anthropomorphism should not be seen as the “solution” to all human–machine inter- action problems but rather it needs to be researched more to provide the “language” of interaction between man*

*and machine. It can facilitate rather than constrain the interaction because it incorporates the underlying principles and expectations people use in social settings in order to fine-tune the social robot's interaction with humans.* (Duffy, 2003)

This statement has been proven in various researches. A good example of this is the study of Eyssel, Hegel, Horstmann, & Wagner (2010) which shows that people respond to robots better if they gave emotional feedback. The degree to which a non-human agent is anthropomorphised, seems to have a positive impact on the forming of a bond (Riek, Rabinowitch, Chakrabarti, & Robinson, 2009) and helps learning to handle the device (Epley et al., 2007)

#### **1.4. Hypotheses**

Based on the literature analysis and the assumptions that were made, a research question and two hypotheses were constructed. The main goal of this research is to analyse the influence of *sociality motivation* on Anthropomorphism. We expect a positive influence. The Three-Factor theory predicts this as well as the previous studies to this topic. Furthermore it was important to reflect this in the hypotheses that we tested in the specific domain of robotics. The research question this paper tries to answer is:

Has *sociality motivation* a positive influence on the anthropomorphisation of robots?

In order to answer this research question we have to split up the construct of *sociality motivation* into operational variables. As the theory suggests, those are the dispositional variable *chronicle isolation* and the situational variable *social disconnection*. It was assumed that both *chronicle* and *situational loneliness* has a positive influence on anthropomorphisation:

- a. Chronically isolated people have a stronger tendency to anthropomorphise robots.
- b. Situational socially disconnected people have a stronger tendency to anthropomorphize robots.

## **2. Method**

### **2.1. Sample**

The method of sampling was a mixture of convenience and snowball sampling. Students of the University of Twente were invited to participate via SONA-systems, which is a system that helps coordinating researches. Those students got university intern credits for participating. Otherwise no rewards were offered. A variety of different participants were also acquired over social networks.

This way a sample of n=29 participants was collected. Two of those were for different reasons excluded from the research. This sample was composed of n=11 women and n=16 men. The 27 participants were evenly by random distributed over two conditions. 14 took the 'Team' condition and

13 took the manipulative condition, the ‘Robinson’ condition. The average age of the participants was 23,89 years. For a full listing see Table 1.

Table 1. *Descriptive*

		Condition		Total
		Team	Robinson	
Gender	Female	5	6	11
	Male	9	7	16
Total		14	13	27

## 2.2. Material

To test the anthropomorphic tendencies, stimuli that represent robots were needed. Those were 20 different videos à 5 seconds of robots performing different tasks. All robots show human like or at least animalistic features. The task range from running to doing chores to simple mimics, but all robots move in some way. The videos are shown in a random order. There are no auditive stimuli given.

Furthermore, two videos were used for a manipulative condition to test situational loneliness. Therefore different scenes from “Cast Away” (Zemeckis & Broyles, 2000) were taken and cut to a short sequence of around 6:30 minutes. These scenes showed moments of great loneliness of the main character, concluding with a moment where he realises that he is completely alone on the island. For the control condition the end of the movie “Major League” (Ward, 1989) was taken. It is a celebration scene from a sports movie showing a great amount of people in a social context. This sequence was also around 4:00 minutes long.

## 2.3. Measures

To test the hypotheses several testing materials are required. Ways to assess as well anthropomorphism, as *sociality motivation* (loneliness) are needed.

### 2.3.1 Loneliness

It was chosen to test the influence of the dispositional and the situational component of the *sociability motivation*, thus it was necessary to use two different forms of testing loneliness. To assess the dispositional determinant, chronic loneliness, the ‘UCLA Loneliness’ was used. This scale is well researched and has a high reliability and validity. As Russell, (1996) claims, it is “reliable, both in terms of internal consistency (coefficient alpha ranging from .89 to .94) and test-retest reliability



over a 1-year period ( $r = .73$ ). It consists of 20 items that measure the perceived loneliness of an individual.

In addition to the questionnaire a treatment was used to test loneliness. This treatment was constructed to test the situational determinant loneliness. Thus, was an experimental condition to alter the feeling of social connection/disconnection was created. The intention was to ask people to put oneself into the position of (a) character(s) in a movie. This movie sequences should enforce the said feeling of social connection/disconnection. The sequence to create the feeling of social disconnection is taken out of the movie “Cast Away” (Zemeckis& Broyles, 2000) and show a scene where the main character realises he is alone on a secluded island. For the control group a short scene of a sport team celebrating a victory from the movie “Major League” (Ward, 1989) was chosen. These to different settings were taken from the research from Epley et al. (2008).

### 2.3.2 Anthropomorphism

To test the degree of anthropomorphism the ‘Perceived Humanness’ scale was used (Ho & MacDorman, 2010a). Respondents had to rate with that scale 20 different videos of robots performing different tasks. The PH-scale has various advantages over other tests for anthropomorphism like the ‘Godspeed’ test (Bartneck, Kulić, Croft, & Zoghbi, 2008). An important one is that the scale is not limited to humanoid robots. This allows a greater variation of the shown robots. Furthermore the scale shows very good psychometric properties and a high internal reliability (Ho & MacDorman, 2010b).

The scale consists of 6 items. Every item has two different directions. For example ‘artificial’ is opposed to ‘natural’. All those six items have one robotic and one human side. The respondents can rate via a 7-point Likert scale, to which side they are inclined to. This scale is applied to in total 20 videos à 5 seconds of robots performing different actions. This scale was also taken from another experiment, the study of Schmettow & Echelmeyer (2014).

## 2.4 Procedure

Every participant of the study was welcomed and seated in a quiet room in front of the laptop. The respondents then signed the informed consent and were introduced to the procedure, both verbally and written.

After that the subjects were shown 10 video clips with the robots performing actions which they had to rate with the ‘Perceived Humanness’ scale. The videos were 5 seconds long but were repeated until the participant has rated and pushed the “n” button to see the next video. After a short break the participants were asked to fill out the ‘UCLA Loneliness’ questionnaire. Half of the respondents (subgroup A) were then shown the “Cast Away” scene. The other half (subgroup B) saw the control sequence, the celebration scene. Following the experimental manipulation all participants had to do once more the explicit measurement of anthropomorphism with rating a different set of 10 video clips of robots.

## 2.4. Research Design

This study aims at testing dispositional traits as well as situational behaviour. To accomplish that and to get the most of the acquired data, there were within-subject as well as between-subject conditions used. The analysis of the situational factor, thus the correlation of the 'UCLA' scores with the 'PH' scores, was the between-subject factor. The experimental condition with one pre-treatment run of 10 stimuli and one post-treatment run of 10 stimuli was the within-subject factor.

## 2.5. Data Analysis

The research question “*sociality motivation* has a positive influence on the anthropomorphisation of robots” was tested through the combination of hypothesis a) and b). We assume that the construct *sociality motivation* consist out of different determinants. In conclusion if those determinant turn out to have a positive influence on anthropomorphism we assume that *sociality motivation* also has this effect.

In order to test the hypothesis a) a correlation analysis is executed. The means for each respondent of the 'UCLA Loneliness' scale are here correlated with the respondent's overall mean of the 'Perceived Humanness' scale. Furthermore the scores were correlated to general variables as gender age and condition to see if there are any confoundations.

To analyse the research question b) a Linear Mixed Model was used. This is a form of regression analysis that has for special cases advantages in comparison to a classical ANOVA. The design of the study had the difficulty of multiple responses of the same respondent to as well the same stimulus as the same item. The LMM takes into account that those multiple responses are not independent from each other.

To create a LMM, random and mixed effect were determined. The item, stimulus and subject Variables were used in this model as 'random effects' and the gender and pre/post treatment and the condition as 'fixed effects'. The dependent variable is the score of the PH scale. The mean scores of the 'UCLA'-scale were used as covariate.

## 3. Results

In the following section the results of the data analysis will be presented. At first a short overview over the general population will be given in the descriptive statistics. Then a more detailed analysis of the data will be executed. Finally, data that is relevant for the hypotheses will be laid out.

### 3.1. Descriptive Statistics

In total 29 people participated in this study. Two of them were excluded. One due to a false procedure while testing, one due to an extreme dataset. The error in the procedure occurred because the order of the stimuli videos were not noted. Through a thorough evaluation of the dataset it was

found that one respondent differed from the general response pattern on the ‘Perceived Humanness’ scale. The amount of 1 scored on the 7-point Lickert-scales indicated that this respondent had some difficulties understanding the task or was lacking the motivation or the scale was simply not differentiated enough. Anyhow, the pattern was so significantly different that it shifted the results in this direction. For this reason it was chosen to exclude this respondent from the study.

The UCLA Loneliness-scale’s mean was in a range that was to be expected. In prior studies, such as the one of Daniel Russell (1996), the respondents means tended to be around 2,00 or a bit lower on a scale from one to four. Also the spreading of the results were on a comparable, but low level. The same is true for the means of the Perceived Humanness scale. The mean was on an expected level scoring a bit under the scales middle. This score is also comparable to previous research (Schmettow & Echelmayer, 2014). Both mean scores did not differ on any significant level for different groups such as gender or the condition they were in.

Table 2. *Descriptive statistics for The UCLA- Loneliness scale and the Perceived Humanness scale.*

	N	Mean	Standard Deviation
Loneliness	27	1,68	0,34
Perceived Humanness	27	3,02	0,58

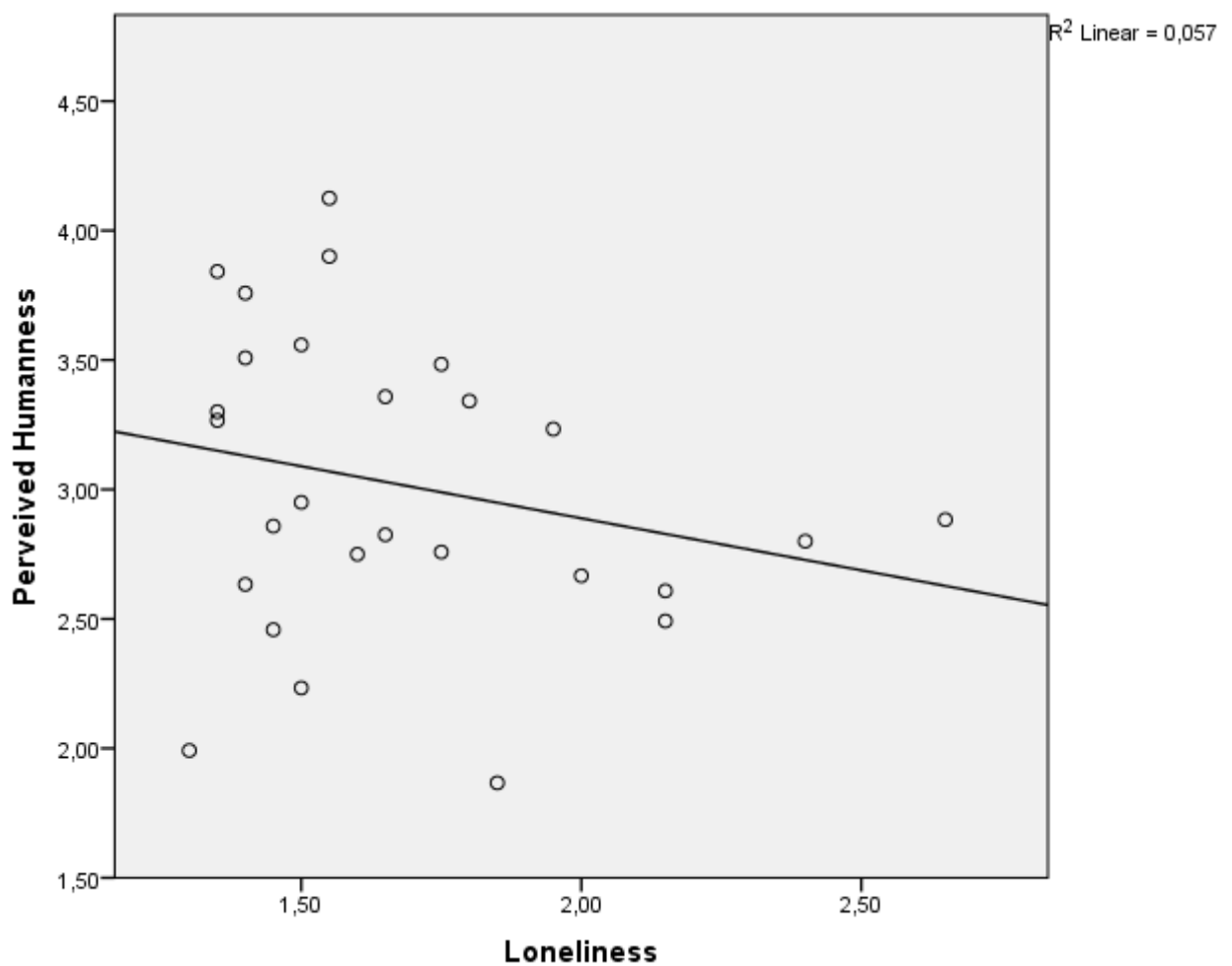
### 3.2. Correlation Analysis

The correlation analysis was conducted to test hypothesis a). Further the demographic data as Age Gender and Condition are correlated to see if any confoundations can be found. The correlation analysis revealed in that regard one statistic significant correlation. To be specific, a strong positive correlation between the Age and the Gender ( $r(27) = .51, p < .01$ ). The correlation that regards the hypotheses a) “Chronically isolated people have a strong tendency to anthropomorphise robots” is not statistical significant ( $r(27) = .24, p < .23$ ). It is not even as expected positive but slightly negative. A graphic resemblance can be seen in Figure 1 and a table of all correlations in Table 3.

Table 3. *Correlation analysis*

	Age	Gender	Condition	Loneliness	Perceived Humanness
Age	1				
Gender	.51**	1			
Condition	-.36	-.11	1		
Loneliness	-.13	.19	-.06	1	
Perceived Humanness	-.06	.02	.10	-.24	1

Figure 1. *Scatterplot of the correlation between Perceived Humanness and the Loneliness– scale.*



### 3.3. Regression Analysis

The Mixed Linear regression analysis was executed in order to test the second hypothesis. The reference group used were people in the pre-treatment and 'Team' condition. This hypothesis b) "Socially disconnected people have a stronger tendency to anthropomorphize robots." was tested through a 2-way interaction effect between the post/pre-treatment and condition. This relation can be found with  $\beta = .354$  on a statistic significant level ( $p = .002$ ). This treatment effect is visualized in Figure 2. The scores on the 'Perceived Humanness' scale are split up in the two conditions and pre/post-treatment: on the left side the 'Team' condition and on the right side the 'Robinson' condition, the pre-treatment is blue and the post-treatment is green. The increase in the mean PH-scores can be seen there. However, not only the means in the 'Robinson' condition raised. In the 'Team' condition did score people higher, too. This main effect that occurs by treatment can be found in the model with  $\beta = 0.128$  (also if not on a statistic significant level ( $p = .076$ )). The weak negative influence of chronicle loneliness is here also to seen with  $\beta = -.235$  and  $p = .069$ , yet it is not above the level of chance.

Due to the construction of the experiment there are some redundant variables. This is because the respondents were only split up after they rated the first 10 robots. Thus is the differentiation of the conditions during the pre-treatment not necessary. Even so those pairs of variables work as control variables for the sample. So is the difference in the estimates between the intercept and the pre-treatment 'Robinson' condition only  $-.137$  with  $p = .570$ .

Table 3 shows a complete listing of the main and interaction effects of the regression analysis.

Figure 2. *Perceived Humanness Responses split up in Pre- and Post-Treatment and sorted by Condition*

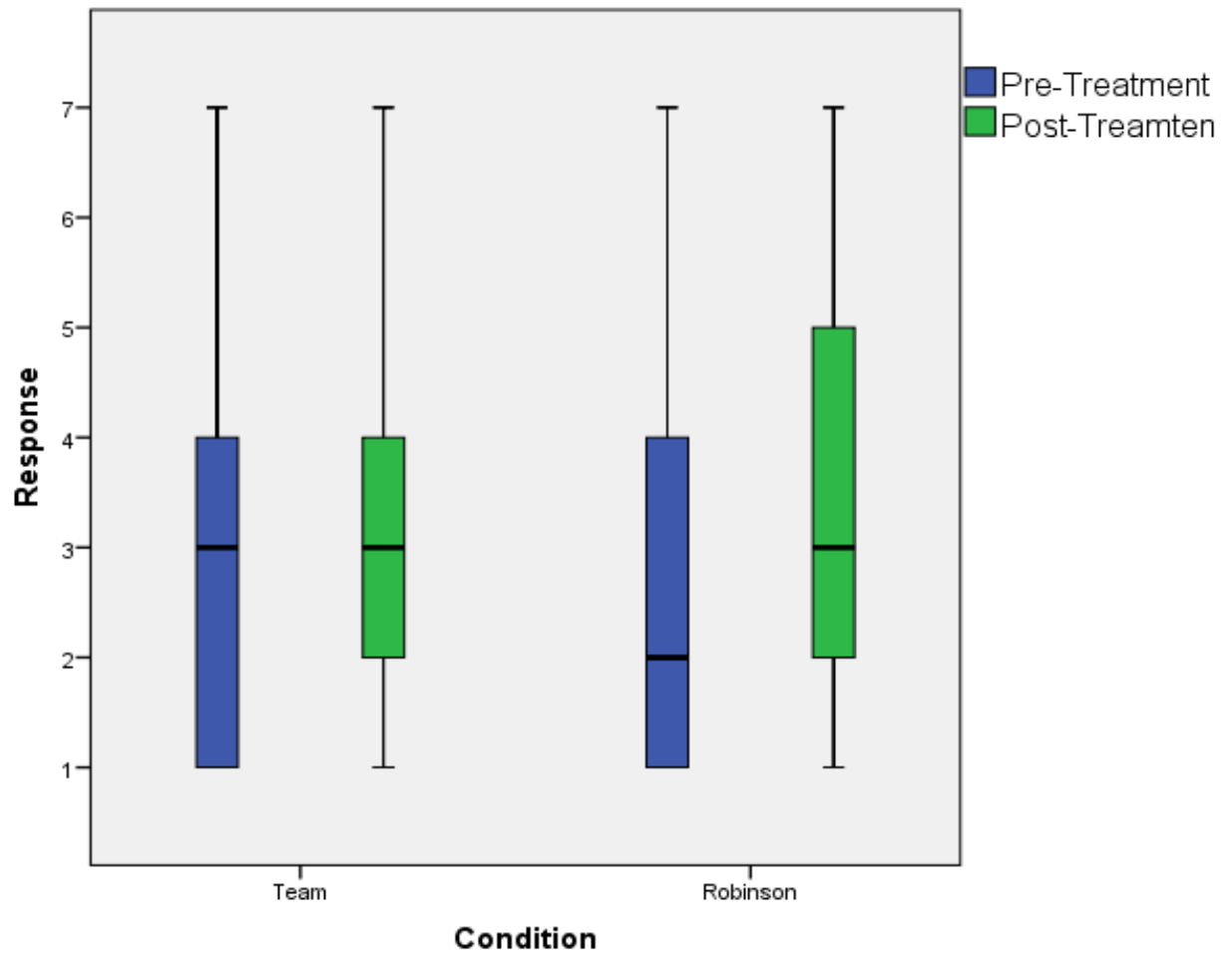


Table 4. *Fixed Effects on 'Perceived Humanness'*

Factor	$\beta$	P	Confidence Interval (95%)	
			Lower Bound	Upper Bound
Intercept	2.919	<,001 ***	2.292	3.698
Loneliness	-,235	,150	-,599	,069
Condition 'Robinson'	-,137	,570	-,624	,359
Post-Treatment	0.128	,076	-,009	,280
Post-Treatment * Condition 'Robinson'	,354	,002 **	,166	,554
Post-Treatment * Loneliness	,116	,094	-,012	,259
Condition 'Robinson' * Loneliness	,101	,716	-,376	,649
Loneliness * Condition 'Robinson' * Post-Treatment	-,041	,708	-,242	,170

## 4. Conclusion and Discussion

### 4.1. Discussion

The aim of the research was to shed further light on the relationship of anthropomorphism and loneliness. Through literature research we hypothesised that people who are lonely tend to anthropomorphize nonhuman agents to a greater degree than people who are not. This is stated in the Three-Factor Theory of Epley, Waytz, & Cacioppo (2007). This theory was the basis for our research question and the two hypotheses. These hypotheses could only be partially confirmed. The research question of this study if “sociality Motivation has an influence Anthropomorphism” could not ultimately be answered. The hypothesis a) that people that are chronicle lonely tend to stronger anthropomorphise robots could not be confirmed. However the second hypothesis b) “Situational socially disconnected people have a strong tendency to anthropomorphize robots” could be confirmed.

Before going into a deeper analysis of the results, some limitations have to be named. First there were some problems concerning the testing material. Some respondents gave as feedback that they had troubles with the UCLA scale. Item number 4, which was a double negation, was difficult to understand, and could have led to some confusion. This feedback we received anyhow cannot be supported by the numbers. The chronbach's alpha (if item 4 deleted) =0,833 does not show any irregularity (chronbach's alpha (total scale) =0,833). As this shows only the reliability it is no real

proof if the item really measures what it should, but it indicates just that. Still, this source of potential problems could be determined by simplifying the questions. In addition the question was not marked as an invert item which should have been the case. Another problem with the material was the translation of the scales. The UCLA scale was translated from English to German and Dutch. Those translations could endanger the validity of the scales. Though this was not especially tested the high reliability of the test indicates that the scale works also in different languages as it was intended. The same restrictions of the proof mentioned concerning item 4 are true for this argument too. The Perceived Humanness was in its German translation concerning two items not perfectly accurate. Also if this may not be a fundamental error it still should be taken into account for further research. Furthermore some confusion of the participants with the second item of this list were reported. Secondly, the size of the sample could be a problem. With N=27 valid participants the number of respondents is on the lower brink of what can be used.

This being said, we now pass on to further analysis of the research. As earlier stated, only one of the two hypotheses could be confirmed. Even if this is not what was expected after the literature study, it does not entirely contradict findings of earlier research. The relation that *sociality motivation* leads to stronger anthropomorphism was hypothesized in the Three-Factor Theory (Epley et al., 2007). Epley et al (2008) found in the earlier mentioned research “Creating social connection through inferential reproduction: loneliness and perceived agency in gadgets, gods, and greyhounds” indications of the existence of this relation. In three different experiments they could show that situational loneliness can lead to stronger anthropomorphisation of different non-human agents. In another experiment Epley, Waytz, Akalis, & Cacioppo (2008) used the UCLA scale to determine if chronic loneliness has an influence on the anthropomorphisation. To determine anthropomorphism they asked respondents to rate different traits of pets. They created three different categories of traits: Non anthropomorphic traits, supportive anthropomorphic traits and non-supportive anthropomorphic traits. Only the supportive traits yielded a statistic significant correlation. Our findings can support the results of the first but not of the second study. There can be found a variety of possible reasons why in this research only the situational disconnection lead to stronger anthropomorphisation but not the dispositional loneliness. First it is possible that the hypothesised relation between dispositional loneliness and anthropomorphism is not existent and that only the situational components play a role. Epley et al (2007) assume that lonely people are more susceptible for social cues like human likeness and that they actively search for social connection. This mechanism is true for chronicle lonely people as well as situational lonely people. This indicates that if we could not find the one relation we should not be able to find the other one. So, assuming the theory is correct – which is supported by our finding in the treatment condition, the literature and earlier research – there maybe have to be another reasons for these findings.



The way of testing anthropomorphism could explain the difference in the results. Epley et al (2008) asked people to rank traits that described their pets the best. This list of traits contained words that were supportive anthropomorphic ones, non-supportive anthropomorphic and behavioural. In this study on the contrary a Human likeness scale was used. That means people were only asked to rate the robotic stimuli after their appearance. Different researches, as earlier mentioned, indicate that the emotional component plays a role by the attribution of features to a non-human agent. To add this emotional component Ho & MacDorman (2010) added the “eeriness”, “attractiveness and “warmth” to the scale. Thus it is advised for following research to use the full scale to assess anthropomorphism. Furthermore if this is true, other problems with the manner of testing occur. The fact that the video clip showed only a 5 second long movement of the robot. First anything more than a mere movement should enhance the chance of attributing a human feature to the robot and secondly a longer sequence should give the respondent the time to connect with the robot and find more humanlike features. But there is a flaw in this argument. As said it is assumed that the mental process behind anthropomorphism is the same for chronicle as well as situational loneliness. So the question why there is a difference in the results remains.

A third possible answer to this is that the sample of this research is flawed. As it can be seen in Figure 1, the results of the UCLA scale cluster around the mean. Only few respondents score significantly higher or lower than the mean and even fewer score in the upper third of the scale. Though this is not an unexpected result it has some implications for the analysis of this research. It could be possible that the slightly negative correlation between the UCLA scores and the Perceived Humanness scores is a result of the lack of participants that feel lonely. Which of this three possible factors is responsible for the divergence of the results has to be determined by future research.

Whereas the results of the hypotheses a) where not as expected, the hypothesis concerning the situational loneliness could be confirmed. Thus can here be concluded that the findings of Epley’s et al. (2008) researches could be reproduced in this study. It supports that a transfer to the subject of robotics is here possible and adds further proof to the Three-Factor Theory through generalization of the stimulus.

The findings of this paper have several implications for further research as well as the praxis. As discussed earlier robotics has a broad variety of possible uses. If it is now the use as workforce, toys or for social care. In all categories the deeper understanding of the mechanisms of anthropomorphism can help to improve the interaction between human and robot. This is especially true for social robotics. There the effectiveness of the used robots is dependent on the acceptance of the robot and if there can be build up a connection. Thus, here is the question of sociality motivation particular interesting. Many of the people that would interact with social robots suffer from loneliness. One of those groups are elderly people. Robinson, MacDonald, Kerse, & Broadbent (2013) showed the big impact a social robot can have. They made a 12 weeklong trial study in a rest home/hospital. They

showed that the companion robot Paro could ease the feeling of loneliness significantly and even more than a real companion animal.

Another field of implication could be learning robots. As Kanda, Hirano, Eaton, & Ishiguro (2004) proved can a robotic tutor improve results. They conducted a field study over 18 days, where Japanese children interacted at school with English speaking robots. The rate of children interacting with the robots dropped sharply in the second week. Those children who kept interacting could improve their English significantly. As (Kanda et al., 2004, p1) states “robots should be designed to have something in common with their users, providing a social as well as technical challenge.” This shows how a better understanding of anthropomorphism could help to better connect with robots and create this way a more efficient and meaningful interaction.

#### **4.2. Summary**

This research aimed to reproduce results of the earlier study of Epley, Akalis, Waytz, & Cacioppo (2008) and go beyond their first approach to test the 3 Factor Theory of anthropomorphism. For that purpose their approach to test social loneliness was used, combined with the method for testing anthropomorphism of the study of Schmettow & Echelmayer (2014) and the UCLA-scale for dispositional loneliness was added. This way the research transfers the insight Epley et al. (2008) gained over the relationship between loneliness and the antropomorphisation of pets onto the field of robotics. However, in the scope of the study could only partially be confirmed that *sociality motivation* has an influence on anthropomorphisation of robots. It could be showed that the situational factor does influence the degree to which people rate robots as humanlike. On the contrary we found no evidence that this is the case for chronic lonely people.

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## 6. Appendix

### 6.1. Syntax

DATASET ACTIVATE DataSet3.

DESCRIPTIVES VARIABLES=Gender Age Condition UCLA\_mean PH\_mean

/STATISTICS=MEAN STDDEV MIN MAX.

FREQUENCIES VARIABLES=Gender Condition

/ORDER=ANALYSIS.

CORRELATIONS

/VARIABLES=Age Gender Condition UCLA\_mean PH\_mean

/PRINT=TWOTAIL NOSIG

/MISSING=PAIRWISE.

DATASET ACTIVATE DataSet1.

MIXED Response BY Gender Condition post\_treat WITH Loneliness

/CRITERIA=CIN(95) MXITER(100) MXSTEP(10) SCORING(1) SINGULAR(0.000000000001)  
HCONVERGE(0, ABSOLUTE) LCONVERGE(0, ABSOLUTE) PCONVERGE(0.000001,  
ABSOLUTE)

/FIXED=Gender Condition post\_treat Gender\*Condition Gender\*post\_treat Condition\*post\_treat  
Gender\*Condition\*post\_treat | SSTYPE(3)

/METHOD=REML

/PRINT=DESCRIPTIVES SOLUTION

/RANDOM=INTERCEPT | SUBJECT(Subj) COVTYPE(VC)

/RANDOM=INTERCEPT | SUBJECT(Stim) COVTYPE(VC)

/RANDOM=INTERCEPT | SUBJECT(Item) COVTYPE(VC).

\* Diagrammerstellung.

GGRAPH

/GRAPHDATASET NAME="graphdataset" VARIABLES=Condition Response post\_treat  
MISSING=LISTWISE REPORTMISSING=NO

/GRAPHSPEC SOURCE=INLINE.

BEGIN GPL

SOURCE: s=userSource(id("graphdataset"))

DATA: Condition=col(source(s), name("Condition"), unit.category())  
DATA: Response=col(source(s), name("Response"), unit.category())  
DATA: post\_treat=col(source(s), name("post\_treat"), unit.category())  
DATA: id=col(source(s), name("\$CASENUM"), unit.category())  
COORD: rect(dim(1,2), cluster(3,0))  
GUIDE: axis(dim(3), label("Condition"))  
GUIDE: axis(dim(2), label("Response"))  
GUIDE: legend(aesthetic(aesthetic.color), label("post\_treat"))  
SCALE: cat(dim(3), include("1", "2"))  
ELEMENT: schema(position(bin.quantile.letter(post\_treat\*Response\*Condition)), color(post\_treat), label(id))  
END GPL.

DESCRIPTIVES VARIABLES=Loneliness

/SAVE

/STATISTICS=MEAN STDDEV MIN MAX.

DATASET ACTIVATE DataSet1.

RELIABILITY

/VARIABLES=Tune Lack\_Companionship Not\_turn\_to Alone Friends Common Not\_Close Interest  
Outgoing

Close Left\_out Superficial Knows\_me Isolated Companionship Understand Withdrawn  
Not\_around Talt\_to

Turn\_to

/SCALE('ALL VARIABLES') ALL

/MODEL=ALPHA

/SUMMARY=TOTAL.

## 6.2. Questionnaires

### Introduction

Thank you for the participation on this research. In the following we will give you a small introduction of the procedure. At the beginning you will be handed out a questionnaire which contains 19 semantic items. Further instructions how to handle them and an example will be given there. As you are ready to start the experiment 10 different video clips will be shown to you and you will rate these videos on this questionnaire via a 7-point Likert scale. Afterwards you fill in a questionnaire, which is about loneliness in general. Then you see a longer video (approximately 5 minutes). The next step is to rate another 10 videos and to fill in the Likert scale. At each step of the experiment you may ask questions if something does not work or is unclear and you can leave the experiment at each step of the experiment. You can leave the room after you finished the research and hand out the filled in questionnaires. We will treat your results anonymous and will not hand out any information to third persons.

### Perceived Humanness Scale

In the following you find a number of word pairs. We would like to know what impression you have received from the robot/robots. Therefore we are asking you to mark but one of the seven digits that stand between the words. The procedure can be explained best through the following example:

What impression gave you the robot?

The Robot is/was: Fast 1    2    3    4    5    6    7 Slow

When you think that the robot is/was for example fast, than you mark digit 1. When you think that the robot is/was slow you mark digit 7. Of course, you may also make use of the digits in between. There is no right or wrong answer, as long as your answers represent the impressions you have received from the robot/robots.

The digits in this example mean the following:

1: fast

2: rather fast

3: a bit fast

4: a bit of both

5: a bit slow

6: rather slow

7: slow

Humanness index (6items):

Artificial 1 2 3 4 5 6 7 Natural

Human-made 1 2 3 4 5 6 7 Humanlike

Without definite lifespan 1 2 3 4 5 6 7 Mortal

Inanimate 1 2 3 4 5 6 7 Living

Mechanical movement 1 2 3 4 5 6 7 Biological movement

Synthetic 1 2 3 4 5 6 7 Real

#### R – UCLA Loneliness Scale

Indicate how often you feel the way described in each of the following statements. Circle one number for each.

---

Statement	Never	Rarely	Sometimes	Often
1. I feel in tune with the people around me.	1	2	3	4
2. I lack companionship.	1	2	3	4
3. There is no one I can turn to.	1	2	3	4

---



4. I do not feel alone.	1	2	3	4
5. I feel part of a group of friends.	1	2	3	4
6. I have a lot in common with the people around me.	1	2	3	4
7. I am no longer close to anyone.	1	2	3	4
8. My interests and ideas are not shared by those around me.	1	2	3	4
9. I am an outgoing person.	1	2	3	4
10. There are people I feel close to.	1	2	3	4
11. I feel left out.	1	2	3	4
12. My social relationships are superficial.	1	2	3	4
13. No one really knows me well.	1	2	3	4
14. I feel isolated from others	1	2	3	4
<hr/>				
15. I can find companionship when I want it.	1	2	3	4
16. There are people who really understand me.	1	2	3	4
17. I am unhappy being so withdrawn.	1	2	3	4
18. People are around me but not with me.	1	2	3	4
19. There are people I can talk to.	1	2	3	4
20. There are people I can turn to.	1	2	3	4

