Psychologie
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The effect of self-reported psychological factors on anthropomorphic tendencies

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ABSTRACT

Aim: This study aimed to find evidence for the theory of Epley et al. (2007), by testing whether people's likelihood of anthropomorphizing animals is related to the following three self-reported psychological factors: 1) the availability and richness of knowledge structures about animals (elicited agent knowledge), 2) the need to control the environment (effectance motivation), and 3) the need and desire for social contact (sociality motivation). It was hypothesised that people are more likely to anthropomorphize when self-reported elicited agent knowledge is low and self-reported effectance and sociality motivation are high.

Methods: A questionnaire was used to obtain the psychological factors. Next, Participants (N = 158; 42 males, 116 females) were instructed to record themselves watching zoo animals or videos of them at home. During these recordings, they had to express their thoughts, feelings, and observations about the animal. The recordings were then used to conduct a speech analysis to measure the participants' anthropomorphic speech. Finally, it was analysed whether anthropomorphic speech correlated with the self-reported psychological factors.

Results: The results showed that none of the self-reported psychological factors had an effect on their own. To investigate whether this lack of effect was caused by cross-over interactions, a post-hoc analysis was performed using the interactions of the main predictors added to the model. Results of this analysis showed one significant cross-over interaction between self-reported elicited agent knowledge and effectance motivation.

Discussion: Contrary to expectations, anthropomorphic speech was not correlated with any of the self-reported psychological factors separately and therefore all three hypotheses were rejected. However, the cross-over effect found indicates that anthropomorphic speech is more complexly related to self-reported elicited agent knowledge and effectiveness motivation than the theory of Epley et al. (2007) suggests.

Keywords: Anthropomorphism, social cognition, speech, animals

LAYMAN'S ABSTRACT

Much research has been done to find out why people attribute human characteristics to non-human entities. In 2007, Epley and his colleagues used all this research to form a theory that could predict the extent to which people do this based on three underlying psychological factors. However, most of the research that was used to form this theory is based on how humans make inferences about other humans. In this study we wanted to test whether Epley's theory also applies when people make inferences about animals. We did this by observing what people say while looking at animals in Artis zoo. We also had them complete a questionnaire to map out their characteristics. We then used a language analysis to find evidence for Epley's theory. Our results show that there is no direct evidence for the theory. Further analysis of the results shows that the psychological factors of Epley's theory may be more complexly related to the extent to which people attribute human characteristics to non-human entities.

CONTENTS

INTRODUCTION

It is already known in various fields of science that people tend to ascribe humanlike characteristics or behaviour to non-human agents (Darwin, 1872; Heider & Simmel, 1944; Hume, 1757). This tendency is called *anthropomorphism* (Soanes & Stevenson, 2005). In the field of psychology, the debate surrounding anthropomorphism is mainly centred around whether it leads to correct or misleading inferences (Cheney & Seyfarth, 1990; McFarland, 1993; Kennedy, 1992). In his book "Are we smart enough to know how smart animals are?", de Waal (2016) argues that evolution resulted in each organism sensing the environment in its own way, being specialized on its needs for survival. This makes that a single environment offers many realities peculiar to each species. For years, scientists believed that elephants were incapable of using tools to establish a certain goal. Tool use was tested by placing a banana out of the animal's reach and placing a stick nearby. To get to the banana, the animal had to pick up the stick and pull it closer. Most animals that can use tools, do so right away. But elephants do not and therefore researchers concluded that elephants were incapable of using tools. However, what the researchers did not consider, is that elephants grab things with their trunk, which is also their nose. Elephants use their sense of smell to identify objects on the ground and picking up a stick blocks their nasal passages preventing them from detecting the banana. This is a perfect example of anthropomorphic thinking that causes researchers to measure elephants by human standards, resulting in misleading conclusions about whether elephants can use tools. Later, other research found that elephants can use a box to reach high-hanging fruit, indicating that elephants are indeed capable of using tools when taking an elephant's qualities into account (Foerder et al., 2011). On the other hand, de Waal (2016) states that anthropomorphism in other cases will assist our understanding of a species'

behaviour. By tickling a young ape, they emit a breathy sound that resembles human laughter. Considering our evolutionary distance from apes, it would be a loss not to use our knowledge of human experience to explain this behaviour. Beyond this interesting discussion, it is also important to investigate the underlying psychological factors that cause humans to anthropomorphise. Research into this is important because it gives us insight into brain mechanisms underlying some important psychological topics, such as social cognition, reasoning and induction, and theory of mind. For example, whether people see an 'agent' as human or non-human greatly influences whether they treat those agents with respect or just as objects (Serpell, 2003). It also influences how people predict those agents to behave and how they interpret their behaviour (Epley, 2007). In addition to the field of psychology, these topics are also relevant to multiple other disciplines that investigate human-computer interactions, with marketing and finance currently being the most societal relevant ones (Waytz et al., 2010). However, unlike research into the accuracy of anthropomorphism, little research has been done on the psychological processes that give rise to this phenomenon.

In 2007, Epley and colleagues hypothesised that the probability to anthropomorphize is based on three psychological factors that work in concert with each other: (1) elicited agent knowledge, (2) effectance motivation and (3) sociality motivation. Firstly, elicited agent knowledge comprises the availability and richness of knowledge structures about an agent, reducing the likelihood of agents being anthropomorphised. Making inferences about an agent's behaviour depends not only on the agent's actual behaviour but also on the knowledge structures accessible to the observer. Since humans have direct access to knowledge structures about what it is like to be human, these are likely to be activated when making inferences about non-human agents. This use of anthropomorphic knowledge structures needs to be corrected and one factor for the likelihood of this happening is the availability and richness of

knowledge structures held about the observed agent. Secondly, effectance motivation comprises the need to control the environment by increasing its predictability and controllability, thereby increasing the likelihood of an agent being anthropomorphized. Just as people use egocentric reasoning when trying to understand other people, they also do it when trying to understand, explain, and predict the behaviour of non-human agents. Due to the availability and richness of the knowledge structures about the self and humans in general, anthropomorphism may contribute to a strong sense of understanding of a non-human agent's behaviour, making it more predictable and controllable. Therefore, the need to understand or explain an agent's behaviour in order to control it may determine the likelihood to anthropomorphize that agent. Thirdly, sociality motivation includes the need and desire for a social connection, which is expected to increase the likelihood of an agent being anthropomorphized. When people have a lack of social connection to other humans, people are expected to anthropomorphise nonhuman agents to satisfy their need for social connection.

Unfortunately, support for this theory and its hypotheses is mainly based on research investigating how humans make inferences about other humans. This is due to a lack of research on how humans make inferences about non-humans. Hence, I will investigate if this theory is also applicable to human-animal interactions. This study aims to fill the current gap in anthropomorphism research by examining whether self-reported psychological factors in humans are related to their likelihood to anthropomorphize animals. Specifically, the study aims to test the three-factor theory of Epley et al. (2007) using data from a field study analysing people's speech when looking at animals at the zoo. Therefore, the hypotheses will be in line with the stated theory. It is hypothesised that: (1) a participant's self-reported elicited agent knowledge is negatively correlated with their number of anthropomorphic

statements per minute; (2) a participant's self-reported effectance motivation is positively correlated with their number of anthropomorphic statements per minute and (3) a participant's self-reported sociality motivation is positively correlated with their number of anthropomorphic statements per minute.

METHODS

Ethics

This study is a part of a larger ongoing research at the ARTIS zoo, investigating human-animal interactions. All participants gave consent, and their participation was completely voluntary (see appendix B). Also, all data were anonymized. Participants received an information letter about the study, and they received a debriefing letter after participating (see appendix A & C). The research was approved by the local ethics committee, the 'Commissie Ethiek Psychologie' (CEP21-V2-2903).

Design

This study has a between-subject design. The data for the independent variables are obtained through a questionnaire, using one question with a continuous response scale for each hypothesis. Due to the continuous response scale, the participants will not be divided into groups but will be distributed on a continuum depending on their answers to the question. The dependent variable is the number of anthropomorphic statements and is controlled for the total number of words a participant speaks. This data is obtained by a speech analysis of transcribed recordings of participants.

This study is a subproject of a larger ongoing research project supervised by Karline Janmaat. The questions used as independent variables are part of a larger questionnaire designed by members of the research team that started the project (Levy Matricon, Dana Holscher, Dirk Woertink). In addition, the stimuli provided consist of online and live recordings. The online part consists of people watching videos of zoo animals on a computer screen at home and the live recording part consists of people recording themselves with either their smartphone or a 360 camera while watching animals in Artis.

Participants

For this study, participants were recruited from visitors of the Artis Royal Zoo in Amsterdam, student channels, and those who were interested. Recruitment took place at the entrance of the zoo and online. The inclusion criteria for this study are that participants:

- Are at least 16 years old;
- Have a device that allows them to record themselves;
- Must follow the test procedure individually;
- Speak either Dutch or English.

Data was excluded when:

- Videos recorded by the participants are shorter than 15 seconds;
- Participant's speech is influenced by others for most of the video (e.g., when others asked questions);
- The video was not the first trial, because only the first trial was analysed;
- It is unclear which animal or plant was recorded.

Questionnaire

The questionnaire that was used to obtain the independent variables contained 33 questions (see appendix D). The questions from the questionnaire had to be answered by placing oneself on a spectrum between two extreme statements. Using a spectrum rather than a discrete scale makes the data more stable for statistical analysis. We also suspected that the use of spectra led to less "neutral" answers from the participants because the need to resist a certain extreme position is greater than that with a neutral question. Questions were exploratory and not validated.

Evolutionary distance

To test the quality of the speech analysis, the evolutionary distance of the animal species from humans was added as a control variable. Our labelled anthropomorphic speech should be positively correlated with evolutionary distance, since evolutionary distance determines the perceived similarity between observers and the animals which is a predictor of anthropomorphism (Epley et al., 2007).

Procedure

In the study, we tried to interfere as little as possible with the participants' natural observation behaviour. We did this by keeping the tasks simple, integrating the experimental design into the zoo visit and letting the participants use their own materials for data collection (for some a camera was provided). The procedure in total took about 45-60 minutes.

Informed consent

In this study, participants received two consent forms (see appendix B). The first is filled in before the procedure. Signing this consent form meant that:

- They have read and understood the information letter;
- They agreed to follow the described procedure;
- Everything was clear and any questions they had have been satisfactorily answered;
- They knew that they could stop participating at any moment;
- Their personal data was stored securely and anonymously.

Signing the second consent form reaffirmed that participants gave us their consent to use their data and that they can withdraw their consent up to three days after participating. In addition,

the data can still be deleted after three days. However, after these three days they were then informed that their data may already have been analysed.

Instructions to participants

Then, it was explained how participants could upload their data on their smartphone and laptop and they received a consent form that had to be filled in. After this, the participants of the live version received a card with a set of 5 (and 2 backup) animals and 1 plant. They were asked to use their own smartphone or a 3d camera to film these animals and this plant for 1 to 3 minutes and they were encouraged to describe their thoughts and feelings when observing the animals. The participants of the online version did the same while watching animal videos from their laptop. After going through this procedure, the participants were asked to come back to the researchers and upload their data to a secure file research drive of the University of Amsterdam. Then, the participants were asked to complete a questionnaire (±10 min). Finally, a second consent form was filled in and the participants were then debriefed about the study.

Debriefing

The debriefing consists of a document with more elaborate information about the study. It contains why the project started and what the researchers are interested in (see appendix C).

Software

Software/hardware that were used, are:

Software:

- Microsoft Excel: for data processing;
- R programming: for statistical analysis;
- UvA Research Drive: for safe transfer of data.

Hardware:

- Laptops: for data processing and analysing;
- Smartphones and laptops of participants: to record themselves.
- 360 video camera: for participants to record themselves

Analysis

General analysis

The recordings of the videos from the participants were transcribed and analysed by means of a self-developed speech analysis to measure the number of anthropomorphic statements. First, speech on the video recordings were transcribed. The transcripts were then coded by an artificial intelligence software (AI) through a self-developed speech analysis. This analysis divides speech blocks into different categories depending on their content. A few of the categories contain a number of anthropomorphic statements and were used in this study for further analysis.

Transcription of videos

The speech from the observer videos was transcribed by splitting the speech into "speech blocks". This was done by the researchers themselves.

Speech analysis

Our speech analysis aimed to quantify different types of speech of the participants regarding the Ail (Animal in the lens). This was done by assigning units of speech to a "speech library", resulting in a database of categorized count data (Table 1). These tasks were performed by the OpenAI GPT-3 engine (OpenAI API beta; https://beta.openai.com/overview). Giving the engine thousands of composite speech samples in multiple languages allowed us to teach the AI our speech analysis. This approach was chosen to circumvent human biases of natural language analysis. More in-depth information regarding the speech analysis can be found in the appendix (see appendix E).

Table 1: Overview of the speech libraries

(Sub)library	***Definition***
Desc: Visual descriptives	All objective descriptions of static features
*DescHuman**	Anthropomorphic descriptives
DescObject	All other descriptives
Act: Activity descriptives	All objective descriptions of activity
*ActHuman**	Anthropomorphic activity descriptives
ActObject	All other activity descriptives
Sphere: Environmental Sphere	All descriptions of the environment
Feel: Subjective Experiences	All base subjective judgements and emotional affect
Trans*: Transcendental Project	All interpretations of mental state, intent, and emotions
*TransPlus**	All positive interpretations
*TransMin**	All negative interpretations
*TransNull**	All other interpretations
Phys: Physical Experiences	All references to physical contact and its envisioned consequences
Exper: (Lack of) Expertise	All questions and statements with an expert tone of voice

Myst: Mystifying Experiences	All references to extreme emotions, confusion, spiritualism and art
Com*: Direct communication	All speech in direct communication to, or as, the Ail
Exit: Irrelevant speech	All speech that does not refer to the Ail

**Categories used as response variable*

Statistical analysis

A generalized linear mixed model (GLMM) with a Poisson distribution was designed in Rstudio to analyze the three-factor theory of Epley (2007) (Baayen, 2008). For using a GLMM, the following assumptions were checked in advance: collinearity, distribution of the residuals, overdispersion. All assumptions were met (see appendix F).

The dependent variable measuring anthropomorphic speech consisted of count data from a set of speech libraries (Table 1). Questions from the questionnaire were used as independent variables, with each question used as a proxy for a psychological factor (Table 2).

Table 2: Overview of proxy questions representing the psychological factors

Psychological factor	*Proxy question*
Elicited agent knowledge	Did you grow up with pets?
	No, I had no contact with animals — 0 — 100 — Yes, I was busy all day long with all my animals
Effectance motivation	How do you approach life?
	My life is exactly planned and calculated — 0 — 100 — I leave my life up to chance. I'll see
Sociality motivation	Do you like having people around you?
	I prefer to walk my path alone — 0 — 100 — I always need to be surrounded by people

To test the hypotheses, the following full model was used:

Anthropomorphism ~ Qeak + Qem + Qsm + Sex + ExpV + Age + ViewO + EvoDis + (1|PartID) + (0 + ViewO |PartID) + (0 + EvoDis |PartID) + (1|ANI) + (0 + ViewO |ANI) + (0 + Age|ANI) + (0 + Sex|ANI) + (0 + Qeak+Qem+Qsm| ANI)

Where:

Anthropomorphism = Anthropomorphic speech units per minute

Qeak = Proxy question elicited agent knowledge z-score

Qem = Proxy question effectance motivation z-score

Qsm = Proxy question sociality motivation z-score

Sex = The sex of the participant

ExpV = The online vs. live version

Age = The mean of the age group of the participant in years z-score

ViewO = The order in which the animals were viewed z-score

EvoDis = The evolutionary distance of the animal species to humans z-score

PartID = The ID number of the participant

ANI = The animal species

Sex, Experiment Version, Age, Viewing Order, and Evolutionary Distance were added as control variables. In terms of age in years, the following categories were used to divide the participants: 16-25, 26-35, 36-45, 46-55, 56-65, 66+. Participant ID and Animal species were added as random effects. A full-null model comparison was done by using a likelihood ratio test (Dobson, 2002). The null model consisted of the full model without all the fixed effects (Forstmeier & Schielzeth, 2011).

RESULTS

Descriptive statistics

After extracting participants with missing values, 158 participants (42 male and 73 female) were included in the data analysis with a total of 1004 observations. Of these participants, 73 participants were included in the online version and 85 in the offline version. In terms of age, 82 participants were included in the 16-25 years age category (51,9%), 20 in the 26-35 category (12,7%), 13 in the 36-45 category (8,2%), 18 in the 46-55 category (11,4%), 11 in the 56-65 category (7,0%), and 11 in the 66+ category (7,0%). Finally, a total of 32 different animal species were observed by the participants.

Model

The full-null model comparison showed that the fixed effects had a clear impact on anthropomorphic speech (χ^2=84.677, *df*=8, P=5.57e-15) (Table 3). However, this is caused by the two control variables Experiment Version and Evolutionary distance (Table 4; Figure 1&2). No main predictor effects were found in this model (Table 4)

Table 3: Full-Null model comparison

	Npar	*AIC*	*BIC*	*Loglik*	*Deviance*	*Chissq*	*Df*	*Pr(>Chisq)*
Null model	14	4644.5	4713.3	-2308.2	4616.5			
Full model	22	4575.8	4683.9	-2265.9	4531.8	84.677	8	5.57e-15***

**p < .05. ** p < .01. *** p < .001*

Table 4: Fixed effects of the full model

	Estimate	*Std. Error*	*Z value*	*Pr(>|z|)*
Qeak	-0.056248	0.055938	-1.006	0.315
Qem	-0.004942	0.053328	-0.093	0.926
Qsm	-0.043268	0.055935	-0.774	0.439
Sex	-0.094948	0.114657	-0.828	0.408
Age	0.056605	0.052897	1.070	0.285
ExpV	0.607477	0.103832	5.851	4.90e-09***
ViewO	0.003683	0.028634	0.129	0.898
EvoDis	-0.455040	0.049684	-9.159	< 2e-16***

**p < .05. ** p < .01. *** p < .001*

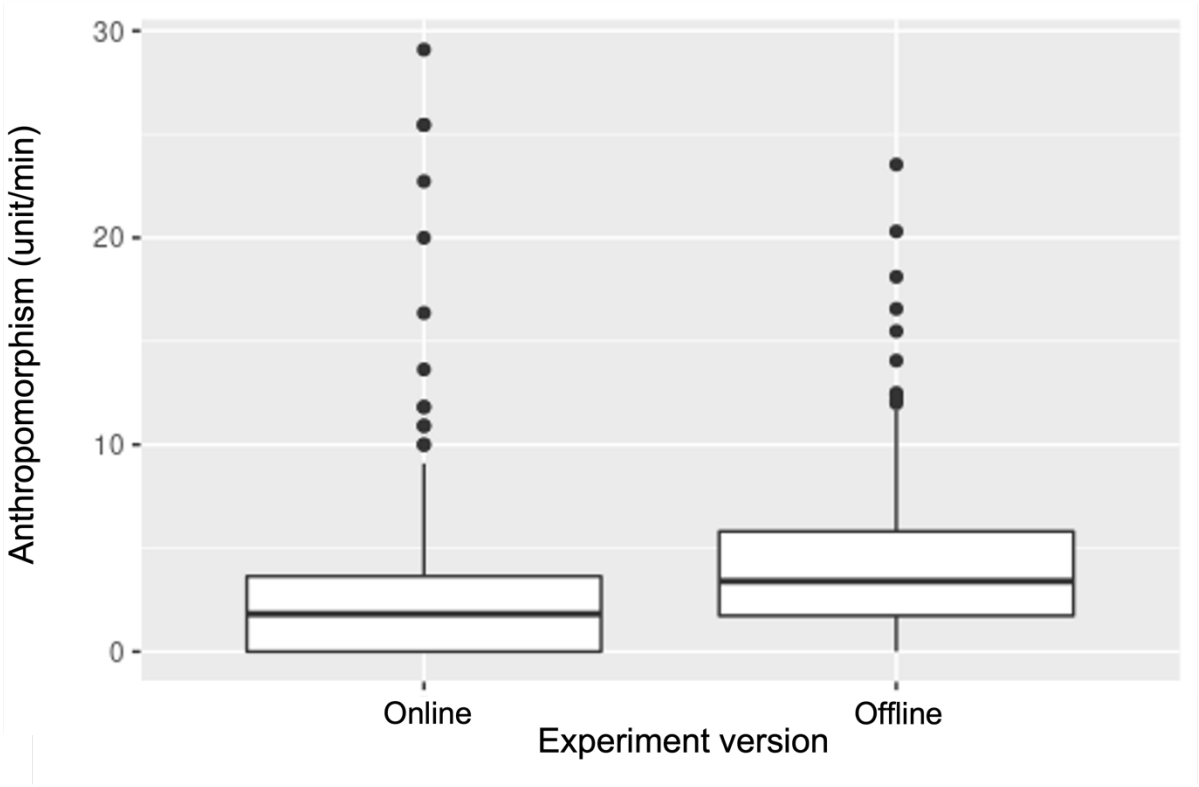

Figure 1: Difference between online and offline anthropomorphic speech

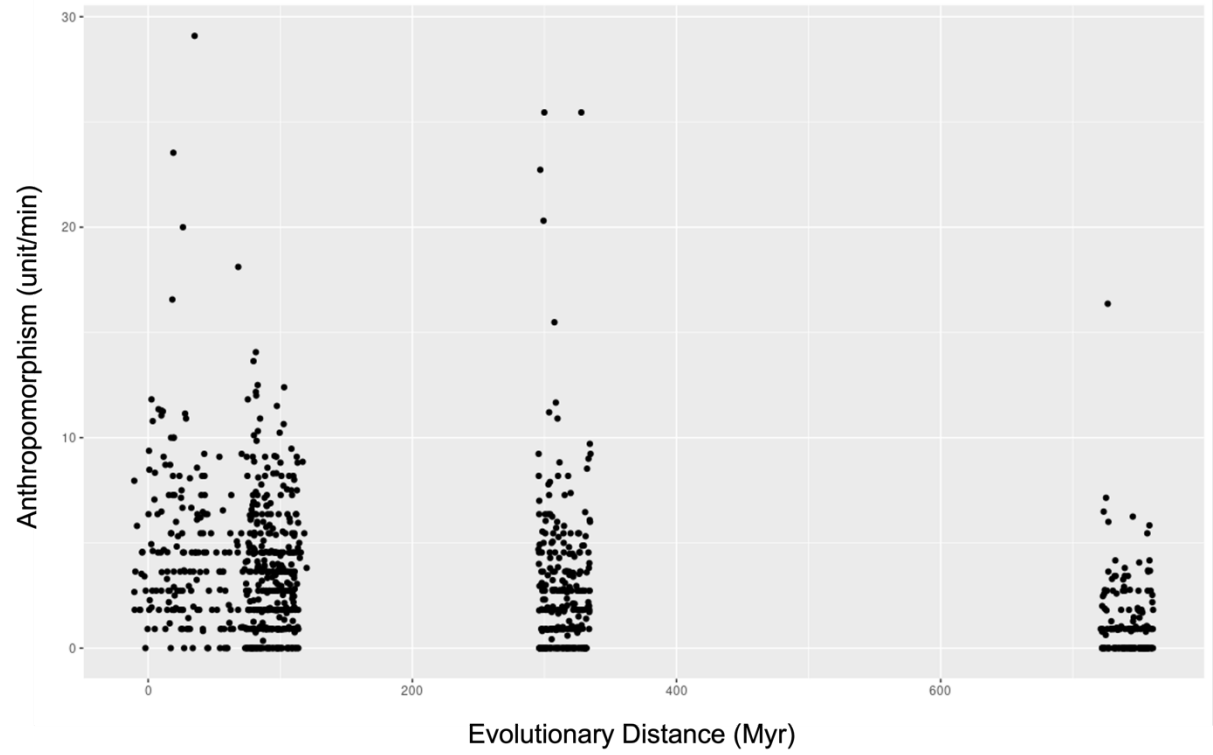

Figure 2: Anthropomorphic speech based on evolutionary distance

Post Hoc

To investigate whether there are possible cross-over interactions that cause the lack of main effects, we did a post hoc analysis where we included the interactions of the three main predictors. Results show a significant cross-over interaction effect between Qeak (experience with animals) and Qem (way of life) ($p<.05$) (Table 5). The effect of Qem on anthropomorphism is the opposite, depending on the value of Qeak (Fig…). This suggests that when people‘s experience with animals (when they had a pet) increases anthropomorphism increases but only (or especially) for people that have a planned way of life. When people did not have planned way of life, no clear effect of experience with animals was found on how often they anthropomorphised (Fig.3). In addition, the frequency of anthropomorphism increased with an increasingly planned way of life, but only for individuals who had experience with animals (Fig. 4).

Table 5: Fixed effects interaction model

	Estimate	*Std. Error*	*Z value*	*Pr(>|z|)*
Qeak	-0.057023	0.057908	-0.985	0.3248
Qem	0.022792	0.055938	0.407	0.6837
Qsm	-0.062047	0.058920	-1.053	0.2923
Sex	-0.097544	0.113932	-0.856	0.3919
Age	0.053224	0.052983	1.005	0.3151
ExpV	0.597118	0.105748	5.647	1.64e-08***
ViewO	0.003935	0.028608	0.138	0.8906
EvoDis	-0.454573	0.049384	-9.205	< 2e-16***
Qeak:Qem	-0.119760	0.054779	-2.186	0.0288*
Qeak:Qsm	0.023622	0.052649	0.449	0.6537
Qem:Qsm	-0.034424	0.053278	-0.646	0.5182
Qeak:Qem:Qsm	0.021600	0.051536	0.419	0.6751

**p < .05. ** p < .01. *** p < .001*

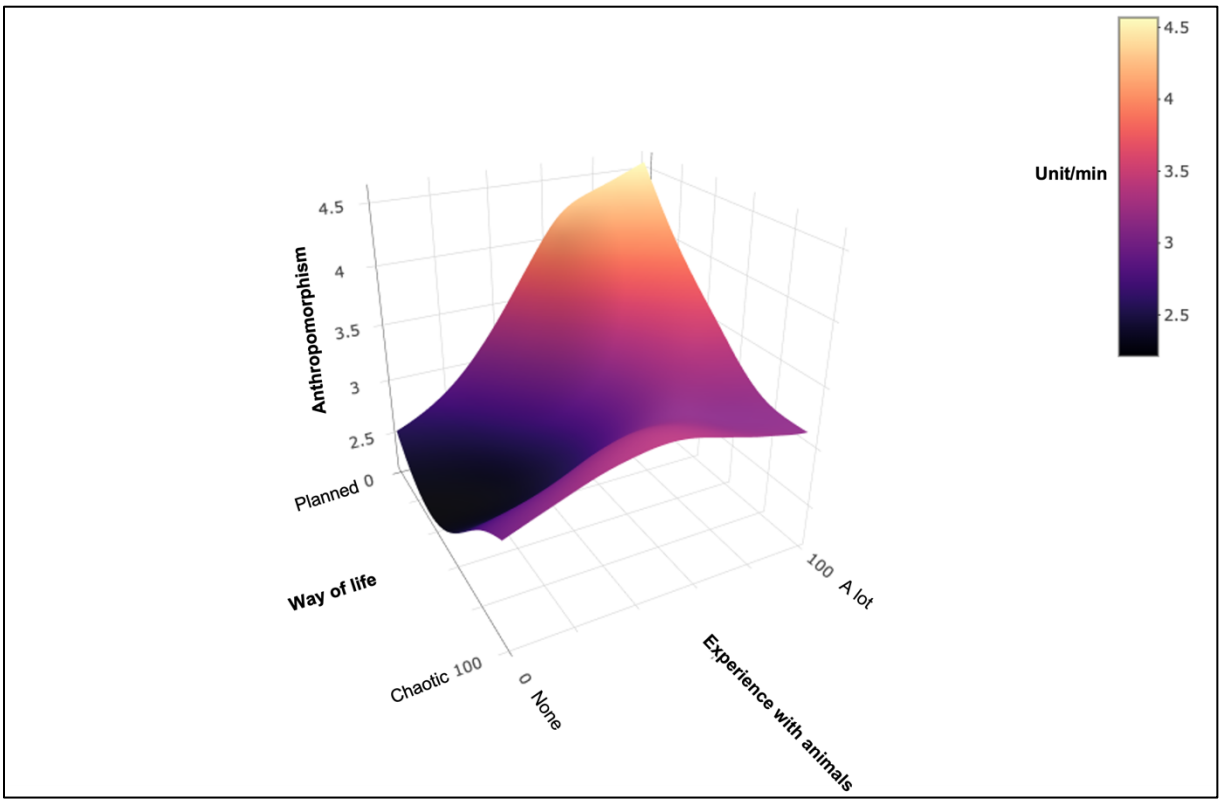

Figure 3: 3D plot Qeak:Qem

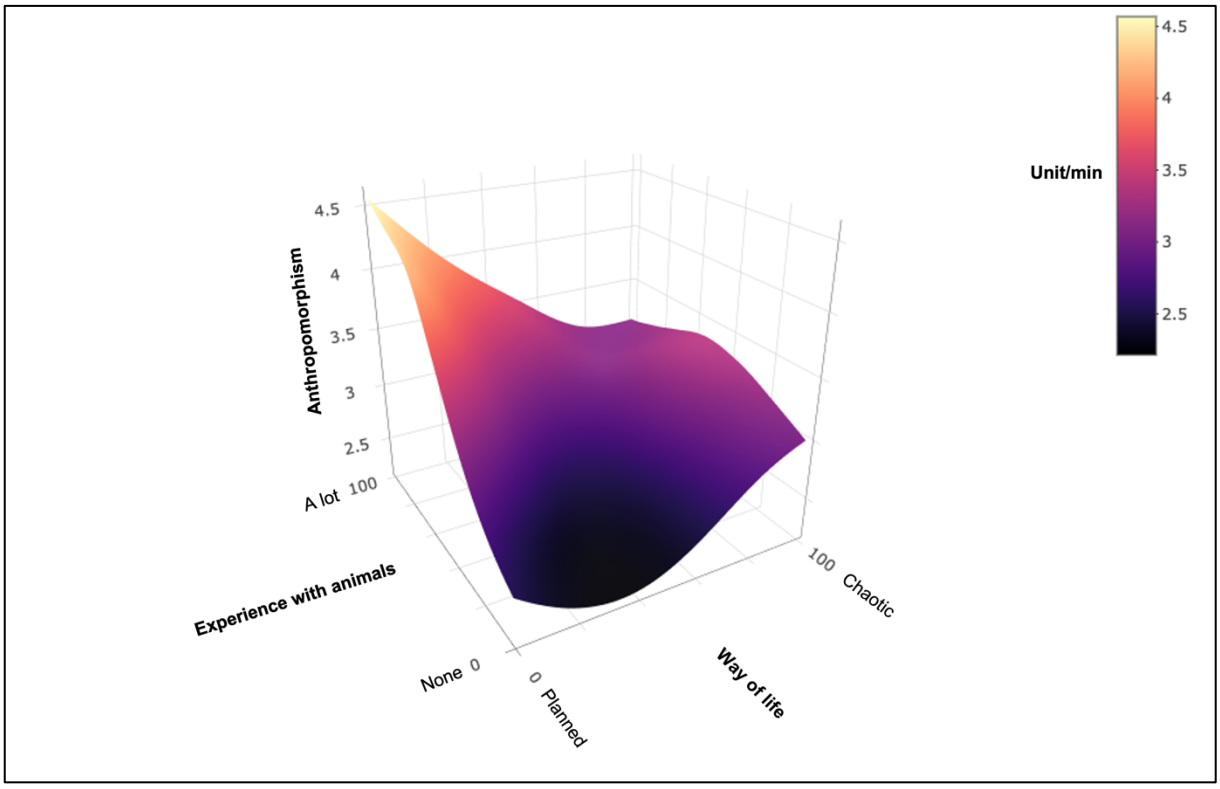

Figure 4: 3D plot Qeak:Qem

DISCUSSION

This study aimed to find evidence for the three-factor theory of Epley and colleagues (2007). Through a field study, we investigated whether self-reported psychological factors in humans are related to their likelihood to anthropomorphize animals. It was hypothesised that a participant's self-reported elicited agent knowledge is negatively correlated and a participant's self-reported effectance motivation and sociality motivation is positively correlated with their number of anthropomorphic statements per minute. Results showed that no main effects were found. Therefore, initially, all three hypotheses were rejected.

However, when I investigated the model further by including cross-over interactions, via a post-hoc analysis with interactions of the three predictors added to the model I found a significant interaction effect between self-reported elicited agent knowledge and self-reported effectance motivation. I found that when experience with animals is high, the number of anthropomorphic statements increases, especially when the participants' way of life becomes more planned. When experience with animals is low, the number of anthropomorphic statements decreases as the participants' way of life becomes more planned (Figure 3&4).

When the results are compared with the theory of Epley et al. (2007), it becomes clear that in this case practice and theory do not match. Since evolutionary distance of the animal species to humans and experiment version were both found significant and both had a stronger effect, one explanation for this could be that the likelihood to anthropomorphize animals depends much more on external factors than on inside psychological factors.

Another explanation can be derived from the significant cross-over interaction. It indicates that the psychological factors influencing anthropomorphism are more complex than Epley's theory states. Although the theory holds that the three psychological factors work in concert, Epley and colleagues only state how each factor influences the likelihood of

anthropomorphizing on their own and do not theorize how these three factors can influence each other. I found that anthropomorphic speech of participants remains the same when their way of life is chaotic, regardless of their experience with animals. This indicates that elicited agent knowledge does not correlate with anthropomorphic speech when effectance motivation is low. When the participant's way of life becomes more planned, anthropomorphic speech goes up when their experience with animals is high and goes down when their experience with animals is low. This indicates that when effectance motivation becomes higher, anthropomorphic speech increases when elicited agent knowledge is high and decreases when elicited agent knowledge is low.

So how can the cross-over interaction be explained? No previous research has found a similar relationship, so the interaction must be explained with logical reasoning. It could be argued that the more experience people have with animals, the more similarities they see, which makes them anthropomorphise more. It could then be argued that seeing these similarities combined with the motivation to control the environment causes people to anthropomorphize more. But it is then difficult to explain why this effect appears to reverse when people have no experience with animals. Although anthropomorphism increased much less steeply, it did increase slightly for people who indicated in the questionnaire to have a more chaotic way of life (Fig. 4). It is difficult, to find a logical explanation for this relationship at this point. Therefore, further research will have to be done first to find out whether this relationship is replicable.

Especially because this study has some limitations. Most importantly, the questions used as main predictors for this study were derived from a non-validated questionnaire. In this study, it was not possible to use a validated questionnaire, as the questionnaire had already been created and used before the start of this study. Another limitation is that it is uncertain

how accurate self-reports are regarding making statements about one's own characteristics. The consequence of these two limitations is that it is uncertain how accurately the questions served as a proxy for the three psychological factors from Epley's theory. Another limitation of the study is that the speech analysis was categorical. This means that speech was either anthropomorphism or not while in reality, anthropomorphism is more of a continuum. Because the speech analysis had to be used for multiple studies, it could not be fully tailored to this study. Although our labelled anthropomorphic speech positively correlated with evolutionary distance, this is still important to mention as it is uncertain how this way of measuring anthropomorphism affected the results.

In conclusion, this study indicates that the factors influencing anthropomorphism may be more complex than the theory of Epley et al. (2007) suggests. The results show that it is questionable whether a theory based solely on psychological factors is suitable for predicting anthropomorphism. For further research, it is recommended to also include the environment and the observed agent as influencing factors in the theory, as these factors may not be separated from the psychological factors when predicting anthropomorphism. At last, future studies seeking to find practical evidence for the theory of Epley et al. (2007), should eliminate the limitations of the current study. This entails measuring the psychological factors in a validated way and measuring anthropomorphic speech on a continuous scale.

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APPENDIX A: INFORMATION LETTERS

Live version

Dear participant,

In collaboration with the ARTIS Royal Zoo and the University of Amsterdam, Leiden University is investigating human-animal interactions. Let's go on a search for animals in ARTIS!

Background

The time when people had to hunt for their food is long gone. We now have a completely different view of the animal world. We are curious about how modern humans experience contact with animals. Why do people go to the zoo? What does man look at then? What do humans think of animals? And perhaps the most important question: what does a person feel when she/he/they is in contact with an animal? We need you to answer these questions.

You can participate if:

- You are at least 16 years old.
- You can speak and read English or Dutch.
- You can use a smarthone to mae your own videos

This is how it works:

1. Film the indicated animals and plants during your visit in ARTIS.
2. Tell us what you see, think or feel while watching these animals.

3. Fill in a short questionnaire about animals, humans and nature.

**The steps above are summarised. During the study, we will provide step-by-step instructions to guide you. We expect that the study can be completed within 30 minutes. The study has been designed to seamlessly integrate in your zoo visit which makes giving an exact time estimate difficult.*

Questions or need help?

You can ask questions to the researchers at any time. You cn reach us digitally with the email address [animalsinthelens@fsw.leidenuniv.nl]. The study is performed by Lévy P. L. Matricon and the project is led by Prof. dr. Karline. R. L. Janmaat [k.r.l.janmaat@uva.nl]. You can also reach us at the following postadres: Prof. Dr. Karline R. L. Janmaat; Afdeling Cognitieve Psychologie, Universiteit Leiden; Wassenaarseweg 52, 2333 AK Leiden.

Privacy & rights

Your privacy is important to us. We process your data according to strict European guidelines. Your data is safely stored in a digital drive of the university. The study has been reviewed by the Leiden Ethical Committee of Psychology and Privacy Officers of Leiden University and the University of Amsterdam. The data may be used for future studies about human-animal interactions. The data we use is comprised of your self-made videos and the questionnaire. Since you, as a participant, have the full control over the submitted data, we cannot state that this data is completely anonymous. These movies are what we call “raw data”. This “raw data” is only accessible to the researchers and this data is always processed so that you are never identifiable in the final publication.

If you want to have your data deleted, you can contact us by email or mail (see page 1). If you have any questions about your privacy and want to know more about what we do with your data, you can always ask the researchers. For general questions regarding your privacy rights, you can contact the Privacy Officer of Leiden via privacy@bb.leidenuniv.nl.

If you have any complaints about this study, please contact the chairman of the Ethics Committee, Dr. Henriët van Middendorp, via ethiekpsychologie@fsw.leidenuniv.nl or via the following postal address: Wassenaarseweg 52, 2333 AK Leiden, Room 2A01.

If you change your mind during the study, you can stop the study at any time by notifying the researchers. If you stop before completion of the study, you revoke your right to eventual compensation. Even if your participation is complete, you can still withdraw your consent up to 3 days after your participation. This has no negative consequences and means that your data will be deleted and not included in the study. After these 3 days, you can always request to have your data deleted, but it may be that your data has already been processed anonymously in an analysis.

Online version

Dear participant,

In collaboration with the ARTIS Royal Zoo and the University of Amsterdam, Leiden University is investigating human-animal interactions. Let’s go on a digital safari!

Background

The time when people had to hunt for their food is long gone. We now have a completely different view of the animal world. We are curious about how modern humans experience contact with animals. Why do people go to the zoo? What does man look at then? What do humans think of animals? And perhaps the most important question: what does a person feel when she/he/they is in contact with an animal? We need you to answer these questions.

You can participate if:

- You are at least 16 years old.
- You can speak and read English or Dutch.
- You can make a video (webcam, smartphone or video camera).
- You have access to internet.

**we advise the use of a computer with a webcam and a cabled internet connection for an optimal experience.*

This is how it works:

1. Watch animal clips
2. Film your reaction and tell us what you see, think or feel
3. Fill in a questionnaire about animals, humans and nature

**The steps above are summarised. During the study, we will provide step-by-step instructions to guide you. We expect you can complete the study within 30 minutes.*

Questions or need help?

You can ask questions to the researchers at any time at [animalsinthelens@fsw.leidenuniv.nl]. We try to respond as quickly as possible! The research is performed by Lévy P. L. Matricon and the project is led by Prof. dr. Karline. R. L. Janmaat [k.r.l.janmaat@uva.nl]. You can also reach us at the following postadres: Prof. dr. Karline R. L. Janmaat; Afdeling Cognitieve Psychologie, Universiteit Leiden; Wassenaarseweg 52, 2333 AK Leiden.

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If you have any complaints about this study, please contact the chairman of the Ethics Committee, Dr. Henriët van Middendorp, via ethiekpsychologie@fsw.leidenuniv.nl or via the following postal address: Wassenaarseweg 52, 2333 AK Leiden, Room 2A01.

If you change your mind during the study, you can stop the study at any time by notifying the researchers. If you stop before completion of the study, you revoke your right to eventual compensation. Even if your participation is complete, you can still withdraw your consent up to 3 days after your participation. This has no negative consequences and means that your data will be deleted and not included in the study. After these 3 days, you can always request to have your data deleted, but it may be that your data has already been processed anonymously in an analysis.

APPENDIX B: CONSENT FORMS

Informed consent 1

By signing this form, you declare that you have read the information letter ("Information letter Animals in the Lens!") and that you agree with all described procedures. You declare that all your questions have been answered to your satisfaction.

I agree to participate in this study. I acknowledge my right to retract this consent at any moment without having to give a reason for this retraction and I understand that when I retract this consent before completion of the study, I will not receive compensation for my participation. I am aware that my data is saved in a coded manner and that it can be used for future studies. I acknowledge that under no circumstance I will be identifiable in the final publication.

NAME:

DATE:

SIGNATURE:

Declaration of consent 2

Now that your participation is complete, we are legally obliged to ask for your permission again to use the video and audio materials you have submitted to us. Without this extra

permission, we are not allowed to use your videos for the study. You still have the right to have your data removed if you change your mind in the future.

I give my consent again for the use of the video and audio materials that I have submitted under the same conditions as those stipulated in the document I have signed at the start of the study “INFORMED CONSENT; Dieren in de Lens!”.

I give consent for my videos to be used for illustrative purposes in scientific presentations or other educative purposes.

I want to receive updates about the findings of the study by email.

NAME:

DATE:

EMAIL (optional): SIGNATURE:

APPENDIX C: DEBRIEFING LETTER

Dear participant,

Thank you very much for your participation! In this research we want to study how people look at animals and what effect an animal can have on human emotions.

In the past, when humans still lived as hunters and gatherers, we lived much closer to nature than we do now. At that time, animals had an important place in our lives. We had to hunt and be careful not to be eaten ourselves, but animals could also help us find plant foods. According to evolutionary theories, a large part of the behaviour that we now exhibit has already been fixed in prehistoric times. Fortunately, our societies have changed, and we no longer have to fear predators. But has our behaviour also changed? Or are we still afraid of the big bad wolf? Thanks to your participation, we hope to unravel what animals mean to us.

It is complicated to determine what happens when a person has contact with an animal. Our behaviour may depend on the animal: we should be more afraid of a tiger than of a pigeon. But humans are strange animals and some of us are more afraid of the pigeon than the tiger! So, it also depends on the personality of the human being.

Thanks to your video, we can analyse your observations to better understand what humans see, think or feel while watching animals. We also asked you to fill in a questionnaire, because we are interested in the different opinions on nature and animals and how these relate to animal observation.

You were also asked to share your reaction of a plant. Plants, just like animals, used to be very important for survival. If one ate the wrong plant, it could quickly be fatal. In order to investigate the role plants, have in our modern society and how plant perception is related to animal perception, it was also important to see how you view plants.

We hope you enjoyed your participation and that your visit to the zoo has become more interesting. However, any scientific research can induce stress and / or negative emotions in some. You can discuss this with the researchers or, if you prefer to speak to a professional, you can contact the student psychologists at Leiden University (071-XXXXXXX). Remember that you can always have your data deleted by contacting the researchers.

If you are as curious as we are about the results of the study, please report this to the researchers. We will note your details and then keep you informed of our findings! You can always reach us using the contact details given below.

Sincerely,

The researchers

APPENDIX D: QUESTIONNAIRE

Part 1

1) What is your gender?

() Male

() Female

() X

2) What is your age category?

() 16-25

() 26-35

() 36-45

() 46-55

() 56-65

() 66+

3) What is your native language? (if several list them under “other:”)

() Dutch

() Other: [ ]

4) Do you like having people around you?*

I prefer to walk my path alone I always need to be surrounded by people

5) Is the opinion of others important?*

No, I don’t care about that Of course, otherwise nobody likes you

6) Do you feel at home in your current society?*

Yes! Nothing should change No, I want to go to another world

7) Which of these do you prefer to read?*

Short messages and chats Long trilogies and encyclopaedias

8) What is more important?*

Animals should help people People should help animals

9) Do you follow a specific diet (for ethical reasons)?

() No

() Organic

() Vegetarian

() Vegan

() Other

Part 2

1) What is your favourite animal and why?

Animal: [ ]

Because: [ ]

2) How connected do you feel to nature?*

I find nature annoying I am one with Mother Nature

3) Do you take the time to get to know nature better?*

No, I don't find nature interesting Yes, I'm an (amateur) biologist

4) In what place did you grow up? (if multiple, estimate their average)* On a remote hill

In the middle of a big city

5) Are you quickly afraid of animals?*

I don't feel comfortable around animals I dare hold a cobra

6) Do you have pets and what kind of animals are they?

Amount: [ ]

Species: [ ]

7) Did you grow up with pets?*

No, I had no contact with animals Yes, I was busy all day long with all my animals

8) Do you work with animals on a daily basis? (veterinary, dog-walking, etc.)

() Yes

() No

Part 3

1) What fits you best?*

Building good thing Removing bad things

2) What is your philosophy?*

First come, first served Share absolutely everything

3) How do you approach life?*

My life is exactly planned and calculated I leave my life up to chance. I'll see

4) Hunter or gatherer?*

I will look for fruits and vegetables I will go on the hunt for a mammoth

Part 4

1) How easily can you place yourself in others?*

I place myself in others' shoes and forget myself That is complicated. I'd rather not do it

2) Working or caring for the house?*

I bring money and food to the table I care for my partner, the kids, the animals and the plants

3) What is better for children?*

Always give good directions Letting them live their life

4) Do you have children?

() Yes

() No

Part 5

1) Have you ever felt the need to cry with/for an animal?*

No, I've never had that Yes, regularly. Animals touch my soul

2) Do all animals have a soul according to you?

No, animals are just animals Yes, animals are magical beings

3) Do you believe in magic or wonders?

No, of course not Yes, I know it for sure

Part 6

1) Why are plants useful to you? Give all the reasons.

Because: [ ]

2) How many plants do you have in your living room?

Amount: [ ]

3) Do plants play a big role in your life?*

No, I don't find plants interesting Yes, I'm an (amateur) botanist

*Note. Questions marked with * are questions with a continuous answer scale. [ ] Indicate an open answer.*

APPENDIX E: SPEECH ANALYSIS RULES

• Base rules		
Hybrid Analysis Method (grammatical-semantic)	• to analyse speech reproducibly, we use grammatical rules and word lists (grammatical). • to analyse speech meaningfully, we use human interpretation (semantic). • the grammatical rules and semantic rules were designed to complement and confirm each other. • in the rare cases where they might contradict, grammatical rules have priority ("we stick to what is said in the video instead of interpreting what the observer meant"). • if the valency of the code is unclear, semantical interpretation is favoured over grammatical rules (except for sarcasm).	
Full Spectrum Analysis	• the goal of the analysis is to translate the remarks of the observer into statistical quantities. • all speech is analysed and categorised (coded) appropriately. • this differs from analyses that only count specific words.	
AiL focus (shifting)	• the Animal in the Lens (AiL) is the main object of the analysis • the AiL is <u>always</u> the animal that is under observation as tasked by the researchers. • the AiL can, however, shift between any members of that species(/clade), even if these members are a memory or just imagined, all within the same sentence.	
General Temporal Insensitivity	• in general, we ignore time indicators embedded in verbal conjugations. • the exception is the use of the past and the future tense to speculate about <u>possible</u> AiL actions. > TRNSC	
Clause Construct Sensitivity	• depending on how certain clause are constructed (as questions, conditions, comparisons), they may recieve a different code.	
Sarcasm Insensitivity	• we read through sarcasm as if it wasn't there, "Wow, you are a beauty queen" {to a spider} >>> [EMOJU+] + [TRNSC+]	
• speechBlock division rules		

Speech division is a crucial process, to separate the speech into "speechBlocks". Every sBlock = 1 unit for our statistical analysis. The way the sBlocks are divided also play an important role in their subsequent coding.		Examples
I) division by active verb	• Every clause containg an inflected verb (+ its subject and its object) is 1 speechBlock • A speechBlock can never span more than one clause.	• [I see a beautiful wolf] • [that is running].
II) division by implicit verb	• When no verb is given and/or the subject left unspecified, we assume that "(the experience with) the AiL" is the subject.	• [Nice.] [Cool animal.]
III) division by enumeration	• All lists (both "and" and "or" lists), are split.	• [He is cute,] [soft] [and nice.]
IV) division by plural content	• Specfic words or expressions that need to be extracted from the speechBlocks that were created through rules I-III are listed in the glossary. (see below for more)	• [The [runnning] wolf is nice.]
• Plural Content Extraction (division rule IV)		
After division by the previously described rules I-III, we always look at the speechBlocks that we "created".If the words listed below can be found in the sBlock, we "extract a novel sBlock from it".We never extract from: EXWe always extract from: DCOMM		Examples
dense AiL references	• nouns describing "something" of the AiL • common for ALL	stripes, his running, the length of, his neck, the king, the group, two, eyes, both
adjectives describing AiL	• adjectives describing "something" of the AiL • common for ALL	nice, cute, sweet, ugly, mean, satanic, friendly, kind

adverbs describing AiL action	• adverbs describing "something" of the AiL's movement. • common for ACTIO/TRNSC/EMOJU/ENVIR/ALIEN	nicely, fast, together
infinitives describing AiL action	• infinitives describing AiL movement. • common for ACTIO/TRNSC	to run, to dance, to eat
gerunds describing AiL action	• gerunds describing AiL movement. • common for ACTIO/TRNSC	running, dancing, eating
nouns describing objects & animals in the environment	• only for ENVIR	girl, tree, food, poop, bird, cage
prepositional phrases describing AiL movement direction & location	• only for ENVIR/DESCR	up the tree, down, left, on his back
• AiL references		
The AiL can be many things. In our analysis, it is the concept we look for first in ObS speech. *Below are listed the specific words we understand to be the AiL.* *The dense AiL references carry information that we code for in our analysis.*		Examples
nouns, pronouns	VOID reference > not coded for (see below for noun exceptions)	he, she, they, it, the creature, the animal, the zebra
plural form of species	VOID reference > not coded for	zebras, the birds
a conspecific	VOID reference > not coded for	the other one
closely related species/clade (by mistake or generalisation)	VOID reference > not coded for	the birds
group signifiers and counts of AiL	DENSE reference > ENVIR	both, the group, all, the majority, together, two AiL
body parts	DENSE reference > DESCR (even if they may be slightly anthropomorphised)	eyes, legs, arms, ears

body parts count	DENSE reference > DESCR (thus "two arms" = 2x DESCR)	one, two, three
static features	DENSE reference > DESCR	stripes, colours, contrast, hairiness
nouns/clauses referring to AiL behaviour	DENSE reference > ACTIO/TRNSC/…	how he runs, his thoughts
anthropomorphic nouns	DENSE reference > TRNSC	queen, mister, sir
• Clause Construct Sensitivity		
Some clauses are used in specific constructions and might therefore need to be given a different sCode.		Examples
Questions	• Most questions are ignored and coded as if they were affirmative statements (see example D). The following exceptions gain an EXTRA code for the interrogative nature of the statement:• WHAT? questions about AiL nature, identity and behaviour. > receive extra XPERT-• WHERE? questions about AiL or object location in environment > receive extra ENVIR• WHY? questions about AiL ACTIO > receive extra TRNSC• WHY? questions about AiL DESCR > receive extra XPERT-Attention! Not all questions are stated directly and some do not have a question mark to identify them (see example E).	A. [[What] is the animal doing?] >>> [XPERT-] + [ACTIO]B. [[Why] is the animal moving like that?] >>> [TRNSC] + [ACTIO]C. [[Where] is the animal now?] >>> [ENVIR] + [EX]D. [Why do I like this animal?] >>> [EMOJU+] (no extra code!)E. [I don't know] [[why] the animal moves like that.] >>> [XPERT-] + [TRNSC] + [ACTIO]
Conditional/Hypothetical Clauses	• Most conditional clauses are ignored and coded as if they were affirmative statements. • Very rarely a conditional clause can cause the valency to flip. Use the context to	A. [If I was a monkey,] [I'd like that.] >>> [TRNSC] + [EMOJU+] B. [If the animal had been white,] [I

	determine whether something positive or negative is meant. (see example B)	would like him much more.] >>> [DESCR] + [EMOJU-]
Comparisons	• Most comparisons belong to DESCR. This includes comparisons to objects and other animal species, including the description of the AiL as a hybrid animal. • However, if the AiL is compared to a specific noun from another sCode, DESCR loses priority to the respective sCode. See glossary for specific nouns. • For indirect comparisons through an adjective, we only code for the adjective and ignore the rest. In example C, we read the statement as follows: *"The animal is soft."*	A. [The animal looks like a chicken.] >>> [DESCR] B. [The animals looks like a human.] >>> [TRNSC] C. [The animal is as soft as a ball of wool] >>> [PHYSI•]
Repetitions & incomplete sentences.	• All repetitions are coded for, even if they are obviously a repetition. • Incomplete sentences are coded only if they contain relevant information (extractable plural content)	A. [Oh, he is now…] [He's …] [I don't know…] [Eating?] [Yes, eating.] [He is eating.] >>> [EX] + [EX] + [EX] + [ACTIO] + [ACTIO] + [ACTIO].

No Implicit Doubling!	• We only code unspecified references ("this, that"), once.In the first example here, we thus ignore the [ACTIO] "that" reference in the second clause.• This rule also applies to lists of statements that are subordinate to a previous clause. See the second example. Here we ignore the implicit meaning of the sentence: *"I like how he runs and I like how he smiles".*• We apply this rule, because without it, it is in practice difficult to tell whether something is an implicit reference or not, especially so since our analysis is built for colloquial language where pauses in speech are common.	A. [He runs [fast.]] [That is cool] >>>[ACTIO + [ACTIO]] + [EMOJU+]B. [I like] [how he runs] [and how he smiles] >>> [EMOJU+] + [ACTIO] + [TRNSC]
Ratio statements	• Similar to the rule on implicit doubling above, we code ratio statements only once. In the example on the right, we only assign 1 DESCR to the clause, even if the clause pertains to 2 horns. (The second DESCR is assigned by dense AiL reference of body part.)	A. [One of his [horns] is longer than the other.] >>> [DESCR] + [DESCR]

Verbal introductory clauses	• Many clauses in colloquial language are introduced by a verbal clause (grammatically the main clause), which are often void of information. See example A.
	
	• Almost all such introductory verbal groups for the main statement are ignored.
	
	• The exceptions are those that drastically change the meaning of the clause:
	"I (don't) know that/whether/if/..." > XPERT+-- (value from context)
	"I thought that ..., but ..." > XPERT-
	"X should (not) Y" > ALIEN•
	"AiL tries/likes/wants/... to ..." > TRNSC•
		A. [It seems that] [the animal is sleeping.]
		>>> [EX] + [ACTIO]
		
		B. [I didn't know] [that he was this big.]
		>>> [XPERT-] + [DESCR]
		
		C. [I should not] [touch this [creepy] animal.]
		>>> [ALIEN] + [PHYSI-] + [PHYSI-]
		
		D. [He tried [to jump].]
		>>> [TRNSC•] + [ACTIO]

• Valency assignation patterns		
For all valency assignations, we always take the context into account. *A negative statement always causes the valency to flip. (He is cool > EMOJU+ ; He is not cool. > EMOJU-)*		Examples
EMOJU valency pattern (+ - •)	This is the simplest pattern:• positive for "compliments" to AiL or "positive (envisioned) experience with AiL"• negative for "insults" to AiL or "negative (envisioned) experience with AiL"• neutral for subjective judgements from which neither pleasure nor disgust can be derived.EMOJU pattern can apply to: verbs, adjectives, adverbs and full clauses.	[EMOJU+] = cute, nice, cool[EMOJU-] = ugly, stinking[EMOJU•] = opvallend

TRNSC & ALIEN valency pattern (+ - •)	Both categories follow the EMOJU pattern. • This mostly concerns: • positive/negative human personality qualifiers • god/demon judgements • fascination/confusion judgements. • positive & negative values are mostly applied to adjectives and more rarely nouns, verbs (e.g. "friend", "adore", "identify oneself with AiL"). See glossary for exact valency.	[TRNSC+] = sweet, kind, loving, friendly, friend. [TRNSC-] = mean, lazy, loser [ALIEN+] = holy, magic [ALIEN-] = satanic, weird, strange

PHYSI
valency pattern (+ - •)
	This pattern largely follows the EMOJU pattern, but is focused on the experience of contact with the AiL by the ObS. Unlike EMOJU, speech is analysed from the ObS perspective: positive feelings about hunting the animal fall under PHYSI+.
	
	• positive for "positive (envisioned) contact with AiL for ObS", "protectiveness", "tameness", "animal (ab)use"
	• negative for "negative (envisioned) contact with AiL for ObS" and "dangerousness",
	• neutral for subjective judgements from which neither pleasure nor fear can be derived and for descriptions of haptic features.
		A. [I want to cuddle with him] [and protect him forever.]
		>>> [PHYSI+] + [PHYSI+]
		
		B. [He is dangerous.] [He is going to attack me.]
		>>> [PHYSI-] + [PHYSI-]
		
		C. [Those [teeth] are very [sharp].] [And he is standing very close to me.]
		>>> [DESCR] + [PHYSI•] + [PHYSI•]

XPERT valency pattern (+ -)	This pattern is distinct from all others: it measures the possesion or lack of knowledge of the ObS about the AiL: • positive for "positive amount of knowledge about AiL" and "expert statements" • negative for "negative/null amount of knowledge about AiL" • NO NEUTRAL	A. [I didn't know that] [he had such [big] [eyes].] >>> [XPERT-] + [DESCR] + [DESCR]
• Speech exclusion rules		
Group communication exclusion	If ObS initiates communication with group members > we accept speechIf ObS answers communication of group members > we do NOT accept speechIf ObS ignores or radically changes subject of the communication > we accept speech	
Online communication exclusion	• We accept speech from the start of the 3 beeps of the video in question - to the start of the 3 beeps of the NEXT video. • This means we include all speech spoken in the intermezzo between both videos. • If ObS continues to talk about the previous animal, while the new video has started, ALL speech related to the previous animal must be moved to EX.	

APPENDIX F: STATISTICAL ASSUMPTIONS