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Emotional response to pictures of farm animals: Influence of picture content and recipient characteristics

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ABSTRACT

Pictures play a dominant role in communication about livestock farming. They are used by competing lobby groups not only to inform their audience cognitively but also to target emotionally. However, few studies have looked at the effects pictures from livestock farming have on recipients. In this study, we used an online survey to investigate the emotional response in the dimensions pleasure and arousal to pictures showing farm animals of the animal classes fish, birds, and mammals in different circumstances. The results show that pictures depicting farm animals in an outdoor environment led to high pleasure and low arousal. Looking at pictures showing animals kept indoors led to less pleasure and higher arousal, a response that was further intensified when recipients were confronted with pictures of suffering animals. While the recipients' characteristics investigated in this study, i.e. professional background, belief in animal mind and personality traits, had no influence on emotional response to pictures showing farm animals outdoors, they affected emotional response to pictures depicting farm animals indoors and suffering. We discuss how awareness of the individuality of emotional response and reflection on one's own emotional states related to livestock farming might lead to more animal and human welfare and a more respectful dialogue between opposing groups.

***Keywords**: Pleasure; arousal; indoor husbandry, outdoor husbandry, suffering animals*

1 Introduction

In livestock farming, pictures play a prominent role in marketing as well as in public discourse. Employing traditional media and increasingly social media, these pictures are commonly used by competing lobby groups, each with opposing priorities regarding the content of the pictures. While the food industry often uses pictures suggesting rural idylls to promote and greenwash animal food products (Busch *et al.,* 2017; Simons *et al.,* 2018), criticism of current agricultural practices is often underpinned with negative pictures, e.g., of suffering animals (Tiplady *et al.,* 2015; Rovers *et al.,* 2018). Farmers, on the other hand, are increasingly using authentic images from everyday practice to make their work more transparent and to inform interested citizens and consumers about contemporary agricultural animal husbandry (Busch *et al.,* 2017; Schütz *et al.,* 2022).

Even if the content of pictures often indicates that they are intended to elicit specific emotions and motivate recipients to act in a way that is desired by the respective lobby group, there have been only a few studies on the perception of pictures from livestock farming so far (Busch and Spiller, 2018). To explain how pictures affect recipients, the stimulus-organism-behavioural response (S-O-R) model proposed by Mehrabian and Russell (1974) can be applied. The relationship between the components of the model can be explained in three stages: the perception of environmental stimuli, the interpretation of the information provided by the stimuli into emotion and the reaction towards the stimuli based on emotional response (Tantanatewin and Inkarojrit, 2018). Pictures can be considered as visual stimuli, which, in addition to factual information, contain emotional information leading to emotional responses in the recipient (Kensinger and Schacter, 2006; Sánchez-Navarro *et al.,* 2006). The emotional response that represent the interpretation of the information can be described with the two independent dimensions pleasure and arousal (Mehrabian and Russell, 1974; Russell and Pratt, 1980; Ridgway *et al.,* 1989). Various studies indicate that the level of pleasure and arousal determines the behavioural reactions, which can be roughly categorised as approach and avoidance, towards environmental stimuli (Ridgway *et al.,* 1989; Kim and Moon, 2009; Tantanatewin and Inkarojrit, 2018). This suggests that emotional response could influence whether goals pursued with releasing specific pictures are achieved or not (Houts *et al.,* 2006) by affecting recipients towards approaching or avoiding the state displayed in the picture and the information conveyed by the pictures.

While some picture elements elicit similar responses from most recipients, emotional response does not only depend on the content of a stimulus, but also on the recipients' characteristics (Houts *et al.,* 2006). An investigation conducted by Else *et al.,* (2015) indicates that emotional response to visual stimuli can differ between laypeople and experts. Expertise modulates the effect of positive- and negative-valenced stimuli on emotional response with experts showing attenuated emotional responses compared to non-experts (Leder *et al.,* 2014).

A further major determinant of emotions are beliefs. Beliefs refer to anything an individual think is true; how an individual believes the world to be (Frijda *et al.,* 2000). Beliefs have substantial cognitive components and are more resistant to questioning and change the more central they are for an individual (Beswick, 2011). Nevertheless, even if the ability to change our beliefs is limited they are dynamic in nature. They are subject to social influences and can change based on experience (Rabin, 1994; Bernack *et al.,* 2011). Regarding animals, beliefs about their consciousness and their emotional experience have changed continuously. Important philosophers of the past centuries found arguments for the non-sentience of animals, culminating in Descartes' (1596-1650) idea that animals were like 'automata'. In early human intuition and articulated already by Hume (1711-1776), on the other hand, the concept of animals being sentient to some extent has been present for hundreds of years. In biology and animal science, the concept of animal sentience has become increasingly important in the last quarter of the 20th century. This research has resulted in the current consensus that most farmed species are sentient. However, it is still a matter of debate where on the phylogenetic scale sentience emerges (Duncan, 2006).

In addition, personality research shows that personality traits influence emotional responses to visual stimuli (Tok *et al.,* 2010; Aluja *et al.,* 2015). A review by Kaspar and König (2012) suggests that personality factors can influence visual attention. Individuals seem to search for information that is congruent to their personality traits and avoid incongruent material. This selective visual attention could in turn influence emotional response (Kaspar and König, 2012). Mardaga *et al.* (2006) note that there is evidence that relationships between neuroticism and negative emotions and between extraversion and positive emotions exist.

Although emotional responses to pictures and the factors influencing it have been widely researched in psychology, often using the International Affective Picture System (IAPS), which is a gallery of emotionally-evocative photographs for eliciting specific emotional responses (Lang *et al.,* 1997), there is a lack of studies examining the effect of pictures showing farm animals. This study contributes to the literature by investigating the emotional response to pictures of farm animals, taking into account the characteristics of the participants. We conducted an explorative online survey in which participants were shown pictures of different farm animals in different situations. For the animal classes fish, poultry, and mammals, we analysed the emotional response to pictures showing animals of these classes that were

respectively in the following three situations: healthy outdoor, healthy indoor and suffering. We expected that the picture content, i.e., the situation in which an animal is depicted, influences the emotional response of the participants. We further hypothesised that emotional response to pictures of livestock depends on participants' characteristics, specifically on their professional relation to livestock, their belief in animal mind and personality traits. Results of multivariable analyses suggest that picture content influenced the emotional response in both dimensions - pleasure and arousal. Professional background, belief in animal mind and personality traits influenced the emotional response to pictures showing healthy animals indoors and suffering animals, but not to pictures showing healthy animals outdoors. These findings may help to better understand how people respond to pictures depicting farm animals that are used, for example, for communication with potential customers of animal-based products or society, and thus how these pictures might influence individual behaviour and public discourse related to livestock farming.

2 Material and Methods

2.1 Survey

To answer our research questions, i.e., to determine the influence of picture content and individual characteristics of the participants on emotional response to pictures of farm animals, an online survey was conducted in the first half of the year 2021 with the software LimeSurvey Professional. In this study, we focused on animals belonging to animal classes (as defined by biological taxonomy; see Campbell and Reece, 2006) that are commonly used for food production, which are mammals, birds (poultry) and fish. When selecting the pictures for each animal class, attention was paid that the animal species included were comparable in terms of attribution of cognitive abilities by laypeople. Eddy *et al.,* (1993) tabulated the cognitive abilities of 30 animals which were assessed by lay people (psychology students). Cows and pigs were both rated with the same values. Considering that farm animals are sentient beings capable of complex cognitive feats affecting their emotional evaluation of personal circumstances and thus their emotional state (Vögeli and Gygax, 2017; Zebunke *et al.,* 2017), we selected the following situations assumed to differently affect the emotional state of animals: extensively housed, healthy animals in an outdoor environment; intensively housed, healthy animals in an indoor environment; and animals in a potentially or acutely life-threatening situation due to disturbances of biological function, hereafter referred to as suffering animals. Healthy farm animals living in an stimulating environment allowing them to express their physiological behaviour, such as extensive outdoor systems, are expected be in a more positive emotional state than animals living in a monotonous environment typical of intensive indoor housing (Temple *et al.,* 2011; Anderson *et al.,* 2021). Animals at risk of impaired biological function, e.g. due to respiratory distress, dehydration, inadequate energy intake, illness, or injury, typically experience negative emotions that can be overwhelming (Mellor, 2012; de Boyer des Roches *et al.,* 2018). Based on the premise that emotional state, especially if persistent, affects animal welfare (Lecorps *et al.,* 2021), it can be surmised that in comparing the three situations described above, suffering animals experience the poorest level of welfare. The level of welfare of healthy animals kept indoors might than best be described as neutral and that of healthy animals living outdoors in favourable weather conditions as the highest (Mellor, 2012). For this study it was of particular interest whether the gradiation of animal welfare visualised by the pictures is reflected in the emotional response of the participants and in this way to get a better understanding of the perception and effect of such pictures.

Before putting the survey online, it was qualitatively pretested with 3 participants and quantitatively with 19 participants to assess the comprehension of the questions. Based on the results of these pretests, the wording of some questions was refined and the display time of the pictures was adjusted.

The survey consisted of four parts: The first part contained items intended to measure the participants' belief in the mental experience of animals (belief in animal mind, BAM) of the animal classes included in the analyses: fish, birds and mammals. Four items were administered to assess the extent to which participants believed that fish, birds and mammals are: (1) conscious, and aware of what is happening to them, (2) capable of experiencing a range of feelings and emotions (e.g., pain, suffering, contentment, maternal affection, aggression, fear, frustration, loneliness, and boredom), (3) able to some extent to solve problems and make decisions about what to do, and (4) more like computer programs: mechanically responding to instinctive urges without awareness of what they are doing (see Hills 1995). Each class of animals was rated on each item on a scale ranging from 1 (I totally disagree) to 9 (I fully agree). The question related to animals as computer programs (4) was reverse coded.

The second and most extensive part of the survey were the questions aiming at capturing the emotional response to pictures depicting farm animals. Pictures of farm animals, belonging to the different animal classes, were shown to the participants in random order. Each picture was displayed on the computer screen for 10 seconds. After each picture, the participants were asked to indicate on a nine-point scale the level of pleasure and arousal they felt when looking at the respective picture using the Self- Assessment Manikin (SAM), which is an established method for measuring emotional response in the dimensions of arousal and pleasure. The SAM is a picture-oriented instrument containing five illustrations of a manikin for each dimension that participants usually rate on a 9-point scale (see Appendix 1). For

assessing pleasure, SAM ranges from a happy, smiling figure (high pleasure) to an unhappy, frowning figure (low pleasure). For arousal, SAM ranges from a excited, wide-eyed figure representing high arousal to a relaxed figure with closed eyes representing low arousal (Bradley and Lang, 1994). The pictures for the analyses were chosen in a way that they show the animals in comparable situations, regardless of the class: healthy animals outdoors, healthy animals indoors (tank, barn) and suffering animals (Table 1). Healthy animals outdoors were visualised by pictures of extensive animal husbandry outdoors: two trout swimming in an open water (fish), dual-purpose chickens and a muscovy duck in a garden-like environment (poultry) and a group of heifers in a pasture in front of a green hilly landscape (mammals). Healthy animals indoors were represented by pictures showing examples of intensive animal husbandry: tilapia in rectangular faded blue plastic tanks with some technical equipment around, but without any enrichment for the well-being of the animals (fish), a flock of broilers in a monotonous barn obviously equipped only with the bare necessities (poultry), and groups of fattening pigs kept on slatted floors in segregated pens in a pigsty without any enrichment for improving animal welfare (mammals). The following pictures were used to portray suffering animals: perch taken out of the water for slaughter, with a perch in respiratory distress in the foreground because it was not properly anaesthetised and killed immediately[1] (fish), a chicken squatting on a metal lattice with its head down, eyes closed and plumage damaged (poultry), and a severely malnourished zebu cattle with its malnourished calf in a drought-suffering barren African environment (mammals). For all pictures not under Creative Common lisenses, permission to use was obtained from the photo authors.

Table 1.
Pictures presented in the questionnaire for different animal classes and different situations

Situation / Animal class	Outdoor	Indoor	Suffering
Fish	 Andreas Hartl	 Rolf Morgenstern	 Otwarte Klatky, Fot. Andrew Skowron; CC BY 2.0
Poultry	 Iris Schröter	 Otwarte Klatki, Fot. Andrew Skowron; CC BY 2.0	 Otwarte Klatki, Fot. Andrew Skowron; CC BY 2.0
Mammals	 Iris Schröter	 K-State Research and Extension; CC BY 2.0	 WTG Welttierschutz-gesellschaft e.V.

Note: Photo authors are indicated below the respective picture. For all pictures not under a Creative Common license, permissions to use was obtained from the authors.

[1] Whether a fish has been properly stunned or killed, i.e., whether it is insensible, can be determined by the vestibulo-ocular reflex ("eye roll"). The eye roll reflex is when the eyes of fish that have been rotated to a lateral position adjust in the opposite direction to the body movement in order to remain in the vertical position. The upper or lower part of the eyeball rotates out of the eye socket (Kestin *et al.*, 2002).

In the third part, data on personality traits were collected according to the HEXACO model. The HEXACO Personality Inventory captures six main dimensions of personality: Honesty-Humility, Emotionality, eXtraversion, Agreeableness, Conscientiousness and Openness to Experience (Ashton and Lee, 2007). The personality traits were collected with the help of 24 items, using the 24-item Brief HEXACO Inventory (BHI) developed by de Vries (2013). The Items were arranged randomly in the online-questionnaire and administered with the following instruction: 'Please describe yourself. Please select the appropriate answer for each point.' Similar to de Vries (2013), the items were rated on a response scale ranging from 1 (strongly disagree) to 5 (strongly agree). For calculating the scores for the personality dimensions, some items were reverse scored (see de Vries, 2013).

Finally, the participants were asked about their relationship to animals (i.e., their professional and private contact with animals) and socio-demographic data.

2.2 Participant details

Participants for our explorative convenience sample were recruited by snowball sampling via Email and WhatsApp in Germany. The questionnaire was completed by 114 participants, consisting of 46.49 % male, 52.63 % female and 0.88 % divers persons with a mean age of 37.33 (SD 15.15) years.

With 51.33 %, about half of the participants reported living in rural environments, 47.79 % lived in urban environments and 0.88 % did not provide this information. The majority of the participants, 85.96 % had high school diploma, 12.28 % stated to have a secondary school leaving certificate and 0.88 % were still in education.

The sample contained 21.05 % professional livestock keepers, in our context here full-time or part-time livestock farmers, referred to simply as farmers in the further course of this paper.

The sample roughly corresponded to the gender ratio of the German population [49.3 % male, 50.7 % female (Statistische Ämter des Bundes und der Länder, Deutschland, 2022a)], was younger than the German average [44.6 years (Statistische Ämter des Bundes und der Länder, Deutschland, 2022b)], contained a considerably higher proportion of persons with high school diploma than the German population [33.5 % (Destatis, 2020)], and a considerably higher proportion of persons living in rural areas than the German population [22.3 % (Destatis, 2021)].

2.3 Statistical analysis

Statistical analyses were conducted with Stata, version 16.1 (StataCorp LLC 2021) and SPSS 27. Because some people did not respond to all questions, all analyses were conducted using the maximum amount of information available. The underlying sample size is reported for each analysis.

To investigate the influence of the content of the pictures, i.e. the situation in which the animals are shown, on the emotional response, repeated measures analyses of variance (rmANOVA) were conducted.

Hierarchical regression analyses were performed to investigate the influence of recipient characteristics on emotional response. For this, the overall mean for each dimension, pleasure and arousal, over the respective three pictures (fish, poultry and mammals) for the three situations (outdoor, indoor, suffering) was calculated for each participant. For each of the six resulting variables [pleasure indoor, pleasure outdoor, pleasure suffering (see Table 3, last row "Across") and arousal indoor, arousal outdoor, arousal suffering; (see Tab 4, last row "Across")], a regression analysis was performed. Background factors were included in the analyses in three steps: (1) Professional background (farmer vs. non-farmer), (2) belief in animal mind (mean over all three animal classes), and (3) personality traits. The hierarchical regression analysis procedure was chosen to examine the specific contribution that each step makes to explain the variance in the respective dependent variable and at the same time to obtain the individual parameter estimates for each independent variable (see Bettencourt *et al.,* 2001). For information purposes, all correlations between the independent variables included in the regression analyses are reported in App 3.

Finally, taking into account the panel structure, linear regression was used to investigate the influence of picture content (situation) and participant characteristics on emotional response jointly in one analysis.

3 Results

3.1 Descriptive statistics

Descriptive statistics for all dependent and independent variables included in further analyses (rmANOVA and regression analyses) are presented below.

3.1.1 *Belief in animal mind*

The boxplots in figure 1 display the data distribution of the participants' responses to the questions related to the belief in animals' mental experience for each animal class (detailed descriptive statistics for each of the four items for each animal class are provided in Appendix 2). The data show that this belief increased with increasing similarity of the animal class to humans. The median increased from 5.00 for fish to 6.75 for birds to 8.00 for mammals. The mean for these animal classes were: belief in fish mind 5.21 (SD 1.86); belief in birds' mind 6.57 (SD 1.71); belief in mammals' mind 7.75 (SD 1.29). Across all animal classes (belief in animal mind, BAM), the median amounts to 6.42 and the mean to 6.51 (SD 1.40). No correlation was found between BAM and participants' professional background (i.e. farmer or not) and between BAM and personality traits (see Appendix 3)

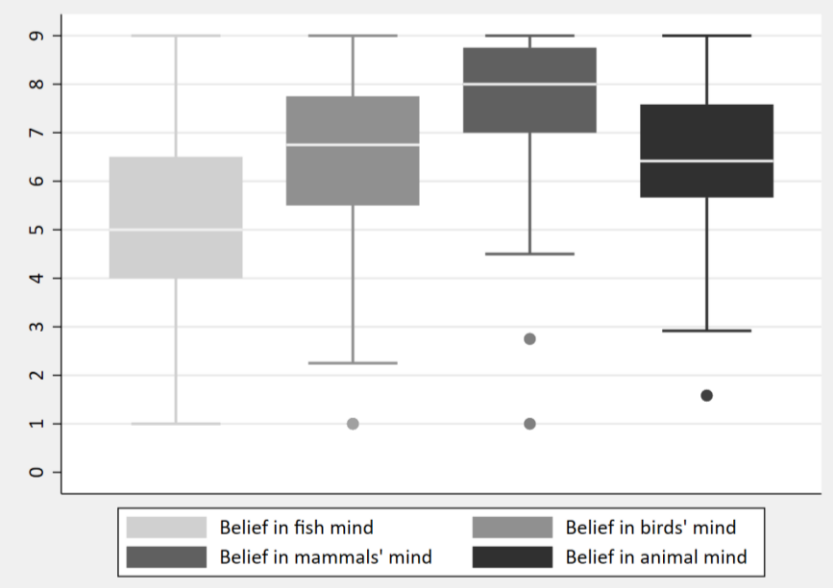

Figure 1. Belief in animal mind (n = 114); values shown for fish, birds and mammals separately and across the three animal classes.

3.1.2 *Personality traits*

Table 2 provides descriptive statistics on the participants' personality traits according to the HEXACO model. The correlations between the HEXACO domains were low to moderate (Appendix 3) and are comparable with other studies on the HEXACO model (see Ashton and Lee 2009). A moderate correlation between the participants' professional background and Openness to experience could be observed suggesting that the farmers of this sample were less open to experience, i.e. less creative and more conventional and traditional (Ashton and Lee 2007), than non-farmers No correlations were observed between the other five personality dimensions and professional background, indicating that farmers and non-farmers did not differ on these personality dimensions.

Table 2.
Descriptive statistics of the HEXACO personality traits

Personality traits	N	Mean	SD
Honesty-Humility	108	4.11	0.69
Emotionality	111	3.11	0.78
eXtraversion	112	3.95	0.72
Agreeableness	113	2.98	0.61
Conscientiousness	111	3.57	0.65
Openness to experience	111	3.68	0.70

3.1.3 *Emotional response to the pictures*

Emotional response in the dimensions pleasure and arousal can be arranged in a circumplex model with four quadrants (Russell, 1980; Stevens *et al.,* 2020a). Following this model, the participants' emotional response to the pictures shown is visualised in figure 2 by combining the mean values of the two dimensions pleasure and arousal for each picture.

Participants experienced the highest pleasure and least arousal when looking at the pictures depicting healthy animals in an outdoor situation. These pictures clearly induced a state of pleasant deactivation. Looking at the pictures showing healthy animals indoors, resulted in less pleasure and higher arousal. According to the circumplex model, participtans experienced a medium level of arousal accompanied by a below-average level of pleasure.

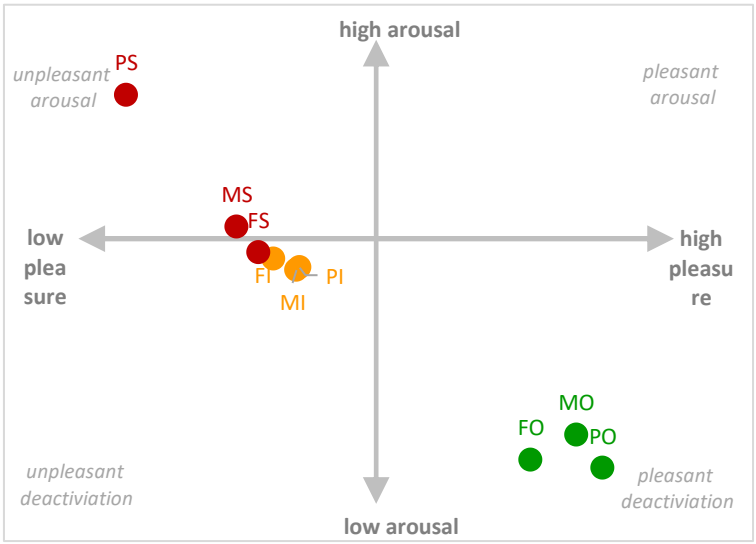

Figure 2. Participants' (n = 114) emotional response (means) on the pleasure and arousal dimensions arranged in a Circumplex model (see (Russell 1980); Animal class is identified by the first letter: F = fish, P = poultry, M = mammals; Situation is identified by the second letter and colour: O = healthy outdoor (green), I = healthy indoor (yellow), S = suffering (red).

The participants experienced the least pleasure and the highest arousal when viewing the pictures with the suffering animals, whereby the levels of arousal and pleasure in relation to mammals and especially in relation to fish differed only slightly from the indoor situation. However, the picture showing suffering poultry clearly induced unpleasant arousal. No clear pattern emerged within the situations,i.e., no clear influence of the proximity of the depicted animals to humans on emotional response could be observed (see also Table 3 and 4).

3.2 Results of repeated measure analysis of variance

The results of the rmANOVA aiming to analyse differences in emotional response to the three situations (healthy outdoor, healthy indoor, suffering, see Figure 2) within each animal class and across all animal classes are reported in table 3 and 4. Where necessary, a Greenhouse-Geisser correction was applied. The differences were highly significant ($P < .001$) in both dimensions, i.e. pleasure and arousal. This means that the situation in which the animals were shown on the pictures significantly influenced participants' emotional response to the pictures. In all analyses, the partial η^2 was greater than 0.14 indicating a large effect size (Cohen, 1988; Richardson, 2011).

Post hoc analyses revealed significant differences between all situations in all analyses, i.e. all pairwise comparisons showed significant differences between all situations for pleasure and arousal, with the exception of fish. For fish, the difference between the situations indoor and suffering was not significant in both dimensions, pleasure and arousal.

Table 3.
Descriptive statistics and results of repeated measures ANOVA comparing emotional response to the three situations (outdoor, indoor, suffering) in the dimension pleasure (n = 114).

	Outdoor *M* (*SD*)	Indoor *M* (*SD*)	Suffering *M* (*SD*)	*F*	*P*-Value	Partial η^2
Fish	7.08 (1.81)	3.62 (1.91)	3.42 (1.84)	(1.78, 200.98) = 183.54	< .001	.62
Poultry	8.04 (1.14)	3.97 (2.06)	1.65 (1.06)	(1.76, 198.43) = 644.91	< .001	.85
Mammals	7.69 (1.60)	3.93 (2.14)	3.13 (1.95)	(1.97, 222.26) = 241.78	< .001	.68
Across	7.61 (1.19)	3.84 (1.73)	2.73 (1.19)	(1.71, 193.63) = 570.53	< .001	.84

Table 4.
Descriptive statistics and results of repeated measures ANOVA comparing emotional response to the three situations (outdoor, indoor, suffering) in the dimension arousal (n = 114).

	Outdoor	Indoor	Suffering			
	M (*SD*)	*M* (*SD*)	*M* (*SD*)	*F*	*P*-Value	Partial η²
Fish	1.66 (1.14)	4.69 (2.48)	4.79 (2.49)	(2.00, 226.00) = 114.28	< .001	.50
Poultry	1.54 (1.05)	4.56 (2.51)	7.17 (2.15)	(1.88, 212.33) = 325.42	< .001	.74
Mammals	2.04 (1.74)	4.53 (2.53)	5.18 (2.31)	(2.00, 226.00) = 95.85	< .001	.46
Across	1.74 (1.02)	4.59 (2.17)	5.71 (1.86)	(1.84, 208.02) = 289.37	< .001	.72

3.3 Hierarchical regression analysis

The results of hierarchical regression analyses aiming to analyse the influence of participants' characteristics on emotional response led to different results for the different situations. None of the independent variables had an influence on emotional response for the outdoor situation. Neither the model for pleasure was significant after including all variables (R^2 = .082, P = .43), nor was the model for arousal (R^2 = .137, P = .09), suggesting that participant characteristics did not affect emotional response to the pictures showing healthy animals outdoor.

However, the hierarchical regressions analysing the emotional response to the pictures showing farmed animals indoor and suffering were significant. After including all independent variables, the model explained 44 % of the pleasure participants felt when looking at pictures depicting healthy animals indoors and 32 % of the arousal. For pictures with suffering animals, the model explained 26 % of the pleasure and 31 % of the arousal (Table 5 and 6).

Table 5.
Results of the hierarchical regression analysing the influence of participants' characteristics on pleasure (n = 100)

Arousal	**Indoor animals**			**Suffering animals**		
	R^2	ΔR^2	Coefficients (full model)	R^2	ΔR^2	Coefficients (full model)
Step 1	**.07****			**.05***		
Farmer (1=yes)			-1.22**			-1.04*
Step 2	**.16*****	**.09****		**.11****	**.06****	
Belief in Animal Mind			0.40**			0.32**
Step 3	**.32*****	**.16***		**.31*****	**.20****	
Honesty-Humility			0.78**			0.64*
Emotionality			0.60*			0.60**
eXtraversion			-0.19			0.08
Agreeableness			-0.43			-0.47
Conscientiousness			0.11			0.35
Openness to Experience			0.06			-0.27
Constant			-1.41			0.19

^{+}P < .10, $^{*}P$ < .05, $^{**}P$ < .01, $^{***}P$ < .001

Table 6.
Results of the hierarchical regression analysing the influence of participants' characteristics on arousal (n = 100)

Pleasure	**Indoor animals**			**Suffering animals**		
	R^2	ΔR^2	Coefficients (full model)	R^2	ΔR^2	Coefficients (full model)
Step 1	**.16*****			**.07****		
Farmer (1=yes)			1.61***			0.70*
Step 2	**.26*****	**.10*****		**.13****	**.06****	
Belief in Animal Mind			-0.34**			-0.21*
Step 3	**.44*****	**.18****		**.26*****	**.13***	
Honesty-Humility			-0.61**			-0.34^{+}
Emotionality			-0.38*			-0.27^{+}
eXtraversion			0.42*			-0.06
Agreeableness			0.36			0.33
Conscientiousness			-0.25			-0.33^{+}
Openness to Experience			-0.05			0.14
Constant			7.65***			6.11***

^{+}P < .10, $^{*}P$ < .05, $^{**}P$ < .01, $^{***}P$ < .001

According to a rule of thumb established by Cohen (1988), an R^2 of 0.26 (i.e., explained variance of 26 %) or higher indicates a high goodness of fit, at least in models investigating human behaviour.

Professional background, which was included in the first step in the regression model, significantly affected emotional response. Being a farmer resulted in higher scores in the pleasure dimension and lower scores in the arousal dimension for both situations healthy indoor, and suffering.

The variable included in the second step, BAM, also contributed significantly to explain variance. The more participants believed that animals are sentient, i.e., the higher their BAM scores were, the less pleasure and the more arousal they felt when looking at pictures showing healthy animals indoors and suffering animals.

Even if each step contributed significantly to explaining variance, the inclusion of personality traits led to the highest change in R^2 in each case. In all four analyses, the emotional response was influenced by the personality traits Honesty-Humility and Emotionality. Higher scores in Honesty-Humility and Emotionality resulted in less pleasure and higher arousal, both for the pictures showing healthy animals indoors and suffering animals. However, the coefficients for Honesty-Humility and Emotionality of the model analysing emotional response to the pictures with suffering animals in the pleasure dimension were significant only in tendency, i.e., at the level of $P < .10$ – also in the simultaneous regression analysis further below (see Table 7).

For the pictures showing healthy animals indoors, eXtraversion had a significant influence on pleasure, with participants scoring higher on eXtraversion experiencing more pleasure when looking at these pictures. More conscientous participants tended to experience higher levels of arousal when looking at pictures depicting suffering animals – which was not confirmed in the simultaneous regression analysis further below (see Table 7).

3.4 Regression analysis for simultaneous influence of pictures and participants

Results of the linear regression analyses considering simultaneous influence of picture content, i.e. the situation in which animals are depicted, and participants' characteristics confirmed the results of the separate regression analyses performed before. The independent variables included in the model for analysing pleasure explained 79 % percent of the variance of the dependent variable and in the model for arousal 64 % of the variance.

In models with interaction effects, the coefficients for the main effects cannot be interpreted meaningfully without taking the interactions into account. Considering the coefficients from the interaction terms by adding the effects for each unit of the respective interaction term (Novustat 2021), a comparable pattern emerged as in the rmANOVA. The outdoor situation led to the highest pleasure and the lowest arousal. For the indoor situation, pleasure decreased and arousal increased. The situation with suffering animals led to the least pleasure and highest arousal (Appendix 4). The coefficients of the interaction terms confirmed largely the results of the hierarchical regression analyses. While no interaction term considering the outdoor situation was significant, neither for pleasure nor for arousal, some coefficients for the situations indoor and suffering were significant. As in the hierarchical regression analyses, professional background (farmer), BAM and the personality traits Honesty-Humility and Emotionality affected emotional response. The values of the respective coefficients also corresponded to the results of the hierarchical regression analyses.

4 Discussion

In this study, we investigated emotional response to pictures depicting farm animals depending on picture content and participants' characteristics. Pictures of animals in different situations caused differentiated emotional response in the dimensions pleasure and arousal. While healthy animals in outdoor situations generated high pleasure and low arousal, i.e. led to pleasant deactivation linked to states of mental health (Gross and Muñoz, 1995; Hu *et al.,* 2014), the opposite applies for suffering animals. Here, two of three pictures led to unpleasant activation. Healthy animals in indoor situations were somewhere in-between. These pictures led to unpleasant deactivation (Stevens *et al.,* 2020a).

Following research on the circumplex model of affect (Russell, 1980), the participants' affective state could also be described more specifically by emotion-descriptive adjectives. Participants experienced positive emotions that might be referred to as calm and tranquil when looking at pictures showing healthy animals outdoors. As positive emotions can stimulate approach behaviour (Ridgway *et al.,* 1989; Donovan *et al.,* 1994), comparable pictures could be useful for marketing agricultural products. In particular, they could be predestined for promoting agritourism, as pleasure is one of the main motivations for travelling (Yeh *et al.,* 2017) and the pictures convey feelings of relaxation. The relaxing effect of these pictures suggest that free-range husbandry may not only enhance animal welfare (Temple *et al.,* 2011), but also human welfare – for on-lookers in general but also more specifically for farmers of free-range livestock husbandry. When looking at pictures depicting animals indoors or suffering animals, the participants experienced negative emotions that might be described by emotion-denoted adjectives like sad, frustrated or even distressed (Russell, 1980; Russell and Lanius, 1984). Anticipating negative emotions when receiving certain information content may entail

deliberate avoidance of this type of information (Deng *et al.,* 2022). Bell *et al.* (2017) observed this information avoidance behaviour regarding livestock farming in a sample of US citizens. About one third of their sample refused to receive picture information on pig housing, i.e. these participants wilfully ignored this information, presumably to prevent feelings of guilt (Bell *et al.,* 2017). However, media pictures that convey negativity can also increase the readiness for political participation, at least if the perceived negativity is rather low (Geise *et al.,* 2021). Therefore, pictures that elicit rather moderate negative feelings, like the pictures showing farmed animals in conventional housing environments, could lead to stronger engagement for more animal welfare.

Table 7.
Linear regression model for analysing influence of picture content and participants' characteristics on emotional response simultaneously.

	Pleasure				**Arousal**			
	R^2	.79			R^2	.64		
	Adj. R^2	.77			Adj. R^2	.60		
	P -Value	< .001			*P*-Value	< .001		
	Coef.	*P*-value	[95% Conf. Interval]		Coef.	*P*-value	[95% Conf. Interval]	
Situation								
Outdoor	Base				Base			
Indoor	2.60	.226	-1.62	6.83	-5.06	.064	-10.41	0.29
Suffering	1.06	.621	-3.16	5.29	-3.45	.205	-8.80	1.90
Situation # farmer								
Outdoor	0.08	.787	-0.51	0.67	-0.01	.975	-0.76	0.74
Indoor	1.61	<.001	1.02	2.20	-1.22	.001	-1.96	-0.47
Suffering	0.70	.020	0.11	1.29	-1.04	.007	-1.78	-0.29
Situation # BAM								
Outdoor	-0.02	.845	-0.19	0.16	0.06	.592	-0.16	0.28
Indoor	-0.34	<.001	-0.51	-0.16	0.40	<.001	0.18	0.62
Suffering	-0.21	.018	-0.39	-0.04	0.32	.005	0.10	0.54
Situation # H								
Outdoor	0.20	.305	-0.18	0.58	-0.23	.341	-0.72	0.25
Indoor	-0.61	.002	-0.99	-0.23	0.78	.002	0.30	1.27
Suffering	-0.34	.081	-0.72	0.04	0.64	.009	0.16	1.13
Situation # E								
Outdoor	0.17	.297	-0.15	0.49	0.06	.773	-0.34	0.46
Indoor	-0.38	.021	-0.69	-0.06	0.60	.003	0.20	1.01
Suffering	-0.27	.094	-0.59	0.05	0.60	.004	0.20	1.00
Situation # X								
Outdoor	0.22	.212	-0.13	0.58	-0.41	.073	-0.86	0.04
Indoor	0.42	.021	0.06	0.77	-0.19	.408	-0.64	0.26
Suffering	-0.06	.728	-0.42	0.29	0.08	.726	-0.37	0.53
Situation # A								
Outdoor	0.31	.171	-0.14	0.76	-0.10	.738	-0.66	0.47
Indoor	0.36	.116	-0.09	0.81	-0.43	.134	-1.00	0.13
Suffering	0.33	.147	-0.12	0.78	-0.47	.105	-1.04	0.10
Situation # C								
Outdoor	0.00	.983	-0.39	0.39	-0.14	.564	-0.64	0.35
Indoor	-0.25	.206	-0.64	0.14	0.11	.662	-0.38	0.60
Suffering	-0.33	.094	-0.72	0.06	0.35	.158	-0.14	0.85
Situation # O								
Outdoor	-0.14	.430	-0.50	0.21	0.24	.298	-0.21	0.69
Indoor	-0.05	.790	-0.41	0.31	0.06	.789	-0.39	0.51
Suffering	0.14	.443	-0.22	0.50	-0.27	.232	-0.73	0.18
Constant	5.04	.001	2.06	8.03	3.65	.059	-0.14	7.43

Note: # marks interactions terms; H: Honesty-Humility, E: Emotionality, X: eXtraversion, A: Agreeableness, C: Conscientiousness, O: Openness to experience

Although the participants' belief in animal mind followed a clear pattern depending on the phylogenetic scale, as also described by Hills (1995), no such pattern could be observed for the emotional response. This suggests that evolutionary proximity to humans either did not play a role in the emotional responses to the pictures shown or that other picture content superimposed such an influence. Research by Westbury and Neumann (2008), who describes an effect of phylogenetic similarity on empathy towards animals, might suggest that the latter is the more likely explanation. Picture content that might have influenced participants' emotional response besides the animals is, inter alia, the environment in which the animals were shown (Busch *et al.,* 2019). For example, the suffering poultry sat on a metal lattice and was surrounded by darkness, so that the picture as a whole conveys a gloomy atmosphere. This atmosphere might have led to more arousal and less pleasure when looking at the picture than if the animal had been shown against a more neutral background. In contrast, the suffering mammals were in an outdoor situation. The inhospitality of the environment due to drought might not have been obvious to all participants and in addition the brightness of the image might have attenuated the participants' emotional response. Furthermore, the participants might have assumed that it is fairly common that steppe cattle are so thin, and probably did not recognise the critical emaciation. The impression that the animals can freely move around and that there is a sound mother-calf bond might have also influenced emotional response. It is also remarkable that the suffering fish did not elicit stronger negative emotions than the fish indoors. One explanation could be that the participants doubt that fish can feel pain and suffering to a significant extent. This belief is supported by recent behavioural and neurobiological research suggesting that fish are unlikely to experience pain in a manner consistent with those of humans (Browman *et al.,* 2019), which may make it more difficult for humans to feel empathy with fish. One the other hand, it could be that due to a lack of knowledge about fish, participants were not able to assess the situation properly and did not realise that the fish was still alive and might suffer.

Farmers and laypersons did not differ in their emotional response to pictures of healthy animals in outdoor situations, implying that these pictures had an equally relaxing and positive mental health effect on both laypersons and professionals. However, farmers responded to pictures of healthy animals in indoor situations and suffering animals with higher scores in the pleasure dimension and lower scores in the arousal dimension compared to laypersons. These results are in line with findings of Busch *et al.* (2019) who report that a closer relation to agriculture leads to a more positive perception of pictures showing farm animals kept indoors. This suggests that farmers are to some extent accustomed to situations similar to those shown in the pictures, because they see them more often than lay people due to their profession. A more professional judgement of the situations shown might have led to more pleasure and less arousal when looking at pictures of indoor husbandry in particular, but also when looking at pictures showing suffering animals. This does not mean, that the farmers enjoyed these pictures but rather were less displeased, i.e. farmers were more neutral or did not feel as much discomfort as laypersons. This could be attributed to the fact that livestock farmers are sometimes confronted with contradictory competence requirements. On the one hand, they are empathetic caretakers responsible for the well-being of their animals (Bock *et al.,* 2007). This requires that they acknowledge the animals as subjects, which can be associated with emotional closeness. On the other hand, farmers also have to maintain a certain emotional distance from the animals, e.g. when they hand them over to the next production stage or for slaughter or whan animals are sick or die (Gotter, 2018). In this way, farmers face similar challenges as health care professionals or social workers. As these practitioners, farmers develop professional emotion-management strategies and need to set clear boundaries regarding the depth of emotional connections with their animals for self-care reasons. If they are unable to manage their emotions they run the risk of burnout or other health issues related to emotional distress (Lee and Miller, 2013; Buder and Finger, 2016). Farmers' ability to recognise and control their own emotions also influences the relationship farm animals have with the farmer, as animals are sensitive to human emotional cues, i.e., human behavioural signs related to emotions like happy or angry facial expressions (Nawroth *et al.,* 2018). Positive emotional cues facilitate good relationships (Nawroth *et al.,* 2018) resulting in better cooperation between animals and farmers, making daily work more enjoyable. As such, positive emotions can add to both farmer wellbeing as well as animal wellbeing and productivity (Bock *et al.,* 2007). The finding of the study that farmers felt more pleasure (or rather less discomfort) and less arousal when confronted with situations typical for daily work in intensive livestock farming than non-farmers could therefore be beneficial for both farmers and the animals they care for.

Farmers might also put more focus on technical details in the animals' surroundings (Joyner *et al.,* 2018) as checking the proper functioning of technical equipment is part of the daily work and regulated by law (TierSchNutztV, § 4) in Germany; they might also be generally interested in these technical aspects of the livestock husbandry systems. It is known from the literature that the allocation of visual attention can influence the emotional response (Kaspar and König, 2012), i.e., it could make a difference whether one pays more attention to the animals or to their environment, including technical aspects. If it is suspected that animals might suffer, distracting visual attention away from the animals towards the technical aspects could attenuate negative emotional reactions. In this way, farmers might succeed in establishing some professional distance to farm animals by shifting their focus from the animals to technical aspects. However, affective involvement is an inevitable component of work with animals often leading to "shared suffering",i.e., suffering spreads from animals to their care-givers (Porcher, 2011). Professional training how to deal with emotionality and empathy in livestock farming and continuous exchange with staff and externals, e.g. with other farmers, farm advisors or citizens, could help farmers to acknowledge experiences of emotional discrepancy, uncover unhealthy

familiarisation effects to certain husbandry conditions and reduce "farm blindness" (Gotter, 2018). This reflection on their own emotional experiences might also encourage farmers to change their husbandry system from indoor-only systems to more animal-friendly systems that allow animals access to the outdoors, provided that these husbandry systems are supported by policy frameworks and provide sufficient income.

While belief in animal mind (BAM) had no impact on emotional response to pictures of healthy animals in outdoor situations, BAM significantly affected emotional response to pictures showing healthy animals in indoor situations and suffering animals. The more the participants believed that animals are sentient beings the more negative was their emotional response to the pictures of indoor husbandry and suffering animals presumably because they assume that animals feel similarly to themselves (Harnad, 2016) and that they themselves would suffer in a comparable situation, such as captivity or illness. This indicates a strong relationship between beliefs, which rather belong to the cognitive dimension, and emotions, which are mainly affective (Frijda *et al.,* 2000; Beswick, 2011). As knowledge and awareness of farm animals' sentincence is expected to increase with advances in biological- and animal neuro-sciences, the reception of pictures depicting indoor and suffering farm animals could lead to even stronger negative emotions in the future. Public relations communication of lobby groups in favor of intenisve indoor livestock husbandry systems will probably face increasing challenges to display these husbandry systems as beneficial to farm animals.

For the HEXACO personality traits, especially Honesty-humility and Emotionality affected emotional response. Honest and humble as well as emotional personalities experienced lower levels of pleasure when seeing pictures of healthy animals in indoor situations and suffering animals compared to persons with lower scores in these personality traits. With regard to Emotionality, our results correspond to findings from other research indicating that people scoring high on Neuroticism (the corresponding personality trait in the Big-Five Personality model) may experience more negative emotions, especially under stressful and emotional circumstances (Tok *et al.,* 2010). Thus, persons scoring high in Honesty-Humility and Emotionality might suffer more when they look at pictures of healthy animals in indoor situations or of suffering animals. Especially livestock farmers with high scores in these two personality traits might pay a high emotional price when confronted with deficiencies in their animal husbandry.

Our results might shed some light on the reasons why public discourse on livestock production, human-animal-relationship and animal welfare is often emotional and heated (Blaha, 2022). Pictures from conventional livestock farming as used in this study can evoke strong negative emotions in laypersons. These emotions can be antecedents of conflicts, which are shown to be fundamentally emotionally created and driven processes (Bodtker and Katz Jameson, 2001). In the course of such discourses between farmers and opponents of (conventional) livestock farming, farmers often criticise their counterparts for being highly emotional and demand more rationality in the debate. The results of our study show that the statement of high emotionality might not be entirely wrong. On the other hand, the accusations of opponents regarding deficient animal welfare evoke negative emotions among farmers, which may result in further emotionalising and escalating debates (Stevens *et al.,* 2020b). In addition to professional background, personality structure and beliefs can influence emotional responses, which in turn can also affect how debates evolve. From this, we infer that both proponents and opponents of livestock farming should become more aware of their emotions related to animals and livestock farming and accept that their counterpart might feel differently. Acknowledging and respecting each other's emotions could promote a more open and respectful dialogue between opposing groups (Cass and Walker, 2009), without neglecting rationale arguments, which are indeed important to find satisfactory solutions for the parties involved in the debate (Vogeler *et al.,* 2021).

In this way our results might help representatives of the respective groups to develop a better understanding of their own and of the emotions of the other group, become more empathetic and thereby improve communication on the topic.

Finally, to enable a more comprehensive assessment of the results of this study, we relate them more generally to other studies on emotional response to visual stimuli, point out the limitations of our investigation and offer suggestions for further research. As observed in other studies, picture content had a strong influence on emotional response (e.g., Sánchez-Navarro *et al.,* 2006; Maehr *et al.,* 2015). The effect sizes we found (partial η^2 = .72 for arousal and = .84 for valence) are similar to those reported by Maehr *et al.* (2015) who recorded participants' emotional responses to pictures showing rural landscapes with various technical construction such as wind turbines, pylons or churches (partial η^2 = .83 for valence and = .77 for arousal). In addition to content, other picture properties not considered in our study may influence emotional response. In particular, the perceptual dimensions of colour hue, brightness and saturation, have been shown to affect emotional response (Suk and Irtel, 2010; Wilms and Oberfeld, 2018).

Beyond picture content, we observed significant influences of participants' individual characteristics on emotional response for pictures showing healthy animals indoors and suffering animals: (1) Participants' professional background significantly influenced emotional response, with effect sizes ranging from R^2 = .05 to .16. This is in line with results of previous studies with other professional groups, which also indicate an influence of professional background on emotional response. While van Paasschen *et al.* (2015) describe only a tendentially significant correlation (r = .23) between the level of art expertise and emotional response, investigations by Leder *et al.* (2014) and Else *et al.* (2015)

indicate that art expertise significantly influences emotional response to artwork. Hsieh (2014) describes a significant influence of design expertise on emotional response to visual communication materials. (2) Belief in the mental experience of animals, i.e. their capacity to experience emotions and think, significantly affected emotional response, with effect sizes between R^2 = .06 and .10. This is consistent with findings of Possidónio *et al.* (2019) who asked their participants to rate pictures of animals on the dimensions valence and arousal, as well as on the capacity of the depicted animals to think and feel (similar to BAM). The authors report correlations between the participants' ratings of the animals' capacity to think/feel and ratings of valence/arousal ranging from r = .45 to .52. (3) Our results show that the personality traits Honesty-Humility, Emotionality and eXtraversion significantly influenced emotional response. The impact of Emotionality (which corresponds to a medium extent to the personality trait neuroticism in the Five Factor model of personality (Ashton and Lee, 2007)) as well as of eXtraversion (wich corresponds to a large extent to the eponymous trait in the Five Factor model (Ashton and Lee, 2007)) on emotional response has been repeatedly described in studies based on the Five Factor model (Yik *et al.,* 2001; Tok *et al.,* 2010; Ingendahl and Vogel, 2022). In our study, the inclusion of the HEXACO personality traits yielded effect sizes between R2 = .13 and .20, i.e., they explained between 13 % and 20 % of the variance. These effect sizes were roughly in the range observed by other authors. Yik *et al.,* (2001) who investigated the influence of Big Five personality traits on self-reported momentary affect report that personality explains 36 % of the variance in the valence dimension and 18 % in the arousal dimension. Tok *et al.* (2010) who examined the influence of the Big Five personality traits on emotional response to IAPS pictures describe effect sizes ranging from R^2 =.04 to .14. Tok *et al.* (2010) obtained the highest R^2 value for pictures belonging to the "positive valence-low arousal" dimension. In our study, the pictures showing healthy animals outdoors were assigned to this dimension. However, we could not demonstrate any influence of the participants' individual characteristics, including personality traits, on the emotional response for these pictures.

Factors that might contribute to interindividual variance in valence and arousal ratings not considered in our study are: Sociodemographic characteristics such as gender (Orth *et al.,* 2010; Teismann *et al.,* 2020) and age (Grühn and Scheibe, 2008; Possidónio *et al.,* 2019); prior experience such as familiarity with comparable pictures/scences (Leder *et al.,* 2014; Koivisto and Grassini, 2022) and contact with pets (Possidónio *et al.,* 2019; Possidónio *et al.,* 2021); but also learned strategies for regulating one's own emotions such as focusing attention on specific stimuli content (Dolcos *et al.,* 2022), and participants' mood at the time of completing the survey (Neumann *et al.,* 2001). Ambient conditions during the survey completion, such as colour temperature and illuminance level (Lee *et al.,* 2014) of the room lighting or the participants' computer screens, or acoustic stimuli such as music, conversations or other noises in the background (Gomez and Danuser, 2004) might also play a role.

Further limitations of the study need to be mentioned. For our explorative study we used a convenience sample recruited by snowball sampling, which is by no means representative of any definable population. Due to the recruitment among the network of the authors who work at an agricultural department of a university, there is a high share of farmers, of highly educated and young people among the participants. In order to validate the results for any inferable population a pre-defined sampling frame should be applied in future studies.

The study was explorative in nature and selected those animal-situation combinations for analyses which did not produce too much data noise due to irrelevant picture information. It will be the task of future studies to extend the range of situations and animal classes. Our present results apply for pictures of vertebrates analysed, but might be different when animals of commercially grown non-vertebrates, like mealworms or locusts are included in future studies. It would also be useful to compare different animal species within an animal class, since preferences for certain animal species may influence emotional response. Even among the selected pictures, our results might also be biased by background influences in the pictures as we suspect especially for the picture of the suffering poultry and the suffering mammals.

The assumptions made in the discussion about a different allocation of visual attention between farmers and non-farmers could be verified by conducting eye-tracking experiments. Neuroeconomic methods recording brain activity, such as fNIRS (functional near infrared spectroscopy) or EEG (electroencephalography) could complement the measurements of emotional response by the SAM. With the regard to the SAM, one could consider revising the visualisation of the manikin (see Hayashi *et al.,* 2016). Since many people now use their smartphones to send messages in which they express or underline their emotions with emojis, they might find the SAM, which were developed in the 1980s, antiquated. It might be helpful to use emojis that visualise states of pleasure and arousal as well as the SAM or even better.

5 Conclusions

The aim of the study was to better understand emotional response to pictures showing farm animals in different situations, because such pictures are increasingly used by competing lobby groups to provide information about farm animal husbandry. Our results indicate that pictures depicting healthy farm animals outdoors lead to recipients' relaxation, i.e. high pleasure and low arousal, regardless of the characteristics of the recipients, including their

professional background. This suggests that extensive husbandry systems where animals have access to outdoor areas would not only be desirable from the animal welfare and animal ethic point of view, but would also be beneficial to on-lookers by positively affecting their emotional state and thus their mental health. For consumers and the general public this would be a positive external effect of livestock husbandry as partly exploited by tourism in regions with extentensive pasture-based livestock production. Farmers are challanged to ensure sufficient income with these systems as they are the ones who have to bear the financial costs. Potential emotional benefits for famrers are not sufficient to counterbalance financial costs and should not be used as justification for the dare situation of many livestock farmers. Reception of pictures showing animals in an indoor situation or suffering animals result in less pleasure and more arousal, whereby for these pictures emotional response was affected by the characteristics of the recipients, i.e. their professional background, beliefs and personality traits. Being emotionally less receptive to suffering animals might lead to delayed remedy actions in livestock husbandry. Therefore emotional reactions should not be disqualified as unprofessional in livestock husbandry training and eduction. Emotional reactions should rather be discussed how to deal with them constructively in order to improve human and animal welfare simultaneously. In discussions about livestock farming, recognising that emotional response is often influenced by individual characteristics and experiences, and that the emotions of the counterpart do not have to be identical to one's own emotions, could help to better understand the counterpart's reactions and to face them more constructively and more emphatic. This could help de-escalate conflicts, treat each other with more respect and find compromises that all conflicting parties – livestock-keepers, the general public and animals – agree with. Future research could take this up and investigate whether taking both one's own emotions and those of the other side seriously actually leads to a relaxation of conflictual debates and discussions and to more satisfactory solutions for those involved.

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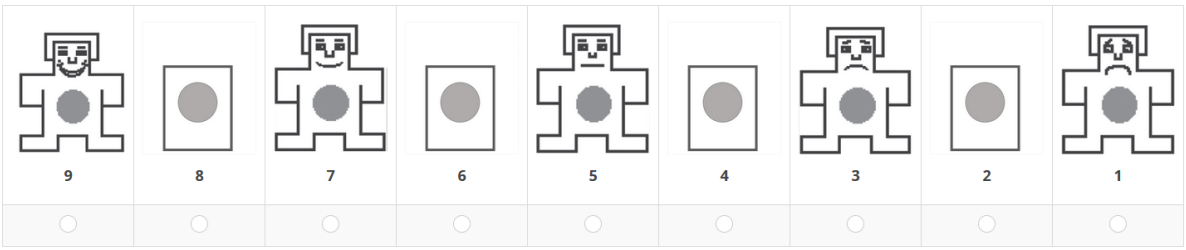
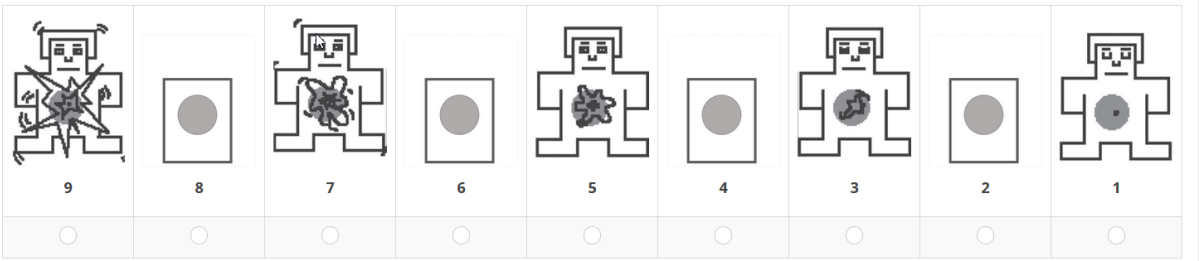
Appendix

Appendix 1.
Self-assessment manikin (SAM) for measuring emotional response.

SAM for measuring pleasure



SAM for measuring arousal



Appendix 2.
Descriptive statistics for all items measuring 'Belief in Animal Mind' separately for each animal class (n = 114)

Animal class	Item	Mean	SD	Correlations		
				Item I)	Item II)	Item III)
Fish	I) conscious, and aware of what is happening to them	5.03	2.35			
	II) capable of experiencing a range of feelings and emotions	5.37	2.19	0.68*		
	III) able to some extent to solve problems and make decisions about what to do	5.26	2.29	0.60*	0.75*	
	IV) more like computer programs: mechanically responding to instinctive urges (RC)	5.17	2.30	0.44*	0.34*	0.50*
Birds	I) conscious, and aware of what is happening to them	6.40	2.10			
	II) capable of experiencing a range of feelings and emotions	6.89	2.01	0.75*		
	III)able to some extent to solve problems and make decisions about what to do	6.72	2.08	0.65*	0.76*	
	IV) more like computer programs: mechanically responding to instinctive urges (RC)	6.26	2.19	0.42*	0.33*	0.44*
Mammals	I) conscious, and aware of what is happening to them	7.92	1.68			
	II) capable of experiencing a range of feelings and emotions	8.30	1.32	0.83*		
	III) able to some extent to solve problems and make decisions about what to do	7.96	1.44	0.73*	0.83*	
	IV) more like computer programs: mechanically responding to instinctive urges (RC)	6.83	2.25	0.24*	0.20*	0.22*

RC = Reverse coded; * $p < 0.05$

Appendix 3.
Correlations between independent variables included in the regression analyses.

	Farmer	BAM	H	E	X	A	C
Belief in animal mind (BAM)	-0.03						
Honesty-Humility (H)	-0.06	-0.03					
Emotionality (E)	-0.04	0.06	0.21*				
eXtraversion (X)	-0.03	0.07	0.01	-0.09			
Agreeableness (A)	0.09	0.00	0.23*	-0.19^{+}	0.12		
Conscientiousness (C)	0.13	-0.14	0.29*	-0.03	-0.20*	0.10	
Openness to Experience (O)	-0.26*	0.02	0.02	0.04	0.19^{+}	-0.03	0.07

Pearson correlation; Farmer; 1 = yes, 0 = no; *$P < 0.05$; $^{+}$ $P < 0.1$, n = 100

Appendix 4.
Calculation for interpreting the main effect (situation) in the linear regression models (see Table 7).

	Coefficients * Units									Sum
	situation	farmer	BAM	H	E	X	A	C	O	
Pleasure										
Outdoor	0.00	0.08*1	-0.02*9	0.20*5	0.17*5	0.22*5	0.31*5	0.00*5	-0.14*5	3.75
Indoor	2.60	1.61*1	-0.34*9	-0.61*5	-0.38*5	0.42*5	0.36*5	-0.25*5	-0.05*5	-1.37
Suffering	1.06	0.70*1	-0.21*9	-0.34*5	-0.27*5	-0.06*5	0.33*5	-0.33*5	0.14*5	-2.82
Arousal										
Outdoor	0.00	-0.01*1	0.06*9	-0.23*5	0.06*5	-0.41*5	-0.10*5	-0.14*5	0.24*5	-2.39
Indoor	-5.06	-1.22*1	0.40*9	0.78*5	0.60*5	-0.19*5	-0.43*5	0.11*5	0.06*5	2.05
Suffering	-3.45	-1.04*1	0.32*9	0.64*5	0.60*5	0.08*5	-0.47*5	0.35*5	-0.27*5	3.06