The Old School, Brewhouse Hill, Wheathampstead,
Hertfordshire AL4 8AN, UK
www.ufaw.org.uk

Animal Welfare 2022, 31: 137-154
ISSN 0962-7286
doi: 10.7120/09627286.31.1.012

The owner-bird relationship: Relevance for pet bird welfare

A-K Burmeister†, K Drasch‡, M Rinder*†, S Prechsl‡, A Peschel†, R Korbel† and NJ Saam‡

† Centre for Clinical Veterinary Medicine, Clinic for Birds, Small Mammals, Reptiles and Ornamental Fish, University of Munich, Munich, Germany
‡ Institute of Sociology, Friedrich-Alexander University, Erlangen-Nürnberg, Germany
* Contact for correspondence: monika.rinder@lmu.de

Abstract

Empathy and anthropomorphism, well-established components of the human-pet relationship, are considered to be especially related to pet animal welfare. We have developed a systematic and standardised approach to explore the effect of the human-pet relationship on animal welfare, focusing on pet birds. Based on a data set measuring the owner-bird relationship as well as bird welfare, cluster analysis and multivariate regressions were used to identify empirical types of bird owners and analyse their effect on bird welfare. Five empirical types of bird owners were identified based on the multi-dimensional relationship between owner and bird which consisted of: (i) the closeness-appreciating anthropomorphising owner; (ii) the closeness-appreciating socially supported owner; (iii) the anthropomorphising socially supported owner; (iv) the inattentive owner; and (v) the distance-appreciating owner. These differed in terms of the owner's tendency to anthropomorphism, the social support the bird provides to the owner, the empathy, attentiveness and respect of the owner towards the bird, and the bird's relationship with the owner. In particular, the inattentive type, but also both anthropomorphising types, raised serious questions as to the well-being of the pet bird. We found significant correlations to bird behaviour, such as imprinting aspects, aggressiveness towards humans, conspecifics and other pet animals, as well as behavioural disorders, such as locomotor stereotypies, courtship behaviour towards humans and feather-plucking.

Keywords: *animal welfare, anthropomorphism, bird behaviour, companion birds, empathy, human-animal relationship*

Introduction

Companion animal keeping is deep-rooted, historically, within Western society. Companion animals or pets (the terms are used synonymously here) are generally kept for company or entertainment. Approximately 34 million pets — excluding ornamental fish and animals living in terraria — live in Germany alone. Around 45% of all households and 63% of all households with children in Germany own at least one pet, and 4.8 million of these animals are pet birds (Industrieverband Heimtierbedarf & Zentralverband Zoologischer Fachbetriebe Deutschlands 2019). Recently, there has been increasing public interest in and research activities on human-animal relationships and their influence on the physical and mental health of the owner. Only a few studies focusing on the health and welfare of the animal, however, are available in this relatively new research area, especially in regard to companion birds (Arluke *et al* 2015). In order to develop hypotheses regarding possible effects of the human-animal relationship on the welfare of companion birds, different concepts linked to anthrozoology were first considered.

Concepts of human relationships with companion animals

According to Hinde (1979), a human-human relationship includes a series of interactions, and the actors are interdependent (Kelley 1997). The characteristics of both individuals influence the relationship, which is always an ongoing process (Auhagen & Hinde 1997). When using the human-human relationship as a model for human-animal relationships, scientists must consider that humans and animals may have different anatomical, physiological, biological and cognitive skills. It is not possible for humans to fully capture the perspective of the animal (Nagel 1974). Thus, the scientific concept of the human-animal relationship is susceptible to bias.

It has to be noted that there are a variety of relationships with animals. Thieme (2015) suggested using the term 'human-animal relation' in a broader meaning for contacts between humans and non-human animals, whether these interactions are beneficial or detrimental, real or symbolic, factual or fictional, contemporary or historical (Jürgens 2017), and to reserve the term 'human-animal relationship'

for contacts featuring a series of interactions, a continuous process and interdependent actors. The human-animal relationship is thus regarded as just one — rather rare — subcategory of the human-animal relation (Thieme 2015). Every different relationship between an owner and his or her pet is further considered to be as unique as the two individuals involved (Triebenbacher 2006).

Motivation for keeping an animal and the pet animal's function for and influence on the owner are important parts of the human-animal relationship. Various theories exist including statements on particular aspects of the human-pet relationship. A pet animal may function as a substitute for interpersonal relationships (Bonas *et al* 2000; Adamelli *et al* 2005; Kurdek 2008; Zilcha-Mano *et al* 2011), as a family member (Albert & Bulcroft 1987; Hirschman 1994; Triebenbacher 2006; Anderson 2014) or friend (Enders-Slegers 2000; Sanders 2003), as a provider of self-esteem (Brown 2007), a subject (Blouin 2013; Charles 2014), or a status symbol (Hirschman 1994). Pet ownership fulfils certain characteristics of a social role (Netting *et al* 1987) or social functions (social support) (Peretti 1990; Zasloff & Kidd 1994; Irvine 2013). Depending on the needs of the owner, the pet will be embedded into the owner's social networks; this defines the role of the pet (Enders-Slegers 2000; Harker *et al* 2000). Exchange theory states that the benefits of pet keeping must outweigh the costs (Netting *et al* 1987). Attachment theory considers attachment (Crawford *et al* 2006; Beck & Madresh 2008; Kurdek 2008, 2009; Zilcha-Mano *et al* 2011, 2012). All these theories can potentially lead to hypotheses on the effects of the human-pet relationship on companion animal welfare. However, this effect on pet welfare is yet to be addressed in a straightforward way thus far.

Human-pet relationships and companion animal welfare

Owner-related factors such as the personality of the owner, the owner's socio-demographic features, the interaction between owner and pet as well as anthropomorphism were regarded as influencing companion animal welfare. It has been shown for horses (*Equus caballus*) that owner personalities leading to high levels of empathy were correlated with better animal welfare conditions (Luna *et al* 2018).

Humans with a higher level of education and with fewer friends cared better for their cats (*Felis silvestris catus*) (Adamelli *et al* 2005). In contrast, the quality of life in dogs (*Canis familiaris*) has been positively associated with the number of emotional bonds the owner has to other people (Marinelli *et al* 2007). The level of knowledge about the pet was found to be important for animal welfare. Owners with a greater general knowledge about guinea pigs (*Cavia porcellus*) were better able to identify dental disease in their pets (Norman & Wills 2016) and cat owners with previous experience cared better for their cats (Adamelli *et al* 2005).

The effects of physical interaction between owner and pets on animal welfare can vary. Some physical human-dog contacts such as petting the dog on its paw or covering the dog's muzzle with a hand, were found to be negative stressors for the pet leading to increased mean heart rates and displacement activities (Kuhne *et al* 2014). Positive interactions (talking softly to the dog, gently stroking the dog or scatching its body and ears) instead led to reduced stress reactions like decreased mean arterial blood pressure and increased plasma beta-endorphin, oxytocin, prolactin, phenyl acetic acid, and dopamine (Odendaal & Meintjes 2003).

Anthropomorphism, defined as the attribution of human mental and emotional capacities to animals and the assumption that animals act from motives similar to those of humans (Kidd & Kidd 1987), was shown to be an important factor. Most of the studies on the relation between anthropomorphism and animal welfare have been done with cats, dogs and horses. There is scientific evidence that animals can experience emotions and many owners attribute emotions to their companion animals (Konok *et al* 2015; Martens *et al* 2016). Critical or careful anthropomorphism has been proposed as a means to understand animal behaviour and establish relationships with animals. When, however, people inaccurately attribute desires or intent to their animals, a so-called situational anthropomorphism might arise including, for example, misinterpreting an animal's behaviour or sharing inappropriate food (Anderson 2014). Misapprehensions by humans regarding the cognitive abilities of animals seem to be one of the main challenges to animal welfare (Bradshaw & Casey 2007).

Over-humanisation in both dogs and cats, and closer human-animal bond in cats, were seen markedly less in owners with normal weight animals as opposed to obese ones which carry a greater risk of obesity-related disease, thereby posing a welfare issue (Kienzle *et al* 1998; Kienzle & Bergler 2006; Tarkosova *et al* 2016; Kocabagli *et al* 2017). On the other hand, anthropomorphism can have positive effects on the animals. In a study on dogs, participants with a higher degree of anthropomorphism reported a greater willingness to adopt dogs and showed more support for animal rights and welfare than less anthropomorphising participants (Butterfield *et al* 2012).

Generalised conclusions on pet-owner relationships, however, should be avoided and each species or at least species group should be evaluated separately (Zasloff 1996). Human relationships with birds are likely to differ fundamentally from those with mammals outlined above, due to birds' primarily flight reflex-based behaviour (Korbel *et al* 2016). It is thus important to explore owners' relationships exclusively to their pet birds and their impact on the birds' welfare. Focusing on pet birds and following a sociological approach (Sanders 2003; Irvine 2008; Tipper 2011), Burmeister *et al* (2020) has shown there to be a multidimensional relationship between birds and their owners which is measurable on a scale: the owner-bird relationship scale (OBRS). The 21 items of the OBRS belong to four dimensions, which were obtained via factor analysis (Principal Component Analysis [PCA]; Fabrigar & Wegener 2012). Item analyses has revealed a good — almost excellent — internal consistency of the entire scale with a Cronbach's alpha value of 0.90. The four main dimensions of the relationship between owner and

https://doi.org/10.7120/09627286.31.1.012 Published online by Cambridge University Press

bird included: (i) the tendency of the owner to anthropomorphise the bird ('bird as human'); (ii) the social support the bird provides for the life of the owner; (iii) the empathy (defined as the ability to understand and share the feelings and emotions of others), attentiveness and respect of the owner towards the bird; and (iv) the bird's relationship with the owner. This scale is used here to investigate how the human-pet relationship affects animal welfare. Based on this scale and its dimensions, different types of bird owners will be distinguished and their relevance for different bird groups and bird welfare will be demonstrated.

Materials and methods

Study procedure

This study was conducted as an online survey (using 'EFS Survey', Unipark & QuestBack®, Cologne, Germany). Data were collected in Germany from August to October 2015, as previously described (Burmeister *et al* 2020). The survey link to the questionnaire was distributed to bird owners throughout Germany, who had been contacted through several sources via the snowball sampling technique. This non-probability sampling technique was used to reach as many bird owners as possible because of the unavailability of any appropriate database, such as a list of registered bird owners in Germany. Participants were reached via the internet (social networks, internet forums, websites, and email discussion groups — all of them about birds) and conventional methods (veterinary clinics, zoo shops, bird journals, and in-person groups for bird owners) with a request for cross-posting and an internet link. After clicking on the link, prospective participants were provided with information on the purpose of the study and issues of data protection on the first page of the online questionnaire. The bird owners were asked for assistance in a study at a bird clinic concerning the relationships between humans and their birds. Once agreement was secured, the questionnaire was undertaken. There is an understanding in German empirical social research that in 2015 this strategy was sufficient to ensure the informed consent of the respondent and thus did not require an ethics review (Küper & Merle 2019; Burmeister *et al* 2020). Participation was anonymous and sensible data were not collected.

The questionnaire was developed in a focus group by an interdisciplinary team of four veterinarians and one sociologist, all of whom were familiar with human-bird relationships in a professional or private capacity. As mentioned above, the questionnaire contained questions on the human-bird relationship, which had been used to develop the OBRS (Burmeister *et al* 2020) (Table 1). In addition, questions and items on bird owners (their pet ownership history, their behaviour if the bird is perceived to be ill, socio-demographic features such as age, gender, marital status and education) and their pet birds (species, age, sex, purchasing cost, housing, socialisation, health, behaviour and behavioural disorders) were included. With regard to the bird health status, participants could select one or multiple options out of the answers 'generally in good health', 'repeatedly ill', 'chronic disease', or 'bird with handicap.' Questions related to behaviour and behavioural disorders included aspects of increased aggressiveness against humans, conspecifics, or other pet animals, locomotor stereotypies, courtship behaviour towards humans, and feather-plucking as described in more detail below. Since the data were collected in Germany, all items and questions were prepared in German. The complete questionnaire is available online as Supplementary Information 1 (see supplementary material to papers published in *Animal Welfare*: https://www.ufaw.org.uk/the-ufaw-journal/supplementary-material). Sampling took place between August and October 2015.

Participants

The participants comprised 1,444 bird owners (1,092 females, 351 males, one unknown) ranging in age from 16 to 99 years (mean: 40 years). Approximately 87% of the participants lived in West Germany and Berlin (a portion which is very similar to the portion of about 85% of the German inhabitants living in West Germany and Berlin in 2015). Details on the socio-demographics of the participants are available in Supplementary Information 2 (see supplementary material to papers published in *Animal Welfare*: https://www.ufaw.org.uk/the-ufaw-journal/supplementary-material). A majority of the participants identified parrots or parakeets (61%; n = 810) as their bird, followed by ornamental fowl (24%; n = 324) and finches (8%; n = 104). Other bird groups were far less represented and included frugivorous birds and lories, raptors and owls, pigeons and ratites. A large number of the study participants (69%) reported that they did not breed their birds, less than 1% were commercial breeders, and 30% categorised themselves as hobby breeders.

Data analysis

Stata Version 14.0 (StataCorp LLC, College Station, TX, USA) was used for all data analyses. These included cluster analysis to identify empirical types of bird owners, descriptive statistics to give information about differences between the types of bird owners with respect to the socio-demographics of the owner and the characteristics of the bird, and multivariate regressions that investigate the effect of the owner-bird relationship on bird welfare. Descriptive statistics of the responses associated with the welfare problems presented by various bird groups can be found in Supplementary Information 3 (see supplementary material to papers published in *Animal Welfare*: https://www.ufaw.org.uk/the-ufaw-journal/supplementary-material).

Cluster analysis to identify empirical types of bird owners

As described previously (Burmeister *et al* 2020), the questionnaire included a scale enabling measurement and characterisation of the relationship between pet bird owners and their birds. Using PCA, four components of the owner-bird relationship had been identified relating to the tendency of the owner to anthropomorphise the bird ('bird as human') (Factor 1), the social support the bird provides for the owner

Table 1 Mean (± SD) owner-bird relationship scale (OBRS) scores with 21 items obtained by a five-point Likert scale*.

Item number	Questionnaire item	Means (± SD)	Factor			
			1	2	3	4
1	I enjoy playing with my bird	3.45 (± 1.46)	**0.61**	0.13	0.24	0.39
2	I think my bird understands me	2.95 (± 1.34)	**0.66**	0.13	0.10	0.37
3	My bird knows when I'm feeling bad	2.55 (± 1.43)	**0.66**	0.13	0.06	0.38
4	I consider my bird to be a friend	3.43 (± 1.44)	**0.70**	0.28	0.21	0.21
5	My bird is an equal member of my family	3.30 (± 1.48)	**0.76**	0.18	0.22	0.17
6	Sometimes I wonder what my bird is thinking	3.83 (± 1.36)	**0.61**	0.13	0.39	–0.01
7	I can talk to my bird about anything	2.47 (± 1.51)	**0.69**	0.29	0.05	0.09
8	My bird is like a child to me	2.46 (± 1.50)	**0.72**	0.26	0.04	0.09
9	My bird provides structure for my life	3.26 (± 1.32)	0.23	**0.71**	0.01	0.07
10	Having a bird gives me something to care for	3.73 (± 1.25)	0.21	**0.73**	0.09	–0.03
11	My bird makes me feel needed	3.28 (± 1.35)	0.37	**0.70**	0.04	0.05
12	Spending time with my bird makes me forget my problems for a while	3.60 (± 1.37)	0.17	**0.68**	0.12	0.13
13	I feel relaxed/more confident because of my bird	3.92 (± 1.12)	0.10	**0.69**	0.15	0.16
14	I feel distressed when my bird is ill and I see it suffering	4.62 (± 0.83)	0.10	0.22	**0.60**	0.07
15	When my bird is ill it is my duty to care for it	4.92 (± 0.41)	–0.13	0.17	**0.60**	0.10
16	I pay attention to my bird's body language	4.61 (± 0.75)	0.24	0.04	**0.68**	0.09
17	My bird has its own unique personality	4.65 (± 0.81)	0.37	0.05	**0.64**	0.10
18	My bird is a sensitive being with its own needs	4.75 (± 0.63)	0.23	0.04	**0.71**	0.01
19	My bird actively tries to be close to me	3.33 (± 1.41)	0.24	0.13	0.10	**0.79**
20	My bird always keeps a little distance from me	3.26 (± 1.38)	0.14	–0.02	–0.01	**0.80**
21	My bird ignores me	3.96 (± 1.22)	0.18	0.08	0.07	**0.77**
	Rotated sum of squares loadings		4.33	2.92	2.47	2.46
	% variance		20.7	13.9	11.8	11.7
	Cronbach's alpha sub-scales		0.89	0.80	0.71	0.76
	Cronbach's alpha scale	0.90				

Translated into English, the original German formulation is given in Burmeister *et al* (2020).
* 1 strongly disagree to 5 strongly agree;
Factor loadings after Principal Component Analysis with varimax rotation are shown with factor loadings above 0.5 shown in bold.
Results based on questionnaires of 1,444 bird owners. The four factors were labelled 'bird as human' (Factor 1), 'social support' (Factor 2), 'empathy, attentiveness, and respect', (Factor 3) and 'relationship of the bird towards the owner' (Factor 4).

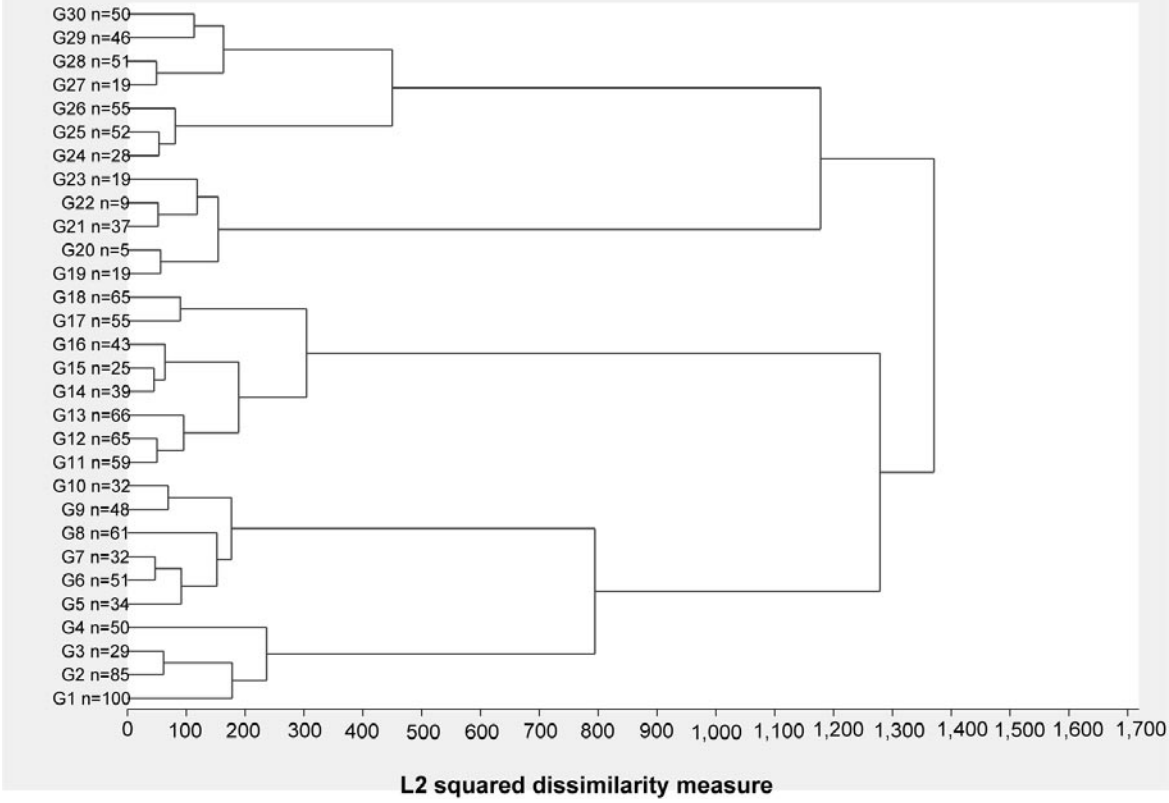
(Factor 2), the owner's empathy, attentiveness and respect towards the bird (Factor 3) and the bird's relationship with the owner (Factor 4). As shown in Table 1, eight of the 21 items of the OBRS showed high loadings on Factor 1, five items showed high loadings on Factor 2, another five items showed high loadings on Factor 3, and three items showed loading on Factor 4. These loadings determine how the factors were grouped (or defined).

Now, in the investigation presented here, the four factors found by PCA were used as variables to examine whether empirical types of bird owners can be identified using cluster analyses (Everitt *et al* 2011). The aim was to identify types with the following attributes: high internal homogeneity and low external heterogeneity using pre-defined variables.

Prior to starting the central parts of the cluster analyses, outliers were removed from the sample. The outliers were recognised using the single-linkage method, which identifies outliers as single clusters by comparing nearest neighbours. In total, nine participants were removed, resulting in a final sample of 1,338 cases as a basis for the first cluster analysis.

https://doi.org/10.7120/09627286.31.1.012 Published online by Cambridge University Press

Figure 1



Dendrogram based on Ward procedure (squared Euclidean distance-L2 measures) and using standardised scores (mean 0; standard deviation 1) of the four factors identified in Principal Component Analysis. These factors were used as variables in the cluster analysis. The figure shows the last six steps of the clustering process. Prior to this step there are 30 clusters of different size (y-axis). During these six steps the dissimilarity of the clusters increases as indicated by the L2 squared dissimilarity measure (x-axis). Gn denotes numerically labelled clusters, n denotes the number of observations in each cluster Gn.

In the first step of the cluster analysis, Ward's hierarchical-agglomerative clustering procedure (using squared Euclidean distance-L2 measures) was applied. We used standardised factor scores (mean 0; standard deviation 1) of the factors identified in PCA and therefore considered large distances more than smaller ones through the process of squaring. To determine graphically the optimal number of clusters, a dendrogram was constructed and we found that the number of clusters should be expected to vary between one and seven. Considering the large distances to the nearest neighbour, the five-cluster solution seemed especially suitable (Figure 1). Additionally, we used a common method for selecting the optimal number of clusters, the Caliński/Harabasz criterion (Caliński & Harabasz 1974) using the local maximum of the pseudo *F*-statistic. The Caliński/Harabasz criterion also preferred a five-cluster solution (Table 2).

For the second step, a non-hierarchical *k*-means clustering procedure was applied. The cluster centres derived from Ward's method (Everitt *et al* 2011; p 77–79) were used as the initial cluster centres. This procedure searches for groups that minimise a global measure of internal heterogeneity based on a Euclidean metric using a pre-defined number of groups. The *k*-means clustering also identified five types of similar bird owners — differing in their relationship to the bird and the bird's proximity-seeking behaviour towards the owner — and confirmed a five-cluster solution supported by the dendrogram and the Caliński/Harabasz criterion.

Stability of the empirically identified types

To decide whether the five-cluster solution may be regarded as a robust result, several procedures were used. Two are especially relevant for the stability of the empirical types. First, we addressed the micro-variability and macro-stability by analysing fictive migratory movements between individuals from *k*-means to Ward clusters. The results indicated that there are some meaningful migratory movements but also a stability level of 63 to 89% of same assignments to the empirical types.

Second, we took the additional step of performing a content-related stability test using distribution diagrams and histograms. This enabled us to address the question of the superiority (beyond the Caliński/Harabasz criterion) of the five-cluster solution over a four-cluster solution that would also give a meaningful interpretation of the results, again using migratory movements. The four-cluster solution was shown to be less stable than the five-cluster solution.

Table 2 Caliński/Harabasz pseudo *F*-statistics to determine the optimal number of clusters.

Number of clusters	Caliński/Harabasz pseudo *F*
2	214.44
3	243.89
4	280.59
5	292.49
6	280.72
7	264.62
8	249.83
9	236.32
10	226.26
11	219.53
12	214.16
13	210.13
14	207.72
15	203.64

Descriptive analysis of the empirically identified types

To describe differences between the identified empirical types of bird owners with respect to the socio-demographics of the bird owners and characteristics of the bird, we used measures of central tendency and dispersion. To test for differences between the clusters, we applied mean comparisons such as UNIANOVA, the Kruskal-Wallis test (*H*-test) and *post hoc* tests (Scheffé test, Tamhane-T2 test), according to the properties of the dependent and independent variables. In order to be regarded as robust, the results were first calculated for Ward's clustering and then confirmed for *k*-means clustering.

Multivariate regressions of the effect of the owner-bird relationship on bird welfare

To address the question of whether the dimensions of the OBRS and the identified empirical types are correlated with bird welfare, a five-point Likert scale was integrated into the questionnaire (never, rarely, sometimes, frequently, very frequently or as a further option: no assessment possible) to measure the agreement of the bird owners to a list of statements. These statements were related to bird welfare, and we expected that they were correlated with our scales and empirical types as dependent variables. Firstly, we queried whether a bird behaves aggressively towards humans, other birds and other pet animals. Secondly, we asked whether birds exhibit locomotor stereotypies (item 'The bird always performs the same recurrent movements') and courtship behaviour towards humans. Thirdly, we questioned whether feather-plucking occurred. Since courtship behaviour towards humans and feather-plucking do not appear equally in all bird species included in this investigation as behaviour disorders, these questions were evaluated only for parrots and parakeets, finches and frugivorous birds, and not for the other bird groups (raptors and owls, pigeons, ornamental fowl and ratites). We then conducted multiple linear regressions (Fox 1997) and examined a correlation with the dimensions of the OBRS and the empirical types as central independent variables. A linear regression requires that the dependent variable can be regarded as quasi-metric. Quasi-metric requires in the present case at least five ordered categories. The independent variables can be either metric or categorical. The assumptions were met. We computed models without control variables except for the bird group. We also estimated a multiple linear regression model on courtship behaviour towards humans. Control variables of this analysis included co-housing (reference: 'Kept alone without contact with other birds'), bird age, purchasing price of the bird: more than €56 (reference: 'Below €56 or unknown'), bird group: parrots and other parakeets (reference: 'All other bird groups except for ornamental fowl') (for those, the questions on courtship behaviour and feather-plucking were not included in the analysis), husbandry condition: bird room or outdoor aviary (reference: 'Everything else'), age of the bird owner (metric), bird: chronic disease (reference: 'No chronic disease') and the four dimensions of the human-bird relationship (metric).

Results

Empirical types of bird owners

Based on the four dimensions of the owner-bird relationship, the tendency of the owner to anthropomorphise the bird ('bird as human') (Factor 1), the social support the bird provides for the life of the owner (Factor 2), the owner's empathy, attentiveness and respect towards the bird (Factor 3), and the bird's relationship with the owner (Factor 4) (Burmeister *et al* 2020), empirical types of bird owners were identified; characterised by a specific combination of these four dimensions. The five types of bird owners represented by the five Ward's clusters including mean (± SD) and variance for the items that refer to these dimensions can be found in Table 3. A corresponding table for the *k*-means clustering is available from the authors on request. The numbering of clusters in the Ward and *k*-means procedure differed for technical reasons. Both procedures revealed a similar but not identical cluster-classification of the bird owners into five clusters (types of owner-bird relationships) (Table 4) and showed qualitatively similar patterns. Only cluster $1_{Ward}/1_{k\text{-means}}$ and cluster $5_{Ward}/3_{k\text{-means}}$ showed a difference > 0.3 in the mean of the dimension 'bird as human'. Likewise, only cluster $2_{Ward}/4_{k\text{-means}}$ showed a difference > 0.3 in the dimensions 'social support' and 'bird's relationship with the owner'. There were distinct differences between the five types of owner-bird relationships regarding the underlying dimensions (Table 3, Table 5, Figure 2).

The closeness-appreciating anthropomorphising owner

Members of this cluster (Ward cluster 1/*k*-means cluster 1) showed above average (Ward) or average (*k*-means) means for the dimension 'bird as human' (Ward 0.49/*k*-means 0.06).

https://doi.org/10.7120/09627286.31.1.012 Published online by Cambridge University Press

Table 3 Ward clusters (five-cluster solution) representing the types of bird owners including mean (± SD) and variance for the items that refer to the four dimensions which characterise the five owner types.

Ward cluster	Factor	Bird as human	Social support	Empathy, attentiveness respect	Bird's relationship with owner
1	Mean (± SD)	0.49 (± 0.57)	–0.79 (± 0.87)	0.34 (± 0.40)	0.72 (± 0.65)
	N	264	264	264	264
2	Mean (± SD)	–1.04 (± 0.58)	–0.00 (± 0.79)	0.08 (± 0.75)	0.65 (± 0.59)
	N	258	258	258	258
3	Mean (± SD)	0.79 (± 0.60)	0.69 (± 0.54)	0.05 (± 0.43)	0.03 (± 0.83)
	N	417	417	417	417
4	Mean (± SD)	–0.31 (± 1.10)	–0.21 (± 1.08)	–2.38 (± 0.86)	–0.36 (± 0.86)
	N	89	89	89	89
5	Mean (± SD)	–0.58 (± 0.70)	–0.16 (± 1.05)	0.43 (± 0.59)	–1.11 (± 0.69)
	N	301	301	301	301
Total	**Mean (± SD)**	**–0.01 (± 0.99)**	**0.01 (± 0.99)**	**0.04 (± 0.88)**	**0.00 (± 1.00)**
	N	**1,329**	**1,329**	**1,329**	**1,329**

They were characterised by far below average values regarding 'social support' (Ward –0.79/*k*-means –1.07) and above average values for 'empathy, attentiveness and respect' (Ward 0.34/*k*-means 0.39). In addition, they displayed strongly above average means for 'bird's relationship with the owner' (Ward 0.72/*k*-means 0.78) (Table 3).

Typical for this type was the below average function of social support. The Ward procedure showed above average values for anthropomorphism, whereas the *k*-means procedure resulted in only average values for this. The bird displays an above average level of proximity-seeking behaviour towards the owner who, in turn, shows above average empathy, attentiveness and respect towards the bird (Figure 2). In the manifestation of the bird's relationship with the owner, this type was similar to the type reported next. To clearly distinguish both types we chose the dimension 'bird as human' as the second part of our label, even though strictly speaking it is only relevant for the Ward procedure. We therefore decided to name this type 'closeness-appreciating anthropomorphising.'

This owner type was predominantly female (Table 5). Only 18.6% (Ward) or 22.3% (*k*-means) of these bird owners were males. The mean age was 41.4 (Ward) or 42.5 years (*k*-means). The owner was more likely to be married or living in a civil union, with a net income of about €2,000–3,000 per month. This type was dominated by individuals with upper secondary education. The highest educational qualification achieved by these owners was the Abitur (equivalent to the A-level). They lived in urban areas, and the value of the reported bird was most often €20. This bird was often a parrot or parakeet, most commonly a budgerigar.

The closeness-appreciating socially supported owner

The owners in this cluster (Ward cluster 2/*k*-means cluster 4) were characterised by strongly below average means for 'bird as human' (Ward –1.04/*k*-means –1.09). They showed an average value for the Ward procedure, but an above average mean for the *k*-means procedure with regard to 'social support' (Ward 0.00/*k*-means 0.62). 'Empathy, attentiveness and respect' displayed average means (Ward 0.08/*k*-means 0.15) and the 'bird's relationship with the owner' showed above average values (Ward 0.65/*k*-means 0.32).

This type was characterised by below average means for anthropomorphism. As with the closeness-appreciating anthropomorphising owner described above, this type showed above average means for the bird's relationship with the owner. The other two dimensions had average manifestations, except social support which was above average. To distinguish this type from the previous one we therefore chose the dimension of social support, although it was only valid for one procedure (Figure 2). Consequently, we named it 'closeness-appreciating socially supported.' Again, these owners were predominantly female. This type was more likely to live in a rural area and more likely to keep ornamental fowl (for more details, see Table 5).

The anthropomorphising socially supported owner

People from this type of cluster (Ward cluster 3/*k*-means cluster 5) showed above average means for 'bird as human' (Ward 0.79/*k*-means 0.86) as well as for 'social support' (Ward 0.69/*k*-means 0.62). They had average means for 'empathy, attentiveness and respect' (Ward 0.05/*k*-means 0.07). The

Table 4 Assignment of bird owners to clusters: comparison of the results of Ward and *k*-means procedure.

K-means cluster	Ward cluster					Total
	1	2	3	4	5	
1	177*	66	3	0	24	**270**
	65.56*	24.44	1.11	0.00	8.89	**100**
	67.05*	25.58	0.72	0.00	7.97	**20.32**
2	1	18	3	79*	8	**109**
	0.92	16.51	2.75	72.48*	7.34	**100**
	0.38	6.98	0.72	88.76*	2.66	**8.20**
3	12	2	41	2	207*	**264**
	4.55	0.76	15.53	0.76	78.41*	**100**
	4.55	0.78	9.83	2.25	68.77*	**19.86**
4	7	168*	29	3	60	**267**
	2.62	62.92*	10.86	1.12	22.47	**100**
	2.65	65.12*	6.95	3.37	19.93	**20.09**
5	67	4	341*	5	2	**419**
	15.99	0.95	81.38*	1.19	0.48	**100**
	25.38	1.55	81.77*	5.62	0.66	**31.53**
Total	**264**	**258**	**417**	**89**	**301**	**1,329**
	19.86	**19.41**	**31.38**	**6.70**	**22.65**	**100**
	100	**100**	**100**	**100**	**100**	**100**

In each cell of the table, the number of participants (n) (first line), the percentage of owners according to *k*-means (second line) and the percentage of owners according to Ward (third line) are given. The clusters that comprised the highest percentages of owners are asterisked. Reading example (1st row/1st column): n = 177 bird owners are assigned to Ward cluster 1 and *k*-means cluster 1, which is 65.56% of all bird owners who are classified as belonging to *k*-means cluster 1, or 67.05% of all bird owners who are classified as belonging to Ward cluster 1; asterisks indicate stability of the cluster solution.

Ward procedure showed average values, and the *k*-means procedure displayed slightly above average values for the 'bird's relationship with the owner' (Ward 0.03/*k*-means 0.22).

More often than the other types, this type of owner saw his or her bird as a friend or member of the family and agreed with the item stating 'I think my bird understands me.' Furthermore, the bird more often provided social support. Empathy, attentiveness and respect for the bird were average. The bird sought neither proximity nor distance from the owner. The chief dimensions were therefore 'bird as human' and 'social support' (Figure 2). Consequently, this type was labelled 'anthropomorphising socially supported.'

Owners of this type were also predominantly female. They were more likely to be younger, unmarried, with a lower income and GCSE-level education. They often lived in an urban area, and their bird type was most likely to be a parrot or parakeet, most often a budgerigar (for more details, see Table 5).

The inattentive owner

Owners of this cluster (Ward cluster 4/*k*-means cluster 2) were characterised by below average means for 'bird as human' (Ward –0.31/*k*-means –0.55), 'social support' (Ward –0.21/*k*-means –0.34) and 'bird's relationship with the owner' (Ward –0.36/*k*-means –0.30) as well as considerably below average means for 'empathy, attentiveness and respect' (Ward -2.38/*k*-means –2.20).

This type had nothing in common with the other four types. It was characterised by below average values for all four dimensions. More particularly, the owner had hardly any empathy, attentiveness or respect for the bird (Figure 2). Apparently, the owner did not see his or her bird as a sensitive living being. This type was therefore labelled 'the inattentive owner.'

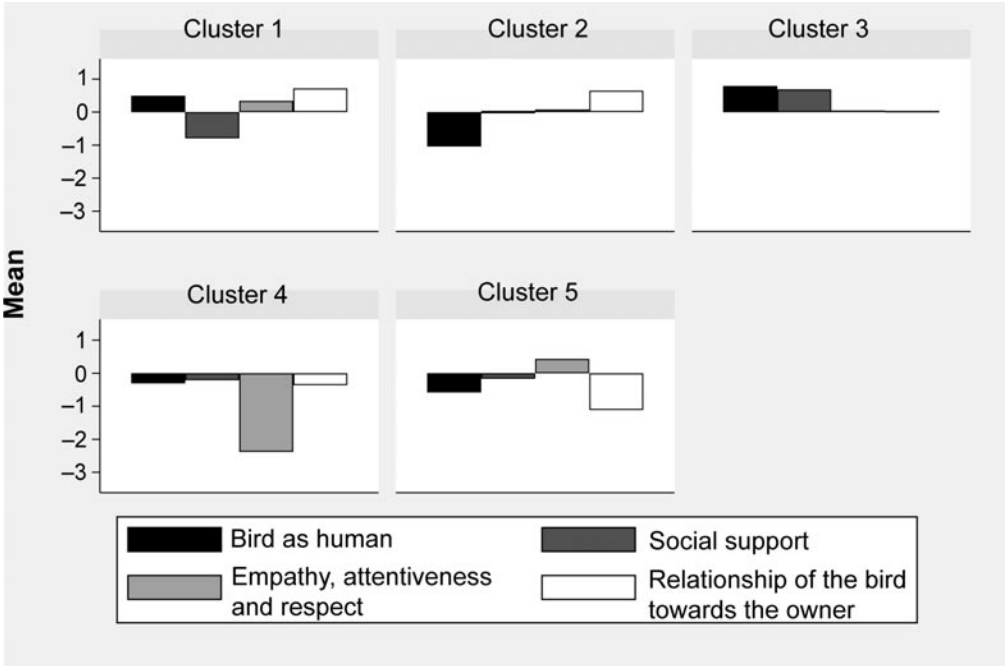
In terms of absolute numbers, equal numbers of females and males were allocated to this type. In relation to the study

https://doi.org/10.7120/09627286.31.1.012 Published online by Cambridge University Press

Table 5 Socio-demographic features of the bird owner and the bird.

	The closeness-appreciating anthropomorphising owner	The closeness-appreciating socially supported owner	The anthropomorphising socially supported owner	The inattentive owner	The distance-appreciating owner
Gender	Female; 81.4% (Ward) 77.7% (*k*-means)	Female; 73.2% (Ward) 70.0% (*k*-means)	Female; 83.7% (Ward) 84.0% (*k*-means)	Female; 48.3% (Ward) 50.5% (*k*-means)	Female; 72.8% (Ward) 80.0% (*k*-means)
Mean age (years)	41.4 (Ward) 42.5 (*k*-means)	40.9 (Ward) 40.3 (*k*-means)	37.3 (Ward) 37.4 (*k*-means)	42.5 (Ward) 41.5 (*k*-means)	39.4 (Ward) 38.8 (*k*-means)
Marital status	Married or living in a civil union	Married or living in a civil union	Unmarried	Married or living in a civil union	Married or living in a civil union
Net household income per month	€2,000–€3,000	€1,000–€3,000	€1,000–€2,000	Bimodal with €1,000–€4,000 resp €5,000 and more	€1,000–€2,000 (Ward) €1,000–€4,000 (*k*-means)
Highest educational qualification	A-level or level 3 equivalent	A-level or level 3 equivalent	GCSE or level 2 equivalent	A-level or level 3 equivalent	A-level or level 3 equivalent
Place of residence in Germany (east/west)	West; 87.9% (Ward) 91.9% (*k*-means)	West; 90.0% (Ward) 87.6% (*k*-means)	West; 87.1% (Ward) 85.9% (*k*-means)	West; 80.9% (Ward) 82.6% (*k*-means)	West; 86.0% (Ward) 85.6% (*k*-means)
Residential area (rural/urban)	Urban; 63.7% (Ward) 61.9% (*k*-means)	More rural; 51% (Ward) 51.4% (*k*-means)	Urban; 63.8% (Ward) 66.6% (*k*-means)	More rural; 51.1% (Ward) 53.7% (*k*-means)	Urban; 60.8% (Ward) 64.0% (*k*-means)
Value and species of the reported bird	Up to €20; parrot or parakeet, most often budgerigar	Up to €20; ornamental fowl	Up to €20; parrot or parakeet, most often budgerigar	Up to €20; ornamental fowl	Up to €20; parrot or parakeet, most often budgerigar

Figure 2



Graphical representation of Ward clusters (five-cluster solution). Factor scores were standardised (mean 0; standard deviation 1).

Table 6 Distribution of bird species groups to different owner types (according to Ward clusters).

Ward cluster	Bird group							
	Parrots and parakeets	Frugivores and lories	Finches	Raptors and owls	Pigeons	Ornamental fowl	Ratites	Total (%)
1	217 (26.79%)	4 (30.77%)	5 (4.85%)	7 (20.59%)	3 (7.89%)	28 (8.48%)	0 (0%)	**264 (19.86%)**
2	89 (10.99%)	3 (23.08%)	13 (12.62%)	14 (41.18%)	10 (26.32%)	129 (39.09%)	0 (0%)	**258 (19.41%)**
3	313 (38.64%)	4 (30.77%)	20 (19.42%)	9 (26.47%)	11 (28.95%)	59 (17.88%)	1 (100%)	**417 (31.38%)**
4	25 (3.09%)	0 (0%)	16 (15.53%)	1 (2.94%)	3 (7.89%)	44 (13.33%)	0 (0%)	**89 (6.70%)**
5	166 (20.49%)	2 (15.38%)	49 (47.57%)	3 (8.82%)	11 (28.95%)	70 (21.21%)	0 (0%)	**301 (22.65%)**
Total	**810 (100%)**	**13 (100%)**	**103 (100%)**	**34 (100%)**	**38 (100%)**	**330 (100%)**	**1 (100%)**	**1,329 (100%)**

In each cell, the number and the percentage of owners keeping birds of this group (in brackets) are given. The owner types of the Ward clusters were named 'The closeness-appreciating anthropomorphising owner' (cluster 1), 'The closeness-appreciating socially supported owner' (cluster 2), 'The anthropomorphising socially supported owner' (cluster 3), 'The inattentive owner' (cluster 4) and 'The distance-appreciating owner (cluster 5).

participants, male owners were over-represented with 14.7/17.4% of the male owners assigned to this cluster, but only 4.2/5.4% of the females. The income of this owner type was highly variable, which is why we have refrained from specifying the average net income per month. They often lived in a rural area, and the bird was most likely to be an ornamental fowl (for more details, see Table 5).

The distance-appreciating owner

This cluster (Ward cluster 5/*k*-means cluster 3) showed below average values for the owners regarding 'bird as human' (Ward –0.58/*k*-means –0.14) and 'social support' (Ward –0.16/*k*-means –0.34). They were characterised by above average values for 'empathy, attentiveness and respect' (Ward 0.43/*k*-means 0.43) and very below average values for the 'bird's relationship with the owner' (Ward –1.11/*k*-means –1.34).

The birds showed a very below average tendency to seek the proximity of the owners, who displayed a below average willingness to anthropomorphise the bird or receive social support (Figure 2). We surmised that the owners kept the birds for their own sake and liked to watch their natural behaviour. Therefore, we called this type 'distance-appreciating.'

Again, these owners were predominantly female. They lived in urban areas, and the bird was most likely to be a parrot or parakeet, most often a budgerigar (for more details, see Table 5).

Overall, the descriptive analysis indicated some socio-demographic similarities and differences among the owner types. Tests for differences between the clusters (available from the authors upon request) confirmed that: (i) the closeness-appreciating anthropomorphic bird owner keeps more valuable birds and the bird is more often a parrot or parakeet; (ii) the closeness-appreciating socially supported bird owner lives in a rural area and more often keeps ornamental fowl; (iii) the anthropomorphic socially supported bird owner is more often female, younger, single, has a lower educational level as well as a lower net income per month, more often keeps more valuable birds, and the bird is more often a parrot or parakeet; (iv) the inattentive owner is more often male, lives in a rural area and more often keeps ornamental fowl; and (v) the distance-appreciating bird owner has a higher educational level and more often keeps a parrot or parakeet than the other types.

Bird species and their owner types

Due to the limited number of cases, matching bird species with owner type was impossible. However, some owner types proved to be more common within certain bird groups (Table 6). For reasons of space, we have not included a species list for the parrots and parakeets of this investigation. A corresponding table is available from the authors on request. The German species list can be found online in Supplementary Information 1 at https://www.ufaw.org.uk/the-ufaw-journal/supplementary-material.

The owners of parrots and parakeets most often (65.43%) belonged to the anthropomorphising types 'anthropomorphic socially supported' and 'closeness-appreciating anthropomorphising.' Large parrots in particular (amazons, macaws, grey parrots and cockatoos) were kept by the 'closeness-appreciating anthropomorphising' type, whereas budgerigars and cockatiels were owned by the 'anthropomorphic socially supported' type. Budgerigars constituted the second biggest bird group (28.47%) kept by the distance-appreciating owners. Only 3.09% of the owners of parrots and parakeets belonged to the inattentive type. A similarly low proportion of raptor owners (2.94%) were assigned to the inattentive type. Among raptor owners, the 'closeness-appreciating socially supported' type (41.18%) predominated, followed by the 'anthropomorphic socially supported' type (26.47%). The owners of finches most often belonged to the 'distance-appreciating' type (47.57%), while the owners of ornamental fowl mostly belonged to the 'closeness-appreciating socially supported' type (39.09%).

https://doi.org/10.7120/09627286.31.1.012 Published online by Cambridge University Press

Table 7 Correlations of human-bird relationship dimensions (metric) with aggressiveness parameters and with bird behavioural disorders as determined by multivariate linear regression.

Independent variable	Dependent variable					
	Aggressiveness towards humans	Aggressiveness towards conspecifics	Aggressiveness towards other pet animals	Locomotor stereotypies	Courtship behaviour towards humans†	Feather-plucking†
	Coefficient (standard error)	Coefficient (standard error)	Coefficient (standard error)	Coefficient (standard error)	Coefficient (standard error)	Coefficient (standard error)
Bird as human	0.048* (0.019)	0.103*** (0.024)	0.037* (0.018)	0.135*** (0.030)	0.164*** (0.035)	0.048 (0.025)
Social support	–0.040* (0.017)	0.041 (0.021)	0.008 (0.016)	0.075** (0.026)	–0.003 (0.030)	–0.040 (0.021)
Empathy, attentiveness and respect	–0.003 (0.018)	–0.035 (0.021)	0.011 (0.016)	–0.044 (0.027)	0.066 (0.035)	0.001 (0.025)
Bird's relationship with owner	0.095*** (0.017)	0.018 (0.021)	0.063*** (0.016)	0.061* (0.026)	0.332*** (0.030)	0.066** (0.021)
Bird group (Ref ornamental fowl; except columns 6 and 7: Ref frugivorous birds, lories and finches)						
Parrots and parakeets	0.147** (0.047)	–0.164** (0.056)	–0.202*** (0.042)	–0.044 (0.072)	0.140 (0.100)	0.014 (0.070)
All other bird groups	0.066 (0.058)	–0.003 (0.070)	–0.017 (0.052)	0.017 (0.088)		
Constant	1.193*** (0.038)	1.555*** (0.045)	1.308*** (0.033)	1.533*** (0.058)	1.431*** (0.091)	1.164*** (0.063)
N	1,319	1,276	1,153	1,293	915	922
Adj R^2	0.044	0.021	0.034	0.026	0.158	0.015

* $P < 0.05$; ** $P < 0.01$; *** $P < 0.001$.

† Occurrence of courtship behaviour towards humans and feather-plucking was asked for parrots and parakeets, finches and frugivorous birds, but not for the other bird groups (raptors, pigeons, ornamental poultry and ratites).

Owner-bird relationship and bird welfare

As shown in Tables 7 and 8, correlations between the types of owners and bird welfare components have been obtained from calculations without control variables except for the bird group, because all these bird behaviours are quite different from each other. Using control variables would have required the development of theory-driven models and hypotheses for each of the bird welfare measures separately. This was beyond the scope of this study. Rather, our aim was to show that the owner-bird relationship is significantly related to a number of welfare-related bird behaviours (increased aggressiveness) and behavioural disorders, thus arguing in favour of its general relevance for animal welfare. The focus of the interpretation is therefore on the significances and not on the explained variance (Adj R^2).

We found several significant correlations between the dimensions of the owner-bird relationships and the variables considering the bird's aggressiveness as well as the measures considering behavioural disorders. Anthropomorphism was significantly and positively related to all forms of increased aggressiveness, locomotor stereotypies, and courtship behaviour towards humans but not to feather-plucking. Social support was significantly and negatively related to aggressiveness towards humans, but significantly and positively related to locomotor stereotypies. The dimension of empathy, attentiveness and respect was not significantly related to any of the variables measuring the bird's aggressiveness or behavioural disorder. Finally, proximity-seeking behaviour towards the owner was significantly and positively related to aggressiveness towards humans and other pet animals, locomotor stereotypies, courtship behaviour towards humans and plucking of own feathers. As compared to ornamental fowl (reference category), parrots and parakeets showed significantly more aggressive behaviour towards humans, but significantly less towards conspecifics and other pet animals. Other bird groups showed no significant differences to ornamental

Table 8 Correlations of types of human-bird relationships (with Ward cluster 1;'The closeness-appreciating anthropomorphising owner' as the reference cluster) with aggressiveness parameters and with bird behavioural disorders as determined by multivariate regression analysis.

Independent variable	Dependent variable					
Types of human-bird relationships	Aggressiveness towards humans	Aggressiveness towards conspecifics	Aggressiveness towards other pet animals	Locomotor stereotypies	Courtship behaviour towards humans	Feather-plucking
	Coefficient (standard error)	Coefficient (standard error)	Coefficient (standard error)	Coefficient (standard error)	Coefficient (standard error)	Coefficient (standard error)
Ward cluster 2 (The closeness-appreciating socially supported owner)	–0.214*** (0.055)	0.043 (0.067)	0.012 (0.051)	0.019 (0.083)	–0.384*** (0.113)	–0.159* (0.077)
Ward cluster 3 (The anthropomorphising socially supported owner)	–0.137** (0.050)	0.067 (0.060)	–0.032 (0.047)	0.194** (0.075)	–0.263** (0.083)	–0.114* (0.056)
Ward cluster 4 (The inattentive owner)	–0.138 (0.079)	0.194* (0.094)	0.057 (0.073)	0.060 (0.119)	–0.705*** (0.168)	–0.177 (0.111)
Ward cluster 5 (The distance-appreciating owner)	–0.320*** (0.053)	–0.096 (0.064)	–0.121* (0.050)	–0.137 (0.080)	–0.803*** (0.091)	–0.214*** (0.062)
Constant	1.460*** (0.039)	1.433*** (0.047)	1.219*** (0.037)	1.465*** (0.059)	1.942*** (0.064)	1.302*** (0.043)
N	1,310	1,276	1,145	1,284	908	915
Adj R^2	0.026	0.008	0.006	0.014	0.083	0.010

* $P < 0.05$; ** $P < 0.01$; *** $P < 0.001$.

fowl. Parrots and other parakeets showed no significant difference for courtship behaviour and feather-plucking compared to frugivorous birds, lories and finches.

We also found several significant correlations between owner type and the variables related to bird welfare. In particular, the bird showed less aggressiveness towards humans and less feather-plucking if it had a closeness-appreciating socially supported owner, an anthropomorphising socially supported owner, or a distance-appreciating owner — always in comparison to the closeness-appreciating anthropomorphising owner. The bird showed less aggressiveness towards other pets if kept by a distance-appreciating owner (same reference group as above). The bird showed more locomotor stereotypies when kept by an anthropomorphising socially supported owner (same reference group) and less courtship behaviour towards humans if the owner did *not* belong to the closeness-appreciating anthropomorphising type (reference category). Again, as compared to ornamental fowl (reference category), parrots and parakeets showed significantly more aggressive behaviour towards humans, but significantly less towards other pet animals. Other bird groups showed no significant differences to ornamental fowl. Parrots and parakeets showed more courtship behaviour as compared to frugivorous birds, lories and finches but there were no differences associated with feather-plucking.

How these correlations may vary when integrated into a multivariate regression with control variables is illustrated by the results for courtship behaviour towards humans (Table 9). With respect to the OBRS items, a higher degree of anthropomorphism of the owner was significantly correlated with more courtship behaviour towards humans. Courtship behaviour towards humans was higher the more the bird sought the proximity of the owner. Neither the social support nor the empathy factor was significantly associated with courtship behaviour.

Birds which were kept together with one or more other birds showed significantly less courtship behaviour towards humans compared to those kept alone without contact with other birds. Older birds showed significantly more courtship behaviour towards humans than younger ones although the effect was rather small. Birds with a chronic disease showed significantly more courtship behaviour towards humans than birds without a chronic disease. The explained variance of this model (Adj $R^2 = 19.1\%$) is good. We additionally controlled for the purchasing price of the bird, the bird group, and the age of the bird owner. It is noteworthy that if we controlled for the dimensions of the human-bird relationship, parrots and parakeets did not show more courtship behaviour towards humans than frugivorous birds, lories and finches (but note that this question was not evaluated for raptors and owls, pigeons, ornamental fowl and ratites). We replicated this model only for parrots and parakeets. The results did not change in any significant way (Adj R^2 dropped slightly to 18.1%).

https://doi.org/10.7120/09627286.31.1.012 Published online by Cambridge University Press

Table 9 Correlation of parameters related to co-housing, human-bird relationships or owner types with courtship behaviour towards humans as dependent variable, determined by multiple linear regression.

		OBRS Coefficient (standard error)	Owner types Coefficient (standard error)
Co-housing (Ref: Kept alone without contact with other birds)	Kept alone, but see and/or hear other birds in the household	–0.171 (0.242)	–0.126 (0.251)
	Kept together with one other bird	–0.500** (0.172)	–0.597*** (0.177)
	Kept together with several other birds	–0.627*** (0.175)	–0.751*** (0.179)
Bird age		0.015** (0.005)	0.018*** (0.005)
Purchasing price of the bird more than €56 (Ref: Below €56 or unknown)		–0.003 (0.082)	0.077 (0.084)
Bird group: parrots and other parakeets (Ref: Frugivorous birds, lories and finches)		0.124 (0.114)	0.240* (0.113)
Husbandry: Bird room or outdoor aviary (Ref: Everything else)		0.031 (0.075)	0.030 (0.077)
Age of the bird owner (metric)		0.001 (0.003)	0.001 (0.003)
Bird: Chronic disease (Ref: No chronic disease)		0.305** (0.116)	0.255* (0.119)
Human-bird relationship (metric)	Bird as human	0.125** (0.039)	
	Social support	0.034 (0.034)	
	Empathy, attentiveness and respect	0.049 (0.041)	
	Bird's relationship with owner	0.278*** (0.036)	
Owner types (Ref:Ward cluster 1: The closeness-appreciating anthropomorphising owner)			
	Ward cluster 2 (The closeness-appreciating socially supported owner)		–0.196 (0.121)
	Ward cluster 3 (The anthropomorphising socially supported owner)		–0.120 (0.089)
	Ward cluster 4 (The inattentive owner)		–0.402* (0.199)
	Ward cluster 5 (The distance-appreciating owner)		–0.527*** (0.106)
Constant		1.852*** (0.226)	2.055*** (0.244)
N		808	803
Adj R^2		0.191	0.150

* $P < 0.05$; ** $P < 0.01$; *** $P < 0.001$.

In the model with owner types, we found that birds showed significantly less courtship behaviour towards humans if the owner was distance-appreciating (in comparison to the closeness-appreciating anthropomorphising owner). All other effects were similar to the ones for the model including the OBRS items, except for the finding that parrots and other parakeets showed more courtship behaviour compared to all other bird groups. The explained variance decreased to Adj $R^2 = 15.0\%$ but is still satisfactory. We replicated this model for parrots and parakeets. The results did not change in any significant way (Adj R^2 dropped slightly to 13.3%).

Discussion

Using the OBRS and additional data obtained in an online questionnaire, distinct owner types were found and significant correlations between owner type, owner-bird relationships and variables related to bird welfare were detected.

Types of owner-bird relationships: Four- or five-cluster solution

We first used the Caliński/Harabasz criterion and the dendrogram for selecting the optimal number of clusters. The results based on the socio-demographic characteristics of the owner type then supported and confirmed the decision in favour of the five-cluster solution. Only in the five-cluster solution did we find two anthropomorphic types — the closeness-appreciating anthropomorphising and the anthropomorphising socially supported bird owner. While each of them was socio-demographically homogeneous, both types differed significantly from each other in five socio-demographic characteristics (gender, age, marital status, education and income). This is a substantive argument against combining the two anthropomorphic types, as is the case in the four-cluster solution. The cluster analysis was based on the relationship between owner and bird, not on owner socio-demographics. The socio-demographic differences therefore provide sociological support in favour of the five-cluster solution.

The significance of owner types and the owner-bird relationship for bird welfare

The main findings of this investigation were that: (i) the bird group does not predict the type of the owner; and (ii) that anthropomorphism may be as dangerous for bird health as negligence.

The bird group does not predict the type of the owner

Many keepers of parrots and parakeets belonged to two different owner types, 'closeness-appreciating anthropomorphising' (larger psittacine species) and 'anthropomorphising socially supported' (smaller psittacine species). This may be explained by the fact that small parakeets tend not to seek the proximity of the owner, whereas the larger parrots do. Both owner groups have their highest scores in anthropomorphism. This could be related to the intelligence and the social behaviour which is highly developed in these birds (Emery 2006; Pepperberg 2006; Grant *et al* 2017). It is easy to attribute human behavioural patterns to them. Another explanatory factor could be the fact that it is especially common for psittacines to be kept indoors, side-by-side with their owners (Lantermann 1998; Pepperberg 2008). It would be interesting to control for the husbandry system by comparing birds kept outdoors and indoors. A large proportion of budgerigar owners, however, do not anthropomorphise their birds, they simply enjoy observing them. So, the bird group does not predict the type of the owner. This also holds for raptors, which have 'closeness-appreciating socially supported' and 'anthropomorphising socially supported' owners. As a result of legal regulations in Germany, special permits and certificates to prove one's knowledge about husbandry and health are prerequisites for keeping a raptor (Anonymous 2018), which may result in an emphasis on social support. The closeness of the bird towards the owner could be due to training with the bird. We did not control for this variable, so this conclusion remains speculative.

Three items were included in the questionnaire to measure the closeness of the bird towards the owner as a part of the bird-owner relationship: 'My bird actively tries to be close to me', 'My bird always keeps a little distance from me' and 'My bird ignores me.' Answers correlated highly leading to Factor 4 in the factor analyses which we interpret as relationship of the bird towards the owner. Two arguments show that there is no bias in responses. Firstly, the question on behaviour and behavioural disorders was asked in a later part of the questionnaire (block 23) while the questions pertaining to the human-bird relationship were asked in an earlier part of the questionnaire (block 14). There are thus nine blocks of questions between both questions which reduces the risk of a bias. And, secondly, the items 'My bird always keeps a little distance from me' and 'My bird ignores me' have no connotation with aggression. As their answers correlate highly with the answers on the item 'My bird actively tries to be close to me', any aggression bias within the answers could be excluded.

The dominance of distance-appreciating owners in the group of finch keepers may be explained by the reserved behaviour of these birds towards humans. Finches seem to prefer flocking together rather than seeking human contact and do not accept humans as social partners as readily as parrots (the authors' own observations; Law *et al* 2019). In addition, they are mostly very small and vulnerable and therefore not suitable for being stroked and other close interaction with their keepers. The small size and the silent or melodious communication of these birds, in contrast to the relatively loud clamour of parrots or budgerigars (again, the authors' own observations), could be an explanation for the relatively high percentage of inattentive owners.

Anthropomorphisms occurred in owners of a wide range of birds. Parrots and parakeets, however, seemed most affected. Ornamental fowl and finches, where anthropomorphisms were less frequently detected, were kept more often by inattentive owners and were thus in greater danger of neglect. Inattentive owners were also found in other bird groups. Animal welfare can therefore be compromised in all bird species by certain features of the owner-bird relationship and, as such, the unique constellation of owner and bird should always be considered.

Anthropomorphism may be as dangerous for bird health as negligence

Six signs of the bird's aggressiveness and behavioural disorders were analysed in our investigation to evaluate health and welfare of the bird. These included increased (above normal) aggressiveness to humans, to conspecifics or to other pet animals as well as three types of behavioural disorders (locomotor stereotypies, courtship behaviour

https://doi.org/10.7120/09627286.31.1.012 Published online by Cambridge University Press

towards humans and feather-plucking) as perceived by the owner. At least locomotor stereotypies might not always be evaluated as an indicator for impaired animal welfare, but can also be regarded as coping, that means as a behavioural response aiming at reducing the effects of averse stimuli and situations on fitness. Successful coping behaviour can thus change an averse situation. Stereotypies were shown to be associated with a reduction of physiological stress parameters in some, but not in all, investigations and were thus only partly successful coping behaviours (Wechsler 1995). An animal with difficulty in coping may increase the duration, frequency or intensity of coping behaviour, and the failure to cope with normal behaviour may result in the development of abnormal behaviour and thus in animal welfare problems (Wechsler 1995). We found anthropomorphism to be an underestimated danger to bird health. One problem of bird-keeping in modern times is the lack of domestication. Only a few pet birds can be described as domesticated (Mignon-Grasteau *et al* 2005). Birds depend on their reflexes, especially the flight reflex, and hide signs of illness as long as they can (Korbel *et al* 2016). So, owners need to observe them thoroughly. From this perspective, it is problematic to anthropomorphise the bird because its behaviour may be misinterpreted. Courtship behaviour against humans, for example, must be regarded as unnatural and as a behavioural disorder caused by non-availability of adequate conspecific mates leading to frustration and thus impaired welfare and health of the bird.

Some other studies on pet welfare have also examined anthropomorphism. A study on dogs found that anthropomorphising participants reported a greater willingness to adopt dogs and more support for dog welfare (Butterfield *et al* 2012). In our study, however, anthropomorphism seemed to be problematic. Anthropomorphism was related to increased aggressiveness of the bird towards humans and conspecifics, more locomotor stereotypies, more courtship behaviour towards humans, and more feather-plucking. In addition, the proximity-seeking behaviour of the bird towards the owner was related to more aggressiveness towards the human and other pets as well as to more locomotor stereotypies, more courtship behaviour towards humans and more feather-plucking. This finding is in contrast to an earlier study, which found that feather-plucking decreased for birds that interacted with their owners for more than four hours a day (Gaskins & Hungerford 2014). A direct comparison with our study is, however, problematic, because the birds included in the investigation of Gaskins and Hungerford, were psittacines, and most of them were housed alone, without a bird partner. A long interaction with humans thus might have acted positively and satisfied essential social needs leading to decreased psychological distress (Grant *et al* 2017) and reduced feather-plucking. It can be speculated that the proximity-seeking behaviour recorded for the birds in our study might, in contrast, indicate imprinting on humans and thus social dependence unsatisfied by the owners, but we did not control for this aspect. It should also be borne in mind that close interaction with the owner may include a high stress potential even in domesticated pet birds, due to their primarily reflex-based behaviour, including the most important flight reflex. This aspect differs from species-to-species and is more applicable to finches than psittacines. We conclude that the two factors 'bird as human' and 'proximity-seeking behaviour of the bird' have negative effects for the birds' welfare. This corroborates the argument that owners who anthropomorphise their pet may have difficulty identifying their real needs (Bradshaw & Casey 2007).

Based on the anthropomorphising and proximity-seeking dimensions of the bird-owner relationship, the association of bird health with the types of owners can be evaluated and explained. Note that the inattentive owner type shows no significant difference from the closeness-appreciating anthropomorphising type in four out of our six exemplary signs of bird aggressiveness and behavioural disorders. The birds of inattentive owners show more aggressiveness towards conspecifics, but less courtship behaviour towards the owner than those of closeness-appreciating anthropomorphising owners. In our sample, then, anthropomorphism turns out to be as dangerous for bird health as negligence. The key to understanding the positive impact of the other three types of owner on bird health is to consider their level of anthropomorphism and the proximity-seeking behaviour of the bird. As the distance-appreciating owner shows the lowest values for these characteristics of the owner-bird relationship, this owner type displays the greatest difference from the closeness-appreciating anthropomorphising type. The remaining types show a higher value either for anthropomorphism or for the proximity-seeking behaviour of the bird and take a middle position with respect to bird welfare. We conclude that the owner type is less important for explaining the effect on bird health than two dimensions of the owner-bird relationship, namely the intensity of the owner's anthropomorphism and the proximity-seeking behaviour of the bird. This implies that, for example, veterinarians treating pet bird patients should concentrate on investigating the anthropomorphism of the bird keeper and the proximity-seeking behaviour of the pet bird. They do not necessarily have to find out the owner type.

Limitations of the study

There are several important limitations to this study, including the sampling and the proxy interviews, the reliance on a national survey only, and the use of cluster analysis techniques in general.

Firstly, there may be a self-selection effect in our online sample with respect to owners who have a closer relationship with their pet bird. Conversely, bird keepers with no personal relationship with their bird may have been less motivated to answer our questionnaire. As a consequence, we cannot rule out the possibility of further types of bird keepers with a specific human-bird relationship. Given the impossibility of drawing a representative sample of bird

owners and questioning them, it is difficult to ascertain how different the results would have been using a representative sample. In principle, it would be possible to use a representative sample of individuals and screen this sample for bird owners, but this procedure was too costly for our purposes. Our sample included several bird species, however, for some of these the number of individuals was rather small. Even if such bird species fell into a bird group category which we controlled for, our results hold rather for the group and not necessarily for each species. Further studies for single bird species are therefore needed.

In addition, the OBRS and thus also the development of the types of owners relies on what the owners infer about their birds. Future research could benefit from the additional inclusion of the views of others, eg veterinarians or behavioural biologists, and could address the stability of the results. Admittedly, this would be a time-consuming and costly process. In particular, the veterinarians or biologists included in the sample would have to be those who treated or observed the behaviour of the bird patient.

Secondly, the scale measuring the owner-bird relationship was developed for German-speaking countries. In order to be used in other languages this scale would need to be adapted and tested in further studies, which requires linguistic as well as cultural equivalence. The human-animal relationship must always be considered within the context of the dominant religion, culture and society (Otterstedt 2009). Based on these adaptations, a cluster analysis in other cultural contexts may provide types of owner-bird relationships, which differ from our results.

Thirdly, cluster analyses in general provide numerous techniques to determine the classification of cases into clusters and the optimal number of clusters. We used a well-established method that relies on Ward clustering and subsequent *k*-means clustering (Soenens *et al* 2009) to identify the clusters. To decide on the optimal number of clusters, we used not only well-established concepts but also content-related stability testing and developed migratory movement techniques. However, recent advances in cluster analysis (Everitt *et al* 2011; p 125) suggest more advanced techniques using bootstrapping to optimise clustering when — as in our sample — data sets are only of moderate size. This is certainly a direction for future research.

Looking ahead, further studies on animal welfare need to take the human-animal relationship into consideration. We would like to test different bird owner types cross-culturally since there may be different types in different cultures. We would also check for similar owner types pertaining to other pets (eg cats, dogs, reptiles). For this, the scale would have to be translated and adjusted for different languages and cultures. Some owner types require more attention: the inattentive owner should be evaluated in more detail, and there are many facets of anthropomorphism — we need to know which features are most dangerous for the pet bird's welfare. There is therefore a need for more detailed records of how birds are kept and cared for.

Animal welfare implications

Veterinarians and pet shop staff should receive advice or training in identifying inattentive and anthropomorphising bird owners (eg a short checklist). Simple behavioural rules should be developed and communicated to reduce the risks arising from excessive empathy in veterinary therapy. For example, if there is more than one owner, the one with less empathy may be better able to implement a therapy ordered by the veterinarian. To improve bird welfare, pet bird owner training should establish a critical awareness of the dangers of anthropomorphism, of too much empathy and of an excessively close relationship between the pet bird and the owner.

Conclusion

Pet bird welfare is related to the owner-bird relationship. We found five empirical types of bird owners based on the multi-dimensional relationship between owner and bird. These types differed with respect to the owner's tendency towards anthropomorphism, the social support the bird provides to the owner, the empathy, attentiveness and respect of the owner *vis-à-vis* the bird, and the bird's relationship with the owner. Although the bird group did not predict the type of the owner, different bird groups showed distinct patterns of predominant owner types.

In particular, the inattentive type, but also the anthropomorphising type, showed a negative influence on pet bird welfare. The distance-appreciating bird owner had a positive impact on the bird's welfare. Unfortunately, birds in close contact with humans were at increased risk for reduced welfare.

Declaration of interest

None.

References

Adamelli S, Marinelli L, Normando S and Bono G 2005 Owner and cat features influence the quality of life of the cat. *Applied Animal Behaviour Science 94*: 89-98. https://doi.org/10.1016/j.applanim.2005.02.003

Albert A and Bulcroft K 1987 Pets and urban life. *Anthrozoös 1*: 9-25. https://doi.org/10.2752/089279388787058740

Anderson PK 2014 Social dimensions of the human-avian bond: parrots and their persons. *Anthrozoös 27*: 371-387. https://doi.org/10.2752/175303714X13903827488006

Anonymous 2018 Verordnung über den Schutz von Wild (Bundeswildschutzverordnung - BWildSchV). Federal ordinance on the protection of wild animals. *Bundesgesetzblatt I*: 1159

Arluke A, Sanders C and Morris P 2015 Mit Tieren denken: Die Soziologie der nicht-menschlichen Tiere in der Gesellschaft. In: Brucker R, Bujok M, Mütherich B, Seeliger M and Thieme J (eds) *Das Mensch-Tier-Verhältnis* pp 79-105. Springer: Wiesbaden, Germany. https://doi.org/10.1007/978-3-531-94110-3_4. [Title translation: Thinking with animals. The sociology of nonhuman animals in society; The human-animal relation]

Auhagen AE and Hinde RA 1997 Individual characteristics and personal relationships. *Personal Relationships 4*: 63-84. https://doi.org/10.1111/j.1475-6811.1997.tb00131.x

https://doi.org/10.7120/09627286.31.1.012 Published online by Cambridge University Press

Beck L and Madresh EA 2008 Romantic partners and four-legged friends: An extension of attachment theory to relationships with pets. *Anthrozoös 21*: 43-56. https://doi.org/10.2752/089279308X274056

Blouin DD 2013 Are dogs children, companions, or just animals? Understanding variations in people's orientations toward animals. *Anthrozoös 26*: 279-294. https://doi.org/10.2752/175303713X13636846944402

Bonas S, McNicholas J and Collis GM 2000 Pets in the network of family relationships: An empirical study. In: Podberscek A, Paul E and JA Serpell (eds) *Companion Animals and Us: Exploring the Relationships Between People and Pets* pp 209-236. Cambridge University Press: Cambridge, UK

Bradshaw J and Casey R 2007 Anthropomorphism and anthropocentrism as influences in the quality of life of companion animals. *Animal Welfare 16*: 149-154

Brown S-E 2007 Companion animals as self-objects. *Anthrozoös 20*: 329-343. https://doi.org/10.2752/089279307X245654

Burmeister A-K, Drasch K, Rinder M, Prechsl S, Peschel A, Korbel R and Saam N 2020 Development and application of the owner-bird relationship scale (OBRS) to assess the relation of humans to their pet birds. *Frontiers in Veterinary Science 7*: 575221. https://doi.org/10.3389/fvets.2020.575221

Butterfield ME, Hill SE and Lord CG 2012 Mangy mutt or furry friend? Anthropomorphism promotes animal welfare. *Journal of Experimental Social Psychology 48*: 957-960. https://doi.org/10.1016/j.jesp.2012.02.010

Caliński T and Harabasz J 1974 A dendrite method for cluster analysis. *Communications in Statistics-Theory and Methods 3*: 1-27. https://doi.org/10.1080/03610927408827101

Charles N 2014 'Animals just love you as you are': Experiencing kinship across the species barrier. *Sociology 48*: 715-730. https://doi.org/10.1177/0038038513515353

Crawford EK, Worsham NL and Swinehart ER 2006 Benefits derived from companion animals, and the use of the term 'attachment'. *Anthrozoös 19*: 98-112. https://doi.org/10.2752/089279306785593757

Emery NJ 2006 Cognitive ornithology: the evolution of avian intelligence. *Philosophical Transactions of the Royal Society B: Biological Sciences 361*: 23-43. https://doi.org/10.1098/rstb.2005.1736

Enders-Slegers M-J 2000 The meaning of companion animals: Qualitative analysis of the life histories of elderly cat and dog owners. In: Podberscek A, Paul E and JA Serpell (eds) *Companion Animals and Us: Exploring the Relationships Between People and Pets* pp 237-256. Cambridge University Press: Cambridge, UK

Everitt B, Landau SL, Leese M and Stahl D 2011 *Cluster Analysis*. Wiley: London, UK. https://doi.org/10.1002/9780470977811

Fabrigar LR and Wegener DT 2012 Structural equation modeling. In: Stevens JP (ed) *Applied Multivariate Statistics for the Social Sciences* pp 549-594. Routledge: New York, USA. https://doi.org/10.4324/9780203843130-20

Fox J 1997 *Applied Regression Analysis, Linear Models, and Related Methods*. Sage Publications, Inc: Thousand Oaks, CA, USA

Gaskins LA and Hungerford L 2014 Nonmedical factors associated with feather picking in pet psittacine birds. *Journal of Avian Medicine and Surgery 28*: 109-117. https://doi.org/10.1647/2012-073R

Grant RA, Montrose VT and Wills AP 2017 ExNOTic: Should we be keeping exotic pets? *Animals 7*: 47. https://doi.org/10.3390/ani7060047

Harker RM, Collis GM and McNicholas J 2000 The influence of current relationships upon pet animal acquisition. In: Podberscek A, Paul E and JA Serpell (eds) *Companion Animals and Us: Exploring the Relationships Between People and Pets* pp 189-208. Cambridge University Press: Cambridge, UK

Hinde RA 1979 *Towards Understanding Relationships*. Academic Press: London, UK

Hirschman EC 1994 Consumers and their animal companions. *Journal of Consumer Research 20*: 616-632. https://doi.org/10.1086/209374

Industrieverband Heimtierbedarf, and Zentralverband Zoologischer Fachbetriebe Deutschlands 2019 *The German Pet Market 2018 - Structure and Sales Data*. https://www.zzf.de/fileadmin/files/ZZF/Marktdaten/ZZF_IVH_Folder_2018_German_Pet_Market_and_Pets.pdf

Irvine L 2008 Animals and sociology. *Sociology Compass 2*: 1954-1971. https://doi.org/10.1111/j.1751-9020.2008.00163.x

Irvine L 2013 Animals as lifechangers and lifesavers: Pets in the redemption narratives of homeless people. *Journal of Contemporary Ethnography 42*: 3-30. https://doi.org/10.1177/0891241612456550

Jürgens UM 2017 How human-animal relations are realized: from respective realities to merging minds. *Ethics and the Environment 22*: 25-57. https://doi.org/10.2979/ethicsenviro.22.2.02

Kelley HH 1997 The 'stimulus field' for interpersonal phenomena: The source of language and thought about interpersonal events. *Personality and Social Psychology Review 1*: 140-169. https://doi.org/10.1207/s15327957pspr0102_3

Kidd AH and Kidd RM 1987 Seeking a theory of the human/companion animal bond. *Anthrozoös 1*: 140-145. https://doi.org/10.2752/089279388787058489

Kienzle E and Bergler R 2006 Human-animal relationship of owners of normal and overweight cats. *Journal of Nutrition 136*: 1947S-1950S. https://doi.org/10.1093/jn/136.7.1947S

Kienzle E, Bergler R and Mandernach A 1998 A comparison of the feeding behavior and the human–animal relationship in owners of normal and obese dogs. *Journal of Nutrition 128*: 2779S-2782S. https://doi.org/10.1093/jn/128.12.2779S

Kocabagli N, Kutay HC, Dokuzeylül B, Süer INE and Alp M 2017 The analysis of computer data regarding obesity and associated diseases in cats examined at private veterinary practices. *Acta Scientiae Veterinariae 45*: 1506. https://doi.org/10.22456/1679-9216.80775

Konok V, Nagy K and Miklósi Á 2015 How do humans represent the emotions of dogs? The resemblance between the human representation of the canine and the human affective space. *Applied Animal Behaviour Science 162*: 37-46. https://doi.org/10.1016/j.applanim.2014.11.003

Korbel R, Reese S and König H 2016 Clinical examination. In: König H, Korbel R and Liebich H (eds) *Avian Anatomy. Textbook and Colour Atlas* pp 263-270. 5M Publishing Ltd: Sheffield, UK

Kuhne F, Hößler JC and Struwe R 2014 Emotions in dogs being petted by a familiar or unfamiliar person: Validating behavioural indicators of emotional states using heart rate variability. *Applied Animal Behaviour Science 161*: 113-120. https://doi.org/10.1016/j.applanim.2014.09.020

Küper AM and Merle R 2019 Being nice is not enough: Exploring relationship-centered veterinary care with structural equation modeling. A quantitative study on German pet owners' perception. *Frontiers in Veterinary Science 6*: 56. https://doi.org/10.3389/fvets.2019.00056

Kurdek LA 2008 Pet dogs as attachment figures. *Journal of Social and Personal Relationships 25*: 247-266. https://doi.org/10.1177/0265407507087958

Kurdek LA 2009 Pet dogs as attachment figures for adult owners. *Journal of Family Psychology 23*: 439. https://doi.org/10.1037/a0014979

Lantermann W 1998 *Verhaltenstörungen bei Papageien: Entstehung, Diagnose, Therapie*. Ferdinand Enke Verlag: Stuttgart, Germany. [Title translation: Behavioral disorders in parrots: development, diagnosis, therapy]

Law G, Nager R and Wilkinson M 2019 Zebra finches (*Taeniopygia guttata*). In: Yeates J (ed) *Companion Animal Care and Welfare: The UFAW Companion Animal Handbook* pp 318-337. Wiley-Blackwell: Oxford, UK. https://doi.org/10.1002/9781119333708.ch15

Luna D, Vásquez R, Yáñez J and Tadich T 2018 The relationship between working horse welfare state and their owners' empathy level and perception of equine pain. *Animal Welfare 27*: 115-123. https://doi.org/10.7120/09627286.27.2.115

Marinelli L, Adamelli S, Normando S and Bono G 2007 Quality of life of the pet dog: Influence of owner and dog's characteristics. *Applied Animal Behaviour Science 108*: 143-156. https://doi.org/10.1016/j.applanim.2006.11.018

Martens P, Enders-Slegers M-J and Walker JK 2016 The emotional lives of companion animals: Attachment and subjective claims by owners of cats and dogs. *Anthrozoös 29*: 73-88. https://doi.org/10.1080/08927936.2015.1075299

Mignon-Grasteau S, Boissy A, Bouix J, Faure J-M, Fisher AD, Hinch GN, Jensen P, Le Neindre P, Mormede P and Prunet P 2005 Genetics of adaptation and domestication in livestock. *Livestock Production Science 93*: 3-14. https://doi.org/10.1016/j.livprodsci.2004.11.001

Nagel T 1974 What is it like to be a bat? *Philosophical Review 83*: 435-450. https://doi.org/10.2307/2183914

Netting FE, Wilson CC and New JC 1987 The human-animal bond: Implications for practice. *Social Work 32*: 60-64. https://doi.org/10.1093/sw/32.1.60

Norman R and Wills A 2016 An investigation into the relationship between owner knowledge, diet, and dental disease in guinea pigs (*Cavia porcellus*). *Animals 6*: 73. https://doi.org/10.3390/ani6110073

Odendaal JS and Meintjes RA 2003 Neurophysiological correlates of affiliative behaviour between humans and dogs. *Veterinary Journal 165*: 296-301. https://doi.org/10.1016/S1090-0233(02)00237-X

Otterstedt C 2009 Die Mensch-Tier-Beziehung im interkulturellen Vergleich. In: Otterstedt C and Rosenberger M (eds) *Gefährten - Konkurrenten - Verwandte. Die Mensch-Tier-Beziehung im wissenschaftlichen Diskurs* pp 294-315. Vandenhoeck & Ruprecht: Göttingen, Germany. [Title translation: The human-animal relationship in an intercultural comparison; Companions - Competitors - Relatives. The human-animal relationship in the scientific discourse]

Pepperberg IM 2006 Cognitive and communicative abilities of Grey parrots. *Applied Animal Behaviour Science 100*: 77-86. https://doi.org/10.1016/j.applanim.2006.04.005

Pepperberg IM 2008 *Alex & Me: How a Scientist and a Parrot Discovered a Hidden World of Animal Intelligence and Formed a Deep Bond in the Process*. HarperCollins: New York, NY, USA

Peretti PO 1990 Elderly-animal friendship bonds. *Social Behavior and Personality 18*: 151-156. https://doi.org/10.2224/sbp.1990.18.1.151

Sanders CR 2003 Actions speak louder than words: Close relationships between humans and nonhuman animals. *Symbolic Interaction 26*: 405-426. https://doi.org/10.1525/si.2003.26.3.405

Soenens B, Vansteenkiste M and Sierens E 2009 How are parental psychological control and autonomy-support related? A cluster-analytic approach. *Journal of Marriage and Family 71*: 187-202. https://doi.org/10.1111/j.1741-3737.2008.00589.x

Tarkosova D, Story M, Rand J and Svoboda M 2016 Feline obesity-prevalence, risk factors, pathogenesis, associated conditions and assessment: a review. *Veterinární Medicína 61*: 295-307. https://doi.org/10.17221/145/2015-VETMED

Thieme F 2015 Einleitung. In: Brucker R, Bujok M, Mütherich B, Seeliger M and Thieme F (eds) *Das Mensch-Tier-Verhältnis* pp 1-21. Springer: Wiesbaden, Germany. https://doi.org/10.1007/978-3-531-94110-3_1. [Title translation: Introduction; The human-animal relation]

Tipper B 2011 Pets and personal life. In: May V (ed) *Sociology of Personal Life* pp 85-97. Palgrave Macmillan: Basingstoke, UK. https://doi.org/10.1007/978-0-230-34421-1_8

Triebenbacher SL 2006 The companion animal within the family system: The manner in which animals enhance life within the home. In: Fine A (ed) *Handbook on Animal-Assisted Therapy* pp 357-374. Elsevier: Amsterdam, The Netherlands. https://doi.org/10.1016/B978-012369484-3/50018-9

Wechsler B 1995 Coping and coping strategies: a behavioural view. *Applied Animal Behaviour Science 43*: 123-134. https://doi.org/10.1016/0168-1591(95)00557-9

Zasloff RL 1996 Measuring attachment to companion animals: a dog is not a cat is not a bird. *Applied Animal Behaviour Science 47*: 43-48. https://doi.org/10.1016/0168-1591(95)01009-2

Zasloff RL and Kidd AH 1994 Attachment to feline companions. *Psychological Reports 74*: 747-752. https://doi.org/10.2466/pr0.1994.74.3.747

Zilcha-Mano S, Mikulincer M and Shaver PR 2011 An attachment perspective on human–pet relationships: Conceptualization and assessment of pet attachment orientations. *Journal of Research in Personality 45*: 345-357. https://doi.org/10.1016/j.jrp.2011.04.001

Zilcha-Mano S, Mikulincer M and Shaver PR 2012 Pets as safe havens and secure bases: The moderating role of pet attachment orientations. *Journal of Research in Personality 46*: 571-580. https://doi.org/10.1016/j.jrp.2012.06.005

https://doi.org/10.7120/09627286.31.1.012 Published online by Cambridge University Press