The relationship between knowing and liking for 91 urban animal species among students

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Abstract

While there is growing consensus that nature should be promoted in cities, it is less clear what kind of nature this should be. One hypothesis is that humans like those parts of nature more that they know better. Using questionnaires, we studied the familiarity of 475 students with 91 urban animal species and the relationship between familiarity and attitude towards the species. Students were familiar with most animals, but not all animals were equally liked. Better-known species were not generally the better-liked ones. The more familiar animal species were on average, the more extreme attitudes became towards them, both positive and negative. Our research shows that familiarity and attitude are not two sides of the same coin. It also emphasizes that there are parts of nature that are not liked by many humans and that this dislike is not necessarily correlated with insufficient knowledge. Detailed studies of what component of nature humans like and reasons underlying this are necessary to successfully increase nature in cities.

Keywords: Urban ecology; animal preferences; animal familiarity; socio-ecology; Germany

Introduction

Urban nature is important for city dwellers. This is because most humans now live in cities, which makes cities the prime place where humans can experience nature in their day-to-day life. There is increasing evidence that urban nature has positive effects on human well-being and health (Hartig et al., 2014; Sandifer et al., 2015), and city dwellers also profit from other ecosystem services provided by urban nature (CBD Secretariat, 2012; Haase et al., 2014; IPBES, 2019; McKinney, 2002). Today, there is widespread agreement that urban

nature is valuable and needs to be saved and fostered (CBD Secretariat, 2012; Duvall et al., 2018; Elmqvist et al., 2013; Lepczyk et al., 2017; Nilon et al., 2017). However, while there is a general consensus that nature should be increased in cities, it is less clear what kind of nature should be targeted. This is not only because humans differ in their attitude to nature (Kellert, 1984b, 1984a), but also because there are elements of nature, e.g. particular species, that are more liked than others (Deliège, 2019; Pett et al., 2016; Schwartz et al., 2013). Because human attitudes will affect the acceptance of programs to conserve or enhance nature, it is important

to investigate people's relations to components of nature (Manfredo et al., 2017). Here, we focus on human attitudes towards animals living in cities, because animals are an important component of urban nature that humans perceive.

A large number of studies have asked humans about their attitude towards particular species, although the purpose of the studies differed greatly. One set of studies specifically focusses on wildlife conflicts that often concerns large mammals which can potentially be dangerous to either humans themselves or to farm animals. These conflicts can concern wildlife coming to cities as in the case of coyotes, which are medium size predators that can thrive in cities in the US and cause conflict through pet killings and attacks on humans (e.g. Manzolillo et al. 2019). It can also concern wildlife only outside cities or inside and outside cities such as the wolves in Europe (Bjerke, Reitan, et al., 1998), bears in Europe or the US (Ambarli, 2016; Booth & Ryan, 2019) or species of the Serengeti National Park in Tanzania (Kaltenborn et al., 2006). There are also a number of studies that investigated the attitude of humans to a larger range of species, up to 33 (Bart, 1972; Bjerke, Ødegårdstuen, et al., 1998a, 1998b; Bjerke et al., 2003; Bjerke & Østdahl, 2004; Collins, 1976; Driscoll, 1995; Herzog & Galvin, 1997; Hosaka et al., 2017; Kellert, 1984b, 1984a, 1993; Kellert & Westervelt, 1983; Rupprecht, 2017; Teel & Manfredo, 2010). These studies found strong differences in attitude towards different animal species, from a clear dislike (e.g. spiders) to a very positive attitude (e.g. squirrels).

Closely related to the question of what animals humans like is the question if the attitude towards a species, or a group of species, depends on how familiar humans are with these species. Several studies report that contact with nature can increase peoples' tolerance towards nature and the willingness to protect it (Hosaka et al., 2017; Kellert, 1984b, 1996; Soga, Gaston, Koyanagi, et al., 2016; Soga, Gaston, Yamaura, et al., 2016; Unterweger et al., 2017). The idea that more familiarity will improve attitudes is also the basis of many environmental education programs (Hostetler et al., 2008; Lindemann-Matthies, 2005). In the theory of environmental education, knowledge affects both attitude and action (Hungerford & Volk, 1990). Environmental education aims at increasing the knowledge about the environment, e.g. about animals, which is then assumed to lead to a more positive attitude, and to more pro-environmental behaviour, e.g. active support of species conservation (Lindemann-Matthies &

Bose, 2007). Environmental education has frequently been shown to increase the knowledge of participants, but the effects on a change in attitude, or even increased pro-environmental behaviour are less clear (e.g. Borchers et al., 2014; Lindemann-Matthies, 2005). While educational programs and public information have been able to positively affect the attitudes towards generally disliked animals such as crocodiles, snakes and tarantulas (reviewed in Hosaka et al. 2017), there are only a few studies that test whether the attitude towards particular urban animal species is positively related to familiarity with a species (e.g. Kellert, 1984a). On the other hand, it has been postulated that a lack of knowledge can be a barrier to behavioural change, such that knowledge is a necessary, but not a sufficient condition for behavioural change (de Pauw & van Petegem, 2011). Interestingly, people who express pro-environmental attitudes do not necessarily have a better environmental knowledge than those who have a less positive attitudes towards the environment (Liefländer & Bogner, 2014). Both knowledge and liking can also arise through the "mere exposure" effect, coined by Zajonc in 1968, whereby repeated exposure to stimuli enhances attitudes towards such stimuli, which has since been affirmed by many studies across a wide range of disciplines and objects including marketing of products (Bornstein, 1989). Importantly, there is also evidence that repeated exposure to a negatively viewed stimulus can weaken the positive effect (Zajonc et al., 1974), or strengthen a negative sentiment (Crisp et al., 2009). Some evidence that this is true also for attitudes towards nature comes from studies comparing the attitudes of people from rural areas to those from cities. For example, Bjerke, Ødegårdstuen, et al. 1998b found that children from the city like animals generally more than those of rural areas, and Bjerke, Reitan, et al. 1998 found those that people that have grown up in a household with farm animals have more negative attitudes towards the wolves. In general, however, the relationship between knowing an animal and the attitude towards it has not been investigated in much detail, or for many species.

In this study, we explored the relationship between knowing and liking for a large number of animal species. We asked university students in Germany to report on their familiarity with 91 species or groups of animal species, and also asked for their attitude towards these animals. We addressed the following questions:

- (1) To what degree are the different animal species known and liked by students?

(2) Are the better-known species also the more liked ones?

Methods

A survey was conducted with the use of an online questionnaire, made through SoSciSurvey (Leiner, 2019). Questionnaires were considered to be an appropriate method, because it limited the range of answers a participant could give and allowed for a standardization of results. We used a Likert scale to assess levels of familiarity and liking for each species.

Surveys were conducted at the Technical University of Munich, the University of Jena, and the University of Kassel. Participants were informed beforehand about the goal of the questionnaire, and could voluntarily join the questionnaire by following a link or a QR code. Participants were also free to drop out of the questionnaire at any point, by which their answers would not be considered, effectively revoking their participation from the questionnaire. Our procedure assured full anonymity, since it would not be possible to find out who did or didn't participate in the questionnaire. We also encouraged students to spread the questionnaire to other people they knew. The survey took place from 22.10.2019 to 12.02.2020.

Questionnaire

The questionnaire had 188 questions. Six of these were demographic questions, of which two were facultative; 91 of these related to familiarity with animals; 91 of these related to their attitudes towards animals. The biologists of the team drew up a list of potential species and then the social scientists and planners of the team went through the list to trim it to below 100. We deliberately kept some species that many people may not know but which are sometimes closely associated with human housing (e.g. dormice). We chose 91 animal species or species groups among mammals, birds, reptiles, amphibians, arthropods and other invertebrates in an attempt to cover a wide range of species (Appendix A). These animals were pre-tested with a smaller group of students. Taxa that were difficult to distinguish for non-experts due to similarity or small size were grouped at the genus level (e.g. redstarts and dormice) or an even higher taxonomic level (e.g. spiders). For the sake of conciseness and consistency, these will henceforth still be referred to as "species". To be able to account for the sociodemographic differences between participants, and account for the variable quantity of participants from

different sociodemographic background, basic classifying questions were asked with regard to participants' gender, age, formal education, profession, region of residence, and country of origin. Participants were not obliged to disclose their country of origin, and participants that were not residents of Germany were not obliged to disclose their region of residence. The questionnaire could be answered in either German or English. We presented the common name of each animal in the selected language of the questionnaire, since we cannot expect from non-experts to readily know the scientific names of animals. There were no pictures of animals provided with the questionnaire.

Measures

For attitudes towards animals, there were five response options, with the most negative being "very disliked", the middle option being "Neutral", and the most positive option being "very liked", similar to previous research (Bjerke & Østdahl, 2004; Kellert, 1984a). Familiarity with the animal was divided into three response options. In addition to the answers 'I do not know it', and 'I know and I would recognize it', we added 'I know it, but I would not be able to recognize it', as an indicator of intermediate familiarity. The latter option was added because people might have, for example, heard of or read about a certain animal, which potentially influences their attitude, without being able to recognize it when presented with it.

Data management

All questionnaire answers were imported directly from the SoSciSurvey server into R (R Development Core Team, 2008). Scripts were written in RMarkdown (Allaire et al., 2019; Xie et al., 2018) in RStudio (Rstudio Team, 2015), and composite figures were composed with the patchwork package (Pedersen, 2019). Summary statistics were calculated with the summarySE function of the Rmisc package (Hope, 2013).

Participants

A total of 836 questionnaires were started. Of those questionnaires, 666 were completed. After the filtering of data, the final dataset contained 475 participants. Of the filtered participants, 309 self-reported that they were female, while 166 reported that they were male; 326 studied biology or environment-related studies, and 149 studied in other fields; 114 were from the Jena region, 249 from the Munich region, 25 from Kassel, 65 from other regions in Germany, and of 22 their home region

was unknown; 418 were from Germany, and 57 were foreign students in Germany. The age distribution was skewed towards the younger age groups, with the median age being 21 years old (see Appendix B).

Statistical analysis

All statistical analysis was done using R (R Development Core Team, 2008). We conducted multiple types of analyses at the level of species, but also at the level of higher taxa.

Familiarity and attitude across species

We performed two-sided Bonferroni-corrected t-tests to test for each species whether the means of participants' familiarity with, and attitudes towards, the species were significantly higher or lower than "neutral" (e.g. "1" in the question of familiarity, "2" in the question of attitudes). The same analysis was applied to higher taxa. Additionally, we performed pairwise comparisons between the higher taxa.

Relationship between familiarity and attitude

Correlation analyses were used to investigate relationships between familiarity and attitude across species (irrespective of individual participants).

The mean familiarity of and mean attitude towards each species was used to investigate whether there was a correlation between how familiar an animal species was, and how well it was liked. In order to investigate whether the spread of familiarity or attitudes were influenced by their respective means, standard deviations of familiarity and attitude for each species were related to the respective means of those species' familiarity and attitude.

In order to test for a relationship between the spread of attitudes towards species and familiarity with them, the mean value for attitudes towards species was calculated for values within five equidistant bins on familiarity. In order to test whether the mean attitude towards animal species became more extreme (either positive or negative) with increasing familiarity, the attitude scale was centred around zero (by subtracting 2 from all values) and the absolute value was taken, to test how absolute attitude value depends on familiarity.

To test if people who know a species better also have a more positive attitude towards the species, we conducted Pearson's correlation coefficient tests between

familiarity and attitudes for each species separately, using participants as a replicate. The same analysis was also done at the higher taxonomic levels.

Results

Familiarity and attitude across animal species

Participants of the questionnaire reported that most animals in the questionnaire were known by them. Mean familiarity was 1.75 ± 0.05 (CI), significantly greater than 1 ($t_{90} = 29.34$, $p < 0.001$). For 90 out of the 91 species, individual mean familiarity was greater than 1 at $p < 0.0005$ (Bonferroni corrected p-value for 91 species tests $0.05/91$, Fig. 1). The exception was the rose-ringed parakeet. Students were most familiar with squirrels, ducks, hedgehogs, and house cats.

The participants of the questionnaire had, on average, a positive attitude towards the animals presented. Mean attitude was 2.64 ± 0.16 , significantly greater than 2, i.e. neutrality ($t_{90} = 7.92$, $p < 0.001$). However, there were clear differences between species. 73 species were liked better than neutral, 16 animals were on average disliked, and for two species, cicadas and common adders, mean attitude was not different from neutral (Fig. 1). Within the group of arthropods, there was a high variability in mean attitudes between the different species in this group. The most notable disliked arthropod species were mosquitoes and cockroaches, and the most notable well-liked arthropods were bees and fireflies.

Relationship between familiarity and attitude

There was no significant correlation between how familiar a species was and how positive the mean attitude was toward the species ($r_{89} = 0.15$, $p = 0.16$; Fig. 2a). However, the variability of attitudes towards species increased as familiarity increased ($r_3 = 0.91$, $p = 0.033$; Fig. 2b). Additionally, the mean attitudes became significantly more extreme (deviation from neutral) with increasing mean familiarity, in both the positive and negative direction ($r_{89} = 0.4$, $p < 0.001$; Fig. 2c).

When standard deviations of attitude and familiarity of each species were plotted against their own respective means, variability peaked at intermediate values (Appendix D, Fig. D1a,b). This indicates that species with a more extreme mean attitude or familiarity also have a higher degree of consensus among participants towards the score, than species with a neutral mean.

Figure 1. Mean familiarity and attitude towards individual animal species, and the correlation coefficient between them. Boxes indicate mean ± 95% CI. Bold correlation coefficient values indicate a significant correlation; cursive values indicate no significant correlation. See Appendix C for a tabular representation of the data.

Figure 2. Across-species patterns in participants' attitude towards and familiarity with animal species. (a) Correlation between the average scores of familiarity and attitude, calculated for each species across all participants ($N=475$). Each point represents a species. (b) Correlation between the standard deviation of attitude to mean familiarity. Species were allocated to one of 5 bins based on their familiarity scores, and the standard deviation of attitude was then calculated for all animal species in the bin (see APPENDIX D, figure D1c). (c) Correlation between mean familiarity and the absolute value of attitude, calculated by subtracting 2 from the mean scores and taking the absolute value. The grey areas around the lines represent the confidence interval.

The relationship between attitude and familiarity across participants was also assessed for each animal species individually, by correlating scores for familiarity and attitude separately for each species, using each participant as a unit of replication. For 68 species, there was a positive correlation between being familiar with the species, and the attitude towards that species, while for 21 species, there was no such relationship (Fig. 1). Thus, within species, there was, for many species, the expected increase in positive attitude towards the species with increasing familiarity. For two species, however, cockroaches and crane flies, there was a significant negative correlation between familiarity and attitude, i.e. the better the species was known, the more disliked it was. In addition, the strength of the relationship between familiarity and attitude within species differed strongly among species (Fig. 1). For example, the correlation coefficient for deer was only 0.24 ($p < 0.001$), while the correlation coefficient for kingfishers was 0.63 ($p < 0.001$).

Taxon-level analyses

Participants were quite familiar with the different taxa (Appendix E, Fig. E1), reflecting the results of the species level. However, there were differences between taxa. Participants were most familiar with the group of 'Other invertebrates', which included slugs, earthworms, and snails; this was followed by the equally familiar groups of amphibians/reptiles, mammals, and arthropods; least familiar were birds due to the fact that some species that were less known (Fig. E1). Average attitude towards the taxa was also generally positive, or at least neutral, with a notable divide in attitude between the vertebrate groups birds and mammals (more positive) and invertebrates, i.e. arthropods and other invertebrates (less positive or neutral, Fig. E1). There was a significant positive correlation between the familiarity of participants with the taxon, i.e. pooled average of all species within a taxonomic group, and their attitude towards the taxon, except for the group of "Other Invertebrates" (Appendix E, Fig. E2).

Discussion

The goal of this research was to investigate the relationship between familiarity of people with different animal species, and their attitude towards these species. Our study was carried out in a local context, but included many animal species, which also allowed to draw inferences about higher taxonomic groups. Students were familiar, i.e. stated that they know of the animal, with a surprisingly high number of species. Students also had a generally positive attitude towards the majority of the species. Interestingly, there was no relationship between the overall familiarity of a species and positive attitudes; on the contrary, well-known species could also be very disliked. However, for most animals, there was a positive relationship between individual participants' familiarity with the species and the attitude towards them.

Known and unknown species

Most of the species presented in our questionnaire are common in urban environments; thus, it is not surprising that students are, on average, quite familiar with them. The most familiar species were squirrels, ducks (as a group), hedgehogs, and house cats, which are omnipresent in European urban environments, and the last one is a common companion animal. It is also not surprising that the Coypu and Rose-ringed parakeet are the species that

people are least familiar with. The coypu is not as readily associated with urban environments, and the rose-ringed parakeet is a relatively recent alien addition to German urban environments. The result that students are least familiar with birds as a higher taxon is due to the fact that both the number of species as well as taxonomic resolution was highest, and species selection included some species that were not very well known, such as the rose-ringed parakeet, but also jackdaws, swifts or larks. In contrast, the low number of species (groups) and low taxonomic resolution among arthropods and other invertebrates underlies the overall high familiarity with arthropods. Overall, our study shows that participants are at least aware of the diversity of animals within cities, and suggests that the notion of a general ‘disconnect’ between people and nature (Miller, 2005; Pyle, 1993: translation by Lefèvre, 2016; Turner, Nakamura, & Dinetti, 2004) needs to be studied in more detail.

Liked and disliked species

Animals were clearly not all equally liked. For the higher taxa, birds, then mammals and then amphibians/reptiles were liked most, while the attitude towards arthropods and other invertebrates was less positive. Pests such as cockroaches, rats, crane flies, mosquitoes, aphids and wasps were not liked, as expected. Similar to Kellert’s (1984a) findings, we found that the most disliked animals were mosquitoes and cockroaches, and, similar to Kellert’s (1984a) findings in the United States and Bjerke and Østdahl’s (2004) and Bjerke, Østdahl, & Kleiven’s (2003) findings in Norway, rats were the least liked mammals. The squirrel was also the most liked mammal in Bjerke, Ødegårdstuen, et al. 1998b. However, while Kellert reported that most insects aroused negative sentiments (Kellert, 1984a, 1996), we found that there was a wide variety in attitudes towards insects, and arthropods in general, similar to the study of Shipley and Bixler (2017), or Hosaka et al. (2017) who found that e.g. butterflies were liked by people in Japan while moths and hornets were least liked. Our results also show that within higher taxa, there are both species that are strongly liked, and those that are strongly disliked. For example, cockroaches and mosquitoes were severely disliked, decreasing the overall score of arthropods, while students had a very positive attitude towards honeybees and fireflies (as in Hosaka et al., 2017), which in turn increased the overall score of arthropods. Our study thus emphasizes that in discussions about the type of nature in cities to be preserved or

increased, it may be worthwhile to be very specific with respect to the target species to be supported, rather than referring to taxa as a whole, such as birds or insects.

The relationship between familiarity and attitude

Environmental education works on the premise that increasing knowledge of the environment positively affects the attitude towards the environment, leading eventually to responsible environmental behaviour (e.g. Hungerford & Volk, 1990). For individual species, there is evidence that increased familiarity with previously unnoticed species due to attending an environmental education program, can result in a higher appreciation of these species (e.g. Lindemann-Matthies, 2005). In our study, there was no relationship between the average familiarity of a species and how positively it was rated on average, i.e. the better-known species were not the more liked ones. For example, deer and mosquitoes were both well known, but the first is well-liked while the second is very disliked. Similar results have been found in a study in Slovakia, where children who had pets had a better knowledge of (a few popular) species, but a more negative attitude towards disliked species such as the mouse or potato beetle (Prokop & Tunnicliffe, 2010). In our study, increasing familiarity increased the range of attitudes towards animal species, so that attitudes on average became more extreme, either positive or negative. Additionally, unfamiliarity with a species among students did not result in a generally negative attitude towards this species, but rather in a neutral attitude, indicating that unfamiliarity does not result in dislike, but rather in indifference.

When animal species were considered individually, there was a clear positive relationship between familiarity and attitude among people, for the majority of species ($N = 72$ species), i.e. if a person was more familiar with that animal, their attitude was generally more positive (Tab. 1). However, even in such cases, a positive correlation did not always imply that attitude was positive for the highest levels of familiarity. In our study, this was the case for bugs and muskrats. For many species that have an on average neutral or lower attitude values ($N = 21$ species), there was also no significant correlation between students’ familiarity and attitude (13/21 species). Cockroaches and crane flies were the only animals in our study for which there was a significant negative correlation between attitude and familiarity across people. A more positive attitude was also associated with increased familiarity for

the higher taxon level, except for the ‘other invertebrates’, the group that includes slugs, snails, and earthworms where there was no significant correlation (Appendix E, Fig E2). While our study allows no conclusion about the success of environmental education programs in changing people’s attitudes, as educating the students was not part of our study, it emphasizes that even though there is a positive relationship between familiarity and attitudes for many animals, one should be careful in assuming that this generally the case.

Caveats

There are a few notable limitations to our investigation. Firstly, we only had one measure for attitude and familiarity, and relied on people self-reporting of how much they liked an animal and how familiar they were with it. While there might be multiple types of ‘liking’ of an animal, for example, one could like an animal but does not want the species to occur in one’s vicinity, the self-reported scale is still a useful tool to assess the attitude of a person to an animal species, as it gives a general idea of the held attitudes. Students assessed themselves to be largely familiar with the species in the survey. Familiarity implies awareness of the species based on the name, probably some skills to identify the species on a photograph, and perhaps some deeper knowledge. Such familiarity can arise from reading about the species, or watching a television program about it.

Additionally, this study only considered the attitudes of students and may not be representative of the wider population. A follow-up study to test the validity of the results found in this study in the wider population would be desirable. Our study was also designed to test the familiarity and attitude at the species level, and our analysis of the higher taxonomic levels therefore suffers from an unequal representation of species among higher taxa, and also an unequal taxonomic resolution within the higher taxa. Nevertheless, we find the taxon-level analysis useful as it clearly indicates that that species within the same taxon are regarded differently (cf. birds). Finally, there are many more animals present in cities than only the ones that we included in our questionnaire. From a practical viewpoint, however, the number of animals we could add to the questionnaire was limited, as not to overwhelm the participants with too many questions. On the other hand, previous studies have not looked into familiarity with animals per se, but at the knowledge that people have about

them. In that way, this study cannot be compared to studies such as those carried out by Kellert (1984, 1993), who asked participants questions about the biology of particular species. Our approach is much less detailed, but has the advantage that we could include a large number of species in the questionnaire.

Conclusions and research prospects

We studied the familiarity with and attitude to a wide range of animals and found strong differentiation in both familiarity and attitude. While past investigations mostly focus on species with a global distribution (e.g. Bjerke et al., 1998; Kellert, 1983, 1984a), our study focussed on local biodiversity, even though the categories of species were partly generic and could also be applied to a global study (e.g. spiders). To our knowledge, there are very few of such for urban species, and the list of animals investigated is still very limited (e.g. Bjerke & Østdahl, 2004; Hosaka et al., 2017). In our study, we found no overall relationship between how well-known animal species were, and how they were appreciated. Attitudes did become more extreme with increasing familiarity, however. Moreover, for individual animals, participants that were more familiar with them also mostly liked them more, but this pattern was not universal. Further research should thus investigate different aspects of ‘attitude’ (e.g. Teel & Manfredo, 2010), but for a wide range of species.

The reasons underlying people’s attitude to animals are complex and not fully understood (cf. Ormandy & Schuppli 2014, Bjerke & Østdahl 2004). Previous research has pointed to a number of human and animal traits that affect a person’s attitude to a particular animal species, as well as to the societal and personal context in which a person grows up, including previous experience with animals. For example, fear and disgust towards particular animals such as rats, spiders and snakes has been linked to human’s innate avoidance of illness and infection (Davey, 1991, 1994). Whether or not an animal has a connotation of illness depends on both animal traits and how these are perceived by humans. For example, animals that are considered ‘dirty’ have been proposed to trigger the fear of infection (Muris et al., 2008). Similarly, humans have a more positive attitude towards intelligent animals that appear to have the ability to reason and to show emotions (Believe in Animal Mind (BAM), Herzog & Galvin, 1997), but whether a species is considered intelligent is again a mixture of animal traits (e.g. curiosity behaviour) and

human judgement of these traits (e.g. Fonseca et al., 2011; Herzog & Galvin, 1997; Knight et al., 2004; Plous, 1991; review in Ormandy & Schuppli, 2014). Similarity to humans has also been proposed to evoke a positive attitude towards a species (Batt, 2009). Judgement of animal traits differ between different people. The place where an animal occurs also affect the attitude, e.g. while tigers or other large and/or dangerous species are rated positively when these occur far away (or are safely caged in a zoo), they are no longer considered positive within the urban environment, similar to species like pigeons or rats that do not appear to accept human dominance in cities (Manzolillo et al., 2019; Rupprecht, 2017). Women appear to rate the intelligence of an animal higher than men (e.g. Nakajima et al., 2002) and gender and sex role orientation has been shown to generally affect attitudes towards animals (e.g. Herzog, 2007; Herzog et al., 1991; Herzog & Galvin, 1997; Kellert & Berry, 1987; Menor-Campos et al., 2019; Plous, 1991; Prokop & Tunnicliffe, 2008, 2010). Age also affects the attitude towards particular species, with contradicting results from different studies: while older people generally show less appreciation for animals, for small birds, butterflies and some other species, preference scores were found to be positively associated with the age of the respondents (e.g. Bjerke & Østdahl, 2004; Kellert, 1996). Attitudes are also correlated with human educational background (e.g. Fonseca et al., 2011; Prokop & Tunnicliffe, 2008), whether they live in an urban or rural area (e.g. Manzolillo et al., 2019), if they have a specific profession or belong to an advocacy group (e.g. Plous, 1991, 1996a, 1996b), whether they had or have a companion animal (e.g. Prokop et al., 2008; Prokop & Tunnicliffe, 2010). Overall, however, it is not clear if having a particular profession, being a pet owner or the liking of outdoor activities have a positive effect on a person's attitude towards animals, or whether both these activities and attitude are the expression of the same underlying personality. Several authors have tried to collapse the complex response of humans to animals into a number of human attitude types, starting from Kellert's (1984a) pioneering work of a typology of basic attitudes towards animals, to the classification of social values with respect to conservation by Manfredo et al. (2017). Basic questions still remain open, however, including the fundamental question if and how far education and hence knowledge can really change attitudes and the willingness to increase nature in cities. We suggest that more effort is necessary to increase our understanding of what shapes the attitude of humans to different animal species, and how we

can use this understanding to bring more nature to cities. Understanding why humans value many animals differently will go some way in understanding current human-nature relationship, and such knowledge would be of much use in the planning of environments where humans and animals are anticipated to interact.

Funding statement

This work was funded by the Bavarian Ministry for Science and the Arts, in the program BAYKLIF – Bavarian Network for Climate Research, project BAYSICS.

Authors' contributions

All authors conceived the idea; F.S.T.S and W.W.W. designed methodology; F.S.T.S., P.N., and T.E.H. collected data; F.S.T.S. analysed the data; F.S.T.S. and W.W.W. led the writing of the manuscript. All authors contributed critically to the drafts and gave final approval for publication.

Conflict of interest statement

The authors declare no conflict of interest.

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