Does Viewing Cats and Dogs Influence People's Mood, Optimism, and the Desire to Have Children?

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Abstract

Photos of cats and dogs are among the most popular kinds of material on the internet. Our large-scale study (N = 8,865) tested the influence of viewing cat and dog images on the desire to have children, mood, and optimism. The main effects of priming on these three variables were insignificant, both in the general population and subpopulations of cat and dog lovers. Nevertheless, a priming–gender interaction had a slight influence on optimism in the general population. Additionally, liking of companion animals was associated with a lower number of children, whereas keeping of animals was associated with a higher number of children. This may indicate that animals do not decrease the fertility of their keepers as previously suggested, but that having children decreases liking for these animals. Our results showed that the effect of watching cats and dogs might be much weaker than previous studies suggest.

Keywords

Many people enjoy viewing photos and videos of cats and dogs on the internet. In December 2019, "#catsofinstagram" was viewed over 120.5 million times, and "#dogsofinstagram" about 170.7 million times. Some cat and dog "influencers" have several million followers on Instagram, Facebook, and YouTube (Bruner, 2019; Leskin, 2019). Moreover, it seems that in Great Britain, images of cats are even more popular than selfies (Williams, 2014). This raises questions about why these materials are so popular and how they influence people.

In general, people tend to believe that companion animals have a positive influence on them. Canistherapy and feline therapy seem to have a positive effect on emotions, and they can potentially aid the treatment of mental disorders (Lundqvist et al., 2017; Nimer & Lundahl, 2007; Tomaszewska et al., 2017). The presence of a cute dog (Aydin et al., 2011) and even just writing about a favorite companion animal (McConnell et al., 2011), makes people feel better after experimentally induced feelings of social rejection. Petting a dog decreases anxiety more than petting a stuffed animal does, especially in anxious people (Wheeler & Faulkner, 2015). The results of studies on companion animals' influence on their keepers are, however, mixed (Herzog, 2011).

Visual materials of cats and dogs seem to affect people in various ways. People tend to judge other persons, or even workspaces, more positively when a dog (Budge et al., 1996; Geries-Johnson & Kennedy, 1995; Lockwood, 1983; Perrine & Wells, 2016; Rossbach & Wilson, 1992; Wells & Perrine 2001) or cat is present (Budge et al., 1996; Perrine & Wells, 2006). Viewing photos of cats and dogs, especially if people are asked to come up with names for them, provides relief from social rejection (Brown et al., 2016). People who regularly watch cat videos claim that their emotions after watching such material are more positive than before (Myrick, 2015). Interestingly, exposure to images of kittens and puppies makes people more careful when performing fine-motor tasks compared to exposure to images of adult cats and dogs (Nittono et al., 2012; Sherman et al., 2009). All in all, it seems that visual materials of cats and dogs have a clearly positive effect on people.

Nevertheless, studies such as those mentioned above are mostly based on relatively small sample sizes and sometimes can be influenced by respondents' opinions on companion animals. Moreover, negative results are much less likely to be published (Herzog, 2011). Thus, one cannot exclude the possibility of publication bias skewing the image of research in this field. This is why we

aimed to replicate previous positive results in an experimental study with a large sample size.

In our study, we tried to avoid several potential methodological pitfalls. First of all, we carefully avoided any hints that we were interested in the influence of cats and dogs on people. We did not even mention these animals during the recruitment of our respondents. This way, we hoped to prevent invalidation of our results through interference with respondents' opinions about cats and dogs and their usefulness to people. Additionally, the steps we took aimed to prevent an inflated representation of cat and dog lovers in our sample who might respond to our images differently from the general population. Finally, we preregistered our study to avoid risk of any data dredging, cherry picking, or p-value fishing artifacts.

In addition to mood and optimism, we decided to also test the effect of priming by cats and dogs on the desire to have children. To the best of our knowledge, this relationship has not been studied yet. It has been shown, however, that people without children in their household are more attached to their companion animals (Paul, 2014). Moreover, liking of cats and dogs is related to a lower number of children (Flegr & Preiss, 2019) and it has been hypothesized that companion animals might be social parasites who compete with children for the same resources (Archer, 1997). We have therefore hypothesized that viewing images of cats and dogs might decrease the desire to have children.

Materials and Methods

Subjects

The online questionnaire was distributed mainly by members of the "Labbunnies" community, a group of approximately 20,000 Czech and Slovak nationals willing to take part in evolutionary psychology experiments. The survey was presented as a "Calculator of partner preferences," computing these preferences based on each participant's rating of photos of cats and dogs with results shown on the last page of the survey.

Participants expressed their consent to providing anonymous responses for scientific purposes and could ask to have their data excluded from the analysis after completing the survey. Data collection started on December 24, 2018, and was completed on February 3, 2019, i.e., one day after our stopping rule was fulfilled. The final sample consisted of 11,778 responses.

The project was preregistered using the OSF system (osf.io/ckf9x, Influence of watching cats and dogs on happiness, optimism, and willingness to have

children, December 24, 2018). The project was approved by the IRB of the Faculty of Science, Charles University ("Komise pro práci s lidmi a lidským materiálem Přírodovědecké Fakulty Univerzity Karlovy") – No. 2019/01.

Questionnaire

The data were collected using an online Qualtrics survey. The questionnaire consisted of four parts: i) the introductory part, ii) rating of cats or dogs, iii) primed questions, and iv) the final part. Participants were randomly divided into two groups of the same size. One group answered the primed questions before rating cats or dogs, while the other half rated cats and dogs prior to responding to the primed questions. Potential differences between these two groups in gender, age, dog/cat keeping, number of their own children, and number of children in a household were checked using *t*-test or contingency table with respect to variable type. Additionally, primed participants were randomly selected to rate either cats or dogs. These two randomizations were independent of each other, and both were performed using Qualtrics' built-in randomizer. The questionnaire also contained questions unrelated to this study.

In the introductory part of the questionnaire, we asked participants about their age (in years), gender ("You were officially born as: male or female"), sexual attraction to people of the opposite and of the same sex (two seven-point rating scales; 0 = definitely not, 6 = definitely yes), liking of cats and dogs "I like cats/dogs very much" (scale 0–100; 0 = I completely disagree, 100 = I completely agree), and four other questions regarding the number of cats and dogs kept currently and in the past (Flegr & Preiss, 2019).

In the rating part of the survey, we asked participants to rate 40 photographs of cat or dog faces using 8-point rating scales in terms of likeability (1 = very unlikeable, 8 = very likeable; in Czech we used the term "sympatičnost") and beauty (1 = very ugly, 5 = very beautiful; in Czech "krása"). Each image was presented on a separate page, with both scales showing below it.

Photographs showing frontal views of cats' and dogs' heads were provided by Labbunnies several years ago for similar studies. We selected high-quality photos of diverse phenotypes of both cats and dogs. We used rating instead of just viewing photographs because we wanted to prevent respondents from suspecting that they were being primed. Moreover, we needed these ratings to provide respondents with interesting feedback about themselves at the end of the survey, which we promised in order to motivate respondents to complete our survey in their free time.

In the survey, we used six primed questions. The first two concerned the desired number of sons and daughters ("How many sons (daughters) would you

ideally like to have (in total)?"), with response taking the form of numbers from zero to five, where five meant they desired to have five or more sons/daughters. These two questions about sons and daughters were placed within a group of four other questions about children to prevent respondents from realizing the actual goal of this study (which could influence their responses). The variable "desired number of children" was computed as a sum of these two variables.

The remaining four primed questions were presented together on one page of the survey. These questions were answered on 6-point rating scales with labels on both sides: i) "I am in a better physical condition than other people" (0 = definitely not, 5 = definitely yes), ii) "I am in a better mental condition than other people" (0 = definitely not, 5 = definitely yes), iii) "How would you rate the quality of your life?" (0 = very bad, 5 = very good), iv) "How do you feel right now?" (0 = very miserable, 5 = very well). Response to the last question was interpreted as indicating actual (conscious) mood. Variable "optimism index" was computed for each respondent as an average z-score of responses to the first three questions mentioned above. Justification of the method used to compute this index is presented in the first part of the discussion.

Data Filtering and Statistical Analyses

All data analyses were done using R. We filtered data in the same way as Flegr and Preiss (2019). Additionally, we filtered data from respondents whose average rating times were lower than 400ms, meaning they likely did not view the photographs carefully.

In the confirmatory part of this study, we analyzed the influence of viewing cats or dogs on i) optimism, ii) actual mood, and iii) the desired number of children. The first relationship was tested using general linear model (GLM; R package stats 3.5.2; function GLM with identity link function); the latter two were explored using ordinal regression models (ORL), also known as cumulative link models (CLM; R package ordinal 2018.8.25; Christensen, 2018; function CLM with logit link function). Power analysis for the confirmatory models was computed using function modelPower from the lmSupport package (Curtin, 2018).

Priming was coded as a binary variable, i.e., we distinguished only whether respondents were primed or not. Respondents' age, gender, and their interactions with priming were used as covariates. Where necessary, proportional odds assumption was relaxed (using the scale option).

In the exploratory part, we tested the same relationships as in the confirmatory part but used subsamples of cat and dog lovers (i.e., liking of cats/dogs > 50 on a 100-point scale). Cat lovers primed by dogs and dog lovers primed by cats were not included. The relationship between the real number of children and

liking companion animals, as well as between the real number of children and the keeping of companion animals was tested using partial Kendall correlation tests (tau; R package ppcor 1.1; Kim, 2015; function cor.test) with age as a covariate.

Differences between the Preregistered and the Implemented Protocol

Our target sample size after data filtering was 5,000 respondents. Based on our previous experience, we supposed the number of responses before filtering would be approximately 10,000, as stated in the preregistration. We terminated data collection one day after our sample size reached the target size. By that time, however, our sample size was approximately 11,750 because of a TV interview with the corresponding author (where, however, neither cats or dogs nor priming was mentioned). Additionally, we had to exclude many fewer responses than the expected half, probably because of the shortness and interesting topic of the questionnaire. The final sample size was therefore significantly higher than expected (8,865 instead of 5,000).

The inclusion of the interaction of gender and age with priming was not explicitly mentioned in the preregistration, nor did we explicitly state that we would filter out the responses of people who went through the rating conspicuously fast. Aside from this, we extended the exploratory analysis to find an explanation for our unexpected results.

Results

Descriptive Statistics

The final sample consisted of 3,963 men (M_{age} = 36.96, SD = 11.13) and 4,902 women (M_{age} = 34.44, SD = 11.14). Distributions of variables used in the models are shown in Figures 1–6. Primed and non-primed respondents did not significantly differ in gender, age, or variables regarding present dog/cat keeping, number of own children, and number of children in the household (p > .08). The internal reliability of three variables used in the computation of optimism index was expressed as Cronbach's alpha = 0.78, which is commonly interpreted as acceptable.

The Confirmatory Part

In this part, we tested the following preregistered hypotheses: i) People are on average in a better mood after rating photos of cats or dogs than before; ii) People are on average more optimistic (i.e., they give higher rating to their
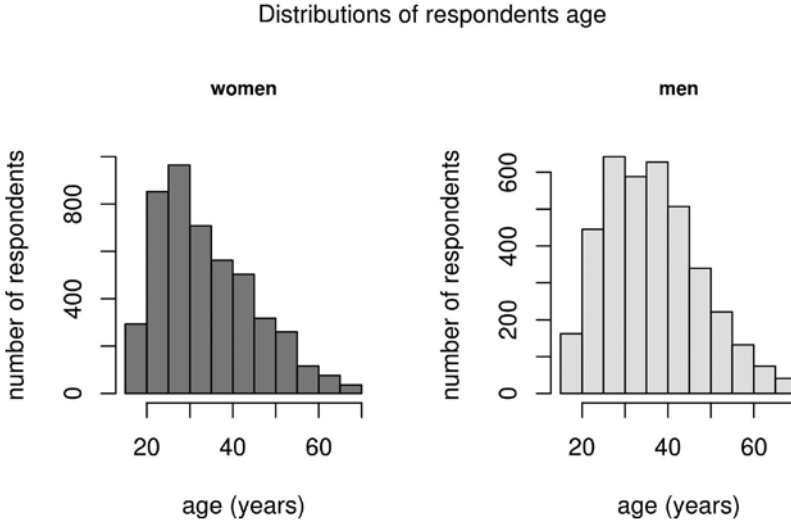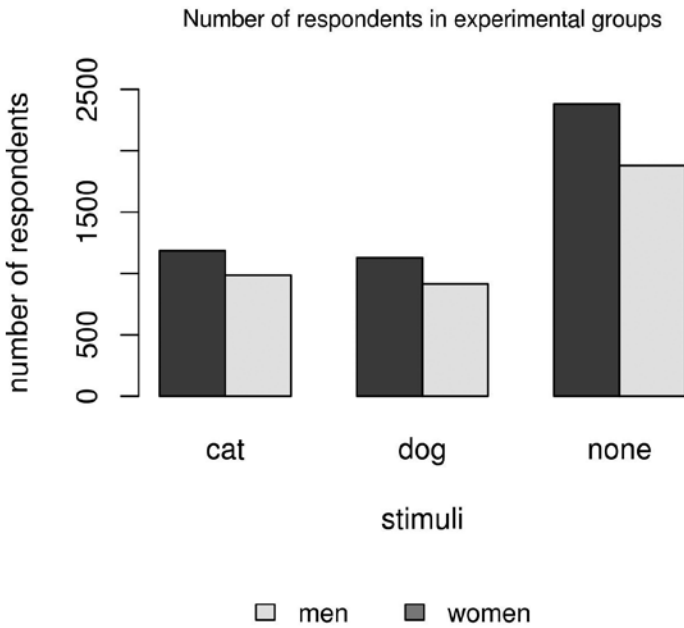
FIGURE 1   Age of respondents in years

FIGURE 2   Number of respondents in experimental groups
Note: Cats – respondents primed by images of cats, dogs – respondents primed by images of dogs, none – non-primed respondents
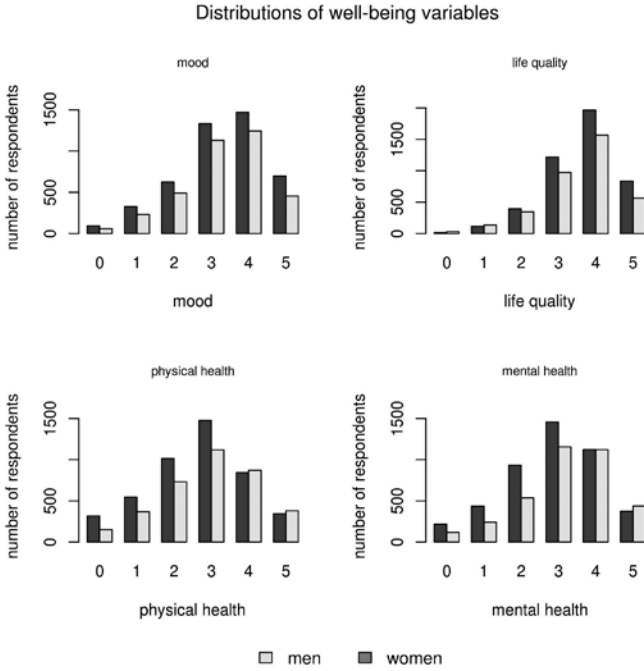
Distributions of well-being variables

FIGURE 3 Distributions of wellbeing variables
Note: Ratings of mood, life quality, physical and mental health on a 6-point rating scale. The higher number means a higher mood/health.
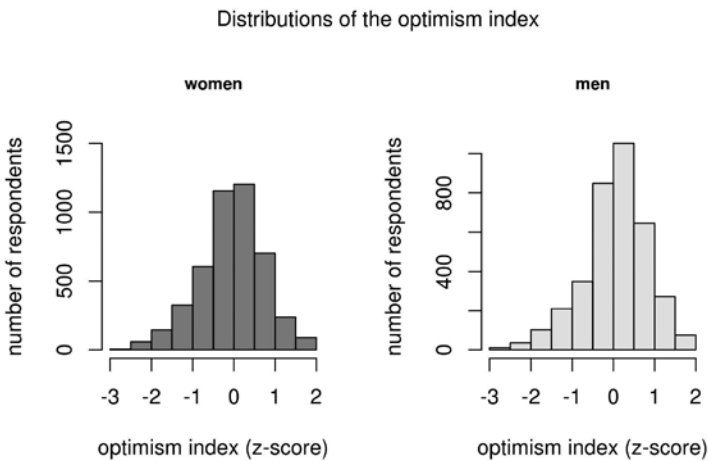
Distributions of the optimism index

FIGURE 4   Distribution of the optimism index
Note: Optimism index was computed as an average *z*-score of self-reported life quality, physical and mental health
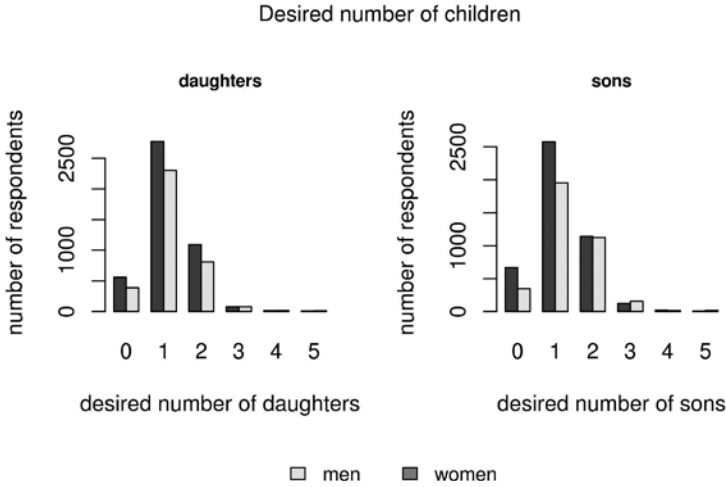
Desired number of children

FIGURE 5   Desired number of children
Note: 5 = Five or more children are desired
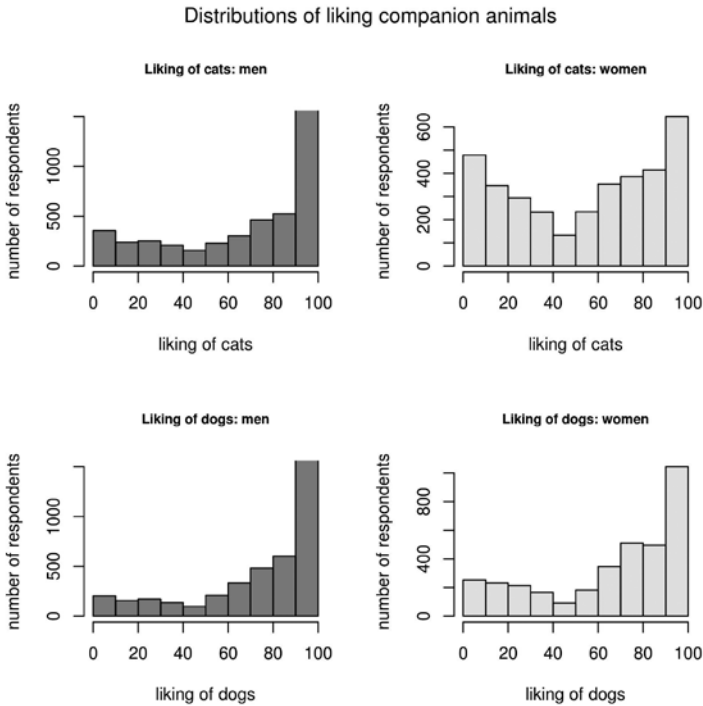
Distributions of liking companion animals

FIGURE 6   Distributions of liking companion animals
Note: Histograms of liking of cats and dogs on a scale of 0–100.
The higher the number, the more strongly respondents like these
animals.

quality of life and mental and physical health) after rating photos of cats or dogs than before rating them; iii) People report wanting to have fewer children after rating photos of cats or dogs than before rating them. All three models – i.e., GLM model with optimism index as a dependent variable and priming, gender, and age as independent variables, ORL with either mood or the desired number of children as a dependent variable and the same independent variables – explained the data significantly better than corresponding null models with *p*-values lower than .0001. Power for detecting effect of size 0.003 in these models was 99.6%. The full results of these analyses are shown in Table S1.

Actual Mood

Actual mood was significantly predicted neither by priming itself (estimate = 0.063, *z* = 0.478, *p* = .63) nor by its interaction with age or gender. The only significant predictor in this model was age, where older people tended to be in a better mood (estimate = 0.021, *z* = 8.380, *p* < .0001).

Optimism

The effect of interaction between priming and gender on optimism was significant (estimate = 0.105, *t* = 3.135, *p* = .002); difference in WAIC (R package blmeco 1.4; Korner-Nievergelt et al., 2015) between this model and corresponding model without this interaction was 5.972. Primed women reported lower optimism than the controls (−0.080 vs. −0.041), while in men the direction of the effect was the opposite (0.028 vs. 0.075). Nevertheless, the effect sizes expressed as Cohen's *d* (R package effsize 0.7.6; Torchiano, 2020) were negligible (primed vs. non-primed men: 0.0627; non-primed vs. primed women: −0.050) and their 95% CIs included zero (non-primed vs. primed men: −0.002 to 0.128; non-primed vs. primed women: −0.108 to 0.008). Generally, the optimism index was almost the same in the primed people and the controls (*M* = −0.01, estimate = 0.059, *t* = 1.057, *p* = .29). The effect of gender itself was not significant (estimate = 0.031, *t* = 1.327, *p* = .18) and optimism index increased with respondents' age (estimate = 0.013, *t* = 12.233, *p* < .0001).

Desired Number of Children

The desired number of children did not significantly depend on either priming itself (estimate = 0.031, *z* = 0.225, *p* = .82) or its interaction with one of the covariates. It did, however, significantly depend on age and gender. Older people wanted to have more children than younger people did (estimate = 0.019, *z* = 7.359, *p* < .0001) and men wanted to have more children than women did (estimate = 0.242, *z* = 4.126, *p* < .0001).

The Exploratory Part

In the exploratory part, we tested relationships between the same variables as in the confirmatory part. In the first model, however, we analyzed data from respondents who liked cats (1,547 men and 2,478 women) or dogs (1,889 men and women 2,757) separately; that is, we tested only subsamples of responders who rated their liking of cats or dogs as at least 50 on a scale of 0–100. In the second model, priming was not coded as a binary variable as in the previous models. Instead, it had three values: "cats," "dogs," or "none." In another model, we coded the desire to have children as a binary variable; that is, we compared respondents who do not want any children with respondents who wanted at least one child. Additionally, we tested the relationship between liking or keeping cats and dogs and both the actual and desired number of children.

Regarding the data from cat and dog lovers, neither the effect of priming nor its interaction with age or gender were significant in any of these models. Even the effect of interaction between priming and gender on the optimism index, which was significant in a model based on the whole dataset, became insignificant in both models based on subpopulations (dog lovers: 0.060, $t = 1.247$, $p = .21$; cat lovers: estimate = 0.085, $t = 1.640$, $p = .10$).

When we tested for the effect of viewing cats or dogs separately, priming was not a significant predictor in any of these three models. Nevertheless, the interaction between priming by cats and gender in the model with optimism as dependent variable turned out to be significant (estimate = 0.150, $t = 3.667$, $p < .001$; difference in WAIC of this model and corresponding model without the priming–gender interaction: 11.004). It seems therefore that viewing cat images had a negative effect on women and a positive effect on men. Viewing images of dogs had a similar, but smaller, effect, and the interaction was not significant. Additionally, older people who viewed cats were more pessimistic than their younger counterparts (estimate = –0.005, $t = –2.775$, $p = .005$). We also found that coding the desire to have children as a binary variable did not significantly affect the results (desire to have children: estimate = –0.258, $z = –0.806$, $p = .42$; priming*age: estimate = 0.011 $z = 1.204$, $p = .23$; priming*gender: estimate = 0.209, $z = 1.088$, $p = .28$).

In all models of the exploratory part, the pattern of significant effects of gender and age was almost identical to a pattern found in the corresponding models based on the whole sample. Additionally, people who liked cats and dogs reported wanting to have fewer children – regardless of whether they were primed (men and liking cats: tau = –0.031, $z = –2.827$, $p = .005$; women and liking cats: tau = –0.032, $z = –3.185$, $p = .001$; women and liking dogs: tau = –0.029, $z = 2.884$, $p = .004$). The only exception to this rule were men who

liked dogs: they wanted to have more children, but the interaction was not significant (tau = 0.006, z = 0.500, *p* = .62). Interactions between having children and keeping cats or dogs were also not significant.

With respect to the actual number of children respondents had, people who liked cats and dogs had fewer children (men and liking cats: tau = −0.080, z = −7.111, *p* < .0001; men and liking dogs: tau = −0.071, z = 6.313, *p* < .0001; women and liking cats: tau = −0.059, z = −5.913, *p* < .0001; women and liking dogs: tau = −0.097, z = −9.800, *p* < .0001). In contrast, people who actually kept cats and dogs had more children (men and keeping cats: tau = 0.043, z = 3.923, *p* < .0001; men and keeping dogs: tau = 0.093, z = 8.601, *p* < .0001; women and keeping cats: tau = 0.066, z = 6.760, *p* < .0001; women and keeping dogs: tau = 0.056, z = 5.806, *p* < .0001). Moreover, a higher number of cats or dogs in a household positively correlated with the number of children (men and number of cats: tau = 0.038, z = 3.535, *p* = .0004; men and number of dogs: tau = 0.089, z = 8.236, *p* < .0001; women and number of cats: tau = 0.064, z = 6.556, *p* < .0001; women and number of dogs: tau = 0.054, z = 5.528, *p* < .0001). In terms of the number of children, it made no difference whether respondents had a dog or a cat. The full results of the exploratory part are shown in Tables S2 and S3.

Discussion

Our results imply that priming by photos of cats and dogs had no effect on respondents' mood or desire to have children. The only factor which may have been affected by priming was optimism (measured as optimism index). We interpreted differences with respect to this index between primed respondents and controls as a proxy for optimism in the sense of an unconscious affect (Shevrin, 2012), that is, not as a long-term or even a lifelong personality trait. This is because priming cannot increase or decrease lifelong optimism or physical and mental health. As expected, primed men seemed more optimistic than non-primed ones. In women, we found the opposite pattern: Primed women seemed more pessimistic than non-primed ones. However, the effect sizes were small in both sexes. In large datasets, such small effects can easily result from very indirect influences of unknown variables correlated with both the dependent and independent variables. According to the exploratory analysis, this effect was driven mainly by the impact that viewing cat images had on men. In this particular case, the strength of the interaction reached the formal border of medium effect size. Since cats are, in the Czech culture, perceived as feminine and nice women are in colloquial Czech even called "cats," one could

speculate that it could be because men perceive cats as a kind of substitution for women. To test this hypothesis, photos of cats and dogs could be replaced by photos of men and women in future studies. Generally, it seems that viewing photographs of cats and dogs had little effect on respondents' feelings, which may contradict the findings of earlier studies.

The relationship between watching videos featuring cats and experienced emotions was studied by Myrick (2015), in whose study respondents ($N = 6795$) were asked to describe their emotions before and after they last watched videos with cats. The statement, "Before/After viewing cat videos and/or photos online, I felt …" was used to get the rating of emotions on a 7-point rating scale. Happiness, hope, and contentment (i.e., all of the positive emotions included in Myrick's study) were significantly higher after watching cat videos than before. We were therefore surprised that the viewing of photographs of cats and dogs resulted in neither better mood nor higher optimism in our priming experiment. This difference could be due to several factors.

Firstly, respondents in Myrick's study may have rated their emotions after watching videos as higher because they felt the need to find some justification for the time they spent on this form of procrastination. Alternatively, they may have unconsciously tried to help the researcher to prove the tested hypothesis or just believed that watching cats makes people happier. This could not happen in our study because our participants were unaware of both the purpose of the experiment and of our interest in the effect of watching cat and dog photos on viewers' moods.

Secondly, one could hypothesize that watching cat or dog images might have a positive effect only on people who like these animals. It is likely that cat lovers constituted a vast majority of respondents in Myrick's study because they intentionally watched cat videos in their free time. Moreover, Stewart and Strickland (2013) found out that decreases in anxiety in the presence of a dog depends on whether a person keeps a companion animal in combination with difficulty of an experimental task (i.e., the guardianship-difficulty interaction). Therefore, we tested our models once again on subsamples of our respondents who liked either cats or dogs. We observed no priming effect and moreover, the influence of priming in interaction with gender on the optimism index – which was significant in our original model – was not significant in these new models either. Since this effect as we observed it was small, its absence may have been due to the smaller sample size in the new models. Nevertheless, our exploratory analyses of cat and dog lover subsets showed that the negative results were not caused by the inclusion of people who do not like cats and dogs in our dataset.

Another factor which might have influenced our results is that static photographs may be less powerful stimuli than videos. On the other hand, another study found a positive effect of priming by companion animals even when participants only wrote about them (McConnell et al., 2011). A study by Brown et al. (2016) found that the effect of viewing animals together with assigning names to them was larger than mere viewing: This could be, at least in part, due to the fact that respondents spent more time watching the images during naming. Yet in our study, cats and dogs were rated in terms of beauty and likeability, which may have likewise kept respondents watching for a longer time. In general, we believe that photographs of cats and dogs and the way they were presented in our study should have been a strong enough stimulus to test the hypotheses we postulated.

It is, however, possible that people on the internet choose specific material which affects them differently from the relatively neutral images of cats or dogs presented by us. For example, people may watch funny images and videos of kittens and puppies rather than images of adult animals, which might well have a different effect on them (Nittono et al., 2012; Sherman et al., 2009). On the other hand, viewing and assigning names to cats or dogs in photographs which were not described as funny or cute still reduced feelings of social rejection (Brown et al., 2016), which seems to indicate that even neutral companion animal images can have a significant effect on human emotions. In any case, it would be interesting to repeat our study with "cute" images of cats and dogs.

To the best of our knowledge, the influence of priming by cats or dogs on the desire to have children has not been studied yet. Our data showed that watching cats and dogs did not decrease the desired number of children, although the liking of cats and dogs is related to both a lower desired number of children and a lower actual number of children. Companion animal keeping, on the other hand, correlated positively with a higher actual number of children. Relations between keeping cats or dogs and the desired number of children were not significant.

Flegr and Preiss (2019) found highly similar correlations between liking cats and dogs and the actual number of children. In that study, this correlation was stronger than the correlation between the actual number of children and keeping cats and dogs; however, in the present study, we observed no such clear pattern. In contrast to our results, Flegr and Preiss (2019) observed that women who kept cats and dogs had fewer children. The stronger relation between the number of children and liking cats or dogs than between the number of children and companion animal keeping implies that having cats or dogs does not decrease the desire to have children. If it did, then

keeping cats and dogs should be related to a lower number of children more than just liking cats and dogs. The same is suggested by the notable absence of a significant relationship between priming by cat and dog images and the desire to have children. Instead, having children might decrease the liking for companion animals, which would be also supported by the finding that childless people feel a stronger bond to their companion animals (Paul, 2014). On the other hand, our results do not support the hypothesis that companion animals are social parasites who compete with children for the same resources (Archer, 1997).

Limitations

Since our data were collected using an online questionnaire, we could not control the environment of our experiment. Our respondents could complete their questionnaires in the presence of real cats, dogs, or other potential stimuli, which may have led to a failure to detect existing effects. On the other hand, our sample size was several times larger than sample sizes used by most comparable studies. That should sufficiently compensate for this source of statistical noise which may have caused some false negative results in our study.

Viewing images of cats and dogs when a questionnaire was presented as a calculator of partner preferences may have disappointed some participants and consequently led to worse mood, less optimism, and lower desire to have children. Nonetheless, the fact that men tended to be slightly more, not less, optimistic after viewing the images seems to contradict this possibility.

Strengths

Most importantly, our respondents were unaware that we were testing the effects of priming by cats and dogs on their responses. During recruitment, we did not mention that the questionnaire included rating of cat and dog photos. The questionnaire was presented as a "Calculator of partner preferences" and participants were asked to rate the likeability and beauty of cats and dogs to learn about their own partner preferences. Our results were therefore most unlikely to be influenced by participants' conscious opinions on the influence of cats and dogs on humans, and the proportion of cats and dog lovers in our sample should not be markedly higher than in the general population. Other important advantages of our study include a large and relatively heterogeneous sample, preregistration of all hypotheses of the confirmatory part, and an indirect measure of one of our variables, namely the optimism index (see introduction for details).

Conclusions

In our study, which worked with an unusually large sample of respondents (N = 8,865), we found that priming by photos of cats and dogs did not influence respondents' mood, optimism, or desired number of children. The existence of a significant gender–priming interaction suggests that priming might affect women's optimism negatively and men's positively. Practical relevance of this phenomenon is, however, debatable both in the light of other results and due to its small effect size.

Our results might imply that companion animals do not negatively influence the desire to have children. Rather, it seems that having children decreases the reported intensity of love of companion animals. This is supported by the absence of an effect of viewing images of cats and dogs in conjunction with the stronger relationship between the number of children and liking of cats and dogs as opposed to actual keeping of cats and dogs.

Our results show that the effect of priming by cats and dogs may not be as strong as previous studies indicated. It has been suggested that publication bias could be responsible for the pattern observed in current literature (Herzog, 2011). In this context, the publication of negative results seems rather important, especially when they are obtained on the basis of large datasets. Some scientists claim that in many research areas, false positive results could constitute even the majority of all published studies (Ioannidis, 2005) and this could be one of the main sources of the current replication crisis (Shrout & Rodgers, 2018). We believe that studies on the priming effect of companion animal images might well be a case in point.

Acknowledgements

References

Archer, J. (1997). Why do people love their pets? *Evolution and Human Behavior*, *18*(4), 237–259. https://doi.org/10.1016/s0162-3095(99)80001-4.

Aydin, N., Krueger, J. I., Fischer, J., Hahn, D., Kastenmüller, A., Frey, D., & Fischer, P. (2012). "Man's best friend": How the presence of a dog reduces mental distress

after social exclusion. *Journal of Experimental Social Psychology*, *48*(1), 446–449. https://doi.org/10.1016/j.jesp.2011.09.011.

Brown, C. M., Hengy, S. M., & McConnell, A. R. (2016). Thinking about cats or dogs provides relief from social rejection. *Anthrozoös*, *29*(1), 47–58. https://doi.org/10.1080/20414005.2015.1067958.

Bruner, R. (2019, March 22). *The 10 best animal Instagram accounts to follow in 2019*. Time. https://time.com/5551937/best-animal-instagram-accounts-2019.

Budge, C. R., Spicer, J., Jones, B. R., & George, R. S. (1996). The influence of companion animals on owner perception: Gender and species effects. *Anthrozoös*, *9*(1), 10–18. https://doi.org/10.2752/089279396787001581.

Christensen, R. H. B. (2019). Ordinal – regression models for ordinal data (Version 2019.12-10) [Computer software]. https://CRAN.R-project.org/package=ordinal.

Curtin, J. (2018). lmSupport: Support for Linear Models (Version 2.9.13) [Computer software]. https://CRAN.R-project.org/package=lmSupport.

Flegr, J., & Preiss, M. (2019). Friends with malefit. The effects of keeping dogs and cats, sustaining animal-related injuries and *Toxoplasma* infection on health and quality of life. *PLoS ONE*, *14*(11), e0221988. https://doi.org/10.1371/journal.pone.0221988.

Geries-Johnson, B., & Kennedy, J. H. (1995). Influence of animals on perceived likability of people. *Perceptual and Motor Skills*, *80*(2), 432–434. https://doi.org/10.2466/pms.1995.80.2.432.

Herzog, H. (2011). The impact of pets on human health and psychological well-being. *Current Directions in Psychological Science*, *20*(4), 236–239. https://doi.org/10.1177/0963721411415220.

Ioannidis, J. P. A. (2005). Why most published research findings are false. *PLoS Medicine*, *2*(8), e124. https://doi.org/10.1371/journal.pmed.0020124.

Kim, S. (2015). ppcor: partial and semi-partial (part) correlation (Version 1.1) [Computer software]. https://CRAN.R-project.org/package=ppcor.

Korner-Nievergelt, F., Roth, T., von Felten, S., Guelat, J., Almasi, B., & Korner-Nievergelt, P. (2015). blmeco: data files and functions accompanying the book *Bayesian data analysis in ecology using R, BUGS and Stan* (Version 1.4) [Computer software]. https://cran.r-project.org/web/packages/blmeco/index.html.

Leskin, P. (2019, September 1). *The 22 most popular pet influencers, from Jiff Pom to Doug the Pug*. Business Insider. https://www.businessinsider.com/most-popular-pet-influencers-instagram-youtube-tiktok-jiffpom-lil-bub-2019-8.

Lockwood, R. (1983). The influence of animals on social perception. In A. H. Katcher & A. M. Beck (Eds.), *New perspectives on our Lives with companion animals* (pp. 64–71). University of Pennsylvania.

Lundqvist, M., Carlsson, P., Sjödahl, R., Theodorsson, E., & Levin, L. (2017). Patient benefit of dog-assisted interventions in health care: A systematic review. *BMC*

Complementary and Alternative Medicine, *17*(358), 1–12. https://www.ncbi.nlm.nih
.gov/pubmed/28693538.

McConnell, A. R., Brown, C. M., Shoda, T. M., Stayton, L. E., & Martin, C. E. (2011).
Friends with benefits: On the positive consequences of pet ownership. *Journal
of Personality and Social Psychology*, *101*(6), 1239–1252. https://doi.org/10.1037/
a0024506.

Mitchell, R. W., & Ellis, A. L. (2013). Cat person, dog person, gay, or heterosexual: The
effect of labels on a man's perceived masculinity, femininity, and likability. *Society
& Animals*, *21*(1), 1–16. https://doi.org/10.1163/15685306-12341266.

Myrick, J. G. (2015). Emotion regulation, procrastination, and watching cat videos
online: Who watches internet cats, why, and to what effect? *Computers in Human
Behavior*, *52*, 168–176. https://doi.org/10.1016/j.chb.2015.06.001.

Nimer, J., & Lundahl, B. (2007). Animal-assisted therapy: A meta-analysis. *Anthrozoös*,
20(3), 225–238. https://doi.org/10.2752/089279307x224773.

Nittono, H., Fukushima, M., Yano, A., & Moriya, H. (2012). The power of kawaii: Viewing
cute images promotes a careful behavior and narrows attentional focus. *PLoS ONE*,
7(9), e46362. DOI:10.1371/journal.pone.0046362.

Paul, E. S., Moore, A., McAinsh, P., Symonds, E., McCune, S., & Bradshaw, J. W. S. (2014).
Sociality motivation and anthropomorphic thinking about pets. *Anthrozoös*, *27*(4),
499–512. https://doi.org/10.2752/175303714x14023922798192.

Perrine, R. M., & Wells, M. (2006). Labradors to Persians: Perceptions of pets in the
workplace. *Anthrozoös*, *19*(1), 65–78. https://doi.org/10.2752/089279306785593928.

R Core Team (2019). R: A language and environment for statistical computing (Version
3.6.1) [Computer software]. https://www.R-project.org.

Rossbach, K. A. & Wilson, J. P. (1992). Does a dog's presence make a person appear
more likable?: Two studies. *Anthrozoös*, *5*(1), 40–51. https://doi.org/10.2752/089279
392787011593.

Sherman, G. D., Haidt, J., & Coan, J. A. (2009). Viewing cute images increases behavioral
carefulness. *Emotion*, *9*(2), 282–286. https://doi.org/10.1037/a0014904.

Shevrin, H., Panksepp, J., Brakel, L., & Snodgrass, M. (2012). Subliminal affect valence
words change conscious mood potency but not valence: Is this evidence for
unconscious valence affect? *Brain Sciences*, *2*(4), 504–522. https://doi.org/10.3390
/brainsci2040504.

Shrout, P. E., & Rodgers, J. L. (2018). Psychology, science, and knowledge construction:
Broadening perspectives from the replication crisis. *Annual Review of Psychology*,
69(1), 487–510. https://doi.org/10.1146/annurev-psych-122216-011845.

Stewart, A., & Strickland, O. (2013). A companion animal in a work simulation: The
roles of task difficulty and prior companion-animal guardianship in state anxiety.
Society & Animals, *21*(3), 249–265. https://doi.org/10.1163/15685306-12341287.

Tomaszewska, K., Bomert, I., & Wilkiewicz-Wawro, E. (2017). Feline-assisted therapy: Integrating contact with cats into treatment plans. *Polish Annals of Medicine, 24*(2), 283–286. https://doi.org/10.1016/j.poamed.2016.11.011.

Torchiano, M. (2020). effsize: Efficient effect size computation (Version 0.7.8) [Computer software]. https://CRAN.R-project.org/package=effsize.

Wells, M., & Perrine, R. (2001). Pets go to college: The influence of pets on students' perceptions of faculty and their offices. *Anthrozoös, 14*(3), 161–168. https://doi.org/10.2752/089279301786999472.

Wheeler, E. A., & Faulkner, M. E. (2015). The "pet effect." *Society & Animals, 23*(5), 425–438. https://doi.org/10.1163/15685306-12341374.

Williams, R. (2014). Cat photos more popular than the selfie. Retrieved December 19, 2019, from http://www.telegraph.co.uk/technology/internet/10646941/Cat-photos-more-popular-than-the-selfie.html.