**Materials and Methods**

*Literature search and data collection*

We conducted a systematic review and meta-analysis by systematically searching the literature for empirical studies quantifying animal personality traits in males and females (as classified by Sih *et al*. 2004 & Réale *et al*. 2007). We collected 10,991 papers from both ISI Web of Science and Scopus databases on 18 December 2018, using primary and secondary keyword searches (see Figure 3). We also included every paper that cited one of five key animal personality reviews: (Dall *et al.* 2004; Sih *et al.* 2004; Réale *et al.* 2007; Schuett *et al.* 2010; Dingemanse & Wolf 2010). A secondary search was used to find and include studies that measured ‘personality-like behaviours’; behaviours not explicitly defined as personalities but were measures of activity, aggression, boldness, exploration or sociality.

After removing duplicates, 3,737 papers were left for title and abstract screening by LH. A total of 787 papers were excluded based on title and abstract because they were not: 1) personality studies, 2) animal studies, 3) empirical studies, or 4) published in English. This left 2,950 papers for full text screening. We included papers only if they met the following inclusion criteria: 1) provided raw means and some measurement of error for both males and females given raw summary statistics are required for the derivation of variance-based effect size measures and provide greater opportunities to control for sources of non-independence (Nakagawa *et al.* 2015; Noble *et al.* 2017). Studies that only report PCAs and factor loadings were excluded as their interpretation can be challenging (e.g. Tarka *et al*. 2018). Briefly, we excluded papers at the full text stage if they met the following exclusion criteria: 1) were not personality studies, 2) the full text was unavailable/inaccessible, 3) studies used domestic or agricultural animals where individuals were neutered, 4) studies did not compare males and females (i.e. studies where animals were hermaphroditic, clonal or gynandromorphs), or 5) data were unsuitable/missing (as shown in the PRISMA in Figure X).

In total, this provided 245 eligible studies with suitable data that could be included in our meta-analysis (see Figure X). We extracted means, error (standard deviation, standard error) and sample sizes from text, tables, figures and supplementary data files for both males and females on all personality traits. We used the R package *metaDigitise* (v1.0.0, Pick et al. 2019) to extract summary statistics from figures where needed.

*Effect size and sampling error*

To understand how males and females differ in their personality and variability in their personality we used two contrast-based effect size measures. To understand changes in mean personality between the sexes we calculated Hedges’ *g* (sample size adjusted standardised mean difference; Hedges & Olkin 1985) and its associated sampling error as follows:

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Where is the mean, is the pooled standard deviation and N and SD are the sample size and standard deviation for males (M) and females (F), respectively. We used Hedges *g* instead of log response ratios as our chosen effect size as much of the data was not on a ratio scale and as such a response ratio could not be calculated. Effect size direction for a given behavioural trait depended on the way in which it was measured within a study. As such, we carefully examined all behavioural traits and ensured that the directionality (i.e., larger mean) was always consistent, flipping the direction of effect size estimates if directionality was opposite.

We had strong mean-variance relationships in our data. As such, to understand differences in variance in personality traits across the sexes we used the log coefficient of variation (lnCVR) (Nakagawa *et al.* 2015) calculating the effect size and samping variance as follows:

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where CV*M* and CV*F* are *SDM /M* and *SDF /F* , respectively. The lnCVR allows us to quantify the difference in variance between the sexes independent of changes in the mean (Nakagawa *et al.* 2015).

*Moderator variables*

We collected a series of moderator variables that we *a priori* expected to moderate the effect size magnitude and direction. Personality traits extracted for males and females were categorised into one of five types suggested by Réale *et al.* (2007); ‘boldness’, ‘aggression’, ‘activity’, ‘sociality’ and ‘exploration’. We also recorded the taxonomic group (‘invertebrates’, ‘fish’, ‘amphibians’, ‘reptiles’, ‘birds’, ‘mammals’), the age of the sample (‘juveniles’ or ‘adults’), whether the study population was from the lab or the wild, and whether the study was done in the lab or field given this is expected to affect behaviour (Tarka *et al*. 2018). We also generated three moderator variables that attempt to capture the strength of sexual selection. First, we quantified the degree of sexual size dimorphism (SSD) between males and females as this is strongly correlated with the strength of sexual selection (e.g. birds: Székely *et al*. 2004; Dale *et al*. 2007; fish: Walker & McCormick 2009; mammals: Promislow 1992). We created an SSD index by taking the ratio of male and female mean body size, mass or some other sexually dimorphic trait (e.g. wing length). Our second measure attempting to capture the strength of sexual selection was the type of mating system (‘polygynous’, polygamous’, ‘monogamous’, polyandrous’). While mating system is a more indirect measure, a greater amount of data was available to categorise species compared with measures of direct SSD between the sexes. Lastly, we also categorised the parental care strategies exhibited by each species within and across studies (‘biparental’, ‘maternal’, ‘paternal’, ‘none’). Where body size measures for males and females, mating system and parental care were not reported in the research article itself, we obtained these data by searching Web of Science, Scopus and Google Scholar. We used the search terms: “species name” AND male AND female AND body size OR length (for body size measures), “species name” AND parental care OR mating system for parental care and mating system.

*Meta-analyses*

We modelled SMD and lnCVR using multi-level meta-analytic (MLMA) and multi-level meta-regression (MLMR) models in R using the package *metafor* (version Viechtbauer, 2010; R Core Team, 2019). In all our models we subset the data into broad taxonomic groups (i.e., birds, mammals, fish, invertebrates and amphibians and reptiles) as we were: 1) specifically interested in the extent to which patterns varied across these taxonomic groups and 2) because constructing phylogenies were easier within these sub-groups. We first estimated the overall evidence for a sex-specific effect in mean and variance across all personality traits for each specific taxonomic group using MLMA models. We accounted for effect size measurement error in our model and included study and phylogenetic random effects. We also estimated an observational-level (residual) variance as *metafor* does not estimate this by default. Phylogenetic correlation matrices were derived for each group either from existing phylogenetic tree databases (e.g., birds; Jetz et al. 2015) or using TimeTree.org (Hinchcliff, 2015). For the bird phylogeny, we used the XX backbone and took a sample of 100 trees. We used *ape* and *phytools* in R to take an average tree from these 100 which we used for analyses. TimeTree phylogenies were derived by exporting a list of taxa from (TimeTree.org). In all cases, we resolved synonymous taxa across our dataset and trees and pruned our trees where needed. From our MLMA models we derived heterogeneity estimates (I2; Thompson & Higgins; Nakagawa & Santos 2012). More specifically we derived between study heterogeneity estimates (I2study), phylogenetic heterogeneity or phylogenetic heritability (I2phylo) (Nakagawa & Santos, 2012; Hadfield & Nakagawa, 2010) along with total heterogeneity (I2Tot), which is simply the proportion of total variance in effect size estimates excluding the total sampling variance.

We also fitted a series of models that included key moderator variables we predicted would explain variation in effect size. In all models, we again controlled for measurement error, study and phylogeny. Our first MLMR model estimated overall-meta-analytic mean estimates for each personality trait type separately (i.e., ‘activity’, ‘aggression’, ‘boldness’, ‘sociability’, ‘exploration’) within each taxonomic group. We expected that any mean and variance differences between the sexes would depend on the type of personality trait measured because this…. (). We also tested whether the degree of sexual selection, as measured by 1) the degree of sexual size-dimorphism (SSD) or 2) mating system, moderated effect sizes. We predicted that species with strong SSD or that have polygynous mating systems would show stronger difference in mean and variance. However, we also expected such effects to depend on the personality trait being measured. As such, we fitted a model that included personality trait type, SSD and their interaction and a second model that included personality trait type, mating system and their interaction. Finally, for birds and XX we tested how different parental care strategies impact on mean and variance by estimating overall meta-analytic means across different forms of parental care (XX,X<X). We present meta-analytic mean estimates and 95% confidence intervals from our models throughout.

Studies included in our meta-analysis varied greatly in their design and there was a number of additional sources of non-independence within studies (Noble et al. 2017). First, multiple personality traits were quantified on the same sets of individuals (e.g., ‘boldness’ and ‘aggression’). Additionally, …. We conducted a series of sensitivity analyses to ascertain the impact that these sources of non-independence had on our final results. We created correlation matrices among effect sizes that shared the same sets of individuals or XX in the sample used to derive effect sizes. Given that we did not know the exact correlation among traits we created three different dependency matrices (**D**; i.e., correlation matrices) that assumed r = 0.3, r = 0.5 and r = 0.8. We refit our models replacing the identify matrix (**I**) that was assumed when estimating the residual error variance with our **D** matrices.

Finally, if the final dataset contains moderators with fewer than 2 effect sizes per level (or a number that is inappropriate for analysis), they might be removed from further analysis.



3,734

784

245

245

2,705

2,950

10,991

7,257

182

**Figure 3.** *PRISMA* diagram showing the process of finding, screening and including/excluding studies for this meta-analysis. Searches were further refined to agriculture & biology (Scopus), zoology, ecology, biology, multidisciplinary sciences, evolutionary biology (WoS) categories.