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Meta-Analytic Evidence Against Sex Differences in Infants' and Toddlers' Preference for Prosocial Agents

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Can well-documented gender differences in evaluations of prosocial versus antisocial actions found in childhood and adulthood be traced to sex differences in basic sociomoral preferences in infancy? We provide an answer to this question by meta-analyzing sex differences in preference for prosocial over antisocial agents in a set of 53 samples of American and European infants and toddlers aged between 4 and 32 months (N = 1,094). Although the original studies were agnostic to sex differences, we were able to retrieve the original data sets and estimate the effect of infants' and toddlers' sex on sociomoral preferences. Employing both a standard frequentist and a Bayesian approach to meta-analysis, we found strong evidence supporting the absence of sex differences in sociomoral preferences among infants and toddlers. We discuss the relevance of this finding for theories and descriptions of the emergence and developmental trajectory of gender differences in morality.

Public Significance Statement

We found strong evidence that, within the first 3 years of life, males and females do not differ in their tendency to prefer prosocial agents over antisocial agents, a tendency that is considered by many to be a building block of adult moral cognition. The present meta-analysis gives evidence to evaluate theories and hypotheses about the development of gender differences in moral judgment.

Keywords: sex differences, meta-analysis, infancy, morality, prosociality

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Prosociality is one of the cornerstones of human societies. The cooperation afforded by widespread prosocial behaviors such as helping and sharing is among the main factors that have allowed the human species unprecedented success (Boyd & Richerson, 2009; Henrich & Muthukrishna, 2021). Humans' tendencies to expect prosocial interactions and to evaluate prosocial others positively are key components of cooperation (Krebs, 2008). In adults, valuing prosociality and actively caring for others is linked to greater personal and relationship well-being, suggesting that prosociality is broadly beneficial (Le et al., 2018).

Evidence for the capacity to evaluate prosociality can be found even in preverbal infants. A rich and growing literature documents that children under the age of three years view prosocial agents more favorably than antisocial agents, as indicated by their tendency to preferentially interact with prosocial agents (e.g., Geraci & Surian, 2011; Hamlin et al., 2007). Indeed, a recent meta-analysis including 61 experiments and over 1,200 infants and toddlers aged four to 32 months found that about two thirds of them preferred a prosocial agent (who provided help or distributed resources fairly) over an antisocial one (who hindered or distributed unfairly), and that the tendency to prefer prosocial to antisocial agents was consistent across these first 32 months of life (Margoni & Surian, 2018). Moreover, infants' preference for prosocial agents has been shown to predict better parent-reported social adjustment years later, suggesting that

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these early judgments do not merely reflect an understanding of moral behavior, but may also tap into children's emerging social functioning in important ways (Tan et al., 2018).

Despite a general tendency for humans to value prosociality, many studies reveal gender differences in prosocial beliefs, preferences, and values in older children and adults. Women appear to be more concerned about prosociality in their moral judgements than men are. Specifically, two meta-analyses indicate that adult women value ethics of care and fairness more than men do, and are more concerned when antisocial acts violate these principles (Atari et al., 2020; Jaffee & Hyde, 2000). A similar gender difference is evident in men's and women's self-reported traits and values: Despite cross-national variation in the size of these reported gender differences, women in most countries report valuing prosocial actions more strongly (Falk & Hermle, 2018; Hsu et al., 2021), and describe themselves with more prosocial traits than do men (Schwartz & Rubel, 2005).

Whereas gender differences in preferences for prosociality are nearly ubiquitous in adulthood, far less is known about the early developmental trajectory of sex or gender differences in prosocial preferences. Of course, one challenge of assessing this question is that the same methods used to document these differences in older children or adults (largely done using self-report measures) cannot be employed with infants and young children. Nonetheless, children as young as six years of age show gender differences in valuing prosocial goals; on average, girls think it is more important to be helpful and kind than boys do (Block et al., 2018; Ojanen et al., 2005). Similarly, by age 10, girls judge antisocial agents more harshly than do boys (Sierksma et al., 2014), and adolescent girls are more likely than adolescent boys to expect story characters to behave prosocially (Eisenberg et al., 2001). While these tasks vary across different age groups (because of constraints of developmental appropriateness), these findings broadly suggest that gender differences in the evaluation of prosocial acts are present by the time children reach elementary school. These studies, however, did not examine children younger than six, leaving the emergence of such gender differences unclear.

The question that guided the current article is whether any aspects of these gender differences in prosocial preferences could be found in even younger age groups. Preverbal infants cannot express the degree to which they value being kind to others, but they can reveal an understanding of, and even a preference for, prosocial over antisocial agents. In fact, this component of early prosociality has been demonstrated in children as young as 3 months old (Hamlin et al., 2010). However, sex differences in these preferences have not been systematically examined.

The onset of sex differences is domain-specific and thus requires an independent investigation for each domain. Indeed, research suggests that there are some sex differences that arise in infancy; for example, by one year of age girls prefer dolls over toy cars, and boys show the opposite bias (Todd et al., 2018). Other beliefs and behaviors, instead, become sex differentiated in middle childhood (Bian et al., 2017; Halim et al., 2011). Thus, whether sex differences specific to the propensity to prefer prosociality over antisociality are found in infancy is an entirely open question requiring further attention and investigation.

Investigating early sex differences in preferences for prosocial versus antisocial agents has the potential to shed light on the origins of sex and gender differences in moral judgment. Indeed, sociomoral preferences in preverbal infants have been shown to be related to subsequent human sociomoral functioning in preschool (Tan et al., 2018); here, observed relationships were only present in boys (note that there were no sex differences in tendencies to show prosocial preferences in infancy in this—quite small—sample). Of course, the earlier sex differences in a construct emerge, the less likely it is that culturally transmitted gender stereotypes or sex-typed parental behavior create these differences. Given this, if sex differences in a construct are observable in very young infants, one could argue that sociocultural learning processes have played a less significant role in producing them, and therefore that hardwired biological factors may also be responsible. For instance, it has previously been claimed that biologically hardwired factors contribute to young girls' higher social interest and empathy relative to boys (Baron-Cohen et al., 2005); these biological factors are undoubtedly reinforced and strengthened by sociocultural norms during development, but these norms may not be solely responsible for gender differences. According to this reasoning, then, it is at least plausible that young girls will prefer prosociality more than young boys do, even in infancy. However, no research to date has had sufficient power to adequately examine this proposition.

Although research has not directly examined sex differences in infants' or toddlers' preference for prosocial over antisocial agents, a few articles, in passing, note the absence of significant sex differences in their samples (Loheide-Niesmann et al., 2021; Salvadori et al., 2015; Tan et al., 2018; Vaish et al., 2010). These individual studies, however, were not adequately statistically powered to assess sex differences. Given this dearth of research, it is unclear when sex differences in preferences for prosociality can be found in infancy, constraining our ability to adjudicate between different explanations for their presence later in life. Yet given how important humans' preference for prosociality is both for societal functioning and personal well-being, it is important to answer this question.

The current work provides a unique critical test of sex differences in one important type of early sociomoral preferences, by taking advantage of a large collection of existing studies on infants' and toddlers' preference for prosocial agents. Specifically, we examined whether, across 53 samples, there is meta-analytic evidence that female (compared with male) infants and toddlers show a stronger tendency to prefer prosocial to antisocial agents.

Method

For this work, we collected additional information of infants within studies of a recent meta-analytic dataset, which assessed the extent to which infants and toddlers prefer prosocial to antisocial agents (Margoni & Surian, 2018). The original meta-analysis included 61 effect sizes (44 published and 17 unpublished). The effect size of interest in Margoni and Surian (2018) was the number of children preferring the prosocial agent divided by the number of children included in the experiment.

The main aim of the present work was to assess whether the sex of the infant or toddler had an effect on the preference for prosocial over antisocial agents. As no sex information was tabulated in the original meta-analyses, we recontacted all the authors of the studies initially included. The studies are described in detail in the online supplemental material on OSF (https://osf.io/uq3zs/). We retrieved a total of $k = 53$ sex difference effect sizes (of the original 61 from Margoni & Surian, 2018) from single experiments (40 published, 13 unpublished) with a total of 1,094 children (547

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female). This final dataset included experiments conducted on children aged between 139 days (4.6 months) and 960 days (32 months), M_{Age} = 398, *SD* = 221 (of these, about 62%, *n* = 33, were experiments conducted on infants aged ≤12 months and 29 days, whereas *n* = 20 were conducted on older infants and toddlers, allowing us to test for potential developmental effects).[1]

The studies we retrieved were all included in the prior meta-analysis (Margoni & Surian, 2018) based on three inclusion criteria: (a) they included a measure for a preference between a prosocial and an antisocial agent, where prosocial agents were either helping, fair, or giving agents, and antisocial agents were either hindering, unfair, or keeping/taking agents; (b) they tested infants' or toddlers' preferences by specifically employing a manual task (i.e., children were encouraged to manually reach or pick up one of two agents, to selectively help one, or to preferentially give to or receive from the agent some resources); and (c) they included infants or toddlers with a sample-specific average age between four and 36 months.[2] This age range was selected because four months was the youngest age where children have been reliably documented to be able to express a preference through their reaching behavior (Hamlin, 2014), and including toddlers up to 36 months allowed to assess pivotal hypotheses regarding the presence versus absence of developmental changes in children's sociomoral preferences during infancy and toddlerhood.

Results

To estimate sex differences on infants' and toddlers' sociomoral preferences, we first converted each result into a pair of values: a log odds ratio (*OR*; expressing the increase in the odds of choosing the prosocial over the antisocial agent if the child is male vs. female) and its associated sampling variance. In the analyses, we used the log *OR* instead of the *OR* to respect the assumption of normality required by parametric statistical tests. Next, we used a two-step approach. First, we conducted a standard frequentist meta-analysis of the observed effects to test whether there was evidence of a sex difference. Second, we employed a Bayesian approach to estimate the strength of the evidence in favor of accepting the null hypothesis of no sex difference.

We conducted a random-effects meta-analysis with *k* = 53 sex differences and a restricted maximum-likelihood estimation for τ^2 (i.e., estimated amount of heterogeneity among the true effects). We used a random-effects approach instead of a fixed-effects approach to take into account both within- and between-study variability, and assumed that the *k* effects are a sample from a larger population (Viechtbauer, 2010).

The estimated average log *OR* was .009, 95% confidence interval (CI) [−.273, .290], *z* = .06, *p* = .952. For ease of interpretation, this value can be backtransformed to an *OR*, which is 1.009, 95% CI (.761, 1.336). Thus, the odds of a male child choosing a prosocial agent is 1.009 times the odds of a female child choosing a prosocial agent. In other words, male infants and toddlers were a negligible and statistically nonsignificant .9% more likely to prefer the prosocial agent than were female infants and toddlers (see Figure 1).

The frequentist approach employed above provided no evidence that the null hypothesis (of no sex difference) should be rejected, but it cannot estimate the strength of the evidence in support of the null hypothesis. To do this, we next employed a Bayesian approach. We conducted this analysis by setting the distribution expressing the null hypothesis of a lack of sex differences as normal and centered on 0, with a standard deviation of 1.5.[3] Specifying the null hypothesis in this way does not reflect our subjective assessment of the evidence already accumulated in the field in favor of the absence of a sex difference in infants' preferences for prosociality prior conducting this meta-analysis. Rather, this analysis simply allowed us to estimate the positive (Bayesian) evidence in favor of the fact that the data here meta-analyzed are distributed in a way that clearly suggests the absence of an effect of sex (i.e., similarly to a distribution centered on 0)—something that was not a possibility under the standard frequentist approach.

The Bayesian random-effects meta-analysis, with the same *k* = 53 effects (log *OR*s), supported the null hypothesis of no sex difference in children's preferences (Bayes factor $[BF]_{01}$ = 11.43). This number indicates that the observed data are about 11 times more likely to occur under the null hypothesis of no sex difference in sociomoral preferences than under the alternative hypothesis (i.e., a sex difference in preference for prosociality in one of the two possible directions) and is generally taken as indicating strong evidence (Stefan et al., 2019).

No significant heterogeneity between studies was found, Q(52) = 46.80, *p* = .678. The estimated amount of total heterogeneity τ^2 was .00, 95% CI [.00, .60], and Higgins' I^2 was 0%, 95% CI [0%, 35%] (Higgins et al., 2003). Thus, the variability of sex differences between data sets was negligible and left little to no heterogeneity to be explained with additional analyses. However, for completeness, in the SM we report a series of analyses testing whether age, sample size, type of scenarios employed, significance of the original preference effect, and other potentially relevant factors moderated sex differences, none of which was significant.

Here, as an example, we report analyses with the variable age as a moderator. The effect of sex on infants' preferences was not significantly moderated by infants' age. This is true both when age was inserted as a continuous variable (average age in days for each experiment), $Q_M(1)$ = 2.28, *p* = .131 (see Figure S2a in the online supplemental materials on OSF), and when it was inserted as a binary variable (young vs. old; where young = $M_{Age} \leq$ 12 months, 29 days), $Q_M(1)$ = 2.24, *p* = .135. The estimated average *OR* is 1.202, 95% CI [.836, 1.729] for experiments with younger infants (*n* = 33), and .775, 95% CI [.496, 1.210] for experiments with older infants and toddlers (*n* = 20).

Last, worrying that the accuracy of the meta-analytic estimates can be hampered by the inclusion of small studies, an additional meta-analysis was conducted selecting the 10% of all the reported effects with the largest sample size (this approach is termed Top10 strategy; Stanley et al., 2010; see also Margoni & Shepperd, 2020). The random-effects meta-analysis with the six isolated effect sizes (approximately 10% of *k* = 53; see online supplemental materials on OSF for the list of these effect sizes) estimated an average *OR* of 1.009, 95% CI [.588, 1.728], further indicating no evidence for sex differences on children's preferences.

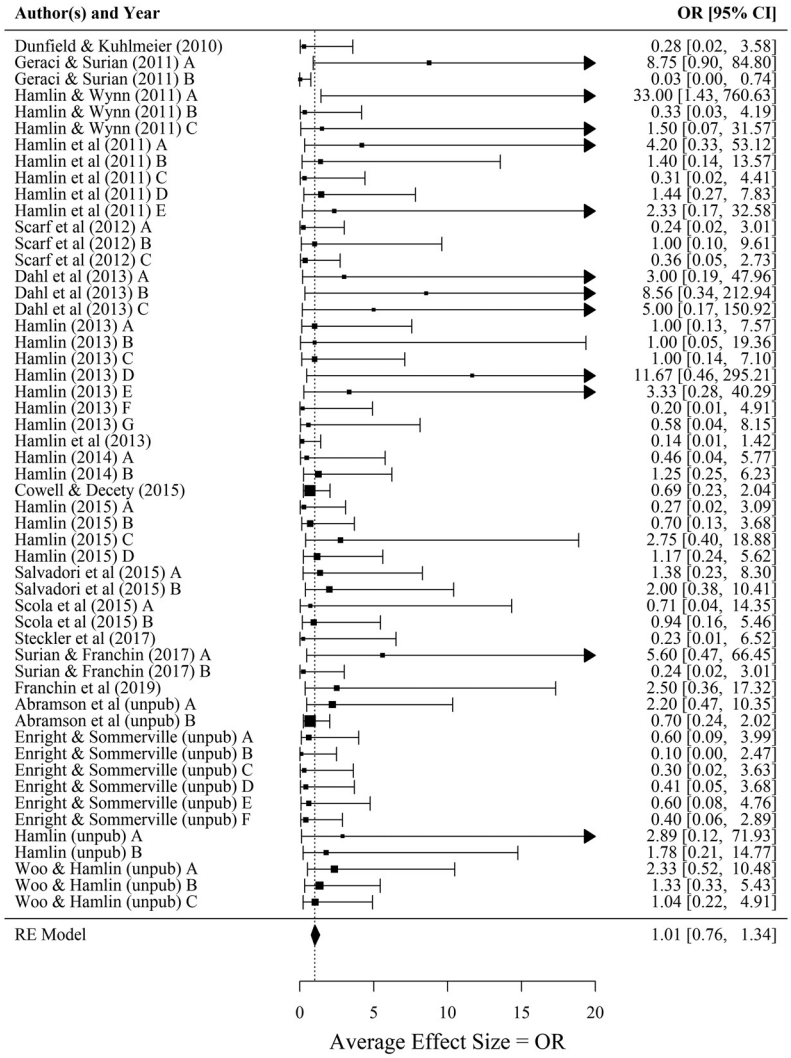
[1] These age ranges were the same as in Margoni and Surian (2018) and were chosen because they allowed us to compare two sets of studies similar in size while still being able to compare children in their first year of life with older children.

[2] To maintain sample homogeneity, Margoni and Surian's (2018) meta-analysis did not include one study that employed preferential looking instead of a manual task (Hamlin et al., 2010).

[3] Please also note that whereas it seems clear that the data favor the null hypothesis, the strength of this conclusion hinges substantially on the prior or null hypothesis specification, as is often the case with Bayesian analyses (Gronau et al., 2021).

Figure 1

Forest Plot Displaying Odds Ratios and 95% Confidence Intervals



Note. Forest plot is for the $k = 53$ studies included in the meta-analysis. Arrows indicate that the upper value of the confidence interval (CI) is greater than 20. An odds ratio (*OR*) >1 indicates that male infants and toddlers were more likely to choose the prosocial agent than female infants and toddlers. The vertical dotted line at 1 represents the reference point indicating no effect of sex on sociomoral preferences. RE = random effects model.

Discussion

Distinguishing and preferring prosocial actions and agents over antisocial actions and agents is one key aspect of sociomoral cognition that contributes to the functioning of human societies (Boyd & Richerson, 2009; Krebs, 2008). In adults, there is a well-documented tendency for women to show greater concern for prosociality across various domains (Atari et al., 2020; Falk & Hermle, 2018; Jaffee & Hyde, 2000; Schwartz & Rubel, 2005) and for girls by age six to express greater value for being kind and helpful (Block et al., 2018). One of the early building blocks of these prosocial values might be infant's tendency to prefer prosocial over antisocial agents (Tan et al., 2018). Whereas infants as young as five months reliably make evaluations leading them to selectively approach prosocial versus antisocial agents (Margoni & Surian, 2018; Van de Vondervoort & Hamlin, 2018), no research to date has adequately tested for sex differences in this phenomenon. Utilizing a large collection of studies in children aged four to 32 months, the current meta-analysis evaluated evidence for sex differences in infants' and toddlers' preference for prosocial agents.

Unlike other studies that have documented early sex differences in a variety of phenomena including toy preferences (Todd et al., 2018) and spatial abilities (Lauer et al., 2019), here we find no evidence for sex differences in infants' and toddlers' preference for prosocial agents. Our findings suggest that both male and female infants and toddlers tend to prefer prosocial over antisocial agents

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and do so to a similar extent. A large collection of studies and the combination of a traditional frequentist meta-analysis with a Bayesian approach increases the confidence in this null finding. Moreover, because we meta-analyzed both published and unpublished studies that were not originally designed to assess sex differences, publication bias was unlikely to affect our estimates (a finding supported by additional analyses reported in online supplemental materials on OSF).

These results contribute to our understanding of one of the potential building blocks of gender differences in prosociality. Whereas infants' and toddlers' preferences for prosocial agents assessed in tasks used by the meta-analyzed studies are not to be equated fully to the complex moral judgements and actions by older children or adults, these preferences may still be an important basis for prosociality, inasmuch as they have been linked to relatively higher sociomoral functioning later in life (Tan et al., 2018). Adding to what we know about the developmental trajectory of sex differences in morality, the current findings suggest that gender differences in valuing prosociality found in older children (Block et al., 2018; Ojanen et al., 2005; Sierksma et al., 2014) and adults (Atari et al., 2020; Falk & Hermle, 2018; Hsu et al., 2021; Jaffee & Hyde, 2000; Schwartz & Rubel, 2005) do not derive from early sex differences in the very basic ability to evaluate prosocial and antisocial behavior, and to prefer the former to the latter.

Our conclusion that there are no sex differences in infants' and toddlers' sociomoral preferences has several notable limitations. First, the meta-analyzed studies measured infants' and toddlers' perception of prosociality in a single, forced-choice trial. In this literature, the strength or stability of the preference, which could be assessed by testing the same individual using multiple test trials or measures, is currently unknown (but see Nighbor et al., 2017; who suggest these preferences might not be stable). Thus, the fact that the meta-analyzed studies relied on such a coarse measure of preference is a limitation of this work, inasmuch as more subtle sex differences in evaluating prosociality might have been obscured. Indeed, whereas our analysis shows that infants and toddlers of both sexes hold a preference of prosocial agents when provided with a single forced choice, we cannot exclude the possibility that the sexes vary in the strength of this preference. A valuable suggestion for future research, then, would be to develop tasks to assess to what degree infants and toddlers value prosociality, which would provide a more fine-grained test of early sex differences in sociomoral evaluation.

Second, and relatedly, the paradigm of the meta-analyzed studies is unable to distinguish between infants' liking of prosocial characters and their dislike of antisocial characters. Introducing a systematic assessment of infants' and toddlers' preferences for prosocial and antisocial versus neutral agents may also help reaching greater clarity on the nature of these early emerging preferences and, as a result, could allow testing new predictions about the development of gender differences. For instance, it is possible that gender differences found later in childhood or adulthood are related to an early emerging preference for prosocial agents (rather than a dispreference for antisocial ones) that is stronger in girls than in boys.

Both these limitations point to a common and general caveat. The primary goal of this study was solely to assess whether a sex difference in one specific, and quite basic, form of moral cognition—preference for prosocial actors—is present in infancy. Our findings cannot rule out the possibility that the sex or gender differences in morality found in older children and adults are related to, originate from, and are perhaps explained by, different or more subtle early-emerging sex differences in other processes that were not measured in the studies meta-analyzed here. Finding a sex difference in the extent to which sociomoral preferences are expressed in infants would have suggested that later emerging sex differences in morality may be traced back to infancy. In contrast, our finding of no evidence for a sex difference in this core preference for prosociality could have a variety of implications. A null effect can suggest that later sex or gender differences in prosociality result from social learning. But it is also consistent with the possibility that later observed differences are governed by other earlier emerging sex differences in moral cognitions or preferences that are simply not captured by the tasks employed in the studies we meta-analyzed. Alternatively, these later differences might be the result of inherent sex differences that are not yet observable during infancy but could be supported by biological influences that emerge only later in development (e.g., hormones). In sum, while we show strong evidence for an absence of early sex differences in one type of moral cognition (i.e., the preference for prosocial over antisocial agents), these results merely scratch the surface of the complex task of explaining where and how later emerging sex differences in morality emerge.

Last, the current work might be considered somewhat outdated, as it only includes experiments on infants' preference for prosocial others conducted prior to November 2016. However, there are two reasons to be wary of this concern: first, our results are based on more than 1,000 children and provide strong evidence for the absence of an effect of sex on infants' and toddlers' preferences. Second, we are aware of no work published after 2016 reporting sex differences in children's preference for prosocial agents. Given this, it seems highly unlikely that adding more recent studies would substantially change our effect size estimate.

To conclude, we have analyzed the results of over 50 experiments to assess whether there is evidence of an early emerging sex difference in the proclivity to choose prosocial over antisocial agents, which, as a fundamental sociomoral judgment, is an important precursor of more complex social functioning. The current work provides meta-analytic evidence for the absence of such a sex difference in infants' and toddlers' preference for prosocial others. This result can be taken into account in evaluating the possible pathways to the gender differences in morality found later in childhood and adulthood.

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