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# Theory of mind, empathy, and prosocial behavior in children and adolescent: a meta-analysis

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## Abstract

Theory of mind (ToM) and empathy are two major influencers of prosocial behavior (PsB). Some scholars hold that children with advanced ToM and high capacity for empathy are more likely to act prosocially, but the empirical findings are mixed. To clarify the relation between ToM/empathy and PsB, we conducted two meta-analysis of cross-sectional and longitudinal studies that met appropriate inclusion criteria. In study 1, a total of 24 studies including 16, 265 participants aged 2 ~ 19 years were identified as eligible for inclusion, and 88 effect sizes for ToM-PsB were yielded. The results showed that there was a significant positive correlation between PsB and ToM ($r = 0.24$, 95%CI [0.18, 0.31]). Age, PsB measurement method and the cultural background had no significant moderating effect on the relationship between ToM and PsB. The ToM measurement method played a borderline significant role in moderating the relationship between ToM and PsB. In study 2, a total of 29 studies including 23, 304 participants aged 2 ~ 19 years were identified as eligible for inclusion, and 89 effect sizes for empathy-PsB were yielded. The results showed that there was a significant positive correlation between PsB and empathy ($r = 0.36$, 95%CI [0.30, 0.41]). Age, the measurement methods of PsB and the cultural background moderated the relationship between empathy and PsB. In conclusion, the studies integrate previous researches on the correlations between ToM/empathy and PsB, explores the causes of inconsistency (i.e., the test of moderating variables), and verifies the important role of social understanding (ToM/empathy) in PsB.

**Keywords** Multilevel meta-analysis · Moderating effect · School-age children · Social understanding · Cultural background

## Introduction

Prosocial behavior (PsB) including sharing, caring, helping, donating, comforting, and cooperating (Guo et al., 2023) is defined as voluntary behavior that is beneficial to others but the actor pays for it (Eisenberg, 2003; Habashi et al., 2016). Children with high prosociality often have good peer relationships. For example, Guroglu et al. (2014) reported that children aged 9–12 years exhibited similar PsBs toward their partners, and teens exhibited more PsBs to their friends as they got older. Besides, some studies have shown that children who regularly participate in social activities are more likely to engage in high-level cooperative play with friends before school (Dunn & Cutting, 1999), form genuine friendships as they move to elementary school (Dunn et al., 2002), and are popular among their peers (Denham et al., 1990). However, children who have few PsBs are more likely to be isolated and even rejected by their peers (Parkhurst & Asher, 1992). Therefore, PsB is an important part of children's social development, and is also important for weaving social fabric (Benish-Weisman et al., 2019).

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## ToM, empathy and PsB in children and adolescents

Social understanding refers to the combination of understanding the psychological state of others (i.e., ToM) and understanding emotions (i.e., empathy) (Cavojova et al., 2011). Numerous studies have shown that ToM and empathy are the two most important factors affecting PsBs (Decety et al., 2016; Imuta et al., 2016).

The concept of ToM was first proposed by Premack and Woodruff (1978) as an ability to attribute mental states to oneself and others. Subsequent researchers have also mostly followed this definition or expanded it. For example, Wellman and Liu (2004) defined ToM as the ability to understand the internal mental states of others, including their beliefs and intentions. Since the 1980s, ToM has become central to the study of human development, particularly the development of social perception and social cognition (Baron-Cohen, 2000). And for many years, the essential indicator that one had developed ToM was understanding the concept of false beliefs (FB; i.e., beliefs contradictory to reality) (Wellman et al., 2001). And the FB task became the classic experimental paradigm for measuring ToM. To successfully pass the FB task, a child has to understand that one's belief is a mental state representing something and can be different from reality (Perner, 1991). Lately, researchers have broadened the concept of ToM, in addition to understanding false beliefs, understanding desires and intentions (Astington, 2001) and affective aspects of the mental state (Baron-Cohen et al., 1997) are also included. Meanwhile, in order to measure the conceptualization of multiple different aspects of ToM, different ToM tasks for assessing understanding of different mental states (e.g., desires, beliefs, knowledge access, hidden emotions, etc.; Wellman & Liu, 2004) were created progressively. Recently, research in ToM has focused on its relationship with language. For example, a longitudinal study found that children's language comprehension is an important predictor of ToM development (e.g., Astington & Jenkins, 1999), children with advanced language abilities often achieve better results on ToM tasks (Jenkins & Astington, 1996; Farrant et al., 2012).

The concept of empathy has been difficult to define, with major cognitive orientation, affective-emotional orientation, and multidimensional orientation aspects. Researchers with an affective-emotional orientation believe that empathy is an emotional-affective response, as Eisenberg and Strayer (1987) emphasize that empathy refers to an individual's ability to understand another person's emotional state and to exhibit emotional experiences and affective responses that are similar to those of others. Cognitively oriented researchers argue that empathy is the cognitively based ability to understand and judge the emotions of others. For example, Ickes (1993) argues that empathy is the ability of an individual to understand and judge the psychological feelings of others; Feshbach (1987) and Hoffman (2001) also believe that empathy is the ability to experience the emotions of others by recognizing their internal emotional states. Multidimensional researchers believe that empathy includes two basic components: cognitive empathy and emotional empathy. For example, Gladstein (1983) believes that cognitive empathy is the main component of empathy, which refers to the ability to recognize others' emotions and understand others' perspectives; while understanding and recognizing the emotions of others, it is also necessary to empathize with others' emotions, i.e., emotional empathy.

In recent years, researchers have gradually formed a consensus that ToM and empathy intricately interact to induce the formation of prosocial predispositions. Specifically, ToM is a necessary cognitive basis of PsB, but it is only a neutral tool to understand the psychological state of others. Whether children's PsB such as sharing and helping can be transformed from a concept level to a practice level also requires the stimulation of empathy (Hétu et al., 2012), which is a booster of PsBs (Klimecki et al., 2016; Guo & Wu, 2020). In summary, we believe that both ToM and empathy are necessary but not sufficient conditions for PsB, and that neither of them can fully explain the emergence of PsB. The relationship between ToM, empathy and PsB can be explained by two models: Social Information Processing Model and A Two-stage Model of Donation Decisions. Social Information Processing Model (Crick, & Dodge, 1994) emphasizes that the first stage of one's PsB is to engage in cue coding, i.e., the individual notices the pained expression of others seeking help (cognitive processes, corresponding to ToM) and empathizes with their pain (affective processes, corresponding to empathy), which is the prerequisite for determining whether a person engages in PsB. Dickert et al. (2011) proposed A Two-stage Model of Donation Decisions, which emphasizes that cognitive decision-making about donations can be divided into two stages: the first stage involves whether an individual donates to others or not, which is mainly affected by the individual's own emotions; the second stage involves the number of donations an individual makes to others, which is affected by the individual's experience of empathy for others. In conclusion, all the above theories emphasize the role of ToM and empathy in the emergence of PsB, which provides a rich theoretical basis for the relationship between ToM, empathy and PsB.

## Study 1 ToM and PsB in children and adolescent: a meta-analysis

Many researchers have explored the role of ToM on PsB in the past two decades, but their views on the correlations between ToM and PsB are mixed. Some studies have found a strong correlation between ToM and PsB in children, that is, children with strong ToM skills are more likely to exhibit prosocial tendencies (Longobardi et al., 2019; Brazzelli et al. 2022; Dwyer & Martin-Chang, 2023). However, some studies have also detected insignificant correlation between ToM/perspective taking and PsB in adolescents (Eisenberg et al., 2001; Van der Graaff et al., 2018; Traverso et al., 2020). For example, Denham (1986) reported that affective perspective taking (APT) was not associated with children's PsB in free play.

Based on the above inconsistency, this study uses a multilevel meta-analysis to explore the possible causes of this inconsistency, aiming to clarify the true relationship between PsB and ToM in children and adolescents. Our primary goal is to examine whether PsB in children and adolescents is significantly correlated to ToM. Previous research meta-analyses have proved the relationship between ToM and social behavior in children and adolescents. For example, Wang et al. (2022b) reported that ToM was negatively correlated with aggressive behavior ($r$ = -0.08), and positively correlated with PsB ($r$ = 0.19) (Imuta et al., 2016) and peer popularity ($r$ = 0.19) (Slaughter et al., 2015). These meta-analyses have also examined the moderators of the relationship between ToM and social behavior, such as gender, age, nationality, ToM and social behavior measurement methods and order, social behavior category, etc. Based on these meta-analyses and related literature, we speculate that the inconsistency may be induced by multiple factors such as age, type, measurement method, and form of PsB, type of ToM, and sociocultural background. These factors may regulate the relationship between ToM and PsB. Therefore, our secondary goal is to test these potential moderators.

### Potential moderator

#### Age

At present, research results of the age effects on the relationship between ToM and PsB are inconsistent, and there are two different views. One view is that the development of ToM and PsB are both closely related to age. Children's ToM abilities increases with years between the ages of 2 and 12 (Peterson et al., 2012), and this change is particularly pronounced in the preschool stage (Wellman et al., 2001). Meanwhile, children's PsB frequency gradually expands and increases over the same period (Dunfield & Kuhlmeier, 2013; Eisenberg & Fabes, 1998). Another view is that children's ToM understanding was positively correlated with their sharing behavior independent of their age (Wu & Su, 2014). Based on the above views, it is unclear whether and what role age plays in the relationships between ToM and PsB. Therefore, this study examines the moderating effect of participant age. We hypothesize that participant age may play a moderating role in the relationships between ToM and PsB.

#### ToM and PsB measurement method

As the present meta-analysis referenced what was done in Imuta et al.'s (2016) study by including perspective taking (PT) in the ToM, the ToM measures in this study were mainly self-assessment questionnaires (e.g., IRI-PT, Carlo et al., 2010) and experimental tasks (e.g., first-order and second-order FB tasks, Bartsch & Wellman, 1989; Sullivan et al. 1994; the Eyes Task involving both emotional and cognitive states, Baron-Cohen et al. 2001). Whereas self-appraisal modalities tend to be more susceptible to social approbability and self-subjectivity than laboratory appraisals, different appraisal modalities of ToM may potentially modulate the relationship between ToM and PsB, and we hypothesize that the ToM for self-appraisal is more strongly related to PsB. The PsB is generally measured by self-rating scale (Carlo et al., 2003; Batson et al., 2007; Carlo et al., 2010), parental-rating scale (Eggum et al., 2011; Wang et al., 2022a), teacher-rating scale (Brazzelli et al., 2022; Lyu & Sun, 2022), and peer nomination (Arefi, 2010; Berger et al. 2015). Children's self-rated prosociality is closely related to their understanding of prosociality (El Mallah, 2019), and may be influenced by their expectations of social desirability (Chambers & Johnston, 2002). However, researchers often draw on children's parents, teachers, and peers (people who know the child well) to provide ratings of children's PsBs (Whitcomb, 2017). The manners these behavioral ratings are provided may be subject to halo effects (El Mallah, 2019), central tendency effects (Leckie & Baird, 2011), and recurrent/unusual incidents of PsB (El Mallah, 2019) that bias the results. Among these manners, teacher rating proves to be valid and objective, especially when dealing with young children (El Mallah, 2019); Whereas parental rating has lower internal consistency and test-retest reliability (Ladd & Profilet, 1996; Stone et al., 2010). Given these differences, the relationships between ToM and PsB measured by different manners may differ.

### Cultural background

Culture affects an individual' values, morality, and moral behavior. Therefore, there may be cultural differences in ToM and moral behavior. Studies have found that culture plays an important role in an individual's emotional cognition (Moriguchi et al., 2005; Adams et al., 2010), and people in eastern cultures have a stronger perspective taking capacity. Since countries with a collectivist culture (characteristics of eastern culture) hold Confucianism in high regard, individuals in this context will have a lower frequency of aggressive behavior (Bergeron & Schneider, 2005). Therefore, we speculate that when individuals become more capable of perspective-taking, they are better able to understand and adjust to the emotions of others and are more likely to exhibit behaviors that are kind to others. In summary, we speculate that cultural background may moderate the relationship between ToM and PsB.

## Methods

### Literature search

Literature was searched from four databases (ProQuest Dissertations and Theses Global (ProQuest), Web of Science (Thomson Reuters), Psych INFO (American Psychological Association) and Google Scholar in January 2023. The key words were any combination of PsB (prosocial behavior, altruism, altruistic behavior, caring, comforting, co-operating, donating, helping, sharing, supporting, altruistic behavior), ToM (social understanding, perspective taking, theory of mind, mind reading, mentalizing, false belief, mental representation*, mind understanding, mental state*, emotions understanding). To mitigate potential publication bias, we also searched gray literature using ResearchGate. Finally, backward searches were performed to further collect relevant literature.

The valid literature were selected based on the following inclusion criteria:

1. Literature investigating the relationship between children's PsB and ToM;
2. Literature involving children and adolescents between the ages of 2 and 19 (The World Health Organization Standard; Plummer et al., 2023) (when only "undergraguate/college students" was reported, we assigned an age of 20, and exclude this literature);
3. Literature reporting sample size and statistics (e.g., correlation coefficient, $\beta$ in linear regression);
4. Participants have no physical and mental disorders (such as autistic spectrum disorder);
5. Literature published in English or Chinese.

A total of 3045 literature (publication time: January 1995 ~ January 2023) were retrieved, and finally 24 literature showing 88 effect sizes for PsB-ToM were included in the meta-analysis. Figure 1 shows the flow of literature selection (The PRISMA 2020 statement, Page et al., 2021). Each literature was independently reviewed by two researchers, and disagreements were resolved via discussion with other researchers.

### Coding procedures

The selected literature and the reported effect sizes are listed in Table S1.

The following variables in the literature were coded: (a) Author; (b) Year of publication; (c) Type of effect size; (d) Correlation coefficients between ToM and PsB; (e) Sample size; (f) Gender (male ratio); (g) Age range; (h) Average age; (i); (j) Type of ToM; (k) Type of PsB; (l) PsB measurement methods; (m) Cultural background. Average age was coded into three groups: Preschool children (6 years old and below), School-age children (6 ~ 12 years old), and Adolescent (12 ~ 19 years old). Type of ToM was also coded into two categories: ToM composite and perspective taking (PT). PsB measurement methods was coded into four categories: self rating, parental rating, teacher rating, and others (including peer rating, observational and multi-measurement). Cultural background was coded into two categories (Anderson et al., 2010): Western and Eastern (China, Japan, Singapore).

### Effect size calculation

To utilize all available data, we calculated effect sizes for each variable dimension, with effect sizes for the same paper coded by paper ID, but with separate effect size IDs. That is, a single study may produce multiple effect sizes, but interdependencies between effect sizes within papers were considered using a three-level random effects model (Cheung, 2014; Assink & Wibbelink, 2016). Literature and effect sizes were coded separately. Effect sizes were measured using the correlation coefficient ($r$).

For all effect sizes of ToM-PsB, 88 of them were reported as correlation coefficients, including 84 Pearson correlation coefficients, 3 partial correlation coefficients, and 1 linear regression coefficient ($\beta$). All effect sizes other than correlation coefficients were transformed to $r$ using the esc (Lüdecke, 2019) packages in R software (version 4.3.0; R Core Team, 2023).

### Meta-analytic procedures

After transforming coefficients into Fisher's z values, we conducted all analyses using the metafor (Viechtbauer, 2010) packages in R. Firstly, a three-level meta-analysis

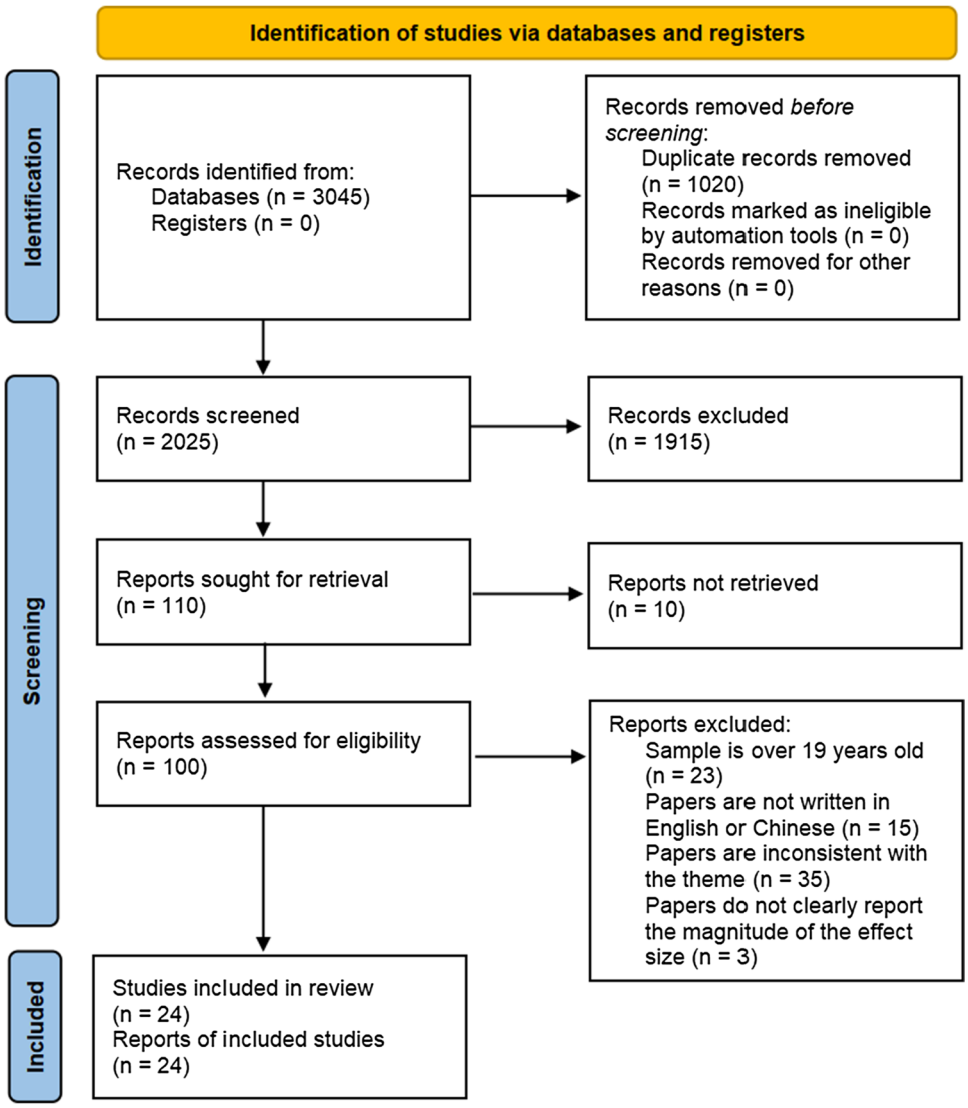


**Fig. 1** Flow of literature selection

was conducted (Assink & Wibbelink, 2016) to estimate the average effect size of TOM and PsB and assess the impact of potential moderators. Traditional meta-analysis cannot overcome the situation that multiple independent effect sizes are in a study. Even if the multiple effects are averaged, it will lead to information loss and inaccurate estimation (van den Noortgate & Onghena, 2003). However, all the effect sizes of a study can be included with the three-level meta-analysis by dividing the sources of variance into: (a) sampling variance, (b) within-study variance, and (c) between-study variance.

In addition, we assessed publication bias by two methods. Firstly, we plotted funnel plots of the relationship between effect sizes and standard errors, and tested the symmetry of the funnel plots on multi-level models (three-level) using the Egger method (Egger et al., 1997; Sterne & Egger, 2001). If the funnel plots are asymmetric, it indicates that there is a publication bias. Secondly, we analyzed the multi-level model using trim-and-fill to estimate the missing studies that would make the funnel plots symmetric (Duval & Tweedie, 2000). If $R_0^+ > 3$, $L_0^+ > 2$, there is a publication bias (Fernández-Castilla et al., 2021).

## Results

### Overall effect size

The three-level meta-analysis model results showed that the overall correlation between ToM and PsB was significant ($r = 0.24$, $p < 0.001$, 95%CI [0.18,0.31]) based on all included studies (Fig. 2).

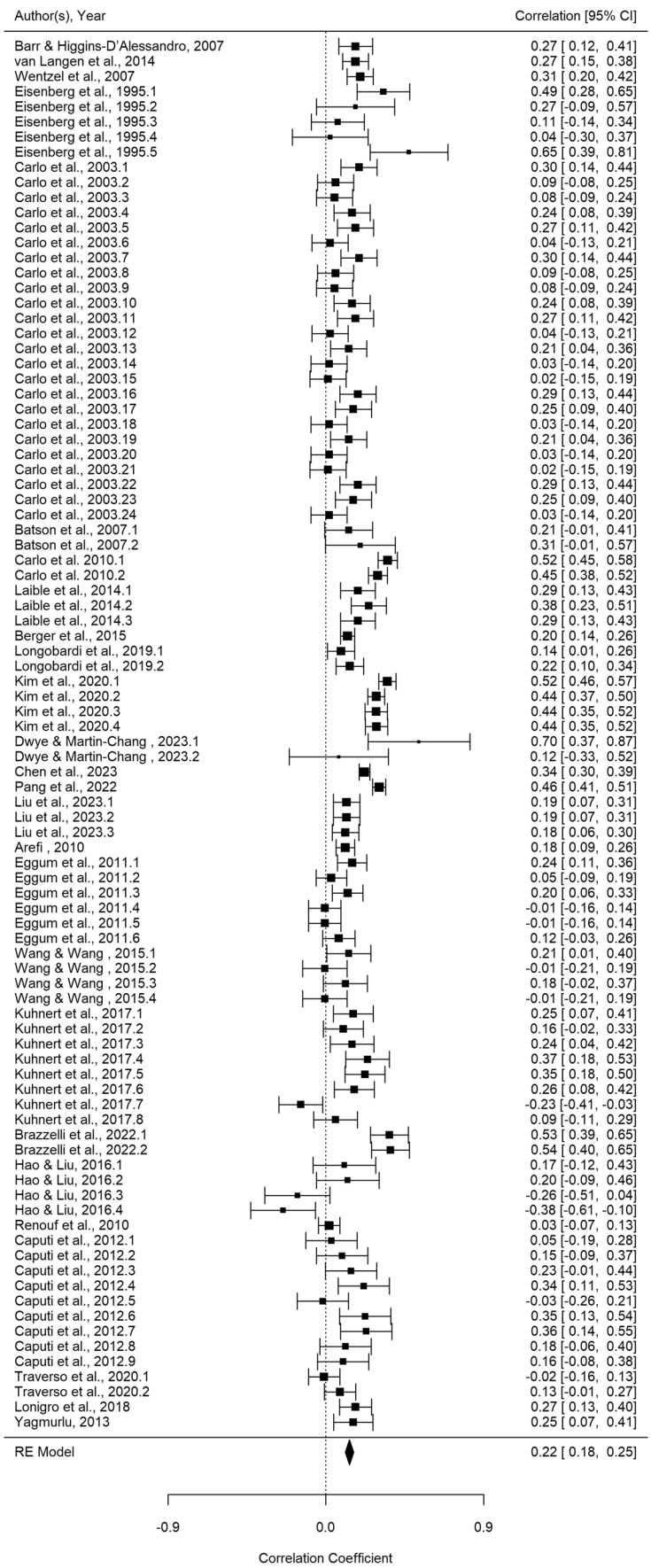


**Fig. 2** Forest plot based on a random-effect model displaying effect sizes with 95% confidence intervals for the relation between ToM and PsB

## Heterogeneity analysis

To determine whether the within-study variance (Level 2) and between-study variance (Level 3) were significant, we performed two separate log-likelihood-ratio tests comparing the results of the three-level model fittings (including both within-study and between-study variances) to the results of the two two-level model fittings (one included only within-study variance, and the other included only between-study variance). The results showed that within-study variances ($\sigma^2 = 29.23$, $\chi^2(1) = 12.97$, $p < 0.001$) and between-study variances ($\sigma^2 = 23.23$, $\chi^2(1) = 24.98$, $p < 0.001$) were significant. The between-study variances accounted for 62.33% of the total variance (Level 3), the within-study variances accounted for 20.20% (Level 2), and the sampling variances accounted for 17.47% (Level 1).

## Analysis of moderators

Since the between-study variance (Level 3) was significant in both models (Table 1), we investigated whether the potential moderators (age, PsB measurement method, ToM measurement method, and cultural background) could account for the heterogeneity in the effect sizes for ToM-PsB (Table 2).

Age had no significant moderating effect on the relationship between ToM and PsB ($F(2, 85) = 1.05$, $p = 0.353$). PsB was positively correlated with ToM both in preschool children aged 6 years and below ($r = 0.19$, $p < 0.001$, 95% CI [0.09, 0.30]), children aged 7 ~ 12 years ($r = 0.27$, $p < 0.001$, 95% CI [0.17, 0.38]), and adolescents aged 12 ~ 19 years ($r = 0.26$, $p < 0.001$, 95% CI [0.17, 0.36]). PsB measurement method also had no significant moderating effect on the relationship between ToM and PsB ($F(3, 84) = 1.21$, $p = 0.312$). PsB was significantly correlated with ToM when PsB was measured via self-rating ($r = 0.28$, $p < 0.001$, 95% CI [0.19, 0.36]), mixed-rating ($r = 0.30$, $p < 0.001$, 95% CI [0.16, 0.44]), and teacher-rating ($r = 0.17$, $p = 0.027$, 95% CI [0.03, 0.32]) questionnaires. The correlation between ToM and PsB was not significant when PsB was measured by parental rating questionnaire ($r = 0.12$, $p = 0.173$, 95% CI [-0.05, 0.29]). ToM measurement method had a marginal significant

**Table 1** Overall effect sizes of ToM and PsB

| Model | k | #es | N | t | Mean r | 95%CI | %Var.at level1 | %Var.at level2 | %Var.at level3 |
|---|---|---|---|---|---|---|---|---|---|
| Random effect model | 24 | 88 | 16, 265 | 7.35*** | 0.24 | [0.18, 0.31] | 17.47 | 20.20 | 62.33 |

*k*, number of studies; # es, number of effect sizes; *t*, *t* test value for the difference between mean effect size and 0; Mean r, transformed effect size (r); CI, confidence interval; % Var, percentage of variance that is distributed at one of the three levels of the meta-analytic model; Level 1, sample variance; Level 2, variance between effect sizes from the same study; Level 3, variance between studies. *, $p < 0.05$; **, $p < 0.01$; ***, $p < 0.001$. The same below

**Table 2** Results for the analysis of moderators of correlations between children and adolescent's ToM and PsB

| Moderator variables | k | #es | $\beta_0$ | 95%CIs | $t_0$ | $\beta_1$ | 95%CIs | $t_1$ | $F(df_1, df_2)$ |
|---|---|---|---|---|---|---|---|---|---|
| Age | | | | | | | | | $F(2,85) = 1.05$ |
| Preschool children | 8 | 25 | 0.19 | [0.09, 0.30] | 3.67*** | | | | |
| Children | 9 | 19 | 0.27 | [0.17, 0.38] | 5.20*** | 0.08 | [-0.03, 0.19] | 1.39 | |
| Adolescent | 12 | 48 | 0.26 | [0.19, 0.37] | 5.42*** | 0.07 | [-0.07, 0.21] | 0.98 | |
| Measurement of ToM | | | | | | | | | $F(1,86) = 3.13^+$ |
| ToMself | 18 | 61 | 0.28 | [0.21, 0.35] | 7.75*** | | | | |
| ToMlab | 12 | 31 | 0.20 | [0.12, 0.28] | 4.86*** | -0.08 | [-0.17, 0.01] | -1.77+ | |
| Measurement of PsB | | | | | | | | | $F(3,84) = 1.21$ |
| PSBself | 17 | 59 | 0.28 | [0.19, 0.36] | 6.59*** | | | | |
| PSBparent | 4 | 9 | 0.12 | [-0.05, 0.29] | 1.37 | -0.16 | [-0.35, 0.03] | -1.68+ | |
| PSBteacher | 5 | 10 | 0.17 | [0.03, 0.32] | 2.36* | -0.11 | [-0.27, 0.06] | -1.30 | |
| Mix | 4 | 12 | 0.30 | [0.16, 0.44] | 4.20*** | 0.02 | [-0.13, 0.16] | 0.25 | |
| Cultural background | | | | | | | | | $F(1,86) = 0.03$ |
| West | 21 | 79 | 0.25 | [0.17, 0.33] | 6.49*** | | | | |
| East | 5 | 13 | 0.25 | [0.15, 0.35] | 5.08*** | -0.03 | [-0.19, 0.14] | -0.34 | |

For the moderator variables in the table, the first item is the reference category. *k*, the number of studies; **# es**, the number of effect sizes; $F(df_1, df_2)$, the result of the omnibus test; $\beta_0$, the mean effect size of correlation coefficients; $t_0$, t test value for the difference between mean effect size and 0. $\beta_1$, estimated regression coefficient; $t_1$, t test value for the difference between mean effect size and reference category. +, $p < 0.10$; *, $p < 0.05$; **, $p < 0.01$; ***, $p < 0.001$. The same below

moderating effect on the relationship between ToM and PsB ($F$ (1, 86) = 3.13, $p$ = 0.080). PsB was significantly correlated with ToM when ToM was measured via self-rating ($r$ = 0.28, $p$ < 0.001, 95% CI [0.21, 0.35]), laboratory-rating ($r$ = 0.20, $p$ < 0.001, 95% CI [0.12, 0.28]). Cultural background did not have a significant moderating effect on the relationship between PsB and ToM ($F$ (1, 86) = 0.11, $p$ = 0.737). PsB was positively correlated with ToM both in western culture ($r$ = 0.25, $p$ < 0.001, 95% CI [0.17, 0.33]), and eastern culture ($r$ = 0.22, $p$ = 0.003, 95% CI [0.08, 0.37]).

### Publication bias

For ToM-PsB, the shape is almost symmetrical in the funnel diagram. Egger's test for multilevel models produced a non-significant result ($\beta_1$ = -0.95, $z$ = -1.19, $p$ = 0.235). This indicates that there is no publication bias in this meta-analysis. The trim-and-fill analysis results also supported this conclusion ($R_0^+ = 0 < 3$ and $L_0^+ = 0 < 2$).

## Discussion

### Moderators of the relationship between ToM and PsB

Age didn't play a significant moderating role in the relationship between ToM and PsB. The relationship between ToM and PsB was stronger in school-age children (6 ~ 12 years old) than in preschoolers (6 years old and below). This is consistent with the conclusion of Imuta et al. (2016) and Carlo et al. (2010) in general. In one hand, children's ToM abilities increase in the age range of 2 ~ 12 (Peterson et al., 2012), ToM equips children to engage in prosocial conduct (Hoffman, 2000), and PsB increases over both the preschool and school years (Eisenberg & Fabes, 1998). In the other hand, this may be due to that PsBs are behaviors that conform to social expectations, and young children implement PsBs simply out of social norms (Paulus, 2014) or the desire to interact with others (Paulus & Moore, 2012), without really considering the needs of others. It was found that the relationship between ToM and PsB in adolescence was approximately equal to that in school-age children. This is consistent with that ToM skills were associated positively with early adolescents' PsBs (Caravita et al., 2009). One possibility is that as school-age children age, their PsB becomes more selective and responsive to the needs of others (Hay & Cook, 2007), but at the same time PsB emerges is also susceptible to situational factors (e.g., openness or anonymity) and emotional aspects (e.g., empathic ability), and the influence of ToM on pro-social behavior becomes limited.

The ToM measurement method play a borderline significant moderating role on the relationship between ToM and PsB, with self-rated ToM having a stronger correlation with PsB compared to ToM scores measured in the laboratory condition, which is in line with our hypothesis and the expectation that the self-rated method would be more influenced by social approbability. PsB measurement method had no significant moderating effect on the relationship between ToM and PsB. The PsB measured by self rating, teacher rating, and mixed rating was significantly positively correlated with ToM and empathy, and the correlation strength based on self rating was close to that of mixed rating, but stronger than that of teacher and parental ratings. This may be due to that self-rated prosocial tendencies are more in line with social expectations than true tendencies. PsB rated by parents was not significantly correlated with ToM. This may be due to that parental rating has been considered to have low internal and external reliability (Ladd & Profilet, 1996). It can not truly reflect the level of PsB of children but weakens the correlation between PsB and ToM.

Cultural background did not have a significant moderating effect. This is consistent with previous meta-analyses (Lee & Imuta, 2021; Sai et al., 2021; Wang et al., 2022b). However, our finding contradicts previous findings that children in Western cultures showed more PsB than children in Eastern cultures (Trommsdorff et al., 2007), and their ToM develops earlier than children living in Eastern cultures (Liu et al., 2008). One possible explanation is that in both collectivist and individualist cultures, ToM can either be an individual's understanding of others' social reasoning and social emotions in a certain situation (Artinger et al., 2014), or it can be an individual's more stable ability to exist; and regardless of the cultural background, PsB is rooted in human nature, and it is also a socially approved behavior. Thus, Recognition of others' needs, desires, feelings, and intentions would facilitate individual's engagement in prosocial acts (Dunfield, 2014), which is a common phenomenon in both Eastern and Western cultures.

## Study 2 Empathy and PsB in children and adolescent: a meta-analysis

Many researchers have explored the role of empathy on PsB in the past two decades, but their views on the correlations between empathy and PsB are mixed. Many studies on the relationship between empathy and PsB have shown that empathy indicates PsB in children and adolescents, and individuals with high levels of empathy exhibit more PsB (Laible et al., 2014; Liu et al., 2023; Chen et al., 2023). However, some studies have also shown that there is no significant correlation between empathy and PsB (Underwood & Moore, 1982; Bekkers, 2006; Einolf, 2008), and neither

cognitive or emotional empathy was significantly correlated with helpful behavior (Oswald, 2003). Although the relationship between the two components of children's PsB and empathy can be reasonably explained theoretically by empathy-altruism hypothesis (Burks et al., 2012), the empirical evidence is still insufficient.

Based on the above inconsistency, this study uses a multilevel meta-analysis to explore the possible causes of this inconsistency, aiming to clarify the true relationship between PsB and empathy in children and adolescents. Our primary goal is to examine whether PsB in children and adolescents is significantly correlated to empathy. Many meta-analyses have proved the relationship between empathy and social behavior in children. For example, Miller and Eisenberg (1988) reported that empathy was significantly negatively correlated with antisocial behavior ($r$ = -0.26). Ding and Zhaohui (2016) reported that empathy was positively correlated with PsB ($r$ = 0.38). Besides, Jolliffe and Farrington (2004) and Langen et al. (2014) reported that both low-level cognitive empathy and affective empathy were significantly negatively correlated with offensive behavior. These meta-analyses have also examined the moderators of the relationship between empathy and social behavior, i.e. study and participant characteristics, age and sex of the participants, and form of social behavior measurement, and subtype of social behavior (Miller & Eisenberg, 1988; Jolliffe & Farrington, 2004; Langen et al., 2014; Ding & Zhaohui, 2016). Based on these studies and related literature, we speculate that the inconsistency may be induced by multiple factors such as age, type, measurement method, and form of PsB, type of empathy, and sociocultural background. These factors may regulate the relationship between empathy and PsB. Therefore, our secondary goal is to test these potential moderators.

## Potential moderator

### Age

The age effects on the relationship between empathy and PsB are inconsistent, and there are three major views. The first is that PsB increases in children and adolescents with age (Matsumoto et al., 2016; Erika et al., 2021), and empathy also improves (Richter & Kunzmann, 2011; Sze et al., 2012). Conversely, the second is that PsB and empathy decrease with age (Carlo et al., 2007; Bailey et al., 2008; Nantel-Vivier et al., 2009). The third is that PsB has no age effect (Afolabi, & Olukayode, 2013) and empathy is stable (Bailey & Henry, 2010; Kelly et al., 2022). Based on the above views, it is unclear whether and what role age plays in the relationships between empathy and PsB. Therefore, this study examines the moderating effect of participant age. We hypothesize that participant age may play a moderating role in the relationships between empathy and PsB.

### PsB measurement methods

The elaboration related to PsB measurement methods is consistent with Study 1. Given these differences, the relationships between empathy and PsB measured by different manners may differ.

### Cultural background

There are differences in the empathy ability of individuals in different cultures (Han & Northoff, 2008; Sinclair et al., 2020). Chinese in eastern cultures are more empathetic than Americans in western cultures (Chentsova-Dutton & Tsai, 2010). Besides, cultural differences have also been found in PsB. For example, Trommsdorff et al. (2007) reported that children in Eastern culture exhibited less PsB than those in Western culture. Therefore, we speculate that cultural background may moderate the relationship between empathy and PsB.

# Methods

## Literature search

Literature was searched from four databases (ProQuest Dissertations and Theses Global (ProQuest), Web of Science (Thomson Reuters), Psych INFO (American Psychological Association) and Google Scholar in January 2023. The key words were any combination of PsB (prosocial behavior, altruism, altruistic behavior, caring, comforting, co-operating, donating, helping, sharing, supporting, altruistic behavior), and empathy (empathy, empathic concern, sympathy). To mitigate potential publication bias, we also searched gray literature using ResearchGate. Finally, backward searches were performed to further collect relevant literature.

The valid literature were selected based on the following inclusion criteria:

1. Literature investigating the relationship between children's PsB and empathy;
2. Literature involving children and adolescents between the ages of 2 and 19 (when only "undergraguate/college students" was reported, we assigned an age of 20, and exclude this literature);
3. Literature reporting sample size and statistics (e.g., correlation coefficient, $\beta$ in linear regression);
4. Participants have no physical and mental disorders (such as autistic spectrum disorder);
5. Literature published in English or Chinese.

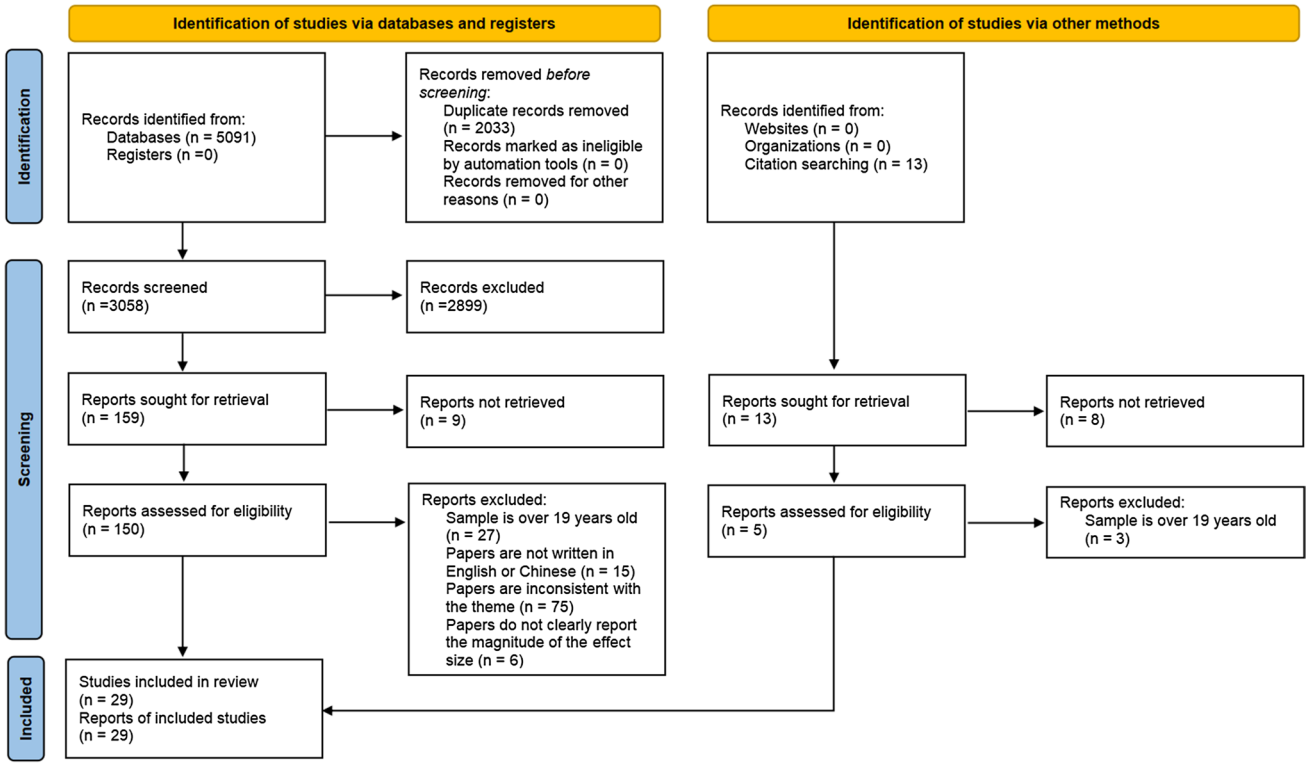


**Fig. 3** Flow of literature selection

A total of 5091 literature (publication time: January 1995 ~ January 2023) were retrieved, and finally 29 literature showing 89 effect sizes for PsB-empathy were included in the meta-analysis. Figure 3 shows the flow of literature selection. Each literature was independently reviewed by two researchers, and disagreements were resolved via discussion with other researchers.

## Coding procedures

The selected literature and the reported effect sizes are listed in Table S2.

The following variables in the literature were coded: (a) Author; (b) Year of publication; (c) Type of effect size; (d) Correlation coefficients between empathy and PsB; (e) Sample size; (f) Gender (male ratio); (g) Age range; (h) Age; (i) Study design; (j) Type of empathy; (k) Type of PsB; (l) PsB measurement methods; (m) Cultural background. Age was coded into three groups: Preschool children (6 years old and below), School-age children (6 ~ 12 years old), and Adolescent (10 ~ 19 years old). Study design was coded into two categories: cross-sectional study and follow-up study. PsB measurement methods was coded into four categories: self rating, parental rating, teacher rating, and others (including peer rating, observational and multi-measurement). Cultural background was coded into two categories: Western and Eastern cultural.

## Effect size calculation

For all effect sizes of empathy-PsB, 89 of them were reported as correlation coefficients, including 85 Pearson correlation coefficients, 3 partial correlation coefficients, and 1 $\beta$. All effect sizes other than correlation coefficients were transformed to $r$ using the esc (Lüdecke, 2019) packages in R software (version 4.3.0; R Core Team, 2023).

## Meta-analytic procedures

After transforming coefficients into Fisher's z values, we conducted all analyses using the metafor (Viechtbauer, 2010) packages in R. Firstly, a three-level meta-analysis was conducted (Assink & Wibbelink, 2016) to estimate the average effect size of empathy and PsB and assess the impact of potential moderators.

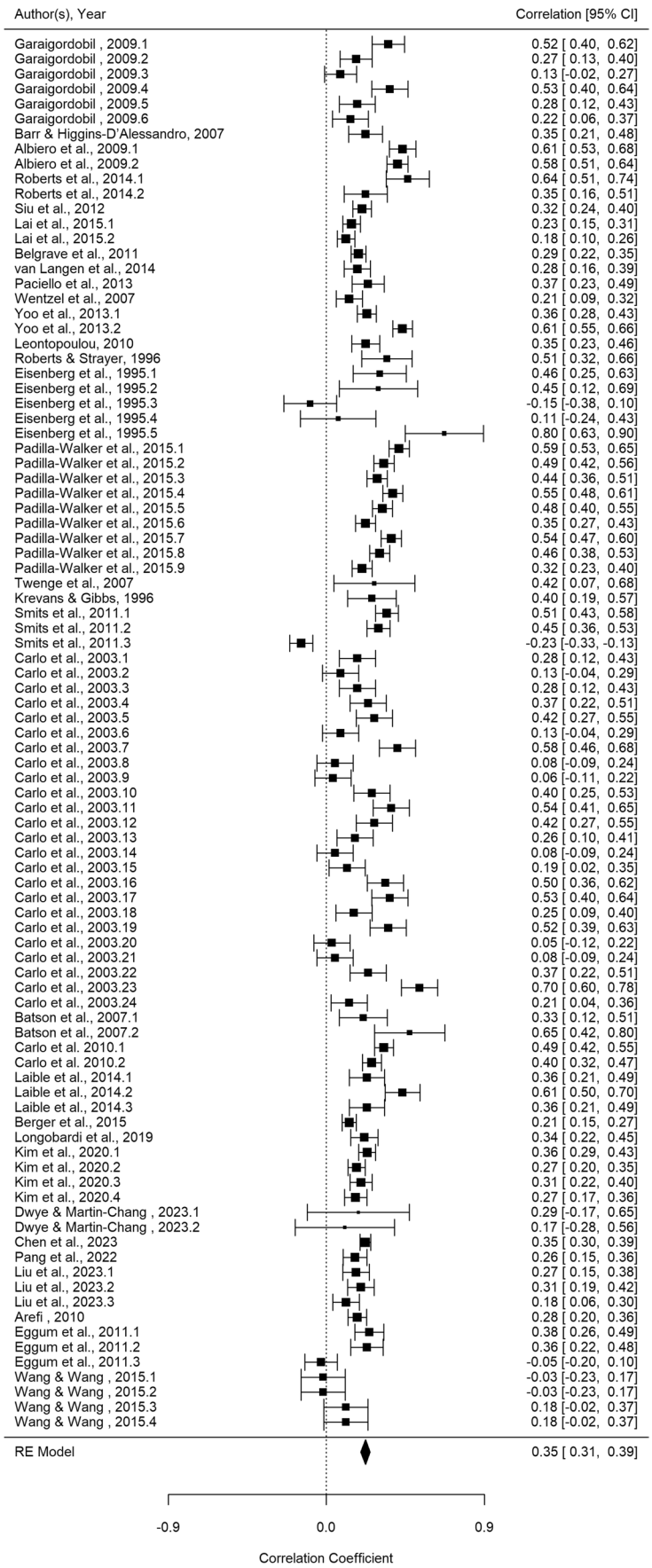


**Fig. 4** Forest plot based on a random-effect model displaying effect sizes with 95% confidence intervals for the relation between Empathy and PsB

## Results

### Overall effect size

The overall correlation between empathy and PsB was significant ($r = 0.36$, $p < 0.001$, 95%CI [0.30, 0.41]) (Fig. 4).

### Heterogeneity analysis

With regard to the relation between empathy and PsB, the log-likelihood-ratio test results showed that the between-study variances accounted for 14.36% of the total effect size variance (Level 3), whereas the within-study variances accounted for 76.22% of the total effect size variance (Level 2). Sampling variances (Level 1) accounted for only 9.42% of the total variance. There was significant heterogeneity for within-study (Level 2) ($\sigma^2 = 125.17$, $\chi^2(1) = 277.59$, $p < 0.001$) but not for between-study (Level 3) ($\sigma^2 = 12.49$, $\chi^2(1) = 2.28$, $p = 0.131$) variances.

### Analysis of moderators

Since the within-study variance (Level 2) was significant in both models (Table 3), we investigated whether the potential moderators (age, type of PsB, PsB measurement method, type of empathy, and cultural background) could account for the heterogeneity in the effect sizes for empathy-PsB (Table 4).

Age significantly moderated the correlation between PsB and empathy marginally ($F$ (2, 86) = 3.02, $p = 0.054$). PsB was positively correlated with the empathy of children aged 7 ~ 12 years ($r = 0.38$, $p < 0.001$, 95% CI [0.27, 0.50]) and adolescents ($r = 0.37$, $p < 0.001$, 95% CI [0.32, 0.43]), but there was no correlation was detected in preschool children ($r = 0.16$, $p = 0.074$, 95% CI [−0.02, 0.33]). The moderating effect of PsB measurement method on the correlation between empathy and PsB was significant ($F$ (3, 85) = 5.28, $p = 0.002$). PsB was significantly correlated with empathy when PsB was measured via self-rating ($r = 0.40$, $p < 0.001$, 95% CI [0.34, 0.45]), parental rating ($r = 0.27$, $p = 0.003$, 95% CI [0.10, 0.44]), and mixed-rating ($r = 0.39$, $p < 0.001$, 95% CI [0.19, 0.58]) questionnaires. The correlation between empathy and PsB was not significant when PsB was measured by teacher rating questionnaire ($r = 0.07$, $p = 0.395$, 95% CI [−0.09, 0.23]). However, cultural background significantly moderated the correlation between PsB and empathy ($F$ (1, 87) = 5.53, $p = 0.021$). PsB was positively correlated with the empathy of children and adolescents in Western cultures ($r = 0.39$, $p < 0.001$, 95% CI [0.33, 0.44]) and Eastern cultures ($r = 0.24$, $p < 0.001$, 95% CI [0.13, 0.35]).

### Publication bias

For empathy-PsB, the shape is also almost symmetrical in the funnel diagram. Egger's test for multilevel models produced a non-significant result ($\beta_1$ = -0.60, $z$ = -0.80, $p = 0.422$). This indicates that there is no publication bias

**Table 3** Overall effect sizes of empathy and PsB

| Model | k | #es | N | t | Mean r | 95%CI | %Var.at level1 | %Var.at level2 | %Var.at level3 |
|---|---|---|---|---|---|---|---|---|---|
| Random effect model | 29 | 89 | 23, 304 | 12.64*** | 0.36 | [0.30, 0.41] | 9.42 | 76.22 | 14.36 |

**Table 4** Results for the analysis of moderators of correlations between children and adolescent's Empathy and PsB

| Moderator variables | k | #es | $\beta_0$ | 95%CIs | $t_0$ | $\beta_1$ | 95%CIs | $t_1$ | F(df1,df2) |
|---|---|---|---|---|---|---|---|---|---|
| Age | | | | | | | | | $F(2,86) = 3.02^{+}$ |
| Preschool children | 2 | 7 | 0.16 | [-0.02, 0.33] | 1.81 | | | | |
| Children | 10 | 15 | 0.38 | [0.27, 0.50] | 6.57*** | 0.23 | [0.02, 0.43] | 2.18* | |
| Adolescent | 22 | 70 | 0.37 | [0.32, 0.43] | 13.60*** | 0.22 | [0.04, 0.40] | 2.42* | |
| Measurement of PsB | | | | | | | | | $F(3,89) = 5.28^{**}$ |
| PSBself | 29 | 75 | 0.40 | [0.34, 0.45] | 13.83*** | | | | |
| PSBparent | 3 | 6 | 0.27 | [0.10, 0.44] | 3.09** | -0.13 | [-0.31, 0.06] | -1.37 | |
| PSBteacher | 3 | 8 | 0.07 | [-0.09, 0.23] | 0.86 | -0.33 | [-0.49, -0.16] | -3.89*** | |
| Mix | 3 | 4 | 0.39 | [0.19, 0.58] | 3.87*** | -0.01 | [-0.22, 0.20] | -0.10 | |
| Cultural background | | | | | | | | | $F(1,87) = 5.53^{**}$ |
| West | 25 | 77 | 0.39 | [0.33, 0.44] | 13.49*** | | | | |
| East | 7 | 16 | 0.24 | [0.13, 0.35] | 4.32*** | -0.15 | [-0.27, -0.02] | -2.35* | |

in this meta-analysis. The trim-and-fill analysis result also supported this conclusion ($R_0^+ = 0 < 3$ and $L_0^+ = 0 < 2$).

## Discussion

### Moderators of the relationship between empathy and PsB

Age played a marginal significant moderating role in the relationship between empathy and PsB. It should be noted that in this study, the relationship between empathy and PsB in preschool children was not significant. This may be due to the limitation in the number of literature (only seven effect sizes (three studies) were included). Eisenberg et al. (2005) found that emotional empathy was present in early infancy and remained stable over time. This study also found that empathy was significantly positively correlated with the PsB of school-age children and adolescents, and the strength of the correlation remained unchanged. These findings support the third view that age has no effect on the relationship between empathy and PsB (Escrivá et al., 2004; Afolabi, & Olukayode, 2013; Bailey & Henry, 2010).

It was found that teacher-rated PsB was not significantly correlated with empathy. This may be due to that teacher rating is influenced by the frequency of children's PsBs (incidental vs. frequent) they observe (Worthen et al., 1993). On the other hand, factors such as the halo effect of children who are prominent in some aspects (EI Mallah, 2019) and the central tendency effect caused by teachers out of affection for certain children (Finley et al., 1977) can also cause the PsB score to deviate from the real level, distorting the correlation between PsB and empathy.

It was found that cultural background played a significant moderating role in the relationship between empathy and PsB. This is consistent with the findings of Trommsdorff et al. (2007). However, the study also found that the relationship between empathy and PsB for children in Western cultures was stronger than that in Eastern cultures. This is inconsistent with previous research results. For example, Wu and Keysar (2007) and Chentsova-Dutton and Tsai (2010) reported that participants in Eastern cultures had higher capacity for empathy than those in Western cultures. The reason for this inconsistency may be that help seekers in Western cultures seek help more directly than Eastern help seekers, and this direct help-seeking manner evokes the helper's sense of social responsibility and obligation, reducing suffering (guilt in not helping others) and inhibition of PsB (Trommsdorff et al., 2007). Future research could further investigate the impact of specific contexts (whether or not direct help) across cultures affects PsB.

## General discussion

This study comprehensively analyzes the existing researches on the relationship between social understanding and PsB using meta-analysis, and also comprehensively explores the relationships between ToM/empathy and PsB using the three-level meta-analysis method. This meta-analysis reveals significant moderate correlations between ToM and PsB ($r = 0.22$) as well as empathy and PsB ($r = 0.36$). These findings verify the role of social understanding in promoting PsB in children and adolescents. We also found that age, PsB measurement method, and cultural background play significant moderating roles in the relationship between empathy and PsB. In addition, several variables play a marginally significant role in the relationship between ToM/empathy and PsB.

### Main effects

ToM and empathy were positively correlated with PsB in children and adolescent (2 ~ 19 years old). This indicates that the stronger the individual's ToM and empathy, the higher the frequency of PsB. This is consistent with previous studies on the relationship between children's ToM and social behavior (Imuta et al., 2016; Lee & Imuta, 2021; Sai et al., 2021) as well as the relationship between empathy and PsB (Ding & Zhaohui, 2016). Crick and Dodge's (1994) SIP model suggests that the encoding and experiencing of others' help-seeking cues is the basis for an individual's PsB. Thus, children and adolescents who use their ToM skills to notice the need for others to seek help and escape from their distress are motivated by empathy and may feel better by engaging in helping behaviors in order to alleviate this distress. The dynamic model of empathy has a similar view (Liu et al., 2009). From a multidimensional perspective, the theory emphasizes that empathy is a dynamic system, including cognitive, affective and behavioral systems, which are closely linked. For example, when another person is in a difficult situation, the cognitive and emotional systems of empathy are first activated, and after generating the emotional feelings of empathy with another person, the individual further perceives and evaluates the other person's emotional condition, and may display certain behaviors when finding that the other person needs help. In addition, the Dual-process Model also emphasizes the joint influence of emotional responses and cognitive reasoning on moral decision-making and moral behavior (Greene et al., 2004). Whereas empathy is an emotional response, children and adolescents' psychological desires, intentions, attributions, and beliefs (ToM) fall under the category of cognitive reasoning, so it is not

difficult to infer that empathy and ToM work together on PsB as a moral behavior. It is important to note that the correlation between empathy and PsB ($r = 0.36$) was stronger than that between ToM and PsB ($r = 0.24$). This indicates that the emotional factor empathy has a greater impact on PsB than the cognitive factor ToM in social understanding. One possible explanation is that, according to Emotional Cognitive Evaluation (Lazarus, 1991), individuals cognitively appraise a situation in order to produce a specific emotional response that in turn influences the subsequent behavior. Therefore, empathy is more strongly related to PsB and ToM may need to draw on empathy to facilitate PsB. However, the weight of the two in the joint effect on PsB needs to be analyzed by methods such as relative weight analysis in future research.

### Limitation and future directions

The present meta-analysis has following limitations. Firstly, this study included both cross-sectional and follow-up studies, and the number of effect sizes extracted from follow-up studies was not much different from that of cross-sectional studies. It should be noted that ToM was first determined, followed by the determination of PsB. This study did not discuss the order of measurement (simultaneous testing vs. sequential testing) as a moderating variable. However, the order of measurement may be a potential cause for the inconsistency in the relationship between ToM/empathy and PsB (Ruffman et al., 2006; Eggum et al., 2011; Caputi et al., 2012; Broeren et al., 2013; Wang et al., 2022b). Therefore, the effect of the order of measurement on the relationship between ToM/empathy and PsB will be examined in future studies.

This study explored the impact of two components of social understanding (ToM and empathy) on PsB. Due to the limitations of methods and techniques, the weight of the influence of ToM and empathy in the joint effect on prosocial behavior is not explored. We will combine relative weight analysis and meta-analysis methods to clarify it in future researches.

## Conclusions

This study reports a multilevel meta-analysis of the relationship between PsB and social understanding (ToM and empathy) in children and adolescents (2 ~ 19 years old). ToM and empathy have a significant positive correlation with PsB. In addition to ToM measurement method, Age, PsB measurement method and cultural background have no significant moderating effect on the relationship between ToM and PsB. Age, PsB measurement method, and cultural background play a significant moderating role in the relationship between empathy and PsB. This study reveals the correlation between social understanding (ToM and empathy) and PsB in children and adolescents by overcoming the independence of effect sizes in traditional meta-analysis, but there are more moderators that need to be included in the study to explain the sources of heterogeneity.

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**CRediT authorship contribution statement** Xin Qiu: Conceptualization, Methodology, Writing;
Man Gao: Conceptualization, Methodology;
Wenlong Li: Retrieving, screening, and coding literature;
Rong Jiang: Retrieving, screening, and coding literature;
Haidong Zhu: Supervision, Editing. Funding.

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**Data availability** The data that support the findings of this study are openly available in the supplementary materials (Table S1, S2 and Code in Meta-analysis).

**Declarations**

We declare that we have no financial and personal relationships with other people or organizations that can inappropriately influence our work, there is no professional or other personal interest of any nature or kind in any product, service and/or company that could be construed as influencing the position presented in, or the review of, the manuscript entitled.

**Conflict of interest** The authors declare that they have no conflict of interest.

**Ethical Approval** This article does not contain studies involving human participants performed by any of the authors.

**Consent to Participate** It is not the case, this is a review article.

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