

REVIEW ARTICLE

Culture–sex interaction in self-report empathy: The theory and meta-analyses

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Abstract

Empathy is sharing and understanding others' emotions. Recently, researchers identified larger Western–Asian cultural differences in self-report empathy with females relative to males (i.e., the culture–sex interaction theory). Neglecting this phenomenon, previous researchers focused on identifying the cultural impact on empathy per se and reported divergent results. This meta-analysis aims to reveal the heterogeneity of the earlier publications and decode the heterogeneity as per the culture–sex interaction. The current results suggested the following: First, the cultural impact on empathy increased along with three sex stratification categories (male-only, mixed-sex, and female-only, in that order). Second, the effect size statistically differed between the binary classifications of sex (female-only > male-only). Third, the mixed-sex samples' effect size was positively regressed on the samples' sex ratio (i.e., percentage of females). The current results revealed the heterogeneity of previous publications and highlighted the significance of the culture–sex interaction effect on empathy for future investigations.

KEYWORDS

cross-cultural comparison, empathy, meta-analysis, the culture–sex interaction, the Western–Asian difference

INTRODUCTION

Empathy is the ability to vicariously experience others' feelings (Baron-Cohen & Wheelwright, 2004; Davis, 1980). Culture is an essential demographic factor impacting people's empathic reactions (Dehning et al., 2013; Xu et al., 2009; Zhao et al., 2021). Nevertheless, cross-cultural researchers had different opinions on whether Western or Asian culture nurtures people to self-report more empathy (Tables 1–3). The inconsistency can relate to an intriguing phenomenon, namely, the Western–Asian culture–sex interaction effect on empathy (Zhao et al., 2019, 2021). Self-report empathy scores reflect individuals' trait empathy (i.e., the generalized empathic traits

in daily life; Zhao et al., 2019). Analyzing the culture–sex interaction effect, Zhao et al. (2019, 2021) found that sex differences in self-report empathy scores were significant in one culture (i.e., Australian female > Australian male) but not in the other (i.e., Chinese female = Chinese male). More importantly, the cultural differences in self-report empathy scores were significant in one sex group (i.e., Australian female > Chinese female) but not the other (i.e., Australian male = Chinese male) (Zhao et al., 2019, 2021). Rather than consistently testing the interaction effect, previous cross-cultural researchers reported discordant conclusions on the cultural difference in trait empathy per se based on mixed-sex (Table 1), female-only (Table 2), and male-only samples (Table 3). The current study

TABLE 1 The Western–Asian cultural differences in trait empathy based on mixed-sex samples

Reference information						Cross-cultural differences in trait empathy data format (1)					
No.	Reference	Westerner	Asian	Sex ratio (female, %)	Scale	Western mean	Western SD	Western <i>n</i>	Asian mean	Asian SD	Asian <i>n</i>
1	Xu et al., 2009	Caucasians	Chinese	52%	IRI-EC	25.60	3.26	16	22.60	3.42	17
2	Xu et al., 2009	Caucasians	Chinese	52%	IRI-PT	27.00	4.25	16	20.20	3.43	17
3	Kaelber & Schwartz, 2014	Americans	Thai	75%	IRI-EC	22.74	3.31	53	18.10	4.03	48
4	Kaelber & Schwartz, 2014	Americans	Thai	75%	IRI-PT	21.11	3.53	53	17.49	3.48	48
5	Melchers et al., 2015	Germans	Chinese	50%	EQ	46.85	10.40	202	39.33	10.40	438
6	Melchers et al., 2015	Germans	Chinese	50%	IRI-EC	19.78	3.62	202	19.64	4.20	438
7	Melchers et al., 2015	Germans	Chinese	50%	IRI-PT	18.17	3.67	202	17.79	4.72	438
8	Melchers et al., 2016(a)	Germans	Chinese	54%	EQ	44.44	10.47	304	39.32	10.41	438
9	Melchers et al., 2016(a)	Germans	Chinese	54%	IRI-EC	18.64	3.68	304	19.60	4.20	438
10	Melchers et al., 2016(a)	Germans	Chinese	54%	IRI-PT	17.49	4.05	304	17.73	4.72	438
11	Melchers et al., 2016(b)	Spaniards	Chinese	40%	EQ	43.21	11.09	62	39.32	10.41	438
12	Melchers et al., 2016(b)	Spaniards	Chinese	40%	IRI-EC	20.79	4.07	62	19.60	4.20	438
13	Melchers et al., 2016(b)	Spaniards	Chinese	40%	IRI-PT	18.78	4.16	62	17.73	4.72	438
14	Melchers et al., 2016(c)	Americans	Chinese	42%	EQ	40.39	10.69	92	39.32	10.41	438
15	Melchers et al., 2016(c)	Americans	Chinese	42%	IRI-EC	19.11	4.14	92	19.60	4.20	438
16	Melchers et al., 2016(c)	Americans	Chinese	42%	IRI-PT	17.46	4.48	92	17.73	4.72	438
17	Lachmann et al., 2018	Germans	Chinese	40%	IRI-EC	19.60	4.72	304	17.72	3.95	612
18	Lachmann et al., 2018	Germans	Chinese	40%	IRI-PT	17.78	4.32	304	15.83	3.93	612
19	Zhao et al., 2019	Australians	Chinese	61%	EQ	44.32	10.66	196	38.07	10.46	211
20	Zhao et al., 2019	Australians	Chinese	61%	IRI-EC	19.95	4.24	196	18.24	3.92	211
21	Zhao et al., 2019	Australians	Chinese	61%	IRI-PT	19.13	3.68	196	17.20	3.52	211
22	Zhao et al., 2021	Australians	Chinese	53%	EQ	48.07	13.83	61	41.82	11.94	68
23	Zhao et al., 2021	Australians	Chinese	53%	IRI-EC	21.10	5.04	61	18.57	4.02	68
24	Zhao et al., 2021	Australians	Chinese	53%	IRI-PT	19.36	4.44	61	17.53	3.46	68
						Cross-cultural differences in trait empathy data format (2)					
						Western mean	Western <i>n</i>	Asian mean	Asian <i>n</i>	<i>p</i> -value	Tails
25	Cassels et al., 2010	Westerners	East Asians	83% ^a	IRI-EC	19.53	32	17.38	74	.05 ^b	2
						Cross-cultural differences in trait empathy data format (3)					
						Western <i>n</i>	Asian <i>n</i>	<i>t</i> -value	direction ^c	/	/
26	de Greck et al., 2012	Germans	Chinese	62%	IRI-EC	16	16	1.94	W > A	/	/
27	de Greck et al., 2012	Germans	Chinese	62%	IRI-PT	16	16	0.26	W > A	/	/

Abbreviation: IRI = Interpersonal Reactivity Index; IRI-EC = total score for the IRI Empathic Concern items; IRI-PT = total score for the IRI Perspective-Taking items; EQ = total score for the Empathy Quotient items.

^aThe sex ratio of Cassels et al. (2010) was an estimation (i.e., 83%) as they had five missing values on sex.

^bAs per information provided by Cassels et al. (2010), the *p*-value of the *t*-test was coded as .050 for the study.

^cIn regards to the *t*-test direction, "W > A = Westerners > Asians.

aims to reveal the heterogeneity of these earlier reports and further decode the heterogeneity according to the theory of the culture–sex interaction effect on empathy (Zhao et al., 2019, 2021).

Researchers have focused on investigating the Western–Asian cultural differences in empathy for a myriad of cultural and social reasons (e.g., Zhao et al., 2019). For example, these two cultures represent the two extremes of the self-construal spectrum (e.g., Singelis, 1994; Xu et al., 2009; Zhao et al., 2019). According to Singelis (1994), Westerners

represent the independent self-construal (i.e., an evident self–other distinction), while Asians represent the interdependent self-construal (i.e., a blurred self–other boundary). It has not been determined whether independent or interdependent self-construal benefits the self-evaluation of empathy (see Tables 1–3). Some researchers proposed that an optimal combination of independent and interdependent self-construal could be essential for being empathic (Zhao et al., 2019). They explained that a close ‘self–other distance’ is necessary for initiating empathic reactions, while a clear self–other differentiation

TABLE 2 The Western–Asian cultural differences in trait empathy based on female-only samples

Reference information						Cross-cultural differences in trait empathy					
No.	Reference	Westerner	Asian	Sex ratio (female, %)	Scale	Western mean	Western SD	Western n	Asian mean	Asian SD	Asian n
1	Jiang et al., 2014	Westerners ^a	Chinese	100%	IRI-EC	18.60	5.56	18	20.60	2.61	18
2	Jiang et al., 2014	Westerners ^a	Chinese	100%	IRI-PT	20.40	4.46	18	21.00	2.93	18
3	Melchers et al., 2015	Germans	Chinese	100%	EQ	48.61	9.90	152	39.65	9.59	168
4	Melchers et al., 2015	Germans	Chinese	100%	IRI-EC	20.57	3.34	152	19.62	4.41	168
5	Melchers et al., 2015	Germans	Chinese	100%	IRI-PT	18.19	3.69	152	17.59	4.28	168
6	Lachmann et al., 2018	Germans	Chinese	100%	IRI-EC	20.66	4.41	207	18.33	3.87	162
7	Lachmann et al., 2018	Germans	Chinese	100%	IRI-PT	17.99	4.44	207	15.30	3.79	162
8	Zhao et al., 2019	Australians	Chinese	100%	EQ	48.13	10.30	95	37.89	10.14	152
9	Zhao et al., 2019	Australians	Chinese	100%	IRI-EC	21.35	4.05	95	18.24	4.12	152
10	Zhao et al., 2019	Australians	Chinese	100%	IRI-PT	19.72	3.46	95	16.90	3.50	152
11	Zhao et al., 2021	Australians	Chinese	100%	EQ	53.84	12.87	32	42.89	13.04	36
12	Zhao et al., 2021	Australians	Chinese	100%	IRI-EC	23.06	4.83	32	18.28	4.46	36
13	Zhao et al., 2021	Australians	Chinese	100%	IRI-PT	20.59	4.82	32	17.31	4.01	36

Abbreviation: EQ = total score for the Empathy Quotient items; IRI = Interpersonal Reactivity Index; IRI-EC = total score for the IRI Empathic Concern items; IRI-PT = total score for the IRI Perspective-Taking items.

^aWestern participants of Jiang et al. (2014) were of mixed nationalities.

TABLE 3 The Western–Asian cultural differences in trait empathy based on male-only samples

Reference information						Cross-cultural differences in trait empathy					
No.	Reference	Westerner	Asian	Sex ratio (female, %)	Scale	Western mean	Western SD	Western n	Asian mean	Asian SD	Asian n
1	Melchers et al., 2015	Germans	Chinese	0%	EQ	41.50	10.14	50	39.13	10.88	270
2	Melchers et al., 2015	Germans	Chinese	0%	IRI-EC	17.38	3.39	50	19.66	4.07	270
3	Melchers et al., 2015	Germans	Chinese	0%	IRI-PT	18.10	3.66	50	17.91	4.98	270
4	Lachmann et al., 2018	Germans	Chinese	0%	IRI-EC	17.34	4.60	97	17.50	3.96	450
5	Lachmann et al., 2018	Germans	Chinese	0%	IRI-PT	17.34	4.03	97	16.02	3.97	450
6	Zhao et al., 2019	Australians	Chinese	0%	EQ	40.73	9.75	101	38.53	11.34	59
7	Zhao et al., 2019	Australians	Chinese	0%	IRI-EC	18.64	4.00	101	18.22	3.37	59
8	Zhao et al., 2019	Australians	Chinese	0%	IRI-PT	18.58	3.81	101	17.97	3.50	59
9	Zhao et al., 2021	Australians	Chinese	0%	EQ	41.69	12.08	29	40.62	10.65	32
10	Zhao et al., 2021	Australians	Chinese	0%	IRI-EC	18.93	4.39	29	18.91	3.50	32
11	Zhao et al., 2021	Australians	Chinese	0%	IRI-PT	18.00	3.60	29	17.78	2.74	32

Abbreviations: IRI = Interpersonal Reactivity Index; IRI-EC = total score for the IRI Empathic Concern items; IRI-PT = total score for the IRI Perspective-Taking items; EQ = total score for the Empathy Quotient items.

is vital for protecting people from becoming exhausted due to empathy-induced personal distress (a concept to be introduced; Zhao et al., 2019). Specifically, Zhao et al. (2019) investigated trait empathy and self-construal within four culture–sex groups (viz., Australian female, Australian male, Chinese female, and Chinese male). Being the representative of femininity and Western culture, the Australian female group was optimal in self-construal (i.e., relatively high in both independent and interdependent self-construal) as well as had higher trait empathy than their culture–sex counterparts (Zhao et al., 2019).

In addition, Westerners and Asians differ in experiencing personal distress due to empathy (Zhao et al., 2019). Personal

distress is self-oriented aversive feelings (e.g., discomfort and loss of control) due to empathizing with others' suffering (López-Pérez et al., 2014). Relatively, females suffer more personal distress than males do, and this sex effect was verified in both Western and Asian cultures (Zhao et al., 2019). Moreover, comparing Australian and Chinese participants, researchers found that Chinese participants (both females and males) self-report more personal distress than their Australian counterparts (Zhao et al., 2019). Additionally, Zhao et al. (2019) found that personal distress had a mediating effect on culture as a predictor of self-report empathy; that is, the cultural group with more personal distress (i.e., Chinese > Australian)

self-reported less empathy (i.e., Chinese < Australian). The reason underpinning Chinese people's relatively intense personal distress could be traced back to their ambiguous self-other differentiation (i.e., high interpersonal self-construal; Zhao et al., 2019). During empathy, individuals with an unclear self-other differentiation are likely to internalize others' negative emotions as their own and eventually be confused about the source of the negative emotions (Zhao et al., 2019). As Batson et al. (1987) pointed out, individuals with intense personal distress may have to withdraw from empathy to protect their own emotional stability. Notably, personal distress is self-oriented, but genuine empathy should be other-oriented (Batson et al., 1987; López-Pérez et al., 2014).

The cultural difference in empathy and the culture–sex interaction effect

As implied above, empathy and its related concepts (e.g., self-construal and personal distress) are impacted by the participant's "culture" and "sex" (e.g., Zhao et al., 2019). For example, females are expected to be more empathic than males (Baron-Cohen & Wheelwright, 2004). This expectation was frequently supported by empirical investigations of self-report empathy with Western populations (i.e., female > male, Cohen's $d = [0.39, 0.88]$) (see a review by Groen et al., 2015). However, with Asian populations (e.g., Chinese and Korean participants), researchers identified insignificant sex differences in self-report empathy (i.e., female = male, Cohen's $d = [0.11, 0.24]$) (Kim & Lee, 2010; Zhao et al., 2018). The above phenomenon may be relevant to the inconsistent polarization of social expectations for different sexes across cultures; that is, the polarization can be more serious in one culture than the other (e.g., Western > Asian cultures; Zhao et al., 2018, 2019, 2021). For example, Westerners may hold the notion of "emotional female and rational male" (Merten, 2005). In contrast, Asian philosophies (e.g., Confucius' Golden Mean and Taoism's Yin–Yang balance) encourage Asian females and Asian males to seek a balance between femininity and masculinity (Huang, 2006; Zhao et al., 2021). Therefore, sex differences in social activities (e.g., empathy; Zhao et al., 2019, 2021) may be insignificant for Asians relative to Westerners (also see Schmitt, 2015).

Hence, researchers proposed the theory of culture–sex interaction effect on empathy (Zhao et al., 2019, 2021), highlighting the indispensability of evaluating this effect in cross-cultural comparisons of empathy (Zhao et al., 2019, 2021). However, in the last decade, researchers focused more on illustrating the impact of culture on self-report empathy per se and tended to ignore the interaction effect (Supplementary Document S1). Accordingly, the accumulated findings of the Western–Asian cultural differences in self-report empathy were heterogenized (Tables 1–3). For example, Kaelber and Schwartz (2014) found that self-report empathy scores were higher for American participants ($N = 53$, female ratio = 81.1%) than for Thai participants ($N = 48$, female ratio = 68.75%). With sex controlled as a confounding factor, Melchers et al. (2016) reported no significant cultural

differences in self-report empathy between Spanish ($N = 62$, female ratio = 56.5%) and Chinese participants ($N = 438$, female ratio = 38.1%). Similarly, Cassels et al. (2010) identified an insignificant cultural difference in self-report empathy based on Westerners (mixed-country of origin, $N = 32$, female ratio = unknown) and Asians (mixed-country of origin, $N = 74$, female ratio = unknown). To date, the heterogeneity of the previous findings of cross-cultural differences in self-report empathy has not been properly described.

Remarkably, among these previous studies (Tables 1–3), a small group of researchers identified the significant culture–sex interaction effect on empathy (Melchers et al., 2015; Zhao et al., 2019, 2021). For example, Melchers et al. (2015) reported significant culture–sex interaction effects in self-report empathy scores with German ($N = 202$) and Chinese participants ($N = 438$). They explained that the interaction effect was due to the inconsistent sex difference in empathy between the two cultural groups (i.e., German > Chinese groups; Melchers et al., 2015). Similarly, Zhao et al. (2019) observed significant culture–sex interaction effects in self-report empathy with Australian ($N = 196$) and Chinese participants ($N = 211$). Additionally, Zhao et al. (2021) detected the same interaction effect with Australian ($N = 61$) and Chinese participants ($N = 68$). Zhao et al. (2019, 2021) depicted the interaction with two simple effects. First, the sex difference in self-report empathy was only significant with Westerners (i.e., Australian female > Australian male) but not with Asians (i.e., Chinese female = Chinese male). Second, the cultural difference was only significant for females (i.e., Australian female > Chinese female) but not males (i.e., Australian male = Chinese male). Thus, Zhao et al. (2019, 2021) formally proposed the culture–sex interaction effect on empathy as a theory. An intriguing research question is whether the inconsistency of the earlier results based on mixed-sex (Table 1), female-only (Table 2), and male-only samples (Table 3) could be deduced in terms of the culture–sex interaction.

The current study

This study aims to tap into the heterogeneity of the previous findings of the Western–Asian cultural difference in empathy by a string of meta-analyses. In addition, the current study plans to decode the heterogeneity in light of the culture–sex interaction (Lachmann et al., 2018; Melchers et al., 2015; Zhao et al., 2019, 2021). After reviewing the previous publications, the current authors conducted three types of meta-analyses to gauge the relative impact of culture on empathy in terms of sex. Moreover, the coding of sex across the meta-analyses was three-fold: a stratification category (i.e., female-only, male-only, and mixed-sex), a binary classification (i.e., female-only and male-only), and a continuous variable (i.e., the female ratio of mixed-sex samples).

The main analytical procedure of this study was: First, three conventional meta-analyses were conducted to evaluate the effect size of the cultural impact on empathy for each stratification category of sex (i.e., female-only, male-only, and

mixed-sex). Second, a meta-group comparison was administered to compare the effect sizes between the binary classification of sex (i.e., female-only vs. male-only). Third, a meta-regression was used to explore the linear relationship between the mixed-sex samples' effect size and sex ratio (i.e., the female ratio). Fourth, the possible moderating impacts (e.g., participants' age and empathy scale) on the above linear relationship between the effect size and the sex ratio were explored. Fifth, heterogeneity, publication bias, and sensitivity of the current data set (Tables 1–3) were verified (e.g., using funnel plots; see Methods section).

The key hypotheses of the current study were: First, referencing the empirical findings of the culture–sex interaction effect (e.g., Zhao et al., 2019, 2021), the effect size of the cultural differences in empathy was expected to vary according to sex. Specifically, the effect size, from largest to smallest, was anticipated for the female-only (i.e., a medium to large effect size, Hedges's $g > 0.4$), the mixed-sex (i.e., a medium effect size, Hedges's $g = 0.2$ to 0.4), and the male-only samples (i.e., a small effect size, Hedges's $g < 0.2$). Second, since Zhao et al. (2019, 2021) identified insignificant Western–Asian cultural differences in self-report empathy for males, publication biases were likely to be an issue for samples including males (i.e., male-only and mixed-sex). Third, as per the culture–sex interaction effect (e.g., Lachmann et al., 2018; Melchers et al., 2015; Zhao et al., 2019, 2021), the issue of heterogeneity could be most serious for the mixed-sex samples (see the varied female ratio among studies; Table 1). Finally, the mixed-sex samples' heterogeneity was anticipated as decodable as per sex (i.e., a positive regression of the mixed-sex samples' effect size and female ratio).

METHODS

Literature selection

Previous publications on the topic were searched from four databases: PubMed, Web of Science, Scopus, and EBSCO (Academic and Library). The search period for each database was from its earliest date to 11 May, 2021. The search areas were the title, abstract, and topic of the articles, and the language was restricted to English. Three groups of keywords were used for the literature searching: (1) the keywords for the self-report empathy: [Empath* OR Empathy Quotient OR Interpersonal Reactivity Index OR EQ OR IRI]; (2) the keywords for Western culture: [Western OR Caucasian OR America OR Australia OR Britain OR British OR English OR Europe OR German]; (3) the keywords for Asian culture: [Asia OR China OR Chinese OR Japan OR Korea].

Excluding replicated articles, a total of 2327 candidate articles were identified (see the flow diagram of literature selection; Supplementary Document S1). These articles were further selected in light of the title (the first step, $n = 2224$ excluded), abstract (the second step, $n = 72$ excluded), and the full text (the third step, $n = 21$ excluded). The exclusion of the 21 articles on the third step was due to: (a) they were irrelevant to the research topic ($n = 12$ excluded); (b) there were no self-report

empathy results ($n = 4$ excluded); (c) there were no numeric values (e.g., mean and SD) for the meta-analyses ($n = 2$ excluded); and (d) there were data repetition issues (e.g., theses and journal articles were based on the same datasets, $n = 3$ excluded).

In the current study, three cases with data replication issues were identified. Atkins, Kaelber, and Zhao had both theses (Atkins, 2014; Kaelber, 2008; Zhao, 2018) and journal articles (Atkins et al., 2016; Kaelber & Schwartz, 2014; Zhao et al., 2019, 2021) published based on the same datasets. To avoid the data replication issues for meta-analyses (see Liu et al., 2021), the above theses were excluded from the current study. After the above literature selection, 10 articles remained (the mean age of participants = [19.31, 31.98]).

We would like to mention that Atkins (2014) and Atkins et al. (2016) kindly provided us with data through personal contact. However, Atkins's dataset reached us after this manuscript was accepted. In the supplementary file, we provide a complete dataset, including Atkins's data. We reconducted all analyses based on all available data (see Supplementary Document S1), and found the main results remained the same as presented in the accepted version of the manuscript (see below).

Self-report scales of empathy

Two self-report empathy scales have been used in the previous cross-cultural studies of empathy (Tables 1–3): Empathy Quotient (EQ; Baron-Cohen & Wheelwright, 2004) and Interpersonal Reactivity Index (IRI; Davis, 1980). Both scales record participants' self-evaluated empathic reactions in generalized daily-life situations, such as talking with a friend or watching the news (Baron-Cohen & Wheelwright, 2004; Davis, 1980). However, the two scales were designed with different obligations: EQ reflects participants' overall empathy or an integrated concept of empathy (Baron-Cohen & Wheelwright, 2004). In contrast, IRI taps into subcomponents of empathy: specifically, the Perspective-Taking subscale of IRI (IRI-PT) gauges cognitive empathy (i.e., the advanced cognitive decoding of others' emotions according to the context); and the Empathic Concern subscale of IRI (IRI-EC) evaluates emotional empathy (i.e., the automatic affective reactions toward others' emotions) (Davis, 1980). According to Baron-Cohen and Wheelwright (2004), however, emotional and cognitive empathy in daily-life situations were largely co-occurring and indissociable. Therefore, self-report empathy items can be deemed as tapping into empathy as a single component (Baron-Cohen & Wheelwright, 2004). Thus, in this study, EQ and IRI scores were considered to evaluate empathy convergently.

Quality checking and data coding

The literature quality was checked according to the Standards for Quality Improvement Reporting Excellence (SQUIRE 1.0; Davidoff et al., 2008) and its revised version (SQUIRE 2.0; Ogrinc et al., 2015). All 19 standardized checking items from

SQUIRE (1.0 and 2.0) were considered in this study. In addition, the current authors designed two additional items to reflect whether the culture–sex interaction effect was considered by each study. A detailed introduction for the above quality checking is summarized in Supplementary Document S1. All remaining articles (Tables 1–3) were adequate for the meta-analyses.

In total, the remaining articles provided 51 contrasts on the Western–Asian cross-cultural difference in the self-report empathy score, consisting of 27 mixed-sex contrasts (see the female ratios of these studies; Table 1), 13 female-only contrasts (Table 2), and 11 male-only contrasts (Table 3). The key information coded from previous studies was: (1) the nationality of the Western participants (e.g., Americans, Australians, Germans, Spaniards, and Caucasians with mixed nationalities) and that of the Asian participants (e.g., Chinese, Thais, and Asians with mixed nationalities); (2) the sex ratio of mixed-sex samples (i.e., the female ratio); (3) the mean age of mixed-sex samples; (4) the self-report empathy measurements (i.e., EQ, IRI-EC, and IRI-PT); (5) the numeric values required by the meta-analyses (e.g., the sample size, mean, *SD*, *t*-value, and *p*-value).

Meta-analyses

Three types of meta-analyses were conducted (all were random-effects models). First, conventional meta-analyses were conducted to evaluate the effect size of Western–Asian cultural differences in self-report empathy for each stratification category of sex (i.e., mixed-sex, female-only, and male-only). Second, a meta-group comparison was conducted to verify whether the effect size statistically differed between the binary classifications of sex (i.e., female-only vs. male-only). Since most of the previous studies reported several self-report scores (i.e., EQ, IRI-PT, and IRI-EC) for each participant group, the “common among-study variance component across subgroups” was assumed for the above meta-group comparison to control the results’ dependency. Third, a group of meta-regression (method = maximum likelihood) was processed to gauge the linear relationship between the mixed-sex samples’ effect size and sex ratio (i.e., the female ratio). According to Melchers et al. (2015) and Zhao et al. (2019, 2021), a positive regression of the effect size on the female ratio was anticipated (i.e., the 1-tailed test). Meanwhile, if the regression interaction was significant, the intercept was included in the above regression model.

Initially, the above meta-analyses were designed to be conducted based on individual empathy scores (EQ, IRI-PT, and IRI-EC) reported by the previous publications since this study aimed to verify the heterogeneity among these earlier reports. Alternatively, some researchers suggested conducting the meta-analyses based on the mean empathy score of each study, which was also the traditional meta-analysis treatment to control the results’ dependency. However, this traditional treatment “may lead to missed opportunities to utilize all available data to address the relevant research questions” (Cheung, 2019, p. 387). In addition, some of the previous researchers (Tables 1–3) presented all three empathy scores

(EQ, IRI-PT, and IRI-EC), while others might report some of the scores (IRI-EC by itself, or IRI-PT and IRI-EC). Hence, the mean score calculated for each study might not be as representative as assumed. Accordingly, the “common among-study variance component across subgroups” ought not to be considered for the meta-group comparison based on the mean empathy score. Except for the above points, the other analytical settings were the same as previously introduced. Pondering the advantages and disadvantages of these treatments, the current authors presented both results based on “the individual empathy score” and “the mean empathy score” for the present meta-analyses (also see discussions on this topic by Cheung, 2019; Hahn et al., 2000).

Besides the “sex” (i.e., the female ratio, a continuous variable), there could be other impact factors for the previous findings based on the mixed-sex samples, including the empathy scale (i.e., EQ, IRI-EC, and IRI-PT, a categorical variable), the Asian cultural background (i.e., Chinese and mixed-Asian, a categorical variable), and the participant age (i.e., in years, a continuous variable). Therefore, meta-regressions with multi-predictors (random-effects model, method = maximum likelihood) were conducted to verify whether the impact of sex was significant with the other factors considered in the regression model (i.e., 1-tailed test). As for the individual empathy scores, a meta-regression with four predictors (i.e., sex ratio, empathy scale, Asian cultural background, and age) was conducted. As for the mean empathy scores, a meta-regression with three factors (i.e., sex ratio, Asian cultural background, and age) was processed. The intercept was compulsory for a meta-regression with categorical variables. A detailed introduction of the current meta-regressions with multi-predictors is presented in the supplementary file (Supplementary Documents S1).

Finally, the risk of publication biases was evaluated for each sample of the stratification category of sex (i.e., mixed-sex, female-only, and male-only) as per Classic Fail-safe *N*, the funnel plots with Duval and Tweedie’s trim and fill correction (2000), and Begg and Mazumdar’s rank test with Kendall’s tau with continuity correction. The stability of these conventional meta-analyses was evaluated using the “one study removed method” (Borenstein et al., 2011). The heterogeneity of the previous reports was evaluated in terms of indexes of *Q* (Card, 2015) and *I*² (Higgins & Thompson, 2002). Referencing Bonfils et al. (2017), the effect sizes were classified as small (e.g., Hedges’s *g* < 0.2), medium (e.g., Hedges’s *g* = 0.2 to 0.5), and large (i.e., Hedges’s *g* > 0.5). All of the current meta-analyses were conducted using the Comprehensive Meta-analysis V3 (CMA V3) statistical software (Biostat. Inc., Englewood, NJ, USA) (Borenstein et al., 2014).

RESULTS

Overall description

The current meta-analyses were first conducted based on the individual empathy scores, covering 27 mixed-sex contrasts (Table 1), 13 female-only contrasts (Table 2), and 11 male-only contrasts

(Table 3). Alternatively, the meta-analyses were conducted according to the mean empathy scores calculated for each study, consisting of 11 mixed-sex contrasts, five female-only contrasts, and four male-only contrasts (the data set is given in the supplementary file). Results of the above two groups of meta-analyses are summarized in Tables 4 and 5, respectively. Figures for these meta-analyses are given in Supplementary Document S1.

Conventional meta-analyses

Effect size

Based on the individual empathy scores (Table 4), the effect sizes of the Western–Asian cultural difference in self-report empathy (Hedges's g), from highest to lowest, were 0.58 for the female-only samples (95% CI = [0.39, 0.78], $z = 5.89$, $p < .001$, $Q = 65.63$), 0.38 for the mixed-sex samples (95% CI = [0.25, 0.52], $z = 5.76$, $p < .001$, $Q = 224.75$), and 0.06 for the male-only samples (95% CI = [−0.10, 0.22], $z = 0.76$, $p = .447$, $Q = 25.69$).

Alternatively, based on the mean empathy scores (Table 5), the effect sizes of Hedges's g , from highest to lowest, were 0.56 for the female-only samples (95% CI = [0.30, 0.82],

$z = 4.17$, $p < .001$, $Q = 14.21$), 0.41 for the mixed-sex samples (95% CI = [0.24, 0.58], $z = 4.62$, $p < .001$, $Q = 51.21$), and 0.08 for the male-only samples (95% CI = [−0.07, 0.23], $z = 1.07$, $p = .284$, $Q = 2.04$).

Sensitivity tests and publication biases

As summarized in Supplementary Document S1, the sensitivity tests (method = one study removed) were conducted to illustrate the stability of the current meta-analyses. In addition, the forest plots were drawn out based on the individual empathy scores as well as the mean empathy scores. Forest plots are designed to reflect the publication biases for meta-analyses; however, the phenomenon of “publication biases” may be due to the heterogeneity within the earlier publications (see Stuck et al., 1998; Tang & Liu, 2000). Similarly, the “publication biases” or heterogeneity could also be revealed through the following indexes.

First, as per the individual empathy scores (Table 4), Duval and Tweedie's (2000) trim and fill procedure indicated four missing studies for both the male-only and the mixed-sex samples and no missing studies for the female-only sample. With these missing studies considered (see Table 4), the effect size of

TABLE 4 A result summary for the meta-analyses of Western–Asian cultural differences in trait empathy based on the individual empathy scores

Analysis /samples	Contrast	Effect size			Test of null			Heterogeneity			Tau ²	
Conventional meta-analysis	<i>n</i>	Hedges's <i>g</i>	<i>SE</i>	95% CI	Tail	<i>z</i>	<i>p</i>	<i>Q</i>	<i>p</i>	<i>I</i> ²	Tau ²	<i>SE</i>
/Mixed-sex	27	0.38	0.07	[0.25, 0.52]	2	5.76	<.001	224.75	<.001	88.43	0.10	0.04
/Female-only	13	0.58	0.10	[0.39, 0.78]	2	5.89	<.001	65.63	<.001	81.71	0.09	0.05
/Male-only	11	0.06	0.08	[−0.10, 0.22]	2	0.76	0.447	25.69	.004	61.08	0.04	0.03
Publication bias correction	Trimmed <i>n</i>	Effect size correction ^a			Tau correction ^b			Heterogeneity correction ^a			Corrected Tau ^b	
		Hedges's <i>g</i>		95% CI	Tail	<i>z</i>	<i>p</i>	<i>Q</i>			Tau	
/Mixed-sex	4	0.29		[0.16, 0.43]	2	1.58	0.113	271.01			0.22	
/Female-only	0	0.58		[0.39, 0.78]	2	0.43	0.669	65.63			0.09	
/Male-only	4	−0.06		[−0.22, 0.10]	2	0.00	1.000	53.90			0.00	
Meta-group comparison ^d		Compared						Heterogeneity				
		<i>n</i> ₁ and <i>n</i> ₂						<i>Q</i>				
/Female-only versus Male-only		13 vs. 11						16.10				
Meta-regression ^c	Contrast <i>n</i>	Effect size			Test of null			Test for all coefficients = 0			Goodness of fit	
		Coefficient	<i>SE</i>	95% CI	tail	<i>z</i>	<i>p</i>	<i>Q</i>	<i>p</i>		Tau	<i>Q</i>
/Mixed-sex, with intercept	27	/	/	/	/	/	/	6.64	.010		0.28	215.52
Covariate: intercept		−0.38	0.30	[−0.98, 0.21]	1	−1.27	0.102	/	/		/	/
Covariate: female ratio		1.46	0.57	[0.35, 2.57]	1	2.58	.005	/	/		/	/
/Mixed-sex, without intercept	27	/	/	/	/	/	/	40.14	<.001		0.29	215.89
Covariate: female ratio		0.76	0.12	[0.53, 1.00]	1	6.34	<.001	/	/		/	/

Note: The above meta-analyses were conducted based on random-effects models of individual empathy scores of each study.

^aThe effect size correction and heterogeneity correction were processed using Duval and Tweedie's trim and fill method (i.e., look for missing studies to the left of the mean, based on the random-effects model).

^bThe Tau correction was processed using Kendall's tau with continuity correction.

^cThe “common among-study variance component across subgroups” was assumed for the meta-comparison based on individual empathy scores.

^dA 1-tailed test was performed for the meta-regression (method = maximum likelihood) as a positive relationship between the effect size and female ratio was hypothesized.

TABLE 5 A result summary for the meta-analyses of Western–Asian cultural differences in trait empathy based on the mean empathy scores

Analysis/samples	Contrast	Effect size			Test of null			Heterogeneity			Tau ²	
Conventional meta-analysis	<i>n</i>	Hedges's <i>g</i>	<i>SE</i>	95% CI	Tail	<i>z</i>	<i>p</i>	<i>Q</i>	<i>p</i>	<i>I</i> ²	Tau ²	<i>SE</i>
/Mixed-sex	11	0.41	0.09	[0.24, 0.58]	2	4.62	<.001	51.21	<.001	80.47	0.06	0.04
/Female-only	5	0.56	0.13	[0.30, 0.82]	2	4.17	<.001	14.21	.007	71.85	0.06	0.06
/Male-only	4	0.08	0.08	[−0.07, 0.23]	2	1.07	0.284	2.04	0.564	< 0.01	< 0.01	0.02
Publication bias correction	Trimmed <i>n</i>	Effect size correction ^a			Tau correction ^b			Heterogeneity correction ^c			Corrected Tau ^b	
		Hedges's <i>g</i>	<i>SE</i>	95% CI	Tail	<i>z</i>	<i>p</i>	<i>Q</i>	<i>p</i>	<i>I</i> ²	Tau	<i>SE</i>
/Mixed-sex	0	0.41		[0.24, 0.58]	2	1.25	0.213	51.21			0.29	
/Female-only	0	0.56		[0.30, 0.82]	2	0.24	0.806	14.21			−0.10	
/Male-only	0	0.08		[−0.07, 0.23]	2	0.34	0.734	2.04			−0.17	
Meta-group comparison ^c	Compared <i>n</i> ₁ and <i>n</i> ₂							Heterogeneity				
								<i>Q</i>	<i>p</i>	<i>I</i> ²		
/Female-only vs. Male-only	5 vs. 4							9.64	.002			
Meta-regression ^d	Contrast	Effect size			Test of null			Test for all coefficients = 0			Goodness of fit	
	<i>n</i>	Coefficient	<i>SE</i>	95% CI	Tail	<i>z</i>	<i>p</i>	<i>Q</i>	<i>p</i>	<i>I</i> ²	Tau	<i>Q</i>
/Mixed-sex, with intercept	11	/	/	/	/	/	/	3.07	.080		0.22	47.89
Covariate: intercept		−0.20	0.35	[−0.89, 0.49]	1	−0.57	0.286	/	/		/	/
Covariate: female ratio		1.12	0.64	[−0.13, 2.37]	1	1.75	.040	/	/		/	/
/Mixed-sex, without intercept	11	/	/	/	/	/	/	26.08	<.001		0.22	47.90
Covariate: female ratio		0.77	0.15	[0.47, 1.07]	1	5.11	<.001	/	/		/	/

Note: The above meta-analyses were conducted based on random-effects models of the mean empathy score of each study.

^aThe effect size correction and heterogeneity correction were processed using Duval and Tweedie's trim and fill method (i.e., look for missing studies to the left of the mean, based on the random-effects model).

^bThe Tau correction was processed using Kendall's tau with continuity correction.

^cThe "common among-study variance component across subgroups" was not assumed for the meta-comparison based on the mean empathy scores.

^dA 1-tailed test was performed for the meta-regression (method = maximum likelihood) as a positive relationship between the effect size and female ratio was hypothesized.

the mixed-sex samples was reduced from 0.38 to 0.29 (95% CI = [0.16, 0.43], *Q* = 271.01). Meanwhile, the effect size of the male-only samples was converted from 0.06 to −0.06 (95% CI = [−0.22, 0.10], *Q* = 53.90).

In contrast, as per the mean empathy scores (Table 5), Duval and Tweedie (2000) indicated no missing studies for any of the three samples.

Second, in light of the individual empathy scores, to bring the initial *p*-value down to insignificant (i.e., > .050), the number of missing studies suggested by the Classic fail-safe *N* test was 1493 for the mixed-sex samples (i.e., missing vs. observed ratio = 55.30), 633 for the female-only samples (i.e., missing vs. observed ratio = 48.69), and 0 for the male-only samples (i.e., missing vs. observed ratio = 0).

In light of the mean empathy scores, to bring the initial *p*-value down to insignificant (i.e., > .050), the number of missing studies indicated by the Classic fail-safe *N* test was 262 for the mixed-sex samples (i.e., missing vs. observed ratio = 23.82), 82 for the female-only samples (i.e., missing vs. observed ratio = 16.40), and 0 for the male-only samples (i.e., missing vs. observed ratio = 0).

Third, referencing the individual empathy scores, the Kendall's *S* statistic (*P*-*Q*) value for the mixed-sex samples was 77.00 (Kendall's tau with continuity correction, corrected tau = 0.22, *z* for the tau = 1.58, 2-tailed *p* = .113), for the

female-only samples it was 8.00 (Kendall's tau with continuity correction, corrected tau = 0.09, *z* for the tau = 0.43, 2-tailed *p* = .669), and for the male-only samples it was −1.00 (Kendall's tau with continuity correction, corrected tau < 0.01, *z* for the tau < 0.01, 2-tailed *p* = 1.00).

Referencing the mean empathy scores, the *P*-*Q* value for the mixed-sex samples was 17.00 (Kendall's tau with continuity correction, corrected tau = 0.29, *z* for the tau = 1.25, 2-tailed *p* = .213), for the female-only samples it was −2.00 (Kendall's tau with continuity correction, corrected tau = −0.10, *z* for the tau = 0.24, 2-tailed *p* = .806), and for the male-only samples it was −2.00 (Kendall's tau with continuity correction, corrected tau = −0.17, *z* for the tau = 0.34, 2-tailed *p* = .734).

Meta-group comparison between female-only and male-only samples

Based on the individual empathy scores (Table 4), the effect size of Hedges's *g* was significantly larger for the female-only than the male-only samples (i.e., female-only > male-only, *Q* = 16.10, *p* < .001). Consistently, based on the mean empathy scores (Table 5), the group difference remained significant (i.e., female-only > male-only, *Q* = 9.64, *p* = .002).

Meta-regression of the sex ratio

As per the individual empathy scores (Table 4), a positive regression of the mixed-sex samples' effect size on the samples' female ratio was revealed (1-tailed test, coefficient = 1.46, 95% CI [0.35, 2.57], $z = 2.58$, $p = .005$) through a meta-regression model with an insignificant intercept (coefficient = -0.38 , 95% CI [-0.98 , 0.21], $z = -1.27$, $p = .102$). With the intercept excluded from the meta-regression model, the above positive relationship remained as significant (coefficient = 0.76 , 95% CI [0.53 , 1.00], $z = 6.34$, $p < .001$).

As per the mean empathy scores (Table 5), the positive relationship between the samples' effect size and female ratio was implied (1-tailed test, coefficient = 1.12 , 95% CI [-0.13 , 2.37], $z = 1.75$, $p = .040$) by a meta-regression model with an insignificant intercept (coefficient = -0.20 , 95% CI [-0.89 , 0.49], $z = -0.57$, $p = .286$). If without the intercept, the above positive relationship was significant (coefficient = 0.77 , 95% CI [0.47 , 1.07], $z = 5.11$, $p < .001$).

Meta-regression with multi-factors

In light of the individual empathy scores (Supplementary Document S1), a meta-regression with four predictors (i.e., sex ratio, empathy scale, Asian cultural background, and participant age) was conducted. The positive relationship between the mixed-sex samples' effect size and female ratio was indicated (1-tailed test, coefficient = 1.29 , 95% CI [-0.02 , 2.59], $z = 1.93$, $p = .027$) referencing a meta-regression model with a significant intercept (coefficient = -2.11 , 95% CI [-3.54 , -0.68], $z = -2.88$, $p = .002$).

In light of the mean empathy scores (Supplementary Document S1), a meta-regression with three factors (i.e., sex ratio, Asian cultural background, and participant age) was processed. The positive relationship between the mixed-sex samples' effect size and the samples' female ratio was marginally significant (1-tailed test, coefficient = 1.17 , 95% CI [-0.48 , 2.82], $z = 1.39$, $p = .082$) according to a meta-regression model with a significant intercept (coefficient = -2.03 , 95% CI [-3.68 , -0.37], $z = -2.40$, $p = .008$).

DISCUSSION

The current study verified the heterogeneity of the previous publications on the Western–Asian cultural differences in empathy (Tables 1–3). Innovatively, the current authors decoded the heterogeneity in terms of “sex.” As expected, the effect size of the cultural impact on empathy was largest for the female-only samples (i.e., Westerners > Asians; Hedges's $g = [0.56, 0.58]$) and smallest for the male-only samples (i.e., Westerners = Asians, Hedges's $g = [-0.06, 0.08]$), with the mixed-sex samples being located between the two extremes (i.e., Westerners > Asians, Hedges's $g = [0.29, 0.41]$). The effect size statistically differed between the female-only and the

male-only samples (i.e., the former > the latter). The effect of the mixed-sex samples positively regressed on the samples' sex ratio (i.e., the female ratio). More importantly, this positive regression was still evident after other factors (i.e., empathy scale, Asian cultural background, and age) were considered in the meta-regression model. Supporting the culture–sex interaction effect on empathy theory (Zhao et al., 2019, 2021), the current meta-analyses further highlighted the significance of the culture–sex interaction for future investigations.

Notably, most previous researchers have focused on understanding the Western–Asian cultural differences in empathy per se, but have ignored the potential impact of participants' sex (see Items #20 and #21 of Supplementary Document S1). Accordingly, most previous results were for mixed-sex samples (Table 1); a few results were for the female-only (Table 2) and the male-only samples (Table 3); and even fewer results tapped into the culture–sex interaction effect on self-report empathy (Melchers et al., 2015; Zhao et al., 2019, 2021). The current meta-analysis results, however, still reflected the culture–sex interaction effect based on the limited number of studies. Specifically, the present results suggested that “female” might amplify the phenomenon of Western–Asian cultural differences in self-report empathy. The overall trend was that the previous studies with more female participants were likely to present a more significant cultural difference in empathy (i.e., Westerners > Asians).

The above trend was in line with the culture–sex interaction effect on empathy theory (Zhao et al., 2019, 2021). According to the theory (Zhao et al., 2019, 2021), the Western–Asian cultural differences in self-report empathy varied according to the participant sex (i.e., female > male). One social reason underlying the culture–sex interaction could be the social expectations for showing empathy (Zhao et al., 2019, 2021). Naturally, both females and males are under the impact of culture. However, the social expectation for showing empathy may differ in light of sex (Zhao et al., 2019, 2021); moreover, this “social sex differentiation” can vary from culture to culture (Schmitt, 2015). For example, Western cultures emphasize “emotional women and rational men” (see Zhao et al., 2019, 2021), while Asian cultures highlight being moderate during social activities for both males and females (Brody, 1997; Cuddy et al., 2015; Merten, 2005). For example, the essence of both Confucius's Golden Mean philosophy (see Zhao et al., 2019, 2021) and Taoism's Yin–Yang philosophy (Lin et al., 2018) were all about a balance between extremes (e.g., Yin–Yang, feminine–masculine, and tenderness–toughness). As a result, the social expectations for the sexes may converge for Asians relative to Westerners (Brody, 1997; Cuddy et al., 2015; Merten, 2005).

It is worth mentioning that traditional Chinese cultures extensively impact Asian countries beyond China, covering Japan, Korea, and Vietnam (Jin Lee & Chae, 2019; Van, 2020; Wazir & Lei, 2019). Under the same macro-cultural background, the sex differences in empathy can be similar across these Asian countries. For example, Kim and Lee (2010) found that the sex difference in the EQ score was not significant for Koreans, which was convergent with Zhao et al. (2018) for

Chinese participants. Similarly, Groen et al. (2015) reviewed the EQ score of 18 nationalities. They found that the sex difference (i.e., female > male) in the EQ score tended to be more significant for Westerners (e.g., Italian and Dutch; Cohen's d ranged from 0.39 to 0.88) than Asians (i.e., Korean and Japanese, Cohen's d ranged between 0.11 and 0.54). Generally, the above report implied the culture–sex interaction in empathy across Western and Asian cultures. Intriguingly, Trommsdorff et al. (2007) investigated the empathic behaviors of children from Germany, Israel, Indonesia, and Malaysia. They also identified a significant culture–sex interaction effect: specifically, the sex difference in the empathic responses was significant for the German children (i.e., girls > boys) but not for the children from the other three countries (i.e., girls = boys) (Trommsdorff et al., 2007).

Thus, an essential research topic is the generality of the culture–sex interaction effect on empathy theory. For example, the definition of Western and Asian cultures should be verified, especially for Asian cultures (e.g., China, Eastern Asian, or all Asian). Similarly, the applicable age of the theory should be further explored (e.g., only adults or all age groups). The current study conducted a string of exploratory meta-analyses (Supplementary Document S1), and the results suggested that both “Asian cultural background” and “age” might impact the previous findings. The preliminary results showed that cultural differences in self-report empathy (i.e., Western > Asian) could be more significant for Asians in general than for Chinese-only samples. Meanwhile, the current results implied that the cultural differences in self-report empathy (i.e., Western > Asian) could increase as participants aged. Nevertheless, it should be mentioned that even with the impacts of “Asian cultural background” and “age” statistically controlled, the influence of “sex ratio” on the previous findings was still noticeable. The above intriguing phenomena require further confirmation by future cross-cultural research into empathy.

IMPLICATIONS FOR FUTURE STUDIES

To date, researchers have started to explore the culture–sex interaction effect beyond trait empathy (i.e., the generalized empathic traits in daily contexts; Zhao et al., 2019). Significant culture–sex interaction effects have been identified in terms of state empathy (i.e., the specific empathic reaction to a given emotional stimulus; Zhao et al., 2021) and the neurological basis under the emotional processing (i.e., brain activation to specific emotional stimuli; Pugh et al., 2022). Studying state empathy with Australian and Chinese participants, Zhao et al. (2021) observed three- to four-way interactions across traits of participants (i.e., the culture–sex interaction effect) and stimuli (e.g., ethnicity, sex, emotion) (see a summary table on Page 10 of their manuscript). For example, Zhao et al. (2021) found that Australian females showed more empathy for negative emotions (i.e., anger and sadness) expressed by males than by females. Meanwhile, Australian males tended to empathize more with the facial expressions of females (especially Asian females) than of males. In contrast, the impacts of “sex” (i.e., the sex of both participants and stimuli) on empathy were

less evident in Chinese participants. According to Zhao et al. (2021), the empathy-related “sex stereotype” (i.e., females are more empathic and vulnerable, and hence, should show and deserve more empathy than males) could be rooted deeper in Westerners than Asians.

Pugh et al. (2022) investigated the neurological connectivity for processing fear-inducing stimuli with American and Chinese participants. Pugh et al. (2022) reported significant culture–sex interaction effects on the neurological connections among the dorsolateral prefrontal cortex (DLPFC), ventromedial prefrontal cortex (VMPFC), and anterior cingulate cortex (ACC). Moreover, the most distinctive connectivity pattern was identified within the American female group (Pugh et al., 2022). These American females showed weaker and insignificant neurological connections between the DLPFC (i.e., a brain region of emotional regulation) and the other areas (i.e., VMPFC and ACC) relative to the other culture–sex participant groups (i.e., American males, Chinese females, and Chinese males). Pugh et al. (2022) proposed that American females regulated emotions less than the other groups while processing these fear-inducing stimuli (also see Atkins et al., 2016). Accordingly, Pugh et al. (2022) might reveal a neurological note (e.g., DLPFC) underpinning the culture–sex interaction effect on empathy. In all, the cultural bases (e.g., personal distress or self-construal; see Introduction) and the potential neurological bases (e.g., DLPFC) of the culture–sex interaction effect on empathy deserve attention from future researchers.

LIMITATIONS

The current study had several limitations. First, the number of publications included in this study was small, especially for the male-only and female-only samples. Notably, not all of the previous researchers presented their results for the male-only and the female-only samples separately due to a neglect of the culture–sex interaction effect (see Supplementary Document S1). Nevertheless, even based on the limited number of studies, the current meta-analyses still revealed the heterogeneity of previous findings. More importantly, the present results indicated that heterogeneity was relevant to “sex”, as hypothesized.

Second, the generalizability of the Western–Asian culture–sex interaction effect on empathy needs further discussion. Among the previous publications, the country of origin of the Asian participants was biased to China with only two exceptions (i.e., Thai and Asians with mixed nationalities). In contrast, the representation of the Western participants was broader (i.e., Americans, Australians, Germans, Spaniards, and Caucasians with mixed nationalities). After this manuscript was accepted, Atkins (2014; 2016) provided us with his data (i.e., two studies with Eastern Asians and one with Chinese people). With Atkins's data considered, we reconducted all analyses (see Supplementary Document S1) and found that the key results remained as reported in the manuscript.

Finally, the unique impact of sex on each component of empathy requires future investigation. In this study, all

empathy scores (i.e., EQ, IRI-EC, and IRI-PT) were considered to tap into empathy as a single concept. Alternatively, we conducted meta-analyses based on these individual empathy scores and the mean empathy scores. Both results revealed the same type of impact of sex on the previous studies. In addition, through a meta-regression with multi-predictors, the impact of sex was still meaningful even after the impact of the empathy scale was statistically controlled. Hence, the current results might reflect a general culture–sex interaction impact on empathy across these empathy components.

CONCLUSION

The current meta-analysis revealed the heterogeneity of the previous results of the Western–Asian cross-cultural comparisons on trait empathy. Specifically, the effect size of the Western–Asian cultural difference in empathy varied according to “sex.” First, the effect size enlarged along three sex stratification categories (relatively, female-only > mixed-sex > male-only). Second, the effect size significantly differed between the binary categories of sex (statistically, female-only > male-only samples). Third, the effect size of the mixed-sex samples positively regressed on the samples’ sex ratio (linearly, the effect size increased with the female ratio). These observations were hypothesized as per the culture–sex interaction effect on empathy theory. Ergo, the importance of the culture–sex interaction effect on empathy was emphasized by the current study for future cross-cultural investigations of empathy.

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CONFLICT OF INTEREST

The authors declare there are no conflicts of interest.

ETHICS STATEMENT

The protocol code for the meta-analysis was provided.

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