Sex Differences in Mate Preferences Across 45 Countries: A Large-Scale Replication

Kathryn V. Walter*[1], Daniel Conroy-Beam[1], David M. Buss[2], Kelly Asao[2], Agnieszka Sorokowska[3,4], Piotr Sorokowski[3], Toivo Aavik[5], Grace Akello[6], Mohammad Madallh Alhababha[7], Charlotte Alm[8], Naumana Amjad[9], Afifa Anjum[9], Chiemezie S. Atama[10], Derya Atamtürk Duyar[11], Richard Ayebare[12], Carlota Batres[13], Mons Bendixen[14], Aicha Bensafia[15], Boris Bizumic[16], Mahmoud Boussena[17], Marina Butovskaya[18,19], Seda Can[20], Katarzyna Cantarero[21], Antonin Carrier[22], Hakan Cetinkaya[23], Ilona Croy[24], Rosa María Cueto[25], Marcin Czub[3], Daria Dronova[18], Seda Dural[20], Izzet Duyar[11], Berna Ertugrul[26], Agustín Espinosa[25], Ignacio Estevan[27], Carla Sofia Esteves[28], Luxi Fang[29], Tomasz Frackowiak[3], Jorge Contreras Garduño[30], Karina Ugalde González[31], Farida Guemaz[32], Petra Gyuris[33], Mária Halamová[34], Iskra Herak[35], Marina Horvat[36], Ivana Hromatko[37], Chin-Ming Hui[29], Jas Laile Jaafar[38], Feng Jiang[39], Konstantinos Kafetsios[40,41], Tina Kavčič[42], Leif Edward Ottesen Kennair[14], Nicolas Kervyn[35], Truong Thi Khanh Ha[43], Imran Ahmed Khilji[44], Nils C. Köbis[45], Hoang Moc Lan[43], András Láng[33], Georgina R. Lennard[16], Ernesto León[25], Torun Lindholm[8], Trinh Thi Linh[42], Giulia Lopez[46], Nguyen Van Luot[43], Alvaro Mailhos[27], Zoi Manesi[47], Rocio Martinez[48], Sarah L. McKerchar[16], Norbert Meskó[33], Girishwar Misra[49], Conal Monaghan[16], Emanuel C. Mora[50], Alba Moya-Garófano[48], Bojan Musil[51], Jean Carlos Natividade[52], Agnieszka Niemczyk[3], George Nizharadze[53], Elisabeth Oberzaucher[54], Anna Oleszkiewicz[3,4], Mohd Sofian Omar-Fauzee[55], Ike E. Onyishi[55], Baris Özener[11], Ariela Francesca Pagani[45], Vilmante Pakalniskiene[56], Miriam Parise[46], Farid Pazhoohi[58], Annette Pisanski[50], Katarzyna Pisanski[3,59], Edna Ponciano[60], Camelia Popa[61], Pavol Prokop[62,63], Muhammad Rizwan[64], Mario Sainz[65], Svjetlana Salkičević[66], Ruta Sargautyte[57], Ivan Sarmány-Schuller[67], Susanne Schmehl[68], Shivantika Sharad[69], Razi Sultan Siddiqui[70], Franco Simonetti[71], Stanislava Yordanova Stoyanova[72], Meri Tadinac[66], Marco Antonio Correa Varella[73], Christin-Melanie Vauclair[28], Luis Diego Vega[31], Dwi Ajeng Widarini[74], Gyesook Yoo[75], Marta Marta Zaťková[34], Maja Zupančič[76]

[1]Department of Psychological and Brain Sciences, University of California, Santa Barbara, Santa Barbara, 93106, United States. [2]Department of Psychology, University of Texas at Austin, Austin, 78712, United States. [3]Institute of Psychology, University of Wroclaw, Wroclaw, 50-137, Poland. [4]Smell & Taste Clinic, Department of Otorhinolaryngology, TU Dresden, Dresden, 1069, Germany. [5]Institute of Psychology, University of Tartu, Tartu, 50090, Estonia. [6]Department of Mental Health, Faculty of Medicine, Gulu University, Gulu, 0, Uganda. [7]English Language Department, Middle East University, Amman, 11181, Jordan. [8]Department of Psychology, Stockholm University, Stockholm, 10691, Sweden. [9]Institute of Applied Psychology, University of the Punjab, Lahore, 54590, Pakistan. [10]Department of Sociology and Anthropology, University of Nigeria, Nsukka, 410002, Nigeria. [11]Deparment of Anthropology, Istanbul University, Istanbul, 34452, Turkey. [12]North Star Alliance, NA, Kampala, 0, Uganda. [13]Department of Psychology, Franklin and Marshall College, Lancaster, 17603, USA. [14]Department of Psychology, Norwegian University of Technology and Science (NTNU), Trondheim, 7491, Norway. [15]EFORT, Department of Sociology, University of Algiers 2, Algiers, 16000, Algeria. [16]Research School of Psychology, Australian National University, Canberra, 2601, Australia. [17]EFORT, Department of Psychology and Educational Sciences, University of Algiers 2, Algiers, 16000, Algeria. [18]Institute of Ethnology and Anthropology, Russian Academy of Sciences, Moscow, 119991, Russia. [19]NA, Russian State University for the Humanities, Moscow, 119991, Russia. [20]Department of Psychology, Izmir University of Economics, Izmir, 35300, Turkey. [21] Social Behavior Research Center, Wroclaw Faculty of Psychology, SWPS University of Social Sciences and Humanities, Wroclaw, 53-238, Poland. [22]Psychology Faculty (CECOS), Université Catholique de Louvain, Louvain-la-Neuve, 1348, Belgium. [23]Department of Psychology, Ankara University, Ankara, 6560, Turkey. [24]Department of Psychotherapy and Psychosomatic Medicine, TU Dresden, Dresden, 1069, Germany. [25]Grupo de Psicología Política y Social (GPPS), Departamento de Psicología, Pontificia Universidad Católica del Perú, Lima, 15088, Perú. [26]Deparment of Anthropology, Cumhuriyet University, Sivas, 58140, Turkey. [27]Facultad de Psicología, Universidad de la República, Motevideo, 11200, Uruguay. [28]Instituto Universitário de Lisboa (ISCTE-IUL), CIS-IUL, Lisboa,

1649-026, Portugal. [29]Department of Psychology, Chinese University of Hong Kong, Hong Kong, 0, China. [30]Escuela Nacional de Estudios Superiores, Unidad Morelia UNAM, Morelia, 58190, Mexico. [31]Psychology Department, Universidad Latina de Costa Rica, San José, 11501, Costa Rica. [32]EFORT, Department of Psychology and Educational Sciences, University of Setif 2, Setif, 16000, Algeria. [33]Institute of Psychology, University of Pécs, Pécs, 7624, Hungary. [34]Faculty of Social Sciences and Health Care, Department of Psychological Sciences, Constantine the Philosopher University in Nitra, Nitra, 94974, Slovakia. [35]Louvain Research Institute in Management and Organisations (LOURiM), Université Catholique de Louvain, Louvain-la-Neuve, 1348, Belgium. [36]Faculty of Arts, Department of Psychology, University of Maribor, Maribor, 2000, Slovenia. [37]Department of Psychology, Faculty for Humanities and Social Sciences, University of Zagreb, Zagreb, 10000, Croatia. [38]Dept of Educational Psychology and Counseling, University of Malaya, Kuala Lumpur, 50603, Malaysia. [39]Organization and Human Resource Management, Central University of Finance and Economics, Beijing, 102202, China. [40]Psychology Department, University of Crete, Rethymno, 70013, Greece. [41]Palacky University, Olomouc, 771 47, Czech Republic. [42]Faculty of Education, University of Primorska, Koper, 6000, Slovenia. [43]Department of Psychology, University of Social Sciences and Humanities, Hanoi, 100000 Vietnam, NA. [44]Department of Psychology, F.G. College for Men, F-j/d, Islamabad, 44000, Pakistan. [45]Center for Research in Experimental Economics and Political Decision Mating, Department of Economics, University of Amsterdam, Amsterdam, 1081, Netherlands. [46]Department of Psychology, Universita Cattolica del Sacro Cuore, Milan, 20123, Italy. [47]Department of Experimental & Applied Psychology, Vrije Universiteit Amsterdam, Amsterdam, 1081, Netherlands. [48]Department of Social Psychology, University of Granada, Grenada, 18010, Spain. [49]Department of Psychology, University of Delhi, Delhi, 110021, India. [50]Department of Animal and Human Biology, Faculty of Biology, University of Havana, Havana, 0, Cuba. [51]Faculty of Arts, Department of Psychology, University of Maribor, Maribor, 2000, Slovenia. [52]Department of Psychology, Pontifical Catholic University of Rio de Janeiro, Rio de Janeiro, 22451-000, Brazil. [53]Department of Social Sciences, Free Unviersity of Tbilisi, Tbilisi, 2, Georgia. [54]Faculty of Life Sciences, University of Vienna, Vienna, 1090, Austria. [55]School of Education, Universiti Utara Malaysia, Sintok, 6010, Malaysia. [56]Department of Psychology, University of Nigeria, Nsukka, 410002, Nigeria. [57]Institute of Psychology, Vilnius University, Vilnius, 1513, Lithuania. [58]Department of Psychology, University of British Columbia, Vancouver, V6T 1Z4, Canada. [59]Mammal Vocal Communication & Cognition Research Group, University of Sussex, Brighton, BN1 9RH, United Kingdom. [60]Institute of Psychology, University of the State of Rio de Janeiro, Rio de Janeiro, 21941-901, Brazil. [61]Department of Psychology, Faculty for Humanities and Social Sciences, UNATC-CINETIc, Romanian Academy, Bucharest, 30167, Romania. [62]Department of Environmental Ecology, Faculty of Natural Sciences, Comenius University, Bratislava, 842-15, Slovakia. [63]Institute of Zoology, Slovak Academy of Sciences, Bratislava, 845 06, Slovakia. [64]The Delve Pvt Ltd, NA, Islamabad, 44000, Pakistan. [65]Mind, Brain and Behavior Research Center, Department of Social Psychology, University of Granada, Grenada, 18010, Spain. [66]Department of Psychology, Faculty of Humanities and Social Sciences, University of Zagreb, Zagreb, 10000, Croatia. [67]Center for Social and Psychological Sciences, Institute of Experimental Psychology SAS, Bratislava, 841 04, Slovakia. [68]Faculty of Life Sciences, University of Vienna, Vienna, 1010, Austria. [69]Department of Applied Psychology, Vivekananda College, University of Delhi, Delhi, 110021, India. [70]Department of Management Sciences, DHA Suffa University, Karachi, 75500, Pakistan. [71]School of Psychology, P. Universidad Catolica de Chile, Santiago, 8331150, Chile. [72]Department of Psychology, South-West University "Neofit Rilski", Blagoevgrad, 2700, Bulgaria. [73]Department of Experimental Psychology, Institute of Psychology, University of São Paulo, São Paulo, 03178-200, Brazil. [74]Department of Communication, University Prof. Dr. Moestopo (Beragama), Jakarta, 10270, Indonesia. [75]Dept. of Child & Family Studies, Kyung Hee University, Seoul, 024-47, Republic of Korea. [76]Department of Psychology, Faculty of Arts, University of Ljubljana, Ljubljana, 1000, Slovenia.

[*]Corresponding author: Kathryn V. Walter, Department of Psychological and Brain Sciences, University of California, Santa Barbara, 93106; telephone: (925)286-8552; email: kwalter@ucsb.edu

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Abstract

Considerable research has examined human mate preferences across cultures, finding universal sex differences in preference for attractiveness and resources, and sources of systematic cultural variation. Two competing perspectives, an evolutionary psychological perspective and biosocial role perspective, have emerged to explain these findings. However, the original data upon which each perspective relies is decades old and the literature is fraught with conflicting methods, analyses, results, and conclusions. Using a new 45 country sample, *n* = 14,399, we attempt to replicate classic studies and test both the evolutionary and biosocial role perspective. Support for universal sex differences in preferences remains robust: men, more than women, prefer attractive, young mates; and women, more than men, prefer older mates with financial prospects. Cross-culturally, both sexes have mates closer to their own age as gender equality increases. Beyond age, neither pathogen prevalence nor gender equality robustly predicted sex differences or preferences across countries.

Key words: Mate preferences, sex differences, cross-cultural studies, evolutionary psychology, biosocial role theory

Sex Differences in Mate Preferences Across 45 Countries: A Large-Scale Replication

Sex differences are of broad interest across psychology. Their existence and importance are key topics in research areas spanning from spatial navigation (e.g. Levine et al., 2016), to education (e.g. in STEM, Stoet & Geary, 2018), and neuroscience (e.g. Cahill, 2006). However, in no area have sex differences been a greater lightning rod than in human mating research. Here, fundamental questions—why do sex differences exist, what sex differences exist, and how do they vary—have been the source of heated debate for decades.

Two competing perspectives have emerged to explain the nature and origin of sex differences in mate preferences: an evolutionary psychological perspective and biosocial role perspective. Each has taken a body of contrasting findings as foundational to their approach, defining trenches in a decades-long stand-off. However, psychological science is in an era in which many findings once taken as foundational are being questioned due to revelations about prior methodological limitations, unappreciated flexibility in research design and reporting, and the dearth of replication attempts (e.g. Simmons, Nelson, & Simonsohn, 2011). A close look at the literature on cross-cultural sex differences in mate preferences reveals it suffers from many of these symptoms, including great variability across studies in design and analysis, as well as few attempts at replication.

Here, we attempt to remedy this by integrating and replicating prior work using more appropriate analytic techniques; preregistering the predictor, moderator, and control variables and reporting all results transparently in the same analytic framework; and using a new, large, in-person cross-cultural sample. In doing so, we provide new clarity regarding the contrasting results in the prior literature, simultaneously test the predictions of both perspectives, and provide a more secure foundation for theoretical advances in this highly influential research area.

Cross-Culturally Universal Sex Differences

The evolutionary psychological perspective on sex differences in human mate preferences follows largely from Buss (1989). In this classic study, Buss proposed that while both sexes are expected to prefer a mate that is kind, intelligent, and healthy, they are also expected to differentially prefer characteristics related to resources and fertility (see Buss & Barnes, 1986). Women face a larger minimum reproductive investment than men. This inequity has led to evolved psychologies in which women prefer, more so than men, long-term partners with ability to acquire and confer resources, while men, more so than women, prefer partners with high reproductive value, indicated by attractiveness and relative youth.

To test these predictions, Buss collected mate preferences from over 10,000 participants in 37 different cultures (Buss, 1989). Consistent with evolutionary hypotheses, both sexes ranked kindness and intelligence as most important in all samples. However, in 36 out of 37 cultures, women rated “good financial prospects” as more important in a potential mate than men did. In 34 out of 37 cultures, men rated “good looks” as more important than women did. Women also preferred a spouse older than themselves while men preferred a spouse younger than themselves, on average.

Kenrick and Keefe (1992) elaborated upon these findings with additional evidence of a sex difference in age preference reflected in marriage records and advertisements from various countries. Looking at trends of partner age differences across the lifespan, they found that women consistently marry older men as they age, whereas men marry increasingly younger women as they age.

Cross-Cultural Variability in Sex Differences

In 1999, Eagly and Wood offered biosocial role theory (originally social role theory; see Wood & Eagly, 2012, for an updated overview) as an alternative explanation for sex differences in mate preferences. Biosocial role theory locates the origin of sex differences in the contrasting roles men and women occupy in society. Differences in upper body strength and reproductive activities lead to a division of labor driven by efficiency, but with male-dominated roles yielding greater status. Psychological sex differences result from the behavior men and women cultivate based on societal expectations of gender roles.

Eagly and Wood (1999) hypothesized that sex differences would be larger in societies with greater gender inequality. To evaluate this, they reanalyzed the data from Buss (1989), examining the correlation between country-level sex differences and measures of gender equality. They found that gender equality levels diminished sex differences in preferences for good earning capacity, age, and good housekeeping.

Zentner & Mitura (2012) reinforced these findings using Buss (1989)'s data, a new 10 country dataset, and an updated measure of gender equality. Again, the sex difference in preference for age was negatively correlated with gender equality in both samples, but preference for good financial prospects was negatively correlated with gender equality only in their new sample. They also calculated an overall sex difference for each country, which was negatively correlated with gender equality in both samples (but see Schmitt, 2012).

Challenging biosocial role theory, Gangestad, Haselton, and Buss (2006) reexamined cross-cultural variability in mate preferences, using gender equality and pathogen prevalence as competing predictors (see also Gangestad & Buss, 1993). They hypothesized that variability in mate preferences across cultures is driven by environmental factors historically relevant to fitness, such as pathogen prevalence. Using the same data from Buss (1989), Gangestad, Haselton, and Buss (2006) found that gender equality did not significantly predict any sex differences in preferences. However, in countries with higher pathogen prevalence, both men and women placed higher value on physical attractiveness, health, and intelligence, all hypothesized cues of pathogen load.

Table 1

Predictions about the relationship between outcome and predictor variables in cross-cultural mate preference research from evolutionary and biosocial role perspectives

		Predictor Variable		
Outcome Variable	Perspective	Sex	Sex and Gender Equality	Pathogen Prevalence
Good Financial Prospects	Evolutionary	Large sex difference	No prediction	No relationship
	Biosocial	Sex difference; insofar as there is gender inequality	Sex difference decreases as gender equality increases	No prediction
Physical Attractiveness	Evolutionary	Large sex difference	No prediction	Preference increases as pathogen prevalence increases
	Biosocial	Sex difference; insofar as there is gender inequality	Sex difference decreases as gender equality increases	No prediction
Intelligence	Evolutionary	No-to-small sex difference, high level preferred	No prediction	Preference increases as pathogen prevalence increases
	Biosocial	Sex difference; insofar as there is gender inequality	Sex difference decreases as gender equality increases	No prediction
Kindness	Evolutionary	No-to-small sex difference, high level preferred	No prediction	No relationship
	Biosocial	Sex difference; insofar as there is gender inequality	Sex difference decreases as gender equality increases	No prediction

Health	Evolutionary	No-to-small sex difference, high level preferred	No prediction	Preference increases as pathogen prevalence increases
	Biosocial	Sex difference; insofar as there is gender inequality	Sex difference decreases as gender equality increases	No prediction
Age Choice	Evolutionary	Large sex difference	No prediction	No relationship
	Biosocial	Sex difference; insofar as there is gender inequality	Sex difference decreases as gender equality increases	No prediction

The Current Study

The studies described here are central to the debate between the evolutionary and biosocial role perspectives. Their predictions, reviewed in Table 1, are core components of each perspective's research programs. However, these classics demand replication for several reasons. First, the conflicting findings in this literature are challenging to compare because of great variability in design and analysis across studies. For instance, Buss (1989) analyzed both ranked and rated preferences; Eagly and Wood (1999) emphasized ranked preferences; Zentner and Mitura (2012) used rated preferences; and Gangestad, Haselton, and Buss (2006) used composites of ranked and rated preferences. Eagly and Wood (1999) used no control variables; Zentner and Mitura (2012) controlled for GDP, latitude, and sometimes religion; and only Gangestad, Haselton, and Buss (2006) used a world region control. In their new sample, Zentner and Mirtura (2012) measured gender equality with the Global Gender Gap Index (GGGI), but did not report results with measures used by Eagly and Wood (1999). Second, though this research area appears to contain an abundance of data, most studies reanalyze the same dataset: the sample from Buss (1989). Third, previous research did not account for the nested nature of the data. Updated analytic techniques allow for better analyses of cross-cultural datasets without conducting multiple t-tests or calculating correlations based on aggregated nation-level data.

The current study attempts to correct for these issues by examining all of the competing hypotheses in these classic cross-cultural studies from the human mating literature under a single common, transparent, and appropriate analytic framework. Here we use a new, 45 country sample of comparable scope to the original dataset, all of the previously proposed predictor and control variables, and report all of the results. By removing researcher degrees of freedom that have characterized this literature, we can thoroughly reexamine the sex differences in mate preferences and predictors of cross-cultural variation previously thought to be established and provide a more secure launching off point for investigations in this important area of research.

Method

Overall, this study integrates, advances, and replicates classic cross-cultural studies from the human mating literature. Specifically, we examined sex differences in mate preferences across cultures and their multivariate effect size (Buss, 1989; Conroy-Beam et al., 2015); sex differences in the age of chosen long-term partners (Buss, 1989; Kenrick & Keefe, 1992), cross-cultural variability in mate preferences as a function of pathogen prevalence (Gangestad & Buss, 1993; Gangestad, Haselton & Buss, 2006), and cross-cultural variability in sex differences in mate preferences as a function of gender equality (Eagly & Wood, 1999; Zentner & Mitura, 2012).

Participants

Data were collected in 2016, from participants in 45 different countries, n = 14,399 (7,909 female). All participant data were collected in person because online samples tend to be less representative of populations in developing countries (Batres & Perrett, 2014). Each study site collected data from both university populations and community samples. Due to a lack of records from about half of the sites, there is incomplete information about the percentage of each type of sample. From the sites that did keep records (*n* = 6,604), 47.21% (*n* = 3,118) came from community samples. Age of participants ranged from 18-91 years old (*Mdn* = 25, *M* = 28.78, *SD* = 10.62). Of the total sample, most participants reported being in ongoing, committed relationships (*n* = 9,206, 63.93%).

Surveys were distributed to participants through a collaborative cross-cultural data collection project. Researchers around the world were contacted with the intention to include as many country sites as possible, and the resulting countries are those in which researchers were willing and able to collect data at the time of the study. All researchers involved in data collection were required to provide a fixed sample size based on the number of local contributors.

Exclusion criteria. Participants who were under the age of 18 when taking the survey were excluded from all analyses. Participants who did not fill out any part of the mate preferences survey or did not report their sex were excluded as well. Two countries surveyed did not include the mate preferences portion of the survey (Serbia and Ukraine) and are not included in analyses (bringing the total to 45 countries). Participants did not indicate mate age in four countries (Bulgaria, Jordan, Vietnam, Uruguay) and those countries are not included in age analyses. Some participants reported very young ages for mates (mate age less than 10). We were concerned that at least some of these reports may have been erroneous. Therefore, all analyses for age differences were run twice: first all reported mate ages (*n* = 8,920), and second, limited to those participants with reported mate ages older than 10 (*n* = 8,614). In the main text, we report the results of analyses with reported mate ages older than 10. For results with all reported mate ages, see the supplementary material.

Measures

Mate preferences. Participants completed a 5-item questionnaire on ideal mate preferences for a long-term romantic partner. Specifically, participants were asked:

> For the following questions we are interested in what you desire in an ideal long-term mate (e.g. committed, romantic relationship). Each of the following is a trait that a potential mate might have. For each trait, please select the option that best represents your ideal long-term mate. Please remember we are interested in your preferences for ideal long-term (committed, romantic) mates.

Participants then rated their ideal romantic partner on five traits: kindness, intelligence, health, physical attractiveness, and good financial prospects. All items were rated on bipolar adjective scales ranging from 1 (very unintelligent; very unkind; very unhealthy; very physically unattractive; very poor financial prospects) to 7 (very intelligent; very kind; very healthy, very physically attractive; very good financial prospects). We were limited to asking about these five items due to survey space and participant time constraints. Kindness, intelligence, and health were chosen because prior literature has found these to be universally desirable in potential mates; physical attractiveness and financial prospects were chosen to attempt to replicate prior universal sex differences.

This item format differs slightly from that of Buss (1989) in order to address several potential limitations of the original item format. First, in the prior measure, participants were asked to rate how “important or desirable” they found each characteristic on a scale from “irrelevant or unimportant” to “indispensable”. However, because the original item format asked only about the positive pole of each dimension it potentially confounds both the importance of a trait dimension and the preferred value on that trait dimension. A participant who provides a low importance rating to the characteristic "good financial prospect" could mean to say either (1) their partner's wealth is unimportant to them, regardless of whether it is high or low or (2) their partner's wealth is very important to them, but they prefer a partner with more modest financial prospects. The original item format does not allow a researcher to unambiguously discriminate between these possibilities. The bipolar adjective format asks about preferred trait value alone and therefore more clearly represents what participants prefer in a partner.

Second, the original Buss (1989) questionnaire asked participants to rank their preference for kindness compared to other preferences, but did not collect rated preferences for kindness. Additionally, the rated item for intelligence was double-barreled ("education and intelligence"). We included rated items for "kindness" and "intelligence" to more precisely test the preferred value and sex difference in preference for these dimensions.

Finally, the original Buss (1989) questionnaire collected ratings using a relatively restricted 4-point scale, which may not allow enough response variation to detect subtle sex differences. We opted for a 7-point scale to allow participants more response variation.

Age. Participants reported their own age in years as part of a demographic questionnaire. Participants in relationships additionally reported the age of their actual partner. The Buss (1989) study asked participants about their ideal age preferences, not about their actual age choices. We were unable to include items measuring age preferences due to participant time constraints; for this reason, we originally planned to analyze only the rated preferences. However, before pre-registering our analysis plan, we decided to examine age as a variable as well in light of the importance of age and age choice within the prior literature (Kenrick & Keefe, 1992; Eagly & Wood, 1999).

Pathogen prevalence. Pathogen measures include the pathogen prevalence index developed by Low (1990) and used in Gangestad & Buss (1993); years of life lost to communicable diseases (WHO, 2015a; following Debruine et al., 2010); and the average of years of life lost to infectious and parasitic diseases and estimated deaths due to infectious and parasitic diseases (WHO, 2015b). Because the data retrieved from the WHO were gross values, we divided each country's score by its population size to produce comparable values across countries. To create the third index, the two variables (estimated deaths, and years of life lost to infectious and parasitic diseases) were standardized and averaged for each country. The new index was highly correlated with the other two indices (r = .60 with Low index, r = .97 with years of life lost to communicable diseases).

Gender equality. Gender equality measures include the Gender Development Index (GDI) and Gender Empowerment Measure (GEM) used in Eagly and Wood (1999); the Global Gender Gap Index (GGGI) (World Economic Forum, 2016), the Gender Inequality Index (GII) (United Nations Development Programme, 2015b), and the updated version of the GDI (United Nations Development Programme, 2015a); and a composite variable created through principal components analysis (PCA) using the updated GDI, GGGI, and GII. These three variables were entered into a PCA to extract the first principle component. Scores on this principle component were used as each country's gender equality composite score. This composite measure of gender equality explained 80.67% of the variance in the GDI, GGGI, and GII and accordingly is highly correlated with all included measures of gender equality (r = .87 GEM 1995, r = .81 GDI 1995, r = .90 GII, r = .89 GDI 2015, r = .90 GGGI 2016).

Control variables. Control variables include GDP per capita (Central Intelligence Agency, 2016), latitude (Central Intelligence Agency, n.d.), world region (from Gangestad, Haselton, & Buss, 2006), and most common religion (from Zentner & Mitura, 2012; Central Intelligence Agency, n.d.). All controls were based on those used in previous studies of cross-cultural sex differences in preferences, and we used the most current information available at the time of analyses.

Analyses

All primary analyses were conducted using multilevel models. In these models, participants were nested within countries. The models included random effects for both slopes and intercepts. Multilevel models provide several advantages over traditional approaches, such as conducting multiple t-tests or country level correlations, for analyzing this kind of cross-cultural data. These models allow for an estimation of overall sex differences in mate preferences in the data, and an estimate of the variability in these sex differences across cultures based on the random effects. The use of a single multilevel model to assess sex differences across cultures also minimizes both alpha inflation and the risk of Type II errors relative to the approach of conducting multiple *t*-tests (e.g. Buss, 1989). For cross-cultural comparisons, these models take advantage of the nested nature of the data, yielding more statistical power relative to the approach of calculating correlations based on aggregated nation-level data (e.g. Eagly & Wood, 1999).

Additionally, due to the challenge of collecting cross-cultural data, sample sizes vary from country to country (ranging from $n = 80$, in El Salvador, to $n = 1061$, in Turkey). If effect sizes vary more widely in smaller samples, this suggests that a substantial portion of the cross-cultural variation in sex differences is due to sampling error, adding considerable noise to cross-cultural comparisons. To assess the risk of this, we plotted country-level sex differences against sample size from each country to create funnel plots (see supplementary materials). The triangle shape of the graphs illustrate that larger samples have Cohen's *d* values closer to the average sex difference while smaller samples are more varied. This indicates that one source of cross-cultural variation is indeed sampling error. However, multilevel models account for this error introduced by variability in sample size by accounting for unequal sample sizes in estimating the random slopes. Finally, multilevel models allowed for all analyses to be conducted within the same modeling framework, allowing for a clearer interpretation of the results.

Overall, analyses include multilevel models to examine sex differences in univariate mate preferences and partner age, multivariate analyses using Mahalanobis D and logistic regression to assess overall sex differences, and multilevel models with moderators (pathogen prevalence and gender equality) to examine cross-cultural variation in preferences and partner age.

Sex Differences in Mate Preferences. Five multilevel models, one for each preference (kindness, intelligence, health, good financial prospects, physical attractiveness) assessed sex differences in mate preferences across cultures. In these models the preference variable was the outcome variable and participant sex (male or female) was the predictor. Mate preference variables were standardized across countries prior to analysis to provide slope values comparable to Cohen's *d*.

Actual Partner Age. One multilevel model assessed sex differences in actual partner age across cultures. In this model the difference between self and partner age was the outcome variable and participant sex (male or female) was the predictor. This difference was standardized across countries prior to analysis to provide slope values comparable to Cohen's *d*.

Multivariate Analyses. The five preference variables were used to calculate the Mahalanobis distance (*D*) between males and females within each country. Additionally, *D* was calculated separately for putatively sex-differentiated preferences (good financial prospects and physical attractiveness) and those preferences not expected to be as strongly sex differentiated (intelligence, kindness, health). Bootstrapping was used to estimate 95% confidence intervals around these *D* values for each country (for a full list see table in supplemental material).

A Monte Carlo cross-validated logistic regression was used to assess the ability of preferences to predict participant sex. Logistic regression models were trained in a random training set to predict participant sex using their ideal mate preferences; these models were then applied to predict the sex of participants in a separate testing set. Each fold of this cross-validation left out 10% of the data for testing. The relevant outcome variable was the percentage of participant sexes accurately predicted by the model in the testing set. This process was repeated for 10,000 iterations, providing an estimate of out-of-sample predictive accuracy of preferences and estimated confidence intervals around this accuracy.

Pathogen Prevalence. The effect of pathogen prevalence on ideal mate preferences was tested in a series of multi-level models predicting preferences from nation-level pathogen prevalence indices. Three multilevel models were fitted for each of the five mate preference variables. Each model used the relevant ideal mate preference as the outcome variable and predicted this variable using one of three pathogen prevalence indices.

Gender Equality. The effect of nation-level gender equality on sex differences in mate preferences was examined by fitting a series of multilevel models predicting ideal mate preferences from sex and nation-level gender quality. Each model had one of the five ideal preference variables as an outcome variable. These models used the interaction of participant sex and a gender equality variable as the predictor, along with all relevant main effects.

Controls. For all cross-cultural comparisons, we ran both a base model with no controls and models that attempt to approximate relevant controls used in the original papers (Gangestad & Buss, 1993; Gangestad, Haselton, & Buss, 2006; Zentner & Mitura, 2012). Each of the control models included a standard set of control variables: latitude, GDP per capita, world region, and most common religion. These variables were selected because they were each used in the papers replicated here. In the main text, we report only the results of models without the control variables. See the supplemental material for the models and results including control variables.

Outcome variables were standardized in all analyses. Predictor variables were also standardized with the exception of sex.

The analysis plan for this project was pre-registered prior to data analyses. The pre-registration, data, and script can be accessed at https://osf.io/gb5cn/. All data analysis was conducted in R.

Results

Sex Differences in Mate Preferences

Overall, we replicated the sex differences in preference for resources and attractiveness found in Buss (1989) (Figure 1). Women reported a higher preference for an ideal mate with good financial prospects than men, on average, b = -0.30, SE = 0.03, p < .001. Mate preferences were standardized across countries prior to analysis, so this and all b values can be interpreted equivalently to a Cohen's d. The average for women was M = 5.48, 95% CI [5.46, 5.51], and the average for men was M = 5.11, 95% CI [5.08, 5.14]. The smallest sex difference was in Spain, b = -0.12, and the largest sex difference was in China, b = -0.56. Furthermore, men reported a higher preference for a physically attractive ideal mate than women, on average, $b = 0.27$, $SE = 0.03$, $p < .001$. The average for women was $M = 5.56$, 95% CI [5.53, 5.58] and the average for men was $M = 5.85$, 95% CI [5.83, 5.88]. The sex difference ranged from $b = -0.07$ in China, to $b = 0.50$ in Brazil.

In contrast to Buss (1989), we found small but still significant sex differences in reported ideal preference for kindness, intelligence, and health. However, in line with Buss (1989), both men and women reported higher preferences for these traits in an ideal partner than for good financial prospects or physical attractiveness. Women reported preferences for kinder ideal mates than men, on average, $b = -0.12$, $SE = .02$, $p < .001$. The average for women was $M = 6.23$, 95% CI [6.21, 6.26], and the average for men was $M = 6.12$, 95% CI [6.10, 6.15]. The sex difference ranged from $b = -\ 0.23$ in the United States, to $b = 0.06$ in Uganda. Women also reported preferences for greater intelligence in ideal mates, on average, $b = -0.12$, $SE = 0.02$, $p < .001$. The average for women was $M = 6.03$, 95% CI [6.01,6.05] and the average for men was $M = 5.92$, 95% CI [5.89, 5.94]. The sex difference ranged from $b = -\ 0.35$ in China, to $b = 0.04$ in Algeria. Finally, women reported preference for healthier ideal mates than men, on average, $b = -.09$, $SE = 0.03$, $p = .001$. The average for women was $M = 6.10$, 95% CI [6.08, 6.12], and the average for men was $M = 6.00$, 95% CI [5.98, 6.03]. The sex difference ranged from $b = -\ 0.29$ in Belgium, to $b = 0.10$ in Hungary.

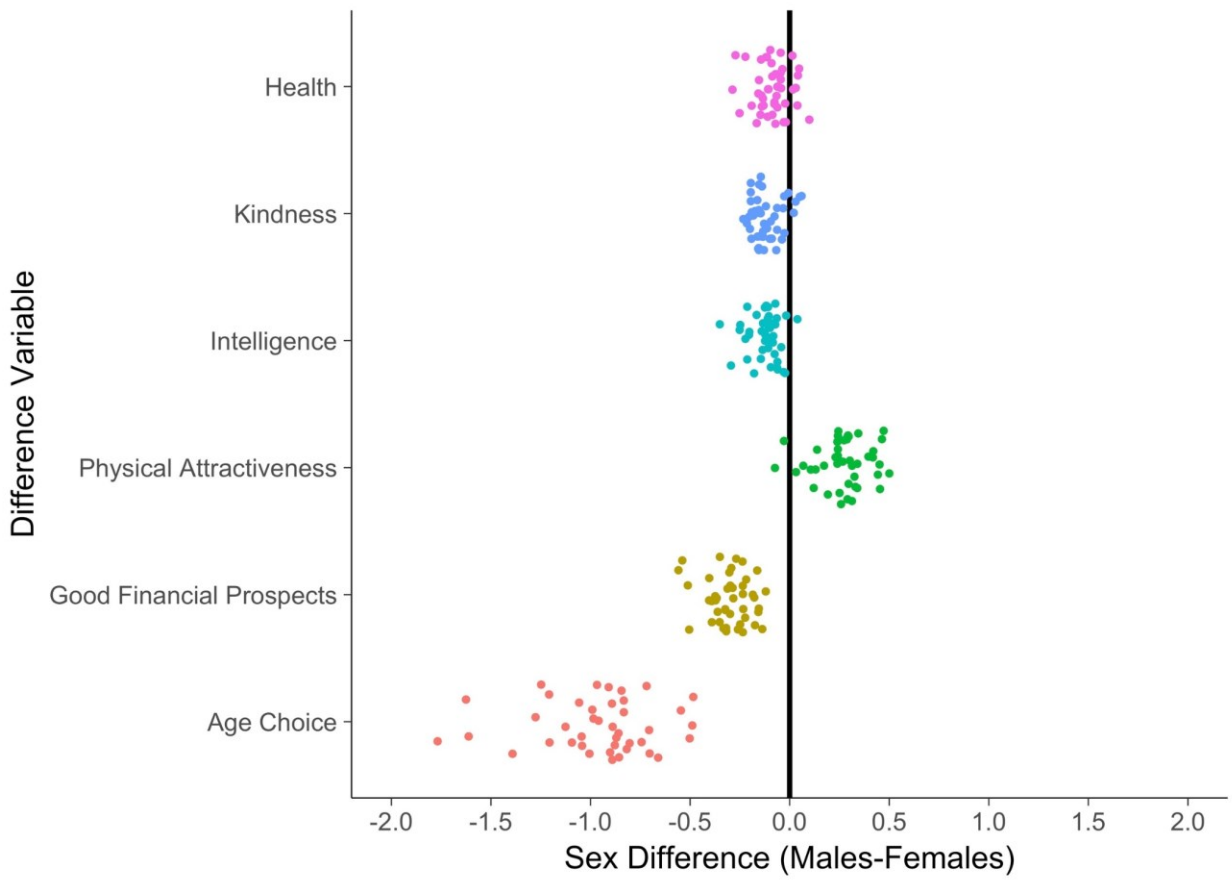

Figure 1. Sex differences in mate preferences and age choice across countries. Dot position reflects the random slope value (*b*) for each country. The black line depicts where values would fall if there was no sex difference. For the five preferences, positive beta values indicate that men had a higher preference than women for a particular trait and negative values indicate that women had a higher preference than men for a particular trait. For age choice, negative beta values indicate that men had younger partners and women had older partners. Data are jittered to reduce overplotting.

Actual Partner Age

In terms of sex differences in the age of mated partners, we replicated Buss (1989) and Kenrick and Keefe (1992). Men reported having partners younger than themselves, while women reported having partners older than themselves, on average, $b = -0.96$, $SE = 0.05$, $p < .001$.

Women reported partners, $M = 2.43$, 95% CI [2.31, 2.55], older than themselves, and men reported partners $M = -2.26$, 95% CI [-2.39, -2.13], younger than themselves. The sex difference ranged from $b = -1.77$ in Algeria, to $b = -0.48$ in the United States. Overall, as men's age increased they reported increasingly younger partners on average, while as women's age increased their reported partner age remained consistently a few years older than themselves on average (Figure 2).

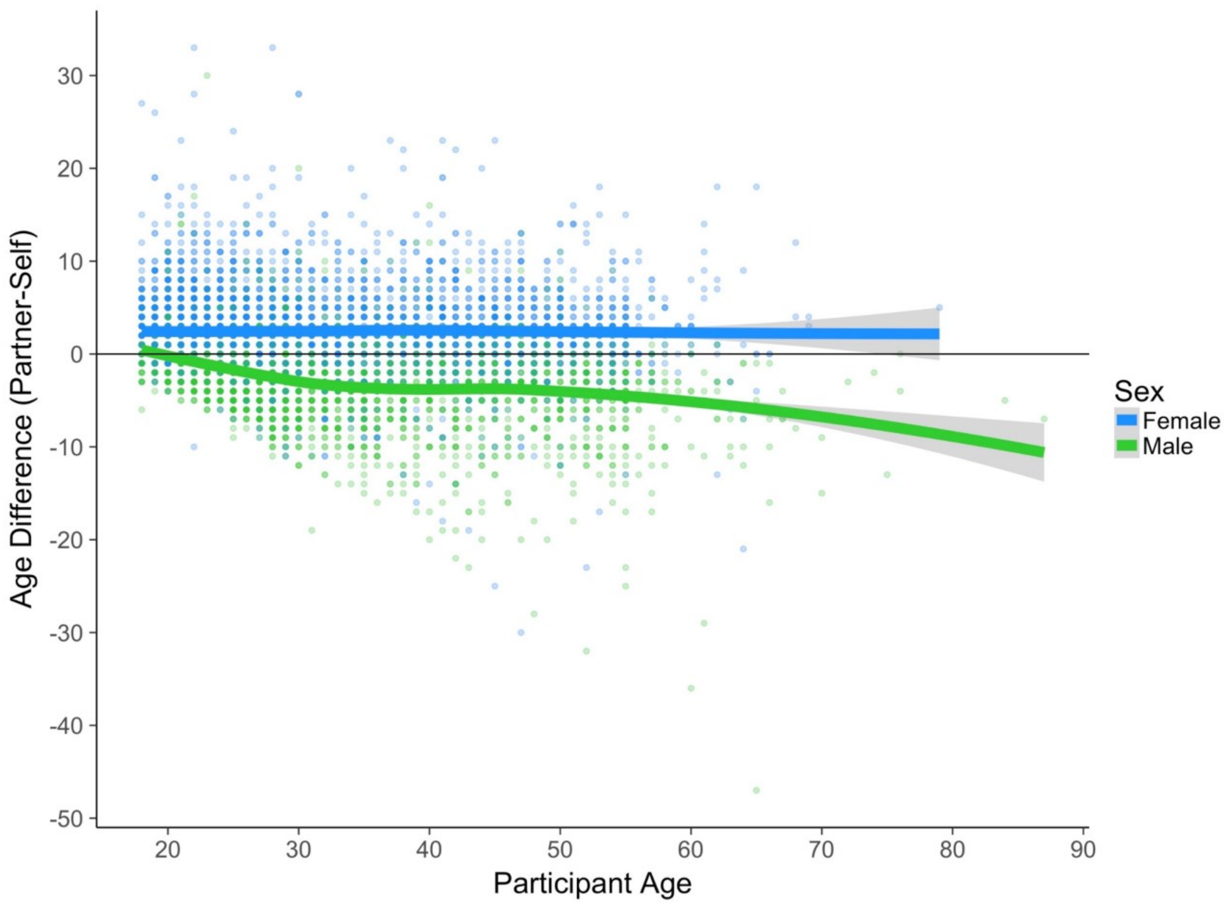

Figure 2. Difference between participant and their reported partner age, across participant ages. Data are jittered to reduce overplotting. Trend lines were generated by loess smoothing to illustrate the pattern of the data. Shaded areas indicate 95% confidence intervals.

Multivariate Effect Size

Our results were overall consistent with Conroy-Beam et al. (2015). When calculating the Mahalanobis distance (*D*) between males and females based on all five preference variables within each country, the overall sex difference was relatively large; $D_{mean} = 0.73$. These D-values ranged from *D* = 1.42, 95% CI [1.15, 1.86] in Georgia, to *D* = 0.30, 95% CI [0.19, 0.62] in Nigeria (Figure 3).

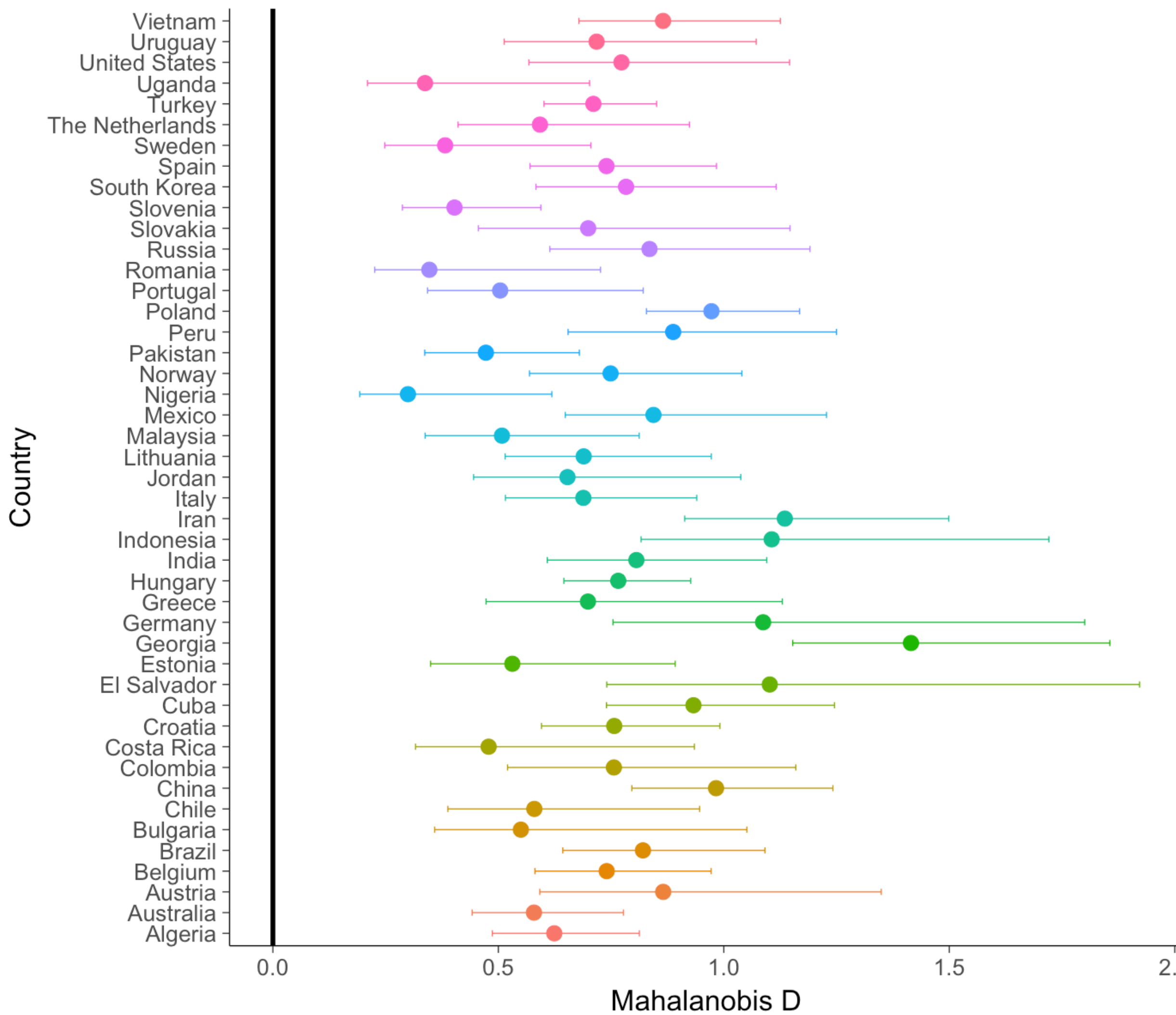

Figure 3. Mahalanobis *D* values with error bars representing bootstrapped 95% confidence intervals for each country. Larger *D* values indicate more sex differentiation in overall pattern of mate preferences.

Additionally, *D* was calculated separately for putatively sex-differentiated preferences (good financial prospects and physical attractiveness) resulting in an average *D* = 0.62, ranging from *D* = 0.26, 95% CI [0.08, 0.52] in Sweden, to *D* = 1.08, 95% CI [0.77, 1.48] in Georgia. For those preferences not expected to be as strongly sex differentiated (intelligence, kindness, health), the Mahalanobis distance was comparatively smaller: *D* = 0.33, ranging from *D* = 0.05, 95% CI [0.05, 0.34] in Italy, to *D* = 0.73, 95% CI [0.36, 1.31] in Germany. For full list of country *D* values and confidence intervals see the supplementary material.

A Monte Carlo cross-validated logistic regression was used to assess the ability of preferences to predict participant sex. The average predictive accuracy was significantly above chance, *M* = 0.63, 95% CI [0.61, 0.65].

Pathogen Prevalence

Table 2 shows the results of the multilevel models predicting preferences from nation-level pathogen prevalence indices, without control variables.

Table 2: Preferences and age as a function of pathogen prevalence

Pathogen Index	Preference	*β*	*SE*	*p*
Gangestad & Buss (1993)	Good fin. Prosp.	0.13	0.05	.027*
	Phys. Att.	-0.01	0.04	.897
	Kindness	-0.002	0.05	.963
	Intelligence	0.03	0.04	.536
	Health	0.20	0.05	.002**
	Age Difference	0.01	0.02	.608
Years life lost to communicable diseases	Good fin. Prosp.	0.08	0.03	.014*
	Phys. Att.	0.04	0.03	.163
	Kindness	-0.01	0.03	.693
	Intelligence	-0.004	0.03	.908
	Health	0.04	0.04	.321
	Age Difference	-0.01	0.02	.419
Composite	Good fin. Prosp.	0.08	0.03	.012*
	Phys. Att.	0.05	0.03	.120
	Kindness	-0.01	0.03	.724
	Intelligence	-0.0001	0.03	.997
	Health	0.04	0.03	.290

	Age Difference	-0.06	0.07	.447

Note: * = p < .05; ** = p < .01; *** = p < .001

Overall, our results did not replicate the findings of Gangestad and Buss (1993) or Haselton, Gangestad, and Buss (2006). While the original papers found that preference for physical attractiveness and health were higher in countries with increased pathogen prevalence, our data did not show the same pattern. Instead, pathogen prevalence predicted preference for an ideal mate with good financial prospects for all measures. Additionally, pathogen prevalence predicted preference for a healthy ideal mate for just one of the measures (the measure used by Gangestad & Buss, 1993), $\beta = 0.20$, $SE = 0.05$, $p = .002$. However, when control variables were included, pathogen prevalence did not significantly predict any outcome variables (see supplementary material).

Gender Equality

Table 3 shows the results of the multilevel models predicting ideal mate preferences from sex and nation-level gender quality, without control variables.

Table 3: Sex differences in preferences and age as a function of gender equality

Gend. Eq. Index	Preference	*b*	*SE*	*p*
GDI (1995)	Good fin. prosp.	0.02	0.03	.414
GDI (1995)	Phys. Att.	0.04	0.03	.208
GDI (1995)	Kindness	-0.02	0.02	.449
GDI (1995)	Intelligence	-0.01	0.03	.648
GDI (1995)	Health	0.02	0.03	.393
GDI (1995)	Age Difference	0.19	0.06	.002**
GEM (1995)	Good fin. prosp.	0.04	0.03	.214
GEM (1995)	Phys. Att.	0.03	0.04	.366
GEM (1995)	Kindness	-0.03	0.02	.143
GEM (1995)	Intelligence	0.02	0.03	.556
GEM (1995)	Health	0.05	0.03	.139
GEM (1995)	Age Difference	0.16	0.06	.007**
GII (2015)	Good fin. prosp.	-0.03	0.03	.277
GII (2015)	Phys. Att.	0.03	0.03	.250

GII (2015)	Kindness	0.01	0.02	.734
GII (2015)	Intelligence	0.004	0.02	.853
GII (2015)	Health	0.02	0.03	.383
GII (2015)	Age Difference	-0.13	0.03	.008**
GGGI (2016)	Good fin. prosp.	0.06	0.03	.036*
GGGI (2016)	Phys. Att.	0.03	0.03	.387
GGGI (2016)	Kindness	-0.04	0.02	.139
GGGI (2016)	Intelligence	0.03	0.02	.202
GGGI (2016)	Health	0.02	0.03	.529
GGGI (2016)	Age Difference	0.13	0.06	.027*
GDI (2015)	Good fin. prosp.	0.02	0.03	.423
GDI (2015)	Phys. Att.	0.05	0.03	.139
GDI (2015)	Kindness	-0.02	0.03	.397
GDI (2015)	Intelligence	-0.02	0.03	.489
GDI (2015)	Health	0.01	0.03	.828
GDI (2015)	Age Difference	0.18	0.06	.003**
Composite	Good fin. prosp.	0.05	0.03	.107
Composite	Phys. Att.	0.002	0.03	.951
Composite	Kindness	-0.03	0.03	.305
Composite	Intelligence	0.005	0.03	.863
Composite	Health	-0.004	0.03	.873
Composite	Age Difference	0.15	0.05	.007**

Note: * = p < .05; ** = p < .01; *** = p < .001. GII (2015) is reverse scored.

Our results partially replicated the findings of both Eagly and Wood (1999) and Gangestad, Haselton and Buss (2006). Gender equality predicted the sex difference in the actual age of long-term romantic partners, for every measure of gender equality, in line with Eagly and Wood (1999), but contrary to Gangestad, Haselton, and Buss (2006). Using the composite measure, gender equality predicted the change in both men's age choices, *b* = 0.09, *SE* = 0.03, *p* = .016; and women's age choices, *b* = -0.07, *SE* = 0.02, *p* = .007 (Figure 4). However, two countries (Nigeria and Malaysia) did not have composite gender equality scores due to missing values (Nigeria does not have a GII value, and Malaysia does not have a 2015 GDI value). To take advantage of the age data from these two countries, we ran an additional analysis looking at the change in both sexes age choices predicted by the GGGI. Gender equality, using the GGGI, again predicted the change in women's age choices, $b = -0.07$, $SE = 0.03$, $p = .013$; and men's age choices were marginally significant in the predicted direction, $b = 0.06$, $SE = 0.03$, $p = .075$.

However, in contrast to Eagly and Wood (1999) and replicating Gangestad, Haselton, and Buss (2006) gender equality did not robustly predict sex differences in any of the mate preference measures. The only exception to this was that one of the measures of gender equality, the GGGI, predicted the sex difference in preference for an ideal mate with good financial prospects, $b = 0.06$, $SE = 0.03$, $p = .036$. This replicates the relationship between the GGGI and good financial prospects that Zentner and Mitura (2012) found in their new 10 country sample. Including controls did not change the pattern of results (see supplementary material).

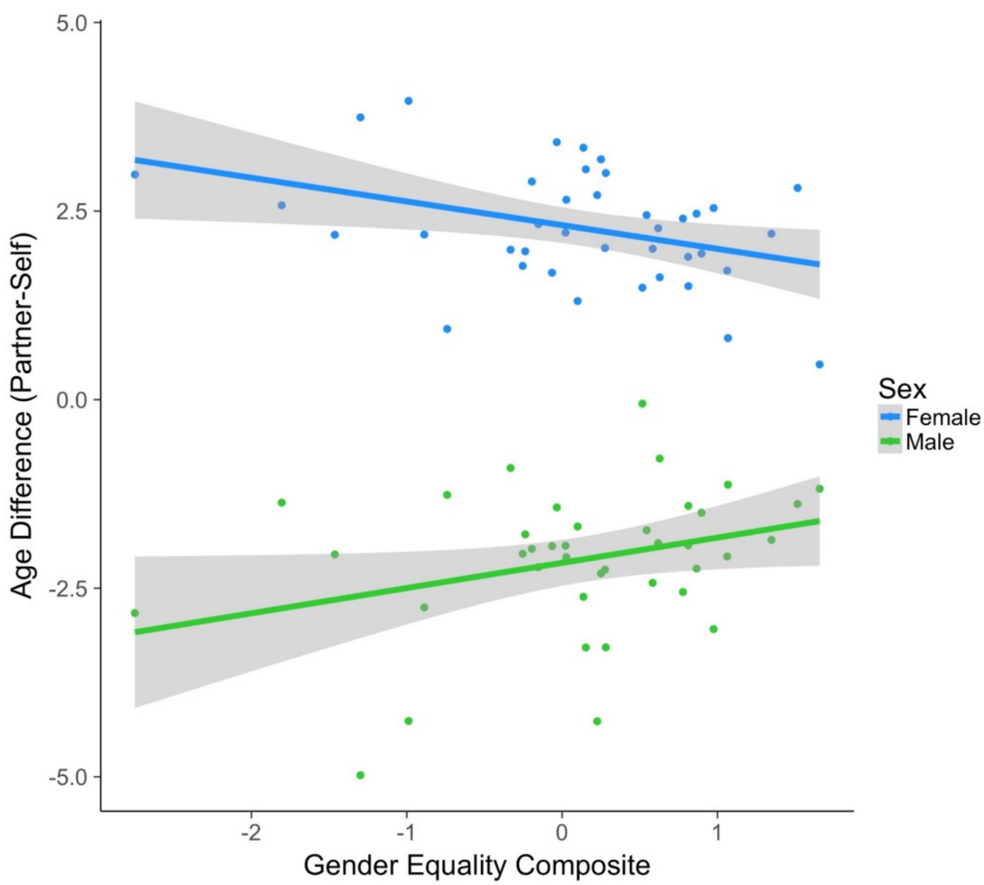

Figure 4. Average age difference between participant and partner for each country separated by sex, across each country's standardized gender equality composite score. Regression lines shown

with shaded areas indicating 95% confidence intervals. Gender equality predicted the change in both sexes age choices, with both men and women choosing partners closer to their own age in more gender equal countries.

Discussion

The debate surrounding sex differences in mate preferences has remained unresolved for decades, due in part to an unstandardized supporting literature hampered by methodological and analytical limitations. Here we attempted to replicate central findings from both an evolutionary and biosocial perspective correcting for these issues. Overall, cross-culturally, universal sex differences in mate preferences remain empirically robust. Specifically, women around the world on average indicated ideal preferences for a long-term mate with greater financial prospects whereas men on average indicated preference for more physically attractive mates. Women had partners that were a few years older than themselves on average, while men had partners increasingly younger than themselves as they aged. Additionally, women indicated slightly higher preferences for kindness, intelligence and health in a long-term mate, replicating other mate preference studies (e.g. Fletcher et al., 2004; Schwarz & Hassebrauck, 2012; Souza, Conroy-Beam, & Buss, 2016). Furthermore, the sex difference in the multivariate pattern of preferences is relatively large, affording above-chance (63%) classification of sex based on mate preferences alone.

Findings concerning cross-cultural variability were mixed. Consistent with biosocial role theory, the sex difference in age of partner decreased as gender equality increased. However, little support was found for the relationship between the sex difference in ideal mate preferences and gender equality. One exception was the relationship between the GGGI and good financial prospects, consistent with Zentner and Mitura (2012). However, gender equality measures differ slightly in components, so this result may be due to a particular factor of the GGGI: a result that was not clear from Zentner and Mitura (2012), but is revealed by our more thorough analysis and reporting.

There was also no support for the relationship between pathogen prevalence and preference for attractiveness, intelligence, and health, failing to support the evolutionary prediction of Gangestad and Buss (1993). The only exception was preference for resources, but this relationship did not remain significant after adding in the control variables. Overall, without the flexibility previously afforded within this literature, previously established predictors of cross-cultural variation demonstrate limited power to predict mate preferences.

Limitations and Future Directions

While we corrected for many of the short-comings of the prior literature, this study also had some limitations. First, although our preference measures were designed to improve on potential limitations of Buss (1989)'s original measures, it is possible that differences in item format account for the difference between our and prior results. However, we successfully replicated the same sex differences found in Buss (1989), indicating these measures are sufficient to detect true effects. Furthermore, preferred trait value ratings and preference importance ratings tend to be strongly correlated (see supplementary materials). Finally, another recent study used the exact measures from Buss (1989) and still failed to replicate the relationship between sex differences in preferences and gender equality (Zhang, Lee, DeBruine, & Jones, 2019).

Second, although we found limited evidence supporting predictors of cross-cultural variability, it is unclear whether country-level variables like pathogen prevalence and gender equality reflect the ecological surroundings or experience of participants. The measurements that form the nation-level predictors may be temporally and spatially distal to the environmental cues available to participant psychologies. Measures that more directly tap the information available to mate preference psychology might yield different results than relatively abstracted nation-level predictors.

Sex differences in mate preferences have far reaching implications in many domains of human life and many fields of scientific inquiry. The foundations of sex difference research therefore demand careful consideration. Using a thorough and transparent approach, we found that the universal sex differences predicted by an evolutionary psychological perspective remain robust 30 years after their initial publication. However, previously reported sources of cross-cultural variation, pathogen prevalence and gender equality, are largely unable to explain the variation in our data. This suggests that even in this highly influential research area, characterized by large samples and intense scientific scrutiny, the lack of replication and transparency in design and reporting can contribute to false positive results. These findings reground the evidence relating to long-standing hypotheses and debates in the field and invite human mating researchers to embark on new research programs aimed at discovering more robust predictors of cross-cultural variability in mate preferences.

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