



Parochial trust and cooperation across 17 societies

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International challenges such as climate change, poverty, and intergroup conflict require countries to cooperate to solve these complex problems. However, the political tide in many countries has shifted inward, with skepticism and reluctance to cooperate with other countries. Thus, cross-societal investigations are needed to test theory about trust and cooperation within and between groups. We conducted an experimental study in 17 countries designed to test several theories that explain why, who, and where people trust and cooperate more with ingroup members, compared with outgroup members. The experiment involved several interactions in the trust game, either as a trustor or trustee. We manipulated partner group membership in the trust game (ingroup, outgroup, or unknown) and if their reputation was at stake during the interaction. In addition to the standard finding that participants trust and cooperate more with ingroup than outgroup members, we obtained findings that reputational concerns play a decisive role for promoting trust and cooperation universally across societies. Furthermore, men discriminated more in favor of their ingroup than women. Individual differences in cooperative preferences, as measured by social value orientation, predicted cooperation with both ingroup and outgroup members. Finally, we did not find support for three theories about the cross-societal conditions that influence the degree of ingroup favoritism observed across societies (e.g., material security, religiosity, and pathogen stress). We discuss the implications for promoting cooperation within and between countries.

cooperation | trust | parochial altruism | reputation | culture

Humans tend to engage in costly behaviors that extend benefits to ingroup members (i.e., cooperate) and also actively engage in aggressive actions toward outgroup members. This phenomenon, known as parochial altruism, is pervasive and omnipresent in human history and across cultures (1, 2). Parochial altruism exacerbates intergroup relations either indirectly through actions that exclusively favor the ingroup (i.e., ingroup favoritism) or directly by actions that harm the outgroup (3). Here, we focus on ingroup favoritism in trust and cooperation. Decades of research have focused on the function, form, and process of the psychological and neural mechanisms underlying ingroup favoritism. One prominent approach addresses why people engage in ingroup favoritism and suggests that this is a strategy that functions to acquire direct, and especially indirect, benefits from ingroup members (4). Other approaches have investigated individual differences and who is more likely to favor the ingroup, including a focus on gender and social preferences for cooperation (5). A third approach theorizes about how variation across ecologies can determine where people are more likely to engage in ingroup favoritism (6).

Although each of the above approaches forwards hypotheses about human universals and/or variation across societies, most research on ingroup favoritism is based on student samples using ad-hoc groups created in the laboratory within a limited range of societies (7). These conditions limit the generalizability of research and fail to address cross-societal variability in ingroup favoritism. Thus, cross-societal investigations are needed to understand why people cooperate more with ingroup members, who is more willing to display this ingroup favoritism, and where people are more likely to discriminate cooperation in favor of ingroup members. Here, we address these three fundamental questions in an experimental study using nationally representative samples from 17 countries

and observe ingroup favoritism in a trust game with partners who share nationality vs. partners from a different nationality.

Why Do People Trust and Cooperate More with Ingroup Members?

Decades of research have tried to solve the puzzle of why humans engage in costly cooperation that benefits others. Evolutionary perspectives propose that humans condition their cooperation when this behavior results in direct or indirect benefits. Bounded generalized reciprocity (BGR) proposes that people favor their group members because groups contain a network for reputation-based indirect reciprocity, and so this can be a strategy to maintain a positive reputation in the group, acquire indirect benefits from ingroup members, and avoid the cost of being ostracized from the group (8). From this perspective, humans have evolved to expect greater cooperation from ingroup members and to be more concerned about their reputation among ingroup, compared with outgroup, members (4).

Support for BGR comes from studies that employed ad-hoc minimal groups created in the laboratory (7). These studies found that, even in contexts where people were categorized in groups according to some trivial category, ingroup favoritism was explained by expectations of partner cooperation. Furthermore, previous research used the common vs. unilateral knowledge paradigm to test the idea that ingroup favoritism is motivated by reputation-based indirect reciprocity (4). In this paradigm, individuals know that their interaction partner knows their group membership (common knowledge), or, alternatively, they know that their interaction

Significance

In a study including 17 societies, we found that people are motivated to trust and cooperate more with their ingroup, than harm the outgroup. Reputation-based indirect reciprocity may offset this ingroup favoritism, because we found that reputational concern universally increases cooperation with both ingroup and outgroup members. We also found that people who are dispositionally cooperative are less parochial and more universal in their cooperation. In a time of increasing parochialism in both domestic and international relations, our findings affirm us of the danger of the strong human universal toward parochial altruism. Yet, our findings suggest that in all societies, there exist people whose cooperation transcends group boundaries and provides a solution to combating parochialism: reputation-based indirect reciprocity.

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partner is unaware of their membership (unilateral knowledge). Supporting BGR, people cooperate more with ingroup members only in the common knowledge condition (7). BGR hypothesizes that this should be a human universal, and here, we test this prediction across 17 countries. Specifically, we test the BGR prediction that people favor their group members when partners share knowledge (vs. unilateral knowledge) about their group membership and that this is mediated by expected partner cooperation.

Who Displays Ingroup Favoritism in Trust and Cooperation?

Two individual differences that have been considered crucial in understanding cooperation within and between groups are gender and social value orientation (SVO). SVO is the dispositional weights people assign to their own and others' welfare during social interactions (9). Theories on parochial altruism hypothesize that the emergence of preferences for cooperation function to benefit the group (10), and so people with a dispositional cooperative preference should contribute to ingroup, but not necessarily outgroup, members. By contrast, alternative perspectives suggest that dispositional cooperative preferences (e.g., SVO and conditional cooperation) may be psychological mechanisms that function to maintain direct, as opposed to indirect, reciprocity (9, 11), and direct reciprocity is less strongly influenced by partner group membership (7). Thus, individuals with dispositional cooperative preferences could be universal cooperators who prefer cooperation, regardless of partner group membership.

Ancestral human groups were likely characterized by patrilocality; that is, men resided in their same group throughout the lifespan, while women transferred groups upon sexual maturity or marriage (12). Moreover, males engaged more in intergroup conflict (13). Patrilocality and intergroup conflict could place selection pressure for a uniquely male coalitional psychology, and, indeed, men, relative to women, have been found to cooperate more with same-sex ingroup members, especially in the context of intergroup conflict (14). Here, we test the prediction that men, compared with women, are more likely to extend greater cooperation to ingroup than outgroup members.

Where (and Under What Conditions) Do People Engage in Ingroup Favoritism?

Previous theory claims that variation across environmental and social ecologies affect when people strongly invest in ingroup, compared with outgroup, members. However, previous research has primarily relied on self-report measures of values, such as collectivism, nationalism, and traditionalism (15–17). In a behavioral experiment conducted in 17 countries, we test three prominent historical–evolutionary perspectives on cross-societal variation in ingroup favoritism in cooperation: material security, religiosity, and pathogen stress.

The material security hypothesis predicts that efficient societal institutions fulfill basic evolutionary needs (e.g., avoiding disease and evading physical harm), and this allows individuals to make relatively risky investments in relationships with strangers (16). By contrast, inefficient institutions require people to invest more in their ingroup as a strategy to secure basic needs. We used several indices of efficient societal institutions to test this hypothesis, including the rule of law, government effectiveness, and market competitiveness. In fact, previous work stresses how these indices of societal institutions relate to trust and cooperation in interpersonal relations. For example, trust in the judicial system and independent, well-functioning courts are hypothesized to relate to greater interpersonal trust (18), and government effectiveness can promote civic participation and cooperation (19). Furthermore, the extent of participation in a market economy can increase fair, cooperative relations among strangers (20), although this research was conducted on small-scale societies, and the present research involves large-scale modern societies that include extensive market integration. Importantly, this previous research has primarily focused

on how these cross-societal indices relate to cooperative interactions between strangers, and here we test the prediction that these cross-societal conditions relate to ingroup favoritism in cooperation. Furthermore, the few studies that have considered how these indices predict ingroup favoritism did so by testing each variable separately using self-report surveys, as opposed to behavioral measures (6). Here, we can examine if either of these cross-societal indices of government effectiveness is more or less related to ingroup favoritism using a behavioral measure of trust and cooperation.

Similarly, religiosity is theorized to fulfill the same basic needs as societal institutions (21), and so societies characterized by high religiosity—that is, societies with a high frequency of religious attendance, prevalent beliefs in heaven/hell, and/or a greater number of protestants—are expected to display less ingroup favoritism. Previous research has considered how religiosity relates to trust and cooperation across societies, and this work has resulted in mixed conclusions (22, 23). However, little previous research has tested whether varying levels of religiosity across societies relate to ingroup favoritism in cooperation (6).

Finally, a pathogen-avoidance approach predicts that in societies with high pathogen load, people interact with ingroup members as a strategy to avoid contact with pathogens (15). Previous research supporting this hypothesis has used self-report measures of values, such as familism and ingroup assortativeness (15). Here, we examined if pathogen-rich societies, as measured by the historical disease prevalence index, produce greater amounts of ingroup favoritism using a behavioral measure of interpersonal trust and cooperation.

The Current Research

We tested these hypotheses about ingroup favoritism in trust and cooperation in a behavioral experiment involving representative samples in 17 countries ($n = 3,236$; *SI Appendix, Table S1*). An a priori power analysis determined a requirement of 93 participants per country to achieve 0.80 statistical power to detect an effect of partner group membership on behavior in the trust game ($d = 0.26$). We achieved this goal in every country. The experiment was the third wave in a longitudinal study, whereby participants completed different surveys in waves 1 and 2 that included measures of gender and SVO. All data were collected via the internet: Participants were sent a link to the online experiment that they completed in a location of their choice. The experiment in wave 3 involved participants making several one-shot decisions in the trust game (24), either as the trust person or the return person. The trust person decided to send any amount of an initial endowment of five monetary units (MUs) to the return person. The amount sent to the return person was tripled, and any amount kept for oneself remained the same. Then, the return person could decide to give back some of the tripled amount to the trust person. We used the strategy method to measure behavior of the return person, and the return person could decide how many MUs they would give back for each possible amount given by the trust person.

The trust person decision was our measure of trust behavior, while the return person decision was our measure of trustworthiness (i.e., reciprocity). We also asked the trust person, after making their decision, how many MUs they expected their partner to return to them (i.e., expected partner trustworthiness). This was our measure of trustor expectation. These were the three dependent variables in our analyses. Importantly, trust behavior and trustworthiness can both be considered a measure of cooperation, since each decision is about incurring a cost to provide a benefit to another person, and both measures have been found in the past and present research to positively correlate (25) (*SI Appendix*). That said, we conducted analyses on each variable separately, since there is an important structural difference between the decisions. The measure of trustor expectation is more closely tied to the construct of trust, i.e., belief about the intentions of another in a situation that contains a conflict of interest (26).

$P = 0.005$). Men, compared with women, also returned greater amounts as the trustee ($b = 3.16$; $P < 0.001$), and men reciprocated similar amounts across partners with different group membership ($b = 0.53$; $P = 0.10$). Men, compared with women, expected more cooperation from others in general ($b = 0.42$; $P < 0.001$), but men also expected greater cooperation from ingroup than outgroup members, ($b = 0.13$; $P = 0.01$).

Outgroup Derogation. We created an additional contrast variable with partner's group membership to understand if people treated outgroup members less favorably than strangers (outgroup = 1; stranger = 0). People displayed greater trust behavior with outgroup members than strangers ($b = 0.12$; $P < 0.001$) and also expected more cooperation from outgroup members than strangers ($b = 0.27$; $P < 0.001$). People also returned more to outgroup members than strangers ($b = 0.78$; $P = 0.02$).

Cross-Societal Variability in Ingroup Favoritism. There was a small but significant amount of variation in ingroup favoritism in trust behavior across the 17 countries [$\text{var}(u_{ij}) = 0.008$, $P < 0.001$]. This cross-societal variation in ingroup favoritism in trust behavior was unrelated to cross-societal variables relevant to testing the material security hypothesis (e.g., rule of law, government effectiveness, and market competitiveness), religiosity hypothesis (e.g., frequency of religious attendance, prevalence of beliefs in heaven/hell, and the number of protestants), and parasite stress (e.g., historical disease prevalence index). Additionally, we did not observe that these cross-societal indices had consistent main effects on trust behavior, trustor expectations, or trustworthiness across interactions with ingroup members, outgroup members, and strangers. See *SI Appendix, Table S6* for a full model with estimates of all of the cross-societal variables.

Discussion

Decades of social and biological research have attempted to explain the ultimate and proximate mechanisms underlying ingroup favoritism in cooperation. We tested some of the most prominent theories in a behavioral experiment conducted across 17 countries. A central theoretical issue is whether humans evolved a psychology that functions to harm outgroup members or favor ingroup members. Across the 17 countries, people were generally more willing to trust and cooperate with ingroup members than outgroup members and partners with unknown group membership (i.e., strangers). A motivation to harm the outgroup didn't produce this ingroup favoritism, since we did not observe greater cooperation with strangers than outgroup members. We proceeded to test several theories about why, who, and where people are more likely to display ingroup favoritism in cooperation.

BGR claims that humans evolved to cooperate more with ingroup members, because groups contained a system of reputation-based indirect reciprocity (4). This perspective hypothesizes that people will cooperate more with ingroup members only when their reputation is at stake. Following previous work testing this theory, we manipulated reputational consequences of actions by manipulating common knowledge of group membership, and, indeed, previous research has found that people have elevated concerns about their reputation in the common vs. unilateral knowledge condition (*SI Appendix*). When examining either trustor or trustee decisions to cooperate, we found that people cooperated more when their reputation was at stake, regardless of their partner's group membership. The effect of reputation on trust and cooperation was uniform across societies. Such a finding underscores the role of reputation-based indirect reciprocity in understanding human cooperation. Furthermore, the benefits of indirect reciprocity may also extend to interactions with outgroup members (27), and humans may have evolved to cooperate to maintain a cooperative reputation, even when interacting with outgroup members. A

practical implication of this finding is that reputation-based cooperation can be a tool used to promote cooperation within and between groups.

The effect of partner group membership on cooperation was partially mediated by expected partner cooperation. People tended to expect greater cooperation from ingroup members than outgroup members. Thus, at least some ingroup favoritism may be explained by a belief that people cooperate more with ingroup members. Furthermore, this belief generalized across all 17 countries and could not be explained by stereotypes of people from certain nationalities being more cooperative (28), and previous work suggests that the belief is not merely a byproduct of a positivity bias in thinking about ingroup members (29). Future research is necessary to understand the development and function of this belief in regulating cooperative interactions within and between groups.

Men, compared with women, tended to discriminate their cooperation more in favor of ingroup members (although this was a small effect size). This supports the hypothesis that an ancestral social ecology characterized by patrilocality and male intergroup warfare may have produced a sex-typical coalitional psychology that promotes cooperation with groups. In fact, previous research has found that men, compared with women, tend to think groups are more important in defining their self-concept (30), are more cooperative in same-sex interactions (31), and display greater ingroup favoritism (7), even at a young age (32), and especially in the context of intergroup conflict (3).

Although previous theory has claimed that social preferences for cooperation may be rooted in favoritism for ingroup members, we found that cooperative preferences, as measured by SVO, predicted cooperation equally with ingroup and outgroup members. Therefore, individual differences in cooperative preferences may not reflect a form of parochial cooperation, but a universal concern about other's outcomes. This finding supports recent research on SVO and intergroup cooperation (33) and challenges previous theorizing and research on the role of intergroup conflict in explaining individual differences in cooperative preferences (2). How these individual differences in cooperative preferences arise over the course of development and are maintained within the human population provides two scientific puzzles yet to be solved.

We found only a small amount of variation in ingroup favoritism in trust and cooperation across the 17 countries. And the little variation that did exist was not explained by three theories of cross-cultural variation in ingroup favoritism, with each theory forwarding a hypothesized interaction between ecological conditions (e.g., quality of societal institutions, religious history, and pathogen stress) and the amount of ingroup favoritism. Furthermore, none of these cross-societal variables were associated with trust, trustor expectations, and trustworthiness across interactions with ingroup members, outgroup members, and strangers.

These findings have both theoretical and practical implications. First, these findings are in contrast with past research that found rule of law, government efficiency, religiosity, and pathogen stress promote trust and cooperation between strangers (20–23). Even though we found a significant positive correlation between self-reported trust and trust behavior in our experiment across societies ($r = 0.19$), we failed to replicate findings from previous cross-societal research that has relied primarily on self-reports of ingroup favoritism (e.g., collectivism) (15–17). This result supports recent research on the gap between self-report and behavioral measures (34). Second, these findings suggest that the psychological processes that promote trust and cooperation between strangers and ingroup members (at least in an online environment) may be less sensitive to variations in social ecologies that occur in modern societies. Therefore, practitioners interested in promoting intergroup cooperation under such circumstances (e.g., social media ratings of services or trading sites like Craigslist) can focus more on general processes rather than on the specific social

ecologies where discrimination occurs. The lack of cross-societal variation reported here could be due to limitations of the study, such as a small number of countries, the type of groups used to study discrimination, and using an online social exchange task. That said, we included a wide range of different countries; nationality is an important natural group for individuals; and cross-societal variation in behavior in the trust game positively correlated with self-reported trust across countries.

To summarize, we observed that people extend greater trust and cooperation to ingroup members compared with outgroup members and unknown others and that this was produced by a motivation to benefit ingroup members as opposed to harm outgroup members. Men were more likely to display this ingroup favoritism than women. However, individual differences in cooperative preferences did not predict who engaged in greater ingroup favoritism. This suggests that these individual differences in cooperative preferences are less parochial and more general, predicting concern even for the outcomes of outgroup members. We found that a manipulation of reputational concern produced a uniform increase in cooperation with both ingroup and outgroup members across all 17 countries. Thus, reputation-based cooperation may be a pervasive human universal that is not bounded by interactions with ingroup members, but also extends to regulating interactions with outgroup members, at least in cyberspace. We observed little variation in the amount of ingroup favoritism across 17 countries, and we did not find support for three prominent theories that explain cross-societal variation in the amount of ingroup favoritism in cooperation. Together, the results of this study demand an extensive refining of existing explanations of why, who, and where people display ingroup favoritism in cooperation.

Methods

The research was approved by the Massey University Human Ethics Committee: Northern Application MUHECNOR 16/31. All data and translation materials are openly accessible at <https://osf.io/r8kwt/>.

Participants. We recruited 3,236 participants from 17 countries (*SI Appendix, Table S1*). Participants were recruited through The Nielsen Company, an international polling agency based in the United States. Participants were stratified according to age, gender, and region of residence. We only invited participants who completed each of the previous two waves of the study (for detailed characteristics and recruitment of the wave 1 sample, see ref. 35).

Procedure and Experimental Design. Participants responded to an online survey. The initial version of the survey was written in English, and then each survey was translated (and back-translated) by experts in the language (or the committee method was used). The procedure of the experiment was the same across countries. First, participants were asked to agree with an informed consent form. Next, they read the instructions of the trust game, which involved two roles: the trust person and the return person. We used the term “trust person” in the instructions to standardize the framing of the task across countries. Finally, participants were asked to make 14 one-shot decisions (see *SI Appendix* for a full description of the instructions and each decision).

Participants made decisions both as a trust and a return person. We manipulated two aspects of the decision task. Specifically, the study involved a 3 (ingroup vs. outgroup vs. stranger) × 2 (common vs. unilateral knowledge) within-subjects design. We also included two additional decisions in which all participants interacted with a person they knew was American or Chinese. These latter two conditions were included to address a research question not discussed in this work and were not included in the analyses reported here. The 14 choices were randomized for each participant (Table 1). Two countries [United Kingdom (UK) and South Korea (SK)] also included a between-subjects manipulation of paid vs. hypothetical decisions (see below).

Payment. Participants’ decisions in the trust game were based on hypothetical outcomes. A previous meta-analysis of >100 studies found that people display the same amount of ingroup favoritism in cooperation in studies that use hypothetical and paid outcomes (7). Nonetheless, we decided to examine this in our own experiment by adding a manipulation of participant payment (payment vs. hypothetical outcomes) in two countries, UK and SK. In the payment condition, participants’ decisions had monetary consequences. The value of MUs was

Table 1. Decisions made by each participant during the experiment

D	Role	Group membership	Common/unilateral knowledge
1	Trustor	Ingroup	Common knowledge
2	Trustor	Ingroup	Unilateral knowledge
3	Trustor	Outgroup	Common knowledge
4	Trustor	Outgroup	Unilateral knowledge
5	Trustor	Stranger	Unilateral knowledge
6	Trustee	Ingroup	Common knowledge
7	Trustee	Ingroup	Unilateral knowledge
8	Trustee	Outgroup	Common knowledge
9	Trustee	Outgroup	Unilateral knowledge
10	Trustee	Stranger	Unilateral knowledge
11*	Trustor	China	Common knowledge
12*	Trustee	China	Common knowledge
13*	Trustor	United States	Common knowledge
14*	Trustee	United States	Common knowledge

For each participant, the order of the decisions was randomized. D, decision; trustee, trustworthiness decision; trustor, trust behavior decision.

*These decisions were included for a research question and project not included in this work.

standardized across countries by having each MU amount to 5 min of the median hourly wage in a specific country (median hourly wage was retrieved from www.salaryexplorer.com/hourly-wage.php?&loctype=1&loc=107). For the UK, each MU corresponded to \$2.03, while for SK, each MU was \$1.79. Participants were informed that at the end of the experiment, they would be paid for the outcome of one of their decisions that would be randomly selected from all 14 decisions. For each decision, they would be randomly matched with a different participant and paid within 2 wk. In the outgroup partner and stranger condition, we selected a partner from the entire sample of countries that were not paid for their decisions. In the hypothetical payment condition, the decisions had hypothetical outcomes worth the same value. We were interested if people would display more or less ingroup favoritism in the payment condition vs. the hypothetical payment condition, but we did not find a significant interaction between the payment conditions and partner group membership (contrast 1) predicting trust behavior ($P = 0.62$), trustor expectations ($P = 0.70$), and trustworthiness ($P = 0.67$). Details on these models can be found in *SI Appendix, Table S7*. Therefore, based on these analyses and the outcome of a previous meta-analysis, we concluded that the use of hypothetical payments does not affect ingroup favoritism.

Gender. Gender was measured in both waves 1 and 2, and we matched these measures to minimize the missing cases across the waves. The total sample contained 47.30% women (*SI Appendix, Table S1*).

SVO. A measure of SVO was administered in wave 2. We used the SVO slider, a six-item measure where participants are asked to state their preference of monetary allocations between themselves and another anonymous person (9). The final score was the inverse tangent of the ratio between the mean allocation for the self (subtracted by 50) and the mean allocations to the other (subtracted by 50). Higher scores in the SVO angle represent individuals with higher cooperative preferences.

Cross-Societal Variables. We coded several cross-societal variables that could possibly moderate the amount of ingroup favoritism in cooperation. The coded variables used to test each hypothesis about cross-societal variation can be found in *SI Appendix, Table S5*. The main sources were the World Value Survey and the World Data Bank. We also coded some additional variables for exploratory purposes, such as nepotism, collectivism, and norms of cooperation (see *SI Appendix* for additional details). When testing our models, we also controlled for economic wealth (per capita gross domestic product) and inequality (Gini).

Analytical Strategy. We used multilevel models where participants (level 2) and countries (level 3) were two random factors. These models considered random intercepts for participants nested in countries and also random slopes for the effect of group membership across the different countries. This model was selected after comparing this model with other models through the Akaike information criteria and the Bayesian information criteria (36). For trustworthiness behavior, we transformed each possible return choice to a percentage. Then, we computed the mean across the five return behavior scenarios (finale

scale: 0–100). Data were analyzed with R (lme4 package) by using random intercept and slopes (37). We used contrast 1 (ingroup vs. outgroup and strangers), contrast 2, and common/unilateral knowledge as level-1 predictors in the models. Gender and SVO were level-2 predictors in the models. We allowed the effects of contrast 1 to vary across level 3. We didn't allow the effects of common/unilateral knowledge to vary across level 3, since this did not vary significantly across countries ($P = 0.94$). Therefore, our model can be described by the following equation (Y_{ijk} can be a measure of trust behavior, trustor expectations, or trustworthiness):

$$\text{Level1: } Y_{ijk} = \beta_{0jk} + \beta_{1jk} \text{CONTRAST1}_{ijk} + \beta_{2jk} \text{KNOWLEDGE}_{ijk} + \beta_{3jk} \text{CONTRAST1}_{ijk} \text{KNOWLEDGE}_{ijk} + e_{ijk}$$

$$\text{Level2: } \beta_{0jk} = \gamma_{00k} + \gamma_{01k} \text{GENDER}_{jk} + \gamma_{02k} \text{SVO}_{jk} + f_{0jk}; \\ \beta_{1jk} = \gamma_{10k} + \gamma_{11k} \text{GENDER}_{jk} + \gamma_{12k} \text{SVO}_{jk} + f_{1jk}$$

$$\text{Level3: } \gamma_{00k} = \delta_{000} + g_{0k} \\ \gamma_{10k} = \delta_{100} + g_{1k}$$

In the cross-cultural analysis, country level variables were level-2 predictors in our model. In this case, the model includes random intercepts for countries

and also random slopes for the effect of group membership across the different countries:

$$\text{Level1: } Y_{ij} = \beta_{0j} + \beta_{1j} \text{CONTRAST1}_{ij} + \beta_{2j} \text{KNOWLEDGE}_{ij} + \beta_{3j} \text{CONTRAST1}_{ij} \text{KNOWLEDGE}_{ij} + e_{ij}$$

$$\text{Level2: } \beta_{0j} = \gamma_{00} + \gamma_{0(1..n)} (\text{SOCIETAL_VARIABLE}_n)_j + f_{0j}; \\ \beta_{1j} = \gamma_{10} + \gamma_{1(1..n)} (\text{SOCIETAL_VARIABLE}_n)_j + f_{1j}$$

The SOCIETAL_VARIABLE term represents the many societal variables used to test our hypotheses (SI Appendix, Table S5). The correspondent R code for each model can be found in SI Appendix. Additionally, we meta-analyzed the level-1 predictors to infer the population-level effect size of contrast 1 and common/unilateral knowledge on trust behavior. These analyses were carried out by using the R package metafor (38), and each country was treated as a different sample. Finally, we used the R package mediation to run the multilevel mediation model (39).

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