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The Perfect Stranger:

Resource Access and the Evolution of Out-Group Relationships

A dissertation submitted in partial satisfaction of the

requirements for the degree Doctor of Philosophy

in Anthropology

by

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ABSTRACT

The Perfect Stranger:

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by

Anne Catherine Pisor

Unlike non-human primates, humans are highly tolerant of out-group strangers, as evidenced by the ethnographic and archaeological records; however, very little research has addressed when and why people build relationships with out-group individuals. What selection pressures might have favored inter-group relationship building in humans? As reducing temporal variation in resource access has been crucial in the human foraging ecology, I suggest that relationships with out-group members may provide access to non-local resources and buffer resource shortfalls striking entire communities. The relevance of out-group relationships is not limited to small-scale or prehistoric contexts either, as out-group members can also provide access to difficult-to-access resources like market items. My research program is focused on the above question; in my dissertation, I address three components of it: Which social and ecological factors favor out-group relationships? What do people look for when picking partners from out-groups? When people value out-group members, will they avoid behavior that would inflict costs on these individuals?

Among three populations of horticulturalists in Bolivia, I measured valuation for out-group members using a non-anonymous economic game in which participants could be generous to in-group and out-group strangers. I found that participants were highly generous to both in-group and out-group strangers. Participants invest more in out-group relationships when they have less non-local (i.e., market) resource access, as proxied by their subjective socioeconomic status relative to others in their community. As has been demonstrated in the literature on in-group partner choice, participants prefer strangers perceived to be “good people” (a term associated with cooperative qualities in the Bolivian context). I also expected that out-group partner choice would track opportunities for resource access; indeed, participants also give more to strangers from out-groups perceived to have more market or political resource access. That said, the effect of resource access on out-group valuation and out-group partner choice varied by proxy.

In a 55-country sample, I found that participants were less likely to condone corrupt acts, which generate costs for others, when they identified with larger groups of individuals, a proxy for valuation of these individuals. However, there was a caveat: participants with local identities were as opposed to corrupt acts as those with country, continent, or world identities, while those with regional identities were the most willing to condone corrupt acts. Consistent with my suggestion that out-group members buffer actors against variation in resource access, participants experiencing the greatest degree of resource shortfalls were more likely to not find corruption permissible; however, this was also true of those experiencing the *least* amount of shortfall.

In sum, valuation for out-group partnerships does track resource access in three populations of horticulturalists and a sample from 55 counties, but the effect varies by measure in instructive ways. For example, the negative relationship between market items owned and out-group valuation in one population may reflect experiences of discrimination in market contexts, rather than a lack of utility for out-group relationships per se. As discussed in the conclusion, my ongoing and future work capitalizes on these variable effects as it delves further into the nature of out-group relationships in the Bolivian context.

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1. INTRODUCTION

Humans are highly inter-group tolerant relative to other primates. While inter-group tolerance is rare among non-human primates, individuals are most tolerant of out-groups when resources are abundant (e.g., Isbell, 1991; Grueter and Van Schaik, 2010) or when they may transfer into these groups (e.g., Saito et al., 1998). Conversely, evidence of human inter-group tolerance, and even inter-group relationship building, is prevalent in the ethnographic and archaeological records. This is a fact often overlooked by evolutionary-minded researchers, including Darwin himself, who focused on inter-group warfare as a primary selection pressure in *The Descent of Man* (1871). What selection pressures might have favored inter-group relationship building in humans? How do social and ecological factors, including contemporary integration into regional, national, and global markets, influence inter-group relationships? Does partner choice among out-group members follow similar criteria as those for in-group members? When an individual values out-group members, is she likely to avoid generating costs that would harm them?

My dissertation addresses the above questions in the context of three horticultural populations from the Bolivian Amazon currently undergoing market integration and a sample of 55 countries from the World Values Survey and European Values Study. This introduction presents my theoretical approach in the context of human ecology, the resulting predictions to be investigated, and the utility of investigating these predictions among three market-integrating horticultural populations in contemporary Bolivia.

1.1 MUTUALISM, RECIPROCITY, AND INTER-GROUP RELATIONSHIPS IN HUMANS

Intra-specific mutualism, or behavior generating benefits for two individuals simultaneously, is widespread in nature (Clutton-Brock, 2009). For example, members of various species rely on divisions of labor according to differential skill sets or access to resources (Noe and Hammerstein, 1994). Reciprocity, or the delayed exchange of benefits between two individuals (Trivers, 1971), is rare in nature – including among non-human primates – but highly prevalent in humans (Van Schaik and Kappeler, 2006; Jaeggi and Gurven, 2013). In humans, mutualism provides the basis of human warfare, common-pool resources, and trade (Van Schaik and Kappeler, 2006), while reciprocity is highly visible in human friendships (Silk, 2003; Hruschka, 2010).

The prevalence of reciprocity and mutualism in humans is likely due to the selective pressures present in our ancestral foraging niche, which was characterized by a high degree of variation in resource acquisition (Kaplan and Hill, 1985; Tooby and DeVore, 1987; Kaplan et al., 2012). In hominins, this foraging niche may have first favored a mutualistic division of labor between pair-bonded males and females (Chapais, 2008; Gurven et al., 2009). This division of labor required tolerance for other individuals in the context of food, a trait absent in many non-human primates; once tolerance was present, the potential for economies of scale in hunting may have favored mutualistic collaboration (Tomasello et al., 2012). Living in proximity to their collaborative partners would have allowed the evolution of mental record-keeping of freeriding among foraging partners, a necessary pre-requisite adaptation for the evolution of reciprocity (Trivers, 1971; see also Delton et al., 2012).

With increased involvement in such a high-risk foraging niche, brains became bigger and required more calories and scarce nutrients; reciprocity between adults outside of pair bonds and across generations would have become mandatory to avoid starvation (Hill and Hurtado, 2009; Kaplan et al., 2009). With this strong selection pressure in play, partner choice may have increased in importance. Actors who violated mutualistic or reciprocal relationships likely faced consequences, perhaps in the forms of ended partnerships, gossip, and social exclusion (Boehm, 1999; Barclay, 2013). Extrapolating from historically documented hunter-gatherers, individuals may have lived in fission-fusion bands with a median size of 30 members (Marlowe, 2005), including numerous non-kin (e.g., 25% of the band among pre-contact Ache and the Ju/'hoansi; Hill et al., 2011). Within such a group structure, individuals could afford to be selective in picking their band mates, avoiding those who were less cooperative (Barclay, 2013). In turn, the existence of a market for social partners may have favored actors' willingness to generate benefits for others as a signal of their quality as a social partner (Van Vugt et al., 2007; Barclay, 2013; Baumard et al., 2013). Selection may have also favored actors sensitive to the convergence of their own interests with those of their prospective social partners (Tooby and Cosmides, 1996).

While within-group social partnerships were crucial for smoothing resource access, resource shortfalls did occasionally occur on scales that included the foraging ranges of an entire band (Kelly, 1995). For example, when a !Kung San band lost access to a water source due to inadequate rains, individuals from that band would disperse, calling on friends from bands up to 150 or 200 km away

(Wiessner, 1982). In such circumstances, when resources were patchy and shortfall could strike an entire community (e.g., Fafchamps and Gubert, 2007), individuals may have sought to build relationships across communities as a "safety net" (Whallon, 2006). The archaeological (Gamble, 1999; Jochim, 2006; Whallon, 2006; Bouzouggar et al., 2007) and ethnographic literatures (Malinowski, 1922; Barth, 1969; Ensminger, 1992; Bourque, 1994; Cashdan, 2001; Wiessner, 2001; Ross and Atkinson, 2016) provide numerous examples of such safety nets. Like the weak ties of the social network literature (Granovetter, 1973), members of these safety nets were not called upon for everyday needs, but for periodic ones. Out-group networks also provided individuals with access to non-local resources (Baugh and Ericson, 1994), such as pottery (Solway and Lee, 1990), salt (Nordenskiöld, 1915), or ornamentation (d'Errico et al., 2009). For example, archaeological, ethnohistoric, and oral history data suggest that the San selectively maintained relationships with their Kgalagadi and Goma neighbors, through which they had access to hunting dogs and iron tools, among other goods (Solway and Lee, 1990). In small-scale societies, gift exchanges (Wiessner, 2001), marriage exchanges (Chapais, 2008), and seasonal aggregations (Kelly, 1995) exposed actors to 1,000 individuals or more with whom to build expanded networks (Dunbar, 2008; Hill et al., 2014).

Despite the importance of between-group relationships, humans are often characterized as parochial, that is, as cooperating with in-group members to engage in inter-group competition. We should expect modern humans to be *strategically* parochial, building connections with out-group members when the expected benefits outweigh the expected costs of these relationships (Hruschka and Henrich, 2013;

e.g., Fessler et al., 2015). When the expected net benefits are positive, we predict that actors should exhibit initial generosity toward strangers (Delton et al., 2011; Raihani and Bshary, 2015), communicating cooperative intent and opening the door for a potential reciprocal or mutualistic relationship.

Before we introduce the specifics of our predictions, let us define the terms "cooperation," "group," and "valuation."

Cooperation refers to behaviors that benefit recipients at a cost to the actor, that have been favored by natural selection *because* of the benefit they provide to the recipient (West et al., 2007). For example, by this definition, a benefit generated for one individual as a byproduct of another's behavior is not cooperation (e.g., Clutton-Brock, 2009). Generosity toward strangers may be cooperative, for example, because it opens the door for a potentially-beneficial reciprocal relationships by signaling the donor's cooperative intent to the recipient, or to an audience of onlookers (Delton et al., 2011; Barclay, 2013; Raihani and Bshary, 2015). Cooperation is different from the term prosociality, which does not necessarily connote behaviors naturally selected *because* they provide benefits (e.g., Gurven and Winking, 2008; Silk and House, 2011). Both mutualism and reciprocity can be forms of cooperation (West et al., 2007).

Groups are networks of individuals (Barth, 2000; Brewer and Caporeal, 2006) that are not necessarily temporally or spatially bounded (Appadurai, 1996). They are defined through delineations of in-group and out-group drawn by individuals who consider themselves members (Tajfel, 1982; Cohen, 2000). Importantly, these delineations may exist in an actor's mind rather than being collectively recognized

by multiple individuals (Turner et al., 1987; Tooby and Cosmides, 2010). Humans are prone to cognizing groups as interdependent sets of people, jointly buffering resource access or engaging in collective action, because of the importance of groups in serving these functions during our evolutionary history (Brewer and Caporeal, 2006; Tooby et al., 2006). That said, whether or not a particular set of individuals is cognized as a group may also differ across cultures and across situations. For example, social categories, such as town of residence, are not salient as the basis of groups in Japan (Yuki and Schug, 2012), and ethnic markers are not salient for delineating groups in Quechua-Aymara areas of the Peruvian altiplano (Moya and Boyd, 2015); one way to make markers (Kurzban et al., 2001) and social categories less salient is to encourage collective action across marker and category boundaries (Gaertner and Dovidio, 2001).

Valuation refers to the amount which an actor values another individual as a potential cooperative partner. Valuation is an internal regulatory variable that weighs the expected cooperative benefits a candidate partner will provide and adjusts the actor's behavior accordingly (Tooby et al., 2008; Hackman et al., 2015; Delton and Robertson, 2016). Traits that are associated with cooperative behavior should increase valuation for candidate partners with these traits, such as a reputation for generosity (Gurven et al., 2000; Barclay, 2013; Baumard et al., 2013) or competence in food production (Eisenbruch et al., 2016). Conditions that may decrease valuation include existing cooperative networks that are sufficient to fill an actor's needs. The aspects of our psychology that enable valuation were likely

naturally selected because of the fitness benefits of smoothing resource access via cooperative networks (Tooby et al., 2008; Hackman et al., 2015).

To re-frame our point about strategic (*lack of*) parochialism, we suggest that actors should have higher valuation for prospective out-group partners when the expected net gains to cooperation are higher. An actor need not consciously calculate the expected benefits and costs of a cooperative relationship, but must have a psychology sensitive to cues associated with expected benefits and costs, which in turn adjusts her behavior – her initial generosity toward an out-group stranger, for example – accordingly (Kiyonari et al., 2000; Cosmides and Tooby, 2005). What are the relevant social and ecological factors that affect out-group valuation? Is out-group partner choice based on the same traits as those on which in-group partner choice is based? Do actors avoid generating costs when prospective out-group partners, or the actor's reputation among out-group members, may be harmed?

1.2 PREDICTIONS

In the following chapters, we investigate the factors that may boost valuation of out-group members, explore whether partner choice among out-group individuals operates by the same criteria as partner choice among in-group members, and examine one potential policy implication of out-group valuation. We predict that actors will exhibit valuation for out-group individuals when the expected benefits of cooperation with those individuals exceed the expected costs. Here we outline what we predict are the relevant benefits and costs, which will be addressed in the coming chapters.

When should an actor invest in out-group relationships? Out-group relationships are safety nets that may be called upon infrequently, when in-group networks cannot buffer wide-reaching shortfalls (e.g., loss of a water source) or provide access to a particular resource (e.g., salt). We predict that an actor's valuation of potential out-group cooperative partners, but not her valuation of potential in-group cooperative partners, should track her opportunities for non-local resource access. Her current degree of need and quality of her existing network connections may not differentially affect her out-group and in-group valuation: If her need is low and her existing connections are supportive, valuation for both may be lower (if her anticipated future need is satisficed) or higher (if she anticipates future need but currently can afford the cost of establishing a new relationship). We measure valuation toward out-group and in-group strangers using a non-anonymous economic game, designed such that participants can be generous toward prospective cooperative partners and have their decisions made known to these recipients.

What qualities should an actor seek in a candidate out-group cooperative partner? If out-groups are a source of resource access, an actor's partner choice among out-group individuals should reflect both individual characteristics and group characteristics, as the latter may be accessed through a partner from that group. The same individual characteristics that predict partner choice among in-group members, such as qualities associated with resource access or cooperative intent, should apply to out-group partner choice. However, we predict that out-group partner choice should also track group resource access, group

status, and an actor's existing information about out-group members. We measure partner choice as differences in valuation, as proxied by the non-anonymous economic game described above.

How might out-group valuation curb the generation of externalities? Under social and ecological conditions favoring out-group valuation, like those outlined above, valuation should affect both an actor's generosity toward prospective cooperative partners and her willingness to *avoid* generating costs impacting them. For example, she should be less likely to engage in corrupt acts if they will negatively affect out-group members who may be future cooperative partners, or damage her reputation with these prospective partners by harming others they value. An actor should especially avoid corrupt acts when she stands to gain from new cooperative partnerships – that is, when she is in a state of need, which may increase valuation for both in-group and out-group partners (as stated above). Consistent with this logic, actors with a larger scope of valued potential partners should be less likely to condone corrupt acts. We test this using self-report data from 55 countries via the World Values Survey and European Values Study.

While the selective environment that may have favored out-group valuation was different from the environments encountered by humans today, contemporary populations still offer tests of the above predictions. Small-scale horticulturalists, for example, tend to be less dependent on inter-household resource buffering than hunter-gatherer or pastoralist households because of the lower variability in the foods they acquire (Godoy et al., 2005; Kaplan et al., 2009; Gurven et al., 2010). On average, horticulturalists may thus be less likely to value relationships with out-

group members, as the expected net benefits of out-group relationships are probably lower among these populations. Further, the integration of small-scale societies to national societies and markets provides quasi-natural experiments in which the expected benefits and costs of out-group relationships may change.

1.3 How might out-group valuation change with market integration?

As actors integrate to national society and national markets, exposure to out-group members increases through a number of avenues. First, market transactions and visits to market towns boost the likelihood of interacting with or seeing out-group members (e.g., Gurven, 2004; Henrich et al., 2010). Second, social and market integration increase mobility, exposing actors to out-group members in the course of migration or travel (e.g., Berry, 2006; Ward, 2008). Third, watching TV or movies can increase passive exposure to out-group members (Buchan et al., 2009), which can boost empathy for out-groups (Roudometof, 2005). This is not an exhaustive list; other sources of exposure are also likely with increases in social and market integration.

Connections made with out-group members through markets may provide resource access or buffering not available via local cooperative partners. Out-group interactions may be required to access certain market items, such as radios, bicycles (Godoy et al., 2005), cloth, metal tools (Reeve, 1993), and firearms (Murphy and Steward, 1956). Further, local communities may stop producing certain goods if markets provide substitutes, such as fuel for fires, making out-group interactions mandatory (De Weerdt and Dercon, 2006). Market integration itself may

also shift an actor's focus to out-group relationships as in-group relationships become difficult to maintain. For example, actors may invest less in local cooperative relationships as they market integrate (e.g., Kasper and Mulder, 2015) because traditional patterns of demand sharing often extend to market items (Fessler, 2002; Peterson, 2013).

While social and market integration can enable us to study the relationship between exposure to out-groups, changes in the net benefits or costs of out-group interactions, and subsequent shifts in out-group valuation, issues with self-selection remain. First, actors with more existing social support may be the first to market integrate, as these networks can buffer some of the risks of interacting with out-group members. Second, the potential for accruing status locally by having access to non-local resources can increase incentives for market integration (e.g., von Rueden et al., 2008). Third, more outgoing or generous individuals may be more likely to form relationships with out-group members (Nettle, 2006; Ashton and Lee, 2007). The following papers directly address these mediating factors, where possible; all are discussed again in the conclusion.

1.4 STUDY POPULATIONS

The Tsimane', the Mosetén, and the community with the pseudonym "Intercultural" are three populations of horticulturalists living in the Bolivian Amazon. While all three rely on the same mode of food production and live within 40 miles of each other, these populations have different degrees of involvement in Bolivian society and the market economy. For example, the Tsimane' earn a median of $47 a month,

the Mosetén $134, and the Interculturales $182 per month. For comparison, 2% of the Tsimane', 19% of the Mosetén, and 21% of the Interculturales interviewed make more than the national private sector median of $560 a month (Instituto Nacional de Estadística, 2014).

The Tsimane' and the Mosetén were once part of a single intermarrying population. The two groups speak different dialects of the same linguistic isolate, Mosetenan (Sakel, 2007), and mtDNA data suggest that they are more closely related to one another than to neighboring groups (Bert et al., 2001; Corella et al., 2007). The Tsimane' do have a long history of interaction with neighboring groups, however (Molina et al., 2009): they were first contacted by missionaries in the 16th century (Huanca, 2006), encountered Trinitarios from the eastern lowlands by the 19th century (Lehm, 1998), and were regionally known as salt traders in the early 20th century (Nordenskiöld, 1915). However, except for the Trinitarios and other indigenous lowland groups, the Tsimane' tended to move away from outsiders, including Catholics who entered Tsimane' territory via the Mosetén (Huanca, 2006). Only in the 1950s did the New Tribes Mission (Molina et al., 2009) and Catholic Redemptorists (Huanca, 2006) begin to missionize in Tsimane' territory. By the early 1980s, some Tsimane' were involved in wage labor (Castillo, 1988). By 1990, the Tsimane' were involved in national politics (Araoz et al., 1993; Molina et al., 2009), making and selling *jatata*, palm roof panels that continue to be a major source of income today, and buying market goods, including mosquito nets and alcohol (Araoz et al., 1993).

Despite some social and economic integration, the Tsimane' remain relatively isolated from national markets and society by choice and due to poverty and lack of transportation infrastructure. Households are often dispersed, located on garden plots. Inter-household sharing is largely kin-biased and dominated by sharing of meat or labor (Jaeggi et al., 2014). Roads in Tsimane' territory are few and poorly maintained; many Tsimane' still rely on river travel, although with the recent advent of accessibly-priced outboard motors known as *pequi pequis*, river transport has become cheaper and faster. At the time of research, focal communities had high schools (grades 1-12), a community well, some access to medicines via community liaisons, and were visited by Aymara or Quechua vendors of commercial goods about once a week. Proficiency in Spanish, the most common language in Bolivia, remains low: only 14% of study participants interviewed could speak fluent Spanish. Ethnic exogamy is also rare and occurs primarily with indigenous lowland groups such as the Mosetén and Trinitarios. Among participants in the present sample, only 4% had one non-Tsimane' parent. Household incomes are primarily generated by cash crops and wage labor: *jatata* is the primary product produced. Participants' households had engaged in a median of 14 days of wage labor in the last month.

The Mosetén were missionized by the Catholic Church starting in 1805 (Mamani et al., 2010). By 1845 a Catholic mission was founded in the area where the present research was conducted (32 miles from the Tsimane' focal communities; see Figure 1). Prior to missionization, the Mosetén had lived as Tsimane' do today: in dispersed households on their garden plots. The Catholic clergy created community centers by constructing adobe houses at the missions. By the mid-20th

century, the Mosetén were attending schools taught in Spanish by the Catholic clergy and were growing *quina* (genus *Cinchona*) as a cash crop. As of the 1960s, they began to intermarry with highlanders, who were moved to the area by relocation plans headed by the central government (Pareja, 1999; Mamani et al., 2010), and with Trinitarios, who had arrived from the East in search of "the sacred land" (*la loma santa*). Population growth forced families to move away from the dense populations at the missions and start new communities in areas with more land but less infrastructure. The Mosetén relied primarily on river travel and travel on foot until the 1970s, when roads began to reach some communities. With the arrival of the roads, illegal logging skyrocketed. By 1990, the Mosetén had formed a tribal government, were cash cropping cacao and rice, and had exhausted much of the wood near the mission (Davalos, 1990).

Today the Mosetén are more mobile and market integrated than the Tsimane'. In the district where the majority of the present research was conducted, community members have access to a paved road, with shared taxis departing daily to the market town; electricity, running (non-potable) water, a high school (grades K-12), and a health outpost staffed 24 hours a day; ~10 stores selling dry goods, meat, and soda; satellite television; and spotty cellular service. Inter-household food sharing is rare, although if one arrives at someone's house and they are eating, they must invite one to eat – a custom also present among the Tsimane'. Participants reported relying on kin-biased networks to help with childcare and to borrow money. Spanish is universally spoken and exogamous marriage is the norm: 57% of the present sample had at least one non-Mosetén parent. The primary product in the

area is plantain; participants' households had spent a median of 10 days of the last month engaged in wage labor.

The district called "Intercultural" is located at the border of the Mosetén territory. The Mosetén resided in the Intercultural area, but in the mid-20th century were displaced by a wave of immigrants searching for work in the *quina* industry (Llojlla Roca, 2011). In the late 1960s, government relocation programs moved a number of Aymara families to the Intercultural area. By 1975, these families had organized and had obtained the funds for a road to the local market town – although the road was not paved and often impassable – and had established a small school. With the arrival of the road, the rate of immigration to Intercultural increased: immigrants came for the temperate, productive growing climate or the logging industry. The majority of immigrants were *themselves* children of Aymara and Quechua immigrants who moved from the highlands to the lowlands. In 1991, the road to the market town was paved and a high school (grades K-12) was established (Llojlla Roca, 2011).

Today Intercultural has the greatest access to markets and Bolivian society of the three populations. At least five shared taxis travel to the market town daily; households have access to electricity, (non-potable) running water, and a mini-hospital staffed 24 hours a day; ~5 stores sell dry goods and fresh vegetables; there are 2 butcheries and ~6 restaurants; and there is satellite television and spotty cellular service. Inter-household food sharing is essentially nonexistent, although participants did report relying on both kin and non-kin networks for help with childcare and to borrow money. The word "intercultural" in Bolivia refers to

communities of highland ancestry, an apt designation for this district: 59% of participants were Aymara and 18% Quechua. Almost all residents of Intercultural speak Spanish, except a few recently immigrated Quechua women. Participants' households spent a median of 9 days in the past month working in wage labor. Thirty-one percent of participants primarily produced cacao, but 20% primarily produced plantain and 12% primarily produced timber. Fifty-four percent also had other sources of income, including driving taxis (14%) and vending (15%), whether via a store, a restaurant, or a vending cart. In fact, 10% of participants did not have gardens or work in logging, but relied entirely on wage labor, taxi driving, and/or vending.

1.5 THE NATURE OF GROUPS IN BOLIVIA

In the Bolivian context, categorical group memberships are salient and relevant. They are the basis of organization for collective action in the labor and political spheres, and ethnic identity is a central feature of the national discourse. Bolivia has a larger indigenous population than the majority of countries in Latin America, with 36 nationally-recognized indigenous groups. Until the revolution of 1952, when *campesinismo* (the peasantry) and *sindicalismo* (labor unions) became important to the political sphere, indigeneity was at the forefront of colonial and national politics (Postero 2013); it returned to the forefront in the early 1980s when increasing disillusionment led to the foundation of organizations representing indigenous rights, such as the *Confederación de Pueblos Indígenas de Bolivia* (Confederation of Bolivian Indigenous Communities) in the lowlands. In the 1990s, indigenous

movements gathered steam as different ethnic groups increasingly coordinated to protest and demonstrate against government policies. Finally, in 2009, Bolivia ratified a new constitution which recognizes the right of Bolivian indigenous groups to self-govern by their own *usos y costumbres* (customary laws). The state began to preferentially invest support in "indigenous native peasants," or rural indigenous individuals living on tribal lands (Albro, 2010; Fontana, 2014).

The new government's efforts to support Bolivian indigenous groups has had mixed consequences for ethnic identity. Identification with an ethnic group pays off in political contexts but often carries little weight in everyday life (Canessa, 2007; Hippert, 2011; Weber, 2013). Whereas indigenous groups banded together for common causes in the 1990s and early 2000s, groups now must compete for resource access in some contexts (Hippert, 2011). For individuals who do not meet the criteria for government support – those who are *mestizo*, live in urban sectors, or live in mixed communities – labor unions and work cooperatives provide alternative avenues for government resource access (e.g., Conzelman, 2007). These alternative means are relevant for communities like Intercultural, for example, as they are not on tribal land and thus feel they receive fewer resources than the Mosetén.

While there is a diverse menu of Christian churches in Bolivia, religious affiliation itself is polarized in favor of the Catholic Church. Since the early 20th century, North American Protestant denominations, known as *iglesias evangelicas*, have had an increasing presence in Latin America; between 1960 and 1990, the number of *evangélicos* in Bolivia quintupled (Stoll, 1990). The success of Protestant

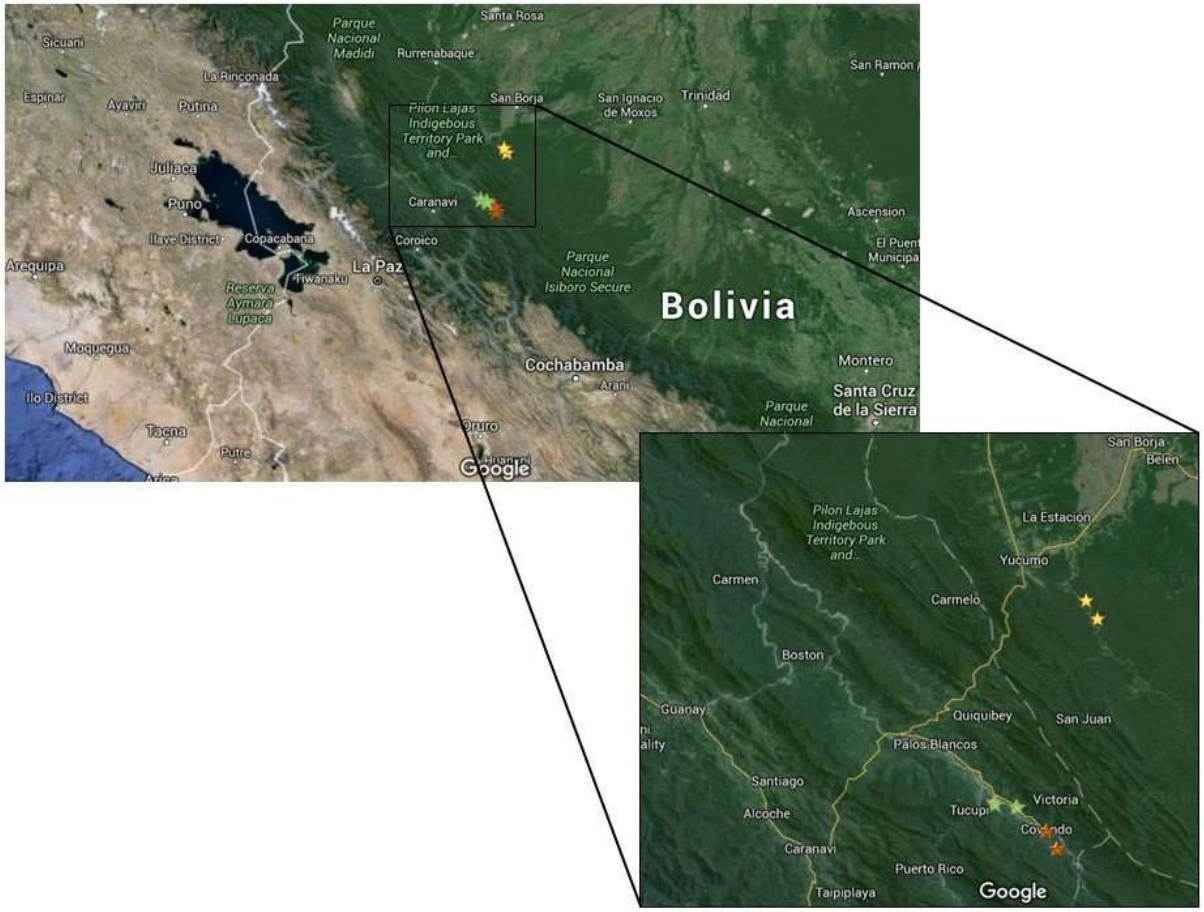
churches in Latin America is at least partially due to missionarys' tactics for recruiting members, such as offering material support, education, and opportunities for self-improvement (Gill, 1998). In an increasingly mobile Bolivia, *evangelica* church membership provide alternative opportunities for resource buffering for Bolivians who have migrated away from their kin (Gill, 1993). In response to competition from Protestants in Latin America, the Catholic Church increased its investment in the poor and tried *evangelica* tactics like televangelism (Gill, 1998); in Bolivia, for example, Catholic mass is broadcast live on the national TV station every Sunday. With these tactics, the Catholic Church has maintained its majority in Bolivia: approximately 87% of Bolivians identified as Catholic in the year 2000 (Froehle and Gautier, 2002; World Bank, 2016).

1.6 Conclusion

Inter-group relationship building in humans may have been favored in a foraging ecology in which non-local resource access and buffering widespread shortfalls were critical to survival and reproduction. Accordingly, we predict that actors should value potential partnerships with individual out-group members more when they perceive net gains from these relationships in terms of additional resource access or buffering. Contemporary contexts favoring out-group valuation need not be identical to those under which out-group valuation was selected: in Bolivia, we investigate the impact of social and economic change among horticulturalists on valuation for members of other ethnic, work, and religious groups. In the next three chapters, we

explore the effects of these candidate factors on out-group valuation, then draw some preliminary conclusions and identify future directions in this research program.

Figure 1. Locations of pilot and focal communities among the three study populations. Tsimane' sites are marked with yellow, Mosetén with orange, and Interculturales with green.



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2. RISK BUFFERING AND RESOURCE ACCESS SHAPE VALUATION OF OUT-GROUP AND IN-GROUP STRANGERS

This chapter is co-authored with Michael Gurven and is currently under review. AP and MG conceived and designed the study, AP collected the data, AP and MG wrote the chapter.

Abstract

Unlike other primates, humans exhibit extensive inter-group tolerance and frequently build relationships with out-group members. Despite its common occurrence, little is known about the conditions leading to out-group relationship building in humans. What are the social and ecological factors that promote valuation of out-group members as potential social partners? Do they differ from those that promote valuation of in-group members? We propose that opportunities for non-local resource access and resource buffering, crucial in the human foraging niche, will increase valuation of out-group strangers. Using survey and experimental data collected among three Bolivian horticultural populations, we find that individuals who have fewer non-locally available resources and more information about out-groups demonstrate more generosity toward out-group strangers. Some variability in the effects of our predictors are instructive, as they appear to reflect particulars of the Bolivian context. Further, depending on the measure, existing network connections affect both out-group and in-group giving, suggesting that new partnerships from both in-groups and out-groups may bolster one's networks. Our

results illustrate how evolved human psychology is sensitive to the costs and benefits of both out-group and in-group relationships, but underscore that the social and ecological factors favoring new relationships with in-group versus out-group strangers may differ.

2.1 INTRODUCTION

Humans have a long history of interaction with individuals from different places and cultural backgrounds. While much research on inter-group relationships in human evolution has focused on competition and conflict [1–4], out-groups as sources of danger [5,6], and in-group favoritism at the expense of out-groups [7], little attention has been given to the conditions that favor building connections with individuals from different groups (cf. [8–12]). Chimpanzees and other primates are mostly indifferent or hostile towards strangers from other groups [13], yet archaeological and ethnographic evidence provide many examples of relationship building with out-groups throughout human history, as facilitated by marriage, trade, and friendship [11,12,14–18]. Between-group relationships served functional roles, including improvement of non-local resource access, resource buffering, and information transmission. Among contemporary industrialized populations, social psychologists and behavioral economists have likewise documented higher valuation for out-group members – measured as cooperation with, trust in, or empathy toward out-group individuals – in contexts where competition is low and mutually beneficial interactions are possible [8,19–21]. Furthermore, an actor is more likely to value out-group members when her in-

group is of low status [22,23], a correlate of poor resource acquisition in situations of resource scarcity [24].

Taken together, these findings suggest that positive valuation of out-group members as potential social partners is governed by an evolved human psychology sensitive to the expected benefits and costs of interaction with others, not unlike the system that governs partner choice and alliance formation with in-group members [25,26]. As with in-group valuation, the expected benefits and costs of interaction with out-groups may be informed by a participant's own observations, past interactions with out-groups, and socially transmitted information [27,28]. When the expected net benefits of interaction are sufficiently high, an actor should be more willing to display tolerance of and cooperative intent towards out-group members, thereby investing in her reputation as a potential social partner [29–32]. Higher valuation of out-group individuals may improve inter-group relations in turn, increasing the likelihood of large-scale collaboration [33] and reducing parochial behavior [34,35].

When might out-group relationships have expected net benefits for an actor? Humans evolved as hunter-gatherers, dependent on a foraging ecology with return rates that varied across space and time. In-group relationships provide crucial buffers to shortfalls caused by illness and food production failure in isolated small-scale populations [32,36]. These relationships remain important in populations integrating to national markets [37,38] and industrialized populations [39], as reliance on credit is not a perfect buffer [40] and resource shortfalls are associated with lower fertility [41,42]. Out-group relationships may likewise buffer shortfalls due to production failures, illness, and other idiosyncratic shocks, but they also expand on the

buffering possible with in-group networks, as they can provide non-local resource access and buffer local resource shortfalls [11,12,15,17]. Out-group connections may be particularly valuable to help cope with shocks that impact all members of an actor's local network. For example, when local sources of water would run out in the 1970s, the San would disperse, calling upon social connections up to 150 or 200 km away [10]. The San also relied on members of different ethnic groups for resource access, trading locally produced goods for pottery, hunting dogs, and iron tools[14].

In the present paper, we suggest that while need and insufficient buffering in existing networks should motivate investment in new relationships, whether with in-group or out-group strangers, the need or desire for non-local resource access should affect valuation for new out-group relationships more than for new in-group relationships. Further, expectations of the gains to be reaped via out-group relationships may be altered by past observations of, experience with, or socially transmitted information about out-groups. We investigate out-group and in-group valuation in relation to non-local resource access among three populations of horticulturalists from lowland Bolivia. Further, we explore the relative roles of existing social support, as well as past experience with out-groups and stereotypes about their resource access, in modulating out-group and in-group valuation.

We predict that:

(P1) Lack of access to resources that cannot be easily obtained in an actor's community will predict positive valuation for out-group members.

(P2) Existing information about out-group members, whether via socially transmitted information or an actor's own past experiences, will modulate her valuation for them.

(P3) An actor's current state of need and the degree to which she can rely on her existing social networks will affect both her out-group and in-group valuation.

Each of the above predictions was tested with several measures. As a proxy for out-group and in-group valuation, participants played a non-anonymous economic game in which they could be generous toward in-group or out-group strangers; recipients, past participants in the study, learned the donor's name and amount sent.

The data analyzed here were collected among the Mosetén, the Tsimane', and a multicultural community nicknamed "Intercultural." Members of these three populations have differential exposure to out-group members and markets, which may boost the benefits to be gained from out-group relationships. These differences in exposure are not solely between-group differences, but include substantial inter-individual differences in market integration and out-group contact; as such, we studied the three populations together to take advantage of this inter-individual variance.

2.2 RESULTS

Each participant was presented with three photos of in-group and three photos of out-group strangers, and was given 21 *bolivianos* (1/3 of a day's wage; $0.14/B1) to allocate among these six individuals and herself (Figure 1). Participants gave away an average of 74% (B15.53) to the six candidate recipients, keeping the remainder for themselves (B5.47; SD=5.77). They sent an average of B2.94 (14% of the stakes; SD=1.56) to each in-group stranger, more than the average of B2.20 (10% of the stakes; SD=1.50) sent to each out-group stranger ($t=4.27$, $p<0.001$). Though

we designed the economic game such that recipients would learn the name of donors, 33% of our sample opted not to share their names with recipients. Other descriptive statistics appear in Supplementary Table 1. Table 1 summarizes our predictions, the proxies used for each prediction, and model results.

(P1) Existing non-local resource access. For proxies of non-local resource access, higher values mean *pre-existing* access to non-local resources. Participants who had higher subjective socioeconomic statuses relative to others in their community (i.e., believed themselves to have more money and market-purchased items relative to others in their communities) were less likely to give money to out-group strangers (-B0.33 for each one unit increase on the log scale, $p<0.10$; Table 2) but no more likely to send money to in-group strangers (B0.14, $p=0.52$) or keep money for themselves (B0.60, $p=0.44$; Figure 2a; Supplementary Table 3). Household income had no significant effect on giving. The dollar value of market items owned had no significant effect across populations, but within the Tsimane' subsample, individuals who had more invested in market items gave significantly less to out-group strangers than Tsimane' participants who owned fewer items (-B2.72 per standard deviation increase in market items, $p<0.01$; Supplementary Table 4).

(P2) Past exposure. Participants who had lived in more locations were significantly more likely to give money to out-group strangers relative to those who had lived in fewer locations (B0.21 for each additional location, $p<0.01$), keeping less for themselves (-B0.62, $p<0.10$; Figure 2b). Those who had watched more TV or movies in the past week also gave more to out-group strangers relative to those

who had watched less (B0.23 for each standard deviation of watching, p=0.10), keeping less for themselves (-B1.06, p<0.10). There was also no effect of number of cities and towns visited on giving.

(P2) Stereotypes. Due to small sample size, separate models were fit to investigate stereotypes, each employing only the variables that reached significance above to preserve degrees of freedom in these models. There was no effect of stereotypes about the out-group's cooperativeness on participant giving to out-group strangers (-B0.09, p=0.84), or even in-group strangers, i.e., to avoid out-group giving (-B0.15, p=0.81; Supplementary Table 6).

(P3) Need. Participants who had been ill in the last month were less likely to give money to out-group strangers than those who had not been ill (-B0.90, p<0.01), although they were no more likely to send money to in-group strangers or keep it for themselves than healthy participants (B0.54, p=0.18; B0.91, p=0.52). There was no consistent effect of resource shortfalls – that is, lower than usual income or production in the last two months, food insecurity, and household dependency – on giving.

(P3) Existing network support. Participants who could borrow money from two or more communities where they had previously lived gave more to *in*-group strangers than those who could not borrow from past communities where they had lived (B1.05, p<0.05); they instead kept less for themselves, although the effect was not significant (-B2.20, p=0.17). Those who do not give or receive in cooperative labor exchanges gave less to out-group strangers than those who do at least some cooperative labor (-B0.52, p<0.05); a trend suggests they instead kept more money

for themselves (B1.87, $p<0.10$; Figure 2c). There was no effect of being able to stay in at least one community where a participant lived previously.

Exploratory analysis: Opting into anonymity. To avoid coercion, participants were allowed to opt out of non-anonymous game play if they chose. Participants who did not opt out (i.e., shared their names with participants) drove the effects for subjective socioeconomic status and recent illness, whereas the effect of number of places lived was robust across both samples (Supplementary Table S7). Sharing one's name is included as a control variable in all models on the full sample (reported in the above sections) and had no significant effect on giving.

Additional variables. Other control variables did not have significant effects on giving. See Supplementary Table 2 for fit statistics.

2.3 Discussion

Little is understood about the social and ecological conditions that favor out-group relationship building in humans, though it is a hallmark feature of human sociality. Here we found that lowland Bolivian horticulturalists demonstrate substantial valuation for both in-group and out-group strangers as potential social partners, as proxied by generosity in a non-anonymous economic game. Generosity toward out-group strangers was higher among those with lower subjective socioeconomic statuses relative to others in their community, a proxy for lack of non-local resource access. Among the Tsimane', but not the Mosetén or Interculturales, those who owned fewer market items were more generous toward out-group strangers. These associations between existing non-local resource access and out-group valuation

are consistent with our approach, which suggests that an actor will consider new social partnerships, investing in her reputation as a reliable partner accordingly, when she expects these relationships to yield net benefits [25,26,29].

We predicted that existing information about out-group members would modulate valuation for them. In general, existing information increased out-group valuation, such as living in a greater number of other communities or watching more TV or movies. Holding negative stereotypes about the cooperative potential of an out-group had no effect on giving.

Finally, we suggested that need and a lack of existing social support may raise valuation for both out-group and in-group members. We found variable effects for these proxies. Participants who had a recent illness were less likely to be generous toward out-group strangers, although there was no effect of a summary measure of recent resource shortfalls (including recent lower-than-expected production or income, food insecurity, and dependency). In terms of existing social support, participants who had cooperative partners for traditional cooperative labor gave more to out-group strangers, while those who could borrow from members of two past communities gave more to *in*-group strangers.

Our results are somewhat at odds with existing studies suggesting that market penetration may increase giving to strangers, as market norms may prescribe behavior toward strangers[43,44] or increased resource access may lower between-group competition by taking care of basic needs[45]. Instead, we find that higher subjective socioeconomic status, a measure of one's access to money and market items, predicts less generosity toward one kind of stranger, out-group

strangers, and not another, in-group strangers. However, our non-anonymous game substantially alters the stakes of the game context (e.g., [46,47]), so our results are not directly comparable. Interestingly, only one proxy for non-local resource access had an effect on out-group giving; market items owned negatively predicted giving in only one population, while household income had no effect. One reason the effect of market items may differ across populations are the different experiences of members of each population as they are exposed to out-groups. For example, Tsimane' participants may experience positive exposure to out-group members via the media – one favorite movie character is a clown from Perú – but negative exposure via market interactions, as some suffer discrimination in local towns.

In this vein, the present study also underscores the importance of existing information about the out-group, need, and existing network connections in modulating out-group valuation. For example, the negative relationship we found between recent illness and out-group relationships may be attributable to risk. Because out-group partnerships may be more risky – because norm systems between groups may differ, increasing transaction costs[16], or because friends that rarely interact are more difficult to monitor[e.g., 25] – out-group valuation may become part of an actor's risk management portfolio once some needs are met, not when resources are especially scarce [e.g., 12,21,48]. Participants who could borrow from members of two of their past communities likewise may have invested more in in-group members because their relative gains from additional sources of resource buffering or access was lower relative to the costs of these risky initial relationships. These explanations are all consistent with an evolved psychology sensitive to the

relative benefits and costs of out-group relationships, as suggested by ourselves and others [25,26]. Our future work will employ experimental manipulations and sources of quasi-natural experiments in Bolivia to better understand why some proxies had effects here and not others, and which weigh the most heavily in out-group valuation.

In conclusion, the idea that out-group valuation may enable non-local resource access and buffering is consistent with existing ethnographic, archaeological, and social psychological data. The human foraging ecology is unique, based on the acquisition of calorically dense, difficult-to-acquire foods; social networks extending beyond an actor's local community were likely crucial sources of resource access and buffering in our ancestral past, particularly for non-local resources and shortfalls striking an entire community [11,12]. The importance of out-group relationships is not limited to small-scale societies, however: it may be even greater in populations integrating to national markets, as the least integrated individuals in these populations have the most to gain from non-local resource access. In the present study, we demonstrated that one measure – low subjective socioeconomic status – predicted out-group generosity across three lowland Bolivian populations, while a second – having few market-purchased items – was a positive predictor in one of the three populations. We suggest that evolutionary selective forces have favored a psychology sensitive to the relative benefits and costs of out-group relationships, particularly the relative benefits in the currency of non-local resource access; our future work will further pin down the subtleties of why some needs for access, but not others, have an effect.

2.4 METHODS

2.4.1 STUDY POPULATIONS

The Tsimane', the Mosetén, and the multicultural community here called "Intercultural" are three populations of South American horticulturalists in the Bolivian lowlands. Together, members of the three populations capture the range of variation in market integration among lowland Bolivian horticulturalists. For example, the Tsimane', Mosetén, and Intercultural households in this sample have median incomes of $36, $260 and $323 per month, respectively (the national private sector median is $560; [49]). By interviewing members of all three populations, we took advantage of this inter-individual variation in exposure to out-group members and the benefits of non-local market access, e.g., via markets. For additional ethnographic details, see Supplementary Methods 1.

"Groups" relevant in the Bolivian context are clusters of individuals who self-identify as the same ethnicity, religion, political party, work cooperative, or labor union. For this study, we identified non-political groups which members of our study populations could join or, in the case of ethnic groups, with whom they regularly interact; focus is on religious and ethnic groups, as they are large enough to contain strangers. Mosetén participants regularly interact with members of six ethnic groups and may become members of two local work cooperatives. The majority of Mosetenes are Catholic, but an Evangelical Friends congregation is also part of the community. Intercultural has four churches and three local cooperatives. We selected five focal ethnic groups of the eight with whom Interculturales regularly

interact. In their language and in conversation, the Tsimane' distinguish between three native lowland ethnic groups (the Mosetén, Yuracaré, and Trinitarios) but cognize Andean immigrants to the lowlands as one group (*collas*) and non-indigenous lowlanders as another (*cambas*). Three churches have an intermittent presence in Tsimane' communities, but Tsimane' participants were not part of any work cooperatives.

2.4.2 EXPERIMENTAL AND SURVEY PROTOCOL

The sample includes 217 individuals (male=50.2%) from these three populations interviewed between August 2014-March 2015. As literacy is not high among these populations, participants gave their informed oral consent to participate. Study protocol was approved by the University of California, Santa Barbara Institutional Review Board and research was carried out in accordance with the approved guidelines. Order of presentation of survey sections and items within sections were counterbalanced across participants. Protocol were designed for these three populations, which include individuals with various levels of schooling and literacy, based on pilot interviews and ethnographic data. See Supplementary Methods 2 for details about sampling and comprehension checks for the economic game.

Participants sorted cards representing local groups on a physical five point scale, which drew on notions linguistic concepts of social closeness in Spanish and the Tsimane' language (Supplementary Fig. 1); cards in the closest square were 1="groups I belong to most or feel most a part of," while groups in the farthest were 5="groups I belong to least." Cards placed in positions 1 and 2 were classified as "in-group" and those from positions 4 and 5 as "out-group"; from these, two groups

were selected: either one ethnic in-group and one ethnic out-group, or one religious in-group and one religious out-group.

Initial generosity. A non-anonymous economic game was designed to improve upon the ecological validity of other game formats (e.g., the Dictator Game[50]) in which participants can demonstrate cooperative intent. Photos of six candidate same-sex candidate recipients, three in-group strangers and three out-group strangers within ten years of her age, were arrayed on the table (Figure 1). All were past participants in the experiment, and we ascertained that all were strangers before proceeding. Participants were told the name, group affiliation, and age (an intended distractor) of each individual. Stacks of three one boliviano coins (Bs; $0.14/B1) were placed on each photo and in front of the participant (total stake of B21; approximately 1/3 of a day's wage). A participant could move any number of coins between photos, from photos to her own stack, or from her stack to the photos. Participants were informed that any Bs left on a photo would be given to that person in the participant's name (unless the participant wished to remain anonymous) and any Bs left in front of the participant would be hers. To avoid confusion and maintain participants' trust, donors who kept money for themselves received their payouts at the end of the interview, while recipients were given their payouts, along with the names of the donors and the amounts given, at the end of the field season. For analysis, we averaged the amounts a participant gave to the three out-group members and, for comparison, to the three in-group members. There was no difference in the amount of money allocated to members of out-group

religions vs. members of out-group ethnic groups, so we include both group types in each analysis.

Existing non-local resource access. Aspects of participants' material style of life [51], including subjective socioeconomic status relative to others in their community [52], were obtained by interview. Per previously evaluated methods used among the Tsimane', household net income was calculated from participants' self-reported earnings and expenditures on debts and wages over the last month. Participants also identified the quantity of popular market possessions owned by their household (Supplementary Methods 3). Current price was used to ascribe dollar amounts to market possessions. Because a participant's comparison of herself to others may affect whether she believes she can access more resources elsewhere [53], net income and dollar amount invested in market possessions were converted to z-scores at the sample level. Subjective socioeconomic status was logged to normalize the positively skewed data.

Need. Participants' access to sufficient basic household resources was measured as self-reported food insecurity ([54]; Supplementary Methods 4), personal illness lasting three days or more in the past month, dependency (number of children living in the home), and whether production and earnings during the previous month were the same, higher, or lower than normative for the household. A summary measure of food insecurity, dependency, and changes in income/production was constructed by including all three in a principal components analysis and extracting the first component (variance explained=47.03%). Recent illness did not load on this factor and is thus considered separately.

Existing network support. To capture whether participants had existing social connections that could buffer shortfalls affecting their local community, participants were asked whether they could stay with a family from a community where they had lived in the past (i.e., in their natal community or in the local market town) during a hypothetical flood affecting their household, and whether they could ask someone from these communities for a loan of B100 (1.5 to 2 days' wages). Additionally, as the availability of existing trustworthy cooperative partners constrains the ability to engage in traditional cooperative labor – *ayni*, cooperative labor often used to harvest rice – in these populations, participants were also asked if they gave or received labor in *ayni* in the previous year.

Past exposure. Participants listed the number of towns and cities they had visited in their lifetime, as well as the number of locations where they had lived; number of locations lived and visited were each summed. They also indicated the number of hours they spent watching TV or movies in the past week. Due to the highly variable distributions of cities or towns visited and hours of TV or movies watched, these two variables were converted to z-scores at the sample level.

Stereotypes. Participants were asked to describe what members of other groups said about the focal out-group. These free-responses were later coded by whether they concerned the presence of traits related to cooperation (or of traits that would reduce the likelihood of cooperative outcomes). These codes were lumped into a binary variable: whether a participant had mentioned a negative stereotype with regard to cooperation, or had not.

2.4.3 ADDITIONAL VARIABLES

We controlled for other factors that might affect out-group valuation beyond the scope of the present hypotheses (Supplementary Methods 5). These include participants' propensity toward risk taking (Supplementary Methods 6) and her Agreeableness (Supplementary Methods 7), which may predict prosocial tendencies in the economic game[55]. Whether a participant preferred to remain anonymous in the economic game is considered in the text, as participants may play differently if they believe their decisions are anonymous[47].

2.4.4 STATISTICAL METHODS

Using the R statistical program[56], we compared the effects for the variables that predict generosity toward out-group individuals to those that predict the generosity toward in-group individuals and money kept by the participant. Because generosity data violated Gaussian distributional assumptions, all models use a Bayesian approach (MCMCglmm [57]). Model estimates are reported as means of the posterior distribution. Unless specified otherwise, all models include data from all three populations and population random intercepts and control for survey version. Data are available in Supplementary Data 1, and are described in Supplementary Methods 8.

Collinearity was assessed for each model with a maximum permissible variance inflation factor of 4. To check the robusticity of our effects, we fit each model within each population. To avoid the influence of outliers, we rounded extreme values and transformed non-normal continuous predictors (Supplementary Table 8).

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Figure 1. An example of the non-anonymous economic game. Six photos were arrayed on a table, all past participants in the experiment. The three men on the left were participants who identify with one ethnic or religious group, the three on the right with another. Participants were told the name and group affiliation of each individual. Stacks of three one boliviano coins were placed on each photo and in front of the participant. The participant could move any number of coins between photos, from photos to her own stack, or from her stack to the photos. Participants were informed that any coins left on a photo would be given to that person in the participant's name (unless the participant wished to remain anonymous) and any coins left in front of the participant would be hers.

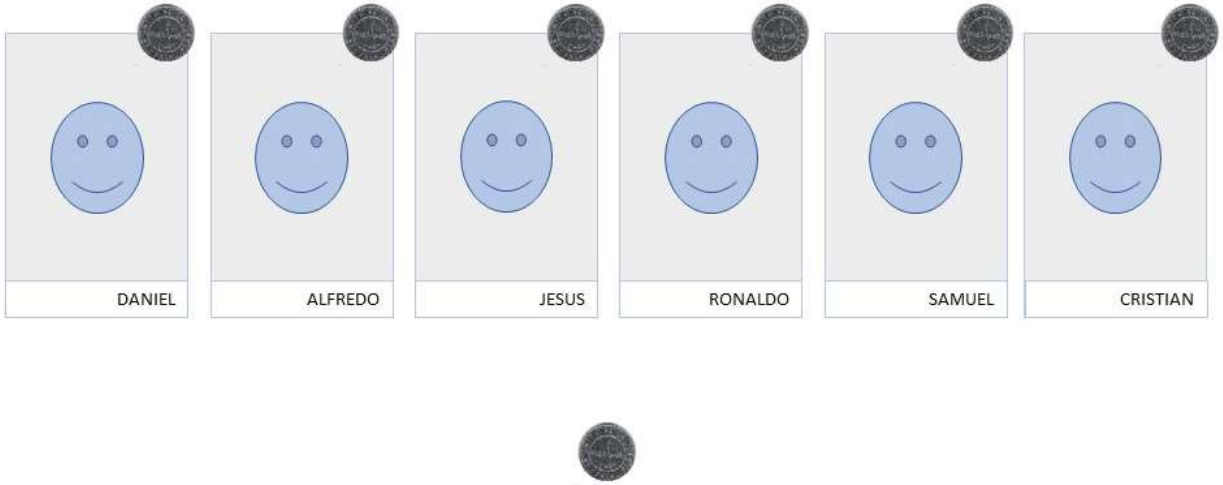

Figure 2. Predicted amounts allocated (with 95% prediction intervals) to an out-group member (dark gray, solid line), an in-group member (medium gray, short-long dash), and the self (light gray, long dash) by (a) log subjective socioeconomic status, (b) number of places lived, and (c) availability of cooperative labor partners.

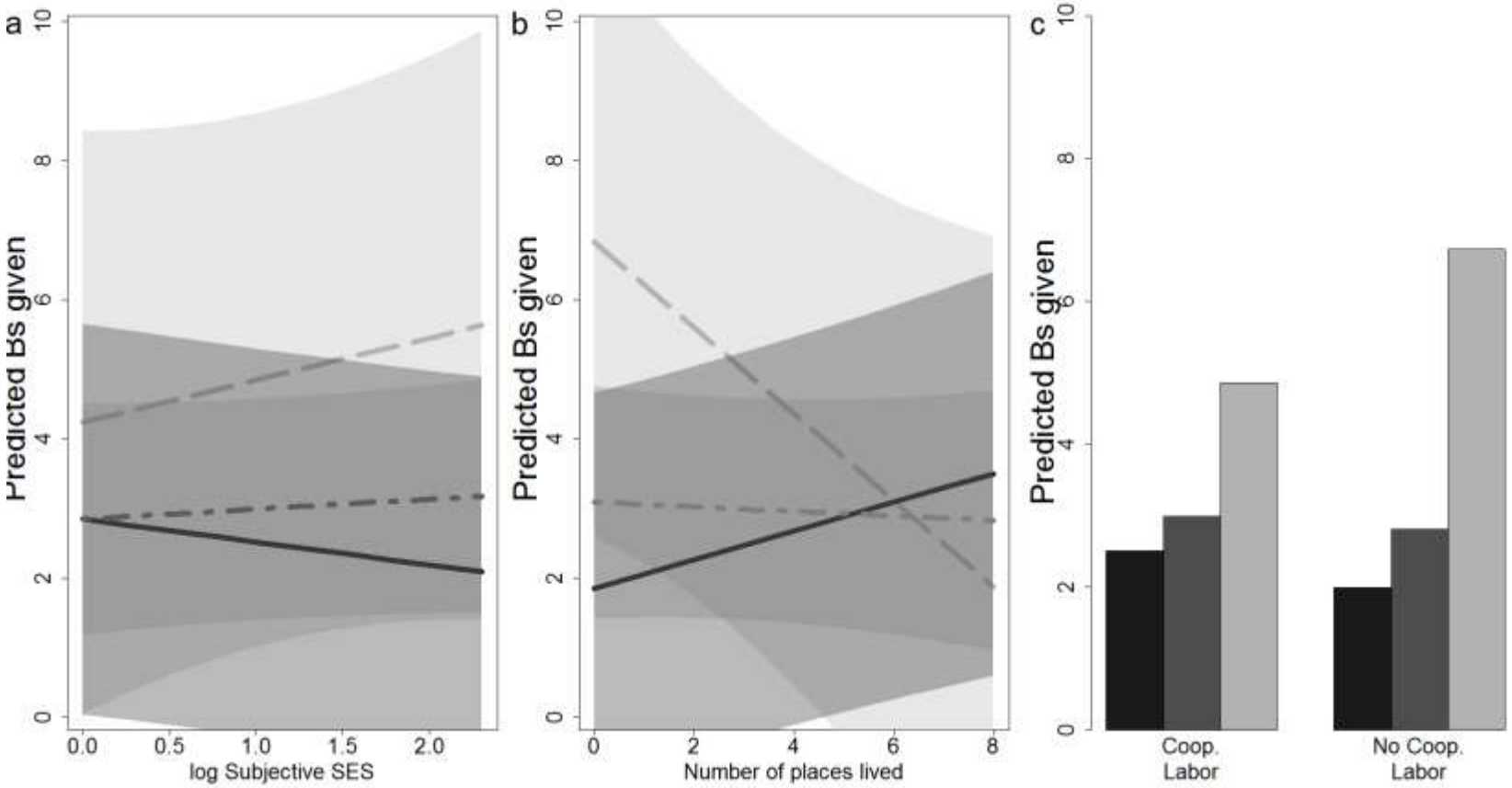

Table 1. Summary of results for valuation of out-group and in-group strangers. All effects for which p<0.10 are reported. N.E. signifies no consistent effect. Estimates for out-group stereotypes appear in Supplementary Table 5. [1]Value of market items has a significant negative effect on out-group giving, but only among the Tsimane'.

	Out-group		In-group	
Variable	**Prediction**	**Result**	**Prediction**	**Result**
Existing non-local resource access	↓		N.E.	
Income last month		N.E.		N.E.
Value of market items		N.E.[1]		N.E.
log subjective SES		↓		N.E.
Need	↑		↑	
Shortfall summary		N.E.		N.E.
Recent illness		↓		
Existing network support	↓		↓	
Can borrow from one past comm.		N.E.		N.E.
Can borrow from two past comms.		N.E.		↑
Can stay in past comm.		N.E.		N.E.
No traditional labor		↓		N.E.
Past exposure	↑		N.E.	
Hours TV/movies		↑		N.E.
Cities/towns visited		N.E.		N.E.
Places lived		↑		N.E.
No negative out-group stereotype		N.E.		N.E.

Table 2. Estimates for the effects of each predictor on out-group and in-group giving, respectively.[1]

	Out-group				In-group			
Variable	**Post. mean**	**Lower 95%**	**Upper 95%**	**p value**	**Post. mean**	**Lower 95%**	**Upper 95%**	**p value**
Intercept	2.13	-0.32	4.50	0.07	0.06	-2.29	2.37	0.96
Existing non-local resource access								
Income last month1	0.06	-0.18	0.30	0.65	0.14	-0.18	0.47	0.40
Value of market items1	-0.03	-0.31	0.27	0.85	0.17	-0.17	0.53	0.32
log subjective SES	-0.33	-0.70	0.01	0.07	0.14	-0.29	0.59	0.52
Past exposure								
Hours TV/movies1	0.23	-0.05	0.49	0.10	0.03	-0.28	0.35	0.83
Cities/towns visited1	0.09	-0.17	0.38	0.50	-0.22	-0.55	0.11	0.19
Places lived	0.21	0.05	0.36	0.01	-0.03	-0.22	0.15	0.73
Existing network support								
Can borrow from one past comm.	-0.30	-1.10	0.47	0.45	0.31	-0.59	1.21	0.51
Can borrow from two past comms.	-0.42	-1.18	0.30	0.26	1.05	0.13	1.89	0.02
Can stay in past comm.	-0.05	-0.58	0.49	0.85	0.30	-0.34	0.96	0.37
No traditional labor	-0.52	-1.01	-0.01	0.04	-0.19	-0.80	0.38	0.52
Need								
Shortfall summary	-0.05	-0.25	0.17	0.67	-0.13	-0.38	0.13	0.33
Recent illness	-0.90	-1.52	-0.26	0.00	0.54	-0.24	1.35	0.18

[1]***=p<0.001, **=p<0.01, *=p<0.05, .=p<0.10. Out-group model sample size = 150, DIC=532.17; in-group model sample size = 133, DIC=513.60. Estimates are means of the posterior distribution (fit with MCMCglmm). Population is included as a random effect in all models. Estimates for control variables (included in the above models, but not

reported here) reported in Supplementary Table 2. No variables evidenced collinearity (i.e., all exhibited a variance inflation factor of less than 4). [2]Variables reflect population-specific z-scores, e.g., a participant's household income in the last month relative to the mean household income in her population.

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3. When to diversify, and with whom? Choosing partners among out-group strangers in lowland Bolivia

This chapter with co-authored with Michael Gurven. AP and MG conceived and designed the study, AP collected the data, AP and MG wrote the chapter.

Abstract

Evidence from the ethnographic and archaeological records suggests that humans often rely on out-group relationships for access to non-local resources and resource buffering. However, little is known about how actors choose out-group cooperative partners. The existing literature suggests that (in-group) partner choice is often based on characteristics associated with cooperation. Is out-group partner choice based on the same criteria as in-group partner choice? Because of the specific kinds of resource access that may be attained through out-groups, we suggest that out-group partner choice should track characteristics of both the candidate partner *and* the partner's group that are associated with benefits for the actor. We collected data among three populations of Bolivian horticulturalists (n=157); together, the individuals in these three populations range in their integration to markets and their mobility, thus capturing a large range of potential benefits to out-group cooperation. Using a non-anonymous, one-shot economic game, we demonstrate that recipients who are perceived to be "good people" and are from groups perceived to have market and political resource access are given more money by donors. These

results suggest that both individual and group characteristics feature in partner choice among out-group members.

3.1 INTRODUCTION

Humans have relied on cooperative resource production since at least the origin of *Homo* (Hooper, Gurven, & Kaplan, 2014). Accordingly, our evolved psychology is attuned to characteristics in others that are associated with higher returns to cooperation (Barclay, 2013; Cosmides & Tooby, 1992; Kurzban & Leary, 2001), and actors prefer to interact with cooperative partners who have these characteristics (Barclay, 2013; Baumard, André, & Sperber, 2013; Noe & Hammerstein, 1994). Through selectively forming and maintaining cooperative relationships, actors are better able to smooth access to resources, such as hunted meat, that are characterized by variable acquisition rates (Jaeggi & Gurven, 2013). Indeed, relative to individual cooperative partners, groups of interconnected cooperative partners even more effectively smooth resource access for an actor (Hruschka & Henrich, 2006; Levine & Kurzban, 2006; Tooby, Cosmides, & Price, 2006). These cooperative groups often engage in more than one type of cooperative endeavor (e.g., economic and political; Lyle & Smith, 2014; Moya & Boyd, 2015; Tooby et al., 2006), which may contribute to their persistence across time (Gómez-Gardeñes, Reinares, Arenas, & Floría, 2012).

While some – including Darwin (1871) – suggest that human evolution has been characterized by inter-group competition and within-group cooperation, the ethnographic and archaeological records also provide abundant evidence of inter-

group cooperation (Barth, 1969; Ensminger, 1992; Gamble, 1999; Jochim, 2006; Ross & Atkinson, 2016; Whallon, 2006; Wiessner, 2001). Inter-group relationships may provide access to non-local resources, buffer shortfalls affecting local cooperative partners (Brewer & Caporeal, 2006; Pisor & Gurven, n.d.), enable actors to specialize in resource production and rely on economies of scale (e.g., De Weerdt & Dercon, 2006), and provide access to alternative cooperative partners if an actor's existing group provides insufficient support (Boyer, Firat, & van Leeuwen, 2015). We previously demonstrated that actors may invest more in out-group relationships when they have less access to market resources (Pisor & Gurven, n.d.). However, how do actors select *among* candidate out-group partners? Do actors select cooperative partners from out-groups based on the same criteria as those guiding in-group partner choice?

Though this question has largely not been addressed by the existing literature, we suggest that both individual-level and group-level qualities may shape out-group partner choice. As with in-group partner choice, out-group partner choice should track individual-level characteristics associated with higher gains to cooperation, including expected competence in food production (Eisenbruch et al. 2016) or specialized labor (Brewer, 1996), anticipated generosity (Barclay, 2013; Baumard et al., 2013; Gurven, Allen-Arave, Hill, & Hurtado, 2000), and resource access (e.g., Gurven, Jaeggi, von Rueden, Hooper, & Kaplan, 2015). Additionally, by virtue of their group membership, candidate cooperative partners may offer additional benefits to an actor. For example, if certain resources are not available locally, out-group partners may provide access via trade, gift giving, or delayed

exchange (Whallon, 2006). Actors belonging to groups that are the numerical minority or of lower social status than out-groups are more likely to positively evaluate out-groups (Bettencourt, Dorr, Charlton, & Hume, 2001; Brewer, Manzi, & Shaw, 1993); this is likely because high status groups have more social capital or resource access (Brewer & Caporeal, 2006) and are therefore high-quality partners. Finally, past exposure to members of an out-group, particularly in the context of cooperative interactions with beneficial outcomes, may increase an actor's valuation of a stranger from that same group, at least in ethnic (Gaertner & Dovidio, 2001; Hewstone & Brown, 1986) and religious groups (Paolini, Hewstone, Cairns, & Voci, 2004).

We hypothesize that selection has favored features of the human psychology that evaluate prospective out-group partners by the same criteria as in-group partners, plus characteristics of out-groups that are reliably associated with their access to resources. Specifically, we predict that if an actor perceives that a prospective partner has qualities suggestive of cooperativeness and is part of a group perceived to have resource access, she will be more generous toward this prospective partner; indeed, generosity in first interactions may initiate longer-term cooperative relationships (Delton, Krasnow, Cosmides, & Tooby, 2011; Henrich et al., 2005; Yamagishi, Terai, Kiyonari, Mifune, & Kanazawa, 2007). Here we investigate whether characteristics associated with perceived individual qualities of prospective partners, such as (P1.1) perceived resource holdings and (P1.2) perceived cooperative intent, as well as group qualities, such as (P2.1) perceived out-group resource access, (P2.2) the size of an out-group or the size of an actor's

own in-group, and (P2.3) an actor's past experience with the out-group, predict generosity toward prospective out-group partners.

To investigate out-group partner choice in action, we collected data among three populations of horticulturalists living in Bolivia. Bolivia is a highly multiethnic country; each of these three populations differs in its average extent of integration to Bolivian society, meaning differential exposure to out-group members and opportunities for non-local market resource access across individuals, both within and across populations. As such, we consider the three populations together to take advantage of this inter-individual variance. We use generosity toward out-group strangers in a non-anonymous economic game as a proxy for partner choice. Each participant could allocate money between three in-group strangers, three out-group strangers, and themselves. Participants knew that if they gave money, recipients would learn their full name and amount given. We interpret the amount of money given to each candidate recipient as indicative of a donor's interest in a relationship with that recipient.

Strikingly, participants gave the majority of money away to strangers. Among participants who sent positive amounts, more money was allocated to candidate recipients perceived to be "good people" (i.e., kind and open to others), and to be members of groups known for having access to market resources. We discuss these results, and some population-specific effects, in light of theoretical approaches to partner choice.

3.2 METHODS

3.2.1 STUDY POPULATIONS

The Mosetén, the Tsimane', and the multicultural community with the pseudonym "Intercultural" are three populations of horticulturalists living in the Bolivian lowlands. The Mosetén and Tsimane' are two of the 36 *pueblos indígenas* recognized by the Plurinational State of Bolivia. The two have a history of intermarriage (Corella, Bert, Pérez-Pérez, Gené, & Turbón, 2007) and spoke different dialects of the linguistic isolate Mosetenan (Sakel, 2007). However, Catholic clergy established schools and centralized communities for the Mosetén in the 19th century (Huanca, 2006; Mamani, Soria, & Huasna Bozo, 2010). Today the Mosetén are more market integrated than the Tsimane', with ready access to roads and higher levels of mobility. The Mosetén are fluent in Spanish, the most common Bolivian language, and often marry exogamously with non-Mosetén: 57% of our Mosetén sample have at least one non-Mosetén parent. The Tsimane' remain primarily endogamous, occasionally intermarrying with lowland groups who have settled in Tsimane' territory. Only 14% of Tsimane' participants in this study speak fluent Spanish.

The community Intercultural is a multicultural (*intercultural*) community on the boundary of Mosetén territory. Residents of Intercultural are predominantly immigrants or the children of immigrants: either they were moved from the Andes by government relocation programs in the 1960s or they immigrated for the favorable growing climate and the now-dwindling logging industry. Intercultural participants were predominantly Aymara (59%) and Quechua (18%), the two most populous

indigenous groups in Bolivia. The vast majority of Interculturales speak fluent Spanish. For additional ethnographic details, see Supplementary Methods 1.

"Groups" relevant in the Bolivian context are individuals who self-identify as the same ethnicity, religion, political party, work cooperative, or labor union. For this study, we focus on religious and ethnic groups, non-political groups large enough to contain strangers. Mosetén participants regularly interact with members of six ethnic groups. The majority of Mosetenes are Catholic, but an Evangelical Friends congregation is also part of the community. Interculturales have four churches and regularly interact with eight ethnic groups; we focused on five of the eight. In their language and in conversation, the Tsimane' distinguish between three native lowland ethnic groups (the Mosetén, Yuracaré, and Trinitarios) but cognize Andean immigrants to the lowlands as one group (*collas*) and non-indigenous lowlanders as another (*cambas*). Three churches have an intermittent presence in Tsimane' communities.

3.2.2 Experimental and survey protocol

The present sample includes 157 individuals (54% male) from these three populations interviewed between August 2014-March 2015. See Supplementary Methods 2 for details about sampling strategy, counterbalancing and randomization, and comprehension checks for the economic game. The study protocol was approved by the University of California, Santa Barbara Institutional Review Board and research was carried out in accordance with the approved guidelines.

3.2.3 Generosity towards out-group strangers

Participants sorted cards representing local groups on a five-point scale from 1="groups I belong to most or feel most a part of" to 5="groups I belong to least" (Figure S1). Cards placed in positions 1 and 2 were classified as in-group and those from positions 4 and 5 as out-group. From this sort, two groups were selected: either one religious in-group and one religious out-group, or one ethnic in-group and one ethnic out-group.

A non-anonymous economic game was designed to improve upon the ecological validity of other game formats (e.g., the Dictator Game; Camerer & Thaler, 1995; see also Gervais, n.d.) in which participants can demonstrate cooperative intent. Three photos of strangers were selected from the participant's in-group and three from her out-group; all were previous participants from other study communities (including those who participated in pilot interviews) of the same sex as the participant and within ten years of her age. The participant was told the name, group affiliation, and age (an intended distractor) of each candidate recipient. We asked whether she knew any individuals in the photos; if an individual was known, this photo was removed and exchanged for another. She was then told she had the opportunity to send (*enviar*) money to these candidate recipients: she could allocate 21 one *boliviano* coins (Bs, $0.14/B1; total stakes approximately 1/3 of a day's wage) among these six strangers and herself (see Figure S2 for an illustration). Participants were informed that if they left any coins on a photo, the person in the photo would learn the participant's name and how much she sent; any money not on a photo would be kept by the participant. To avoid confusion and maintain participants' trust, donors who kept money for themselves received their

payouts at the end of the interview, while recipients were given their payouts, along with the names of the donors and the amounts given, at the end of the field season. Donors who wished to remain anonymous were allowed to do so; we control for this in all analyses.

3.2.4 GROUP CHARACTERISTICS

Access to resources via the out-group. Before game play, participants were asked about the benefits and costs of being a member of the focal out-group. Participants interpreted these questions broadly. When describing benefits and costs, they frequently mentioned access to market goods and skill at obtaining economic resources, or lack thereof. Openness to out-group members and willingness to collaborate across groups, or unwillingness to share resources and collaborate, were also often cited. AP coded the first benefit or cost mentioned by a participant for a given group. For the purpose of analysis, we binned benefits as pertaining to resources or other benefits, and costs as pertaining to between-group competition, lack of market access, other costs, or lack of *any* costs.

Group size. Because differences in group size in the local context are likely more salient to participants than differences in group size on the national level (e.g., the Tsimane' are in the vast numerical majority in their communities, but represent approximately 1/10th of 1% of the Bolivian population), we employ local group size in the present analyses. From the ethnic identification of each participant's mother and father, we calculated the percent representation of each ethnic group within each of the three populations. As we attempted to sample every household in our study communities, these estimates should reflect the percentages of people that are part

of each ethnic group locally. To calculate local religious group size, we used the church participants attended to calculate the percent representation of each religious group within each of the three populations. We then matched group size percentages to out-group recipients, as well as to donors. To explore whether the size of the recipient group relative to the donor group affected donor behavior, we calculated the ratio of recipient group size to donor group size; because of the influence of outliers and because increasing differences in recipient and donor group size may not have additive effects on donor behavior, we logged these values. However, as recipient group size data were not available for all recipients and limited the sample size in our models, we include only donor group size – rather than the ratio of the two group sizes – in all models unless specified otherwise.

Past exposure. Participants reported the ethnic and religious groups with whom they interacted, or with whom their parents interacted, during their childhood. We then coded whether the out-group featured in the game was mentioned in this free response. We also asked participants to detail all the places they had lived previously, as well as all the cities and towns they had visited for more than a week; the number of places lived and places visited were each counted and used as proxies for exposure to out-groups. Likewise, TV watching can be a source of passive exposure to out-group members (e.g., Buchan et al., 2009). Accordingly, we include hours of TV or movies watched per week as a predictor in all models. Because TV watching and number of cities and towns visited were negatively skewed, we z-scored both measures at the sample level.

3.2.3 INDIVIDUAL CHARACTERISTICS

After the economic game was complete, the researcher asked each participant her perceptions of the six candidate recipients. While the accuracy of perceptions of personal characteristics from photos varies (Todorov, Olivola, Dotsch, & Mende-Siedlecki, 2014) – for example, untrustworthiness may be underestimated (Porter, England, Juodis, Ten Brinke, & Wilson, 2008) – affect towards the candidate recipients likely impacts decision-making (Arora, Peterson, Krantz, Hardisty, & Reddy, 2012); see further discussion of this method in the Discussion.

Resource access. Participants were asked to indicate whether each candidate recipient had "a lot of money, money, a little money, or no money." These ratings were converted to a Likert scale (0-3).

Cooperative intent. We asked participants whether each candidate recipient was a "good person" (*una persona buena*, which connotes kindness and openness to others in Bolivian Spanish) or a "bad person," whether the participant could trust the candidate recipient, and whether the participant would want to be friends with the candidate recipient. Each of these responses proxies qualities that could increase partner value, such as generosity and trustworthiness (Cottrell, Neuberg, & Li, 2007).

3.2.5 Additional variables

There are additional factors that may moderate valuation for out-group members, as we address elsewhere, including donor's existing resources and resource access, existing social network (Pisor & Gurven, n.d.), and personality (Ashton & Lee, 2007; Nettle, 2006); because these variables are not of direct relevance to the present

hypotheses, we treat them as secondary here. For further details on these variables, see Supplementary Methods 3.

3.2.6 Statistical methods

Given that a participant differentiated among out-group members, which variables affected whether she gave more or less to a candidate out-group recipient? We analyze these data at the level of a participant's decision for each candidate recipient, with random effects for participant nested within population random effects (nlme; Pinheiro, Bates, DebRoy, Sarkar, & R Development Core Team, 2016). Variables collinear in a given model (i.e., variables with a variable inflation factor of 4 or more) were excluded.

Due to the small number of participants who reported belonging to each evangelical denomination, we collapsed all evangelical denominations into a single category for the economic game, such that candidate recipients were "Catholics" and "Evangelists" for donors playing with religious in-groups and out-groups. This is consistent with the name for non-Catholic Christians in Latin America, *evangélicos* (Stoll, 1990). In accordance with this modification, we collapsed evangelical denominations into a single category for the purposes of calculating group size.

Data were missing at random for participants' perceptions of recipient "goodness," wealth, and trustworthiness. These values were imputed using predictive mean matching (mice; Van Buuren & Groothuis-Oudshoorn, 2011). Descriptive statistics report raw data without imputation; imputed values are included in model fits.

Because donors rated candidate recipients after making allocation decisions, which may introduce self-presentation bias, we calculated an average perceived wealth score for each recipient based on *all* the ratings of that recipient *except* the rating of the donor (i.e., a “leave one out” approach), creating a consensus measure of candidate recipient wealth. The same was done for the “good person” and willingness to trust responses. These measures were used in a robustness check reported in Table S8.

3.3 RESULTS

As amount given to out-group strangers did not differ between donors playing with religious groups vs. ethnic groups (B2.12 [i.e., 2 *bolivianos* and 12 cents] vs. B2.32; t=-1.19, p=0.24), we combine results from both group types in the present analyses. Participants could have kept all the money for themselves with no repercussions; instead, rather than demonstrating pure selfishness, they gave away an average of B14 of the B21 total stakes (67%) to strangers. In total, participants gave an average of B6.37 (46%) to out-group recipients. The average out-group and in-group candidate recipient received B2.18 (SD=1.81) and B2.82 (SD=2.16) respectively. There was less variability in amounts given to out-group strangers than in-group strangers (F=1.36, p<0.001), that is, less selectivity demonstrated among out-group candidate partners. Descriptive statistics at the sample level appear in Tables S1a and S1b, and for each population in Tables S2a-S4b. Average bolivianos allocated to an out-group candidate recipient by categorical predictor appear in Table S5.

3.3.1 CHOOSING AMONG OUT-GROUP STRANGERS

Some participants – 28 of 157, or 18% – did not allocate any money to out-group candidate recipients. Tsimane' participants were especially unlikely to allocate money to out-groups (19 of 48 Tsimane' participants; Figure 1). Fifty-one participants, or 32%, gave evenly to all out-group members; thirty-one of these (21%) gave each out-group member the same amount they kept for themselves. A higher average amount given to out-group members was predicted by a participant having lived more places, having watched more TV or movies, and a donor having a low subjective socioeconomic status relative to others in her community (i.e., a low perceived amount of money and market items relative to others) (Pisor & Gurven, n.d.). For participants who differentiated among out-group candidate recipients, what affected participants' preference for some recipients over others?

(P1.1) Do donors give more to participants perceived to have more resource holdings?

In some models, but not all, recipients perceived as having "some money" were more likely to be allocated money than those perceived as having "no money"; likewise, consensus perceptions of a candidate recipient's wealth positively predicted the amount a donor allocated to her (see Tables S6, S7, S9, S10, S11). There was no reliable difference in amounts given to candidate recipients perceived to have "no money" and "a lot of money."

(P1.2) Do donors give more to recipients perceived to be cooperative?

Candidate recipients who were perceived as “good people” by the donor were more likely to be given money relative to those considered to be “bad people” (B0.93, $p<0.05$; Table 1; Figure 2). The importance of “goodness” for amount given holds when controlling for amount given to in-group members by a subset of participants (Table S6). However, sample consensus about whether a given recipient was “good” or “bad” did not predict how much the donor gave the recipient (Table S7), meaning we cannot rule out self-presentation bias in this result. There was no effect of interest in friendship or willingness to trust on amount allocated (Tables S8), considered separately to avoid collinearity.

(P2.1) Do donors give more to recipients from groups perceived to have more resource access?

Consistent with our predictions, donors gave out-group recipients B0.97 more if the donor viewed the recipient’s group as having market or political resource access, relative to other potential benefits ($p<0.05$; Table 1; Figure 2). Access to these resources reached significance in most models, including a model controlling for average amount given to in-group members (Table S6), but not all (see Tables S7, S10, S11). Due to collinearity, we consider the role of perceived inter-group competition in the full sample, which includes donors who did not differentiate among out-group members. Donors allocated less to candidate recipients when the donor perceived the recipient’s group as engaging in inter-group competition, as compared to other costs of group membership (-B0.86, $p<0.05$; Table S9).

(P2.2) Do donors give more to recipients when the donor is from a smaller out-group, or when the recipient is from a larger group relative to the donor's group?

The size of the donor's group, one measure of group size, had no effect (ethnic=-B1.05, p=0.22; religious=-B0.56, p=0.42). To estimate the effect of the relative size of recipient to donor group size on amount given, we consider all participants – not only those who differentiated among candidate recipients – and subset the data to separately consider games played with ethnic vs. religious groups. The ratio of the recipient's to the donor's group size does not predict allocations for games played with ethnic or religious groups (-B0.07, p=0.37; B0.04, p=0.78; Table S11). Some results reported above do not hold for these subsets, but this may be due to their small size.

(P2.3) Do donors with higher levels of exposure to out-group members in general give more out-group members?

Inconsistent with our expectations, if a participant's parents knew members of the out-group during the participant's childhood, she was *less* likely to give money to strangers from that group relative to participants whose parents had not known members of the focal out-group (-B1.32; p<0.10). However, the sample of individuals whose parents knew members of the focal out-group is quite small (n=10), so this result should be treated with caution. Other measures of out-group exposure had no effect.

3.3.2 ADDITIONAL VARIABLES

Participants with higher subjective socioeconomic statuses gave -B0.45 less to each out-group recipient ($p<0.10$; Table 2); however, this effect is not robust to the inclusion of average amount given to in-group members (Table S6). No other alternative predictors had a consistent effect on amount given in the sample of participants who differentiated. Subjective socioeconomic status, the value of market items owned, lack of cooperative labor partners, a summary measure of shortfall (including recent lower-than-expected produce or income, food insecurity, and number of dependent children), and recent illness were all predictors of giving in the full model; except for the effect of the shortfall summary measure, these effects are consistent with our previous work (Pisor & Gurven, n.d.).

3.4 DISCUSSION

With their heavy reliance on cooperative resource acquisition, humans demonstrate selectivity when choosing cooperative partners. While much research has investigated the factors affecting partner choice with in-group members, little is known about partner choice with out-group members; this is despite extensive evidence that inter-group connections provide non-local resource access and buffer shortfalls striking areas larger than the local community. We predicted that both individual characteristics, such as traits related to cooperative intent and resource acquisition, and characteristics associated with the group, such as an actor's perceptions of the group's resource access and her past experience with the group,

would affect partner choice among out-group members. Among three populations of Bolivian horticulturalists playing a non-anonymous economic game, we found that the two more market-integrated populations (the Mosetén and Interculturales) were more likely to allocate money to out-group strangers than the less market-integrated population (the Tsimane'; Figure 1). Candidate recipients were given more money when they were perceived to be a "good person" (kind, open to others) or when they belonged to a group perceived to have market or political resource access (Figure 2). In some models, perceived wealth was also rewarded with more money. Contrary to predictions, donors whose parents had known members of a candidate recipient's out-group during the donor's childhood gave *less*, although we urge caution in the interpretation of this effect as so few participants indicated their parents knew members of the out-group. When we also considered donors who gave equally to out-group members or gave zero, participants gave less when candidate recipients were from groups donors considered to engage in inter-group competition.

Our results suggest that an actor's perceptions of a candidate partner's individual characteristics, as well as her perceptions about the recipient's group, affect out-group partner choice, at least among these three populations. Our finding that qualities related to resource access and cooperative intent predicted increased generosity is consistent with past research on partner choice among in-group members. In in-groups, a candidate partner's perceived productivity (Eisenbruch, Grillot, Maestripieri, & James, 2016), generosity (Barclay & Willer, 2007; Eisenbruch et al., 2016; Tooby & Cosmides, 1996), and trustworthiness (Cottrell et al., 2007)

predict an actor's generosity towards that candidate partner in first interactions. While we did not find effects for a candidate partner's perceived trustworthiness or value as a friend, we did find that perceived kindness and openness – that is, being a "good person" in Bolivian Spanish – mattered. In some models, donors gave recipients more money when they perceived recipients to be wealthy. This is inconsistent with potential predictions based on the literature suggesting that donations, gifts, or resource transfers are need-based (Aktipis, Cronk, & de Aguiar, 2011; Gurven et al., 2000; Jaeggi & Gurven, 2013; Kaplan & Gurven, 2005; Winterhalder, 1996). The importance of perceived wealth may reflect the importance of obtaining resource access via new cooperative partners. In fact, donors may selectively target individuals who have some money, but not "a lot," as those with some money may have more to gain from an additional relationship than a wealthy person.

Though we found effects for some group characteristics on out-group giving and out-group partner choice, a number of variables had no effect. Candidate recipients from groups perceived to have more market access and to engage in less inter-group competition were given more money by donors. This is consistent with the idea that out-groups can be important sources of resource access and buffering (Gamble, 1999; Whallon, 2006) – at least, when inter-group competition for resources is not high (Kelly, 1995). While the lack of importance of relative group size in partner choice was contrary to our predictions, this result is compatible with the often mixed findings on minority-majority status and inter-group relationships (Bettencourt et al., 2001; Brewer et al., 1993). Though only one of our several

measures of past out-group exposure had an effect on out-group generosity, these variables were imperfect proxies of *positive* interactions with out-group members. A large body of social psychological research suggests that positive inter-group interactions, rather than neutral or negative, are key to building connections between groups (Brewer, 1996; Gaertner & Dovidio, 2001). Further, only some of this literature speaks directly to whether contact between religious groups should have the same effect on valuation of strangers from that group as does contact between ethnic groups (e.g., Paolini et al., 2004). At least in the present sample, whether a participant played with religious or ethnic out-group members did not change the direction of effect for three of the four out-group exposure proxies (Table S11).

In this vein, we found that the Tsimane', the least market-integrated population, were substantially less likely to give money to out-group strangers than the other two populations. As reported elsewhere, more market-integrated Tsimane' were especially unlikely to allocate money to out-group strangers, a pattern not seen for in-group strangers (Pisor & Gurven, n.d.). In anonymous games, as opposed to the non-anonymous game reported here, more market-integrated Tsimane' participants were also less likely to be generous toward anonymous in-group members from the same community (Gurven, 2004). One possible interpretation of these findings is that Tsimane' who are more market-integrated do not focus on relationship building with strangers, but rather focus on building social capital with known in-group members (Gurven et al., 2015; Reyes-Garcia, Godoy, Vadez, Huanca, & Leonard, 2006). This inward focus may be reinforced by discrimination

the Tsimane' face from non-Tsimane' in market towns. These findings strike a contrast to recent results from other market-integrating populations (Kasper & Mulder, 2015) and suggest that the importance of in-group and out-group relationships may not be reliably associated with market integration across populations.

We note several limitations of the present study. First, the researcher conducting the interviews (AP) was herself an out-group member, which could have impacted participant responses: some participants may have been more likely to bias their self-representation than others (Hoffman, McCabe, Shachat, & Smith, 1994). While cultural transmission (Henrich et al., 2010) and the role of institutions in buffering risk (Hruschka et al., 2014) may shape the perceived benefits and costs of out-group relationships, the present data do not speak to these possibilities. Second, participants may also have biased their self-presentation when providing their perceptions of the candidate recipients, as descriptions of the recipients were given after allocation decisions were made. Interestingly, while consensus perceptions of a recipient's wealth predicted the amount she received from a donor, wealth ratings by an individual donor did not; on the other hand, goodness ratings by an individual donor predicted amount the donor gave to a recipient, but consensus ratings of a recipient's goodness did not. The effect of consensus wealth ratings on giving suggests that participants are detecting some of any number of features of the face that could be increasing the likelihood of giving (Todorov et al., 2014). Additionally, the present data are cross-sectional and cannot address how changing levels of resource availability or out-group exposure affect out-group

partner choice. Future data collection will address the potential importance of cultural transmission, institutional effects, and changes in exposure and opportunity, particularly important to consider in the ever-changing Bolivian social context, and will employ a new method to minimize the role of self-presentation bias in participant ratings.

3.5 Conclusion

The ethnographic and archaeological records underscore the importance of out-group relationships to humans. However, little is known about how actors choose cooperative partners among out-groups. We suggest that both actors' perceptions of the individual characteristics of prospective partners and actors' perceptions of *group* characteristics should affect out-group partner choice, especially when these characteristics are associated with benefits for the actor. Among three populations of Bolivian horticulturalists, we find that perceived qualities of the individual out-group strangers, as well as characteristics of the groups to which they belong, predict generosity. While not all variables measured affect generosity, the pattern of effects is instructive: for example, discrimination may explain the low level of generosity to out-group strangers among the Tsimane'. Taken together, these findings shed light on the predictors of partner choice among out-group members, an as-yet understudied aspect of human sociality.

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Figure 1. The proportion of each population represented in the sample (horizontal bar width) and the proportion of each population that allocated zero or even amounts to out-group candidate recipients, or differentiated among recipients.

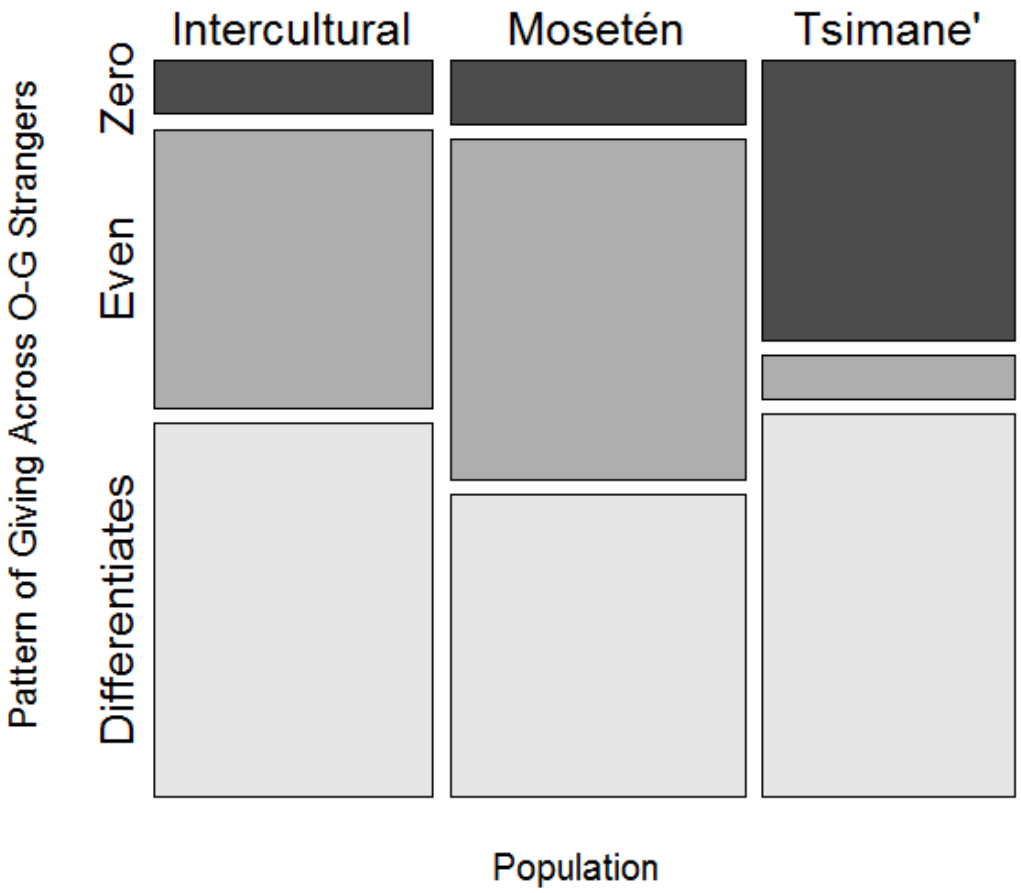

Figure 2. Predicted *bolivianos* given to a candidate out-group recipient based on the perceived "goodness" of the recipient and the perceived market and political resource access of the recipient's group. Error bars represent standard errors of the predicted mean value.

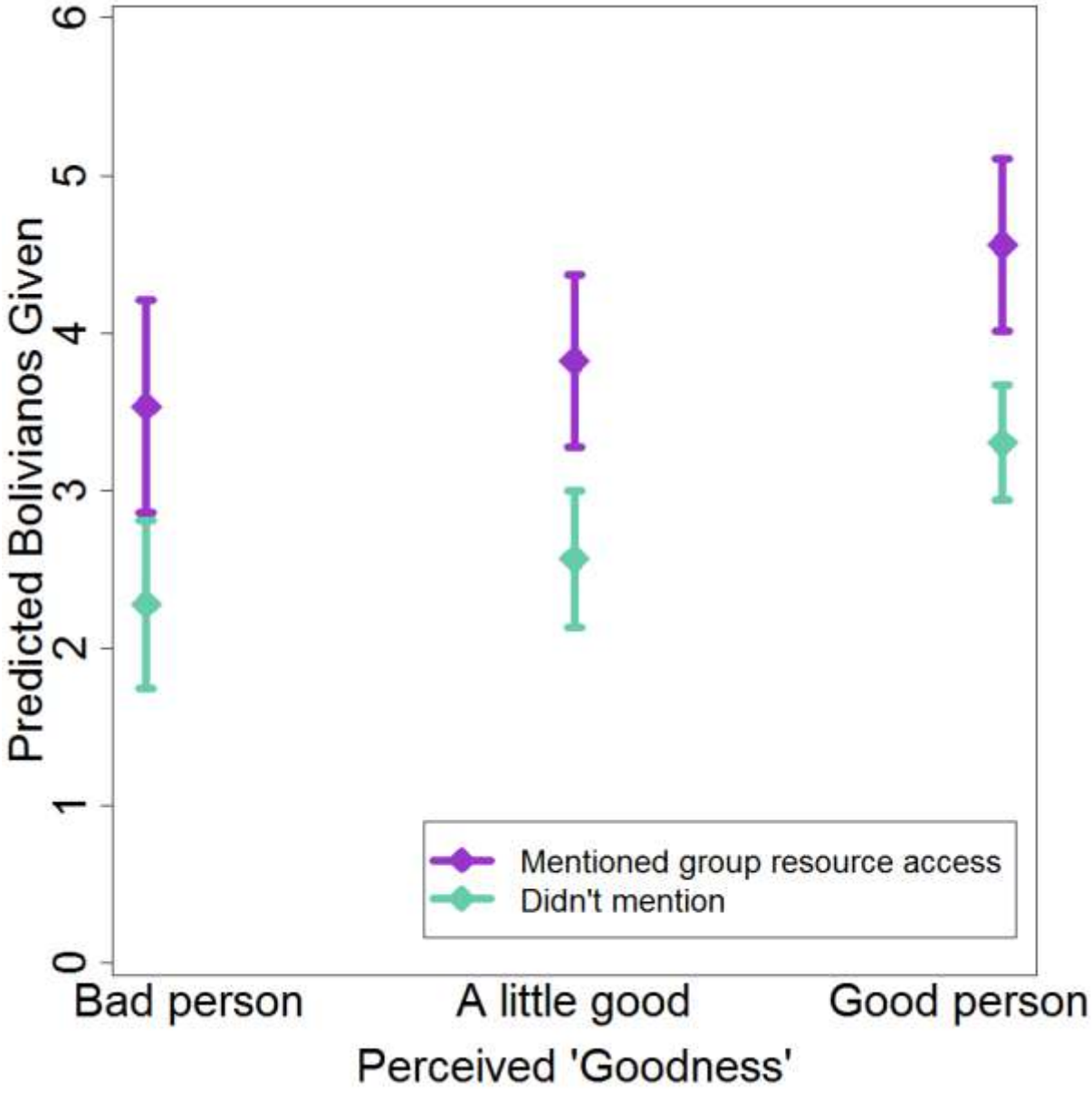

Table 1. Given a participant differentiated among out-group members, estimates of the amount of money she gave a candidate out-group recipient.

		Estimate	S.E.	p value
Individual Characteristics	*(Intercept)*	3.30	1.47	0.03
	A little good	0.20	0.48	0.67
	Good person	0.93	0.44	0.03
	Has some money	0.50	0.49	0.31
	Has money	-0.30	0.48	0.54
O-G Resource Access	*Benefits: Resources*	0.97	0.43	0.03
Relative Group Size	*Donor ethnic grp. % size*	-1.05	0.86	0.23
	Donor relig. grp. % size	-0.56	0.69	0.42
O-G Past Exposure	*Parents knew out-group*	-1.32	0.72	0.07
	No. places lived	-0.04	0.11	0.69
	*No. places visited**	0.20	0.19	0.30
	*Hours of TV per week**	-0.02	0.17	0.89
Additional Variables	*Lodging during flood*	-0.28	0.39	0.48
	*Net household income**	0.09	0.15	0.56
	*Market items owned**	0.12	0.19	0.54
	log Subjective SES	-0.45	0.23	0.06
	No traditional labor	-0.38	0.35	0.28
	Shortfall summary	-0.02	0.16	0.88
	Recent illness	-0.38	0.52	0.47
	Agreeableness	-0.01	0.05	0.86
	Extraversion	0.02	0.07	0.79
	Risk aversion	0.02	0.06	0.69
	Age	0.01	0.01	0.70
	Years of school	0.03	0.06	0.61
	Sex: male	-0.09	0.41	0.83
	Times attends church per mo.	-0.01	0.11	0.89
	Shared name with recips.	0.03	0.38	0.94

AIC=976.99. Number of observations=219. Number of participants=73. Effects of out-group costs and log ratio of recipient to donor group size not estimated due to constraints of over-parameterization or collinearity. *z-scored at the sample level.

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4. CORRUPTION AND THE OTHER(S): SCOPE OF SUPERORDINATE IDENTITY MATTERS FOR CORRUPTION PERMISSIBILITY

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Abstract

The decision to engage in corruption – public and private corruption, nepotism, and embezzlement – is often attributed to rational actors maximizing benefits to themselves. However, the importance of reciprocal relationships in humans suggests that an actor may weigh the costs of harms of her corrupt behavior to individuals who may generate future benefits for her. We hypothesize that actors who have a larger circle of actual and potential social partners will have more individuals to consider when generating harms and will thus be less likely to find corrupt acts permissible than actors with smaller circles of valued others. Using data from the World Values Survey and European Values Study (WVS), we explore whether participants with a larger geographic identity or a greater number of group memberships (i.e. a larger scope of actual and potential social partners) are less likely to find accepting bribes permissible. We find mixed support for our hypotheses, but consistently find that WVS participants with local, country,

continent, or world geographic identities are less likely to find accepting a bribe permissible than those with regional identities – that is, actors whose primary identities encompass more than their region find corruption less permissible. We discuss the importance of considering an actor's valuation of others when modeling corruption persistence, noting that establishing scopes of positive valuation is a precursor to predicting where actors will target benefits and shunt costs.

4.1 INTRODUCTION

Corruption, commonly defined as taking advantage of public office for private gain [1,2], is considered a major deterrent to economic development [3]. The World Economic Forum [4] estimates that 5% of global GDP is lost to corruption each year. Pervasive corruption is also blamed for reducing public and private trust [5,6] and for promoting greater socioeconomic inequality [7,8]. The prevalence of corruption (or its perceived prevalence, as is often measured) is higher in countries with non-democratic institutions, strong kin ties, and greater ethno-linguistic heterogeneity (measured as the number of ethnic groups or languages spoken in a nation; [1,9,10]). Individuals perceive corruption as more prevalent when transparency is low (e.g. [11]), often true in contexts of high income inequality [12].

Whether the focus is on country-level or individual-level analyses, this research holds that rational actors will engage in corrupt behaviors when the expected benefits outweigh the expected costs. However, corrupt acts generate harms for others, and most models of corruption assume that actors are unconcerned about those who will have to absorb any costs the actors generate.

Alternatively, one might expect an actor to be less willing to engage in a corrupt act if it will harm bystanders that she positively values as actual or potential social partners (i.e. individuals with whom she currently engages, or could potentially engage in repeated, mutually-beneficial interactions). The rational logic of avoiding corrupt behavior when the immediate benefits might seem high is that generating harms for others may reduce the likelihood of later being selected as a trustworthy social partner.

This paper explores how having larger numbers of positively valued social partners affects an actor's likelihood of finding corruption permissible. We hypothesize that an actor who identifies with larger superordinate groups, where superordinate groups unify sub-groups (e.g., religious groups, ethnic groups) of both known individuals and strangers who are positively valued as potential social partners [13,14], will be more likely to avoid and disapprove of corrupt behavior because she stands to harm a greater number of potential social partners, thereby potentially damaging her reputation. Both harm to others and reputational damage will reduce the likelihood that other superordinate group members will trade with, support, or buffer the actor in the future. If the sum total of these costs outweighs the selfish benefits of engaging in corrupt acts, an actor may avoid them altogether. We test this hypothesis using individual judgments of corruption permissibility from the World Values Survey and European Values Study, as judgments of corruption permissibility may reflect one's own willingness to engage in corrupt acts. If superordinate group size predicts corruption permissibility, this relationship may explain why countries with high kin loyalties, e.g. low-income or predominantly

Catholic countries, are perceived by their citizens to be more corrupt than high-income, Protestant countries with fewer kin loyalties [1,15], and why subjective ethno-linguistic heterogeneity (i.e. whether an actor views local groups as diverse and different from one another) is a better predictor of corruption prevalence than objective ethno-linguistic heterogeneity [16–20]. It is less a question of religious affiliation or number of ethnic groups in a country as it is the number of people an actor values sufficiently to avoid generating costs for them. Our results show that superordinate group size, as proxied by the geographic size of one's primary group identity, explains variation in corruption permissibility not considered by previous research. This relationship suggests an avenue for future investigation. Further, we outline how approaching the question of corruption persistence from an evolutionary perspective motivates the present hypothesis and can organize some existing findings.

4.1.1 CORRUPTION AS EXTENDED SELF-INTEREST

A broad definition of corruption is the private appropriation of a public resource, which generates costs to society. Narrower definitions depict corruption as an abuse of power by public officials ("public" corruption). Researchers espousing a narrow definition believe broader interpretations ought to distinguish private corruption (e.g. bribery of a non-public figure who can provide a service), nepotism (e.g. favoring kin or friends for a particular position or windfall), and embezzlement (e.g. drawing extra money from an organization while in a power position) from public corruption [21]. All four contexts – public and private corruption, embezzlement, and nepotism –

have features in common, however. First, in all four, actors strategically channel benefits to self, kin, or social partners. Indeed, actors are known to use corrupt acts to build and maintain social relationships [22–24], obtain resources [25–27], and avoid undesirable costs [28,29]. Second, in all four, an actor's behavior violates national or international laws or norms. Third, all diminish societal well-being because private gain comes at the expense of others, either by increasing the cost of a service (whether in monetary or other currency, including time) or by drawing from a depletable resource (such as public funds). Given these commonalities, consistent with some existing work [22,30] we broadly define corruption as behaviors providing private gain to self, kin, and/or other group members that 1) generate harms for others by 2) “jumping the queue” of resource allocation [1] 3) in violation of norms or laws that *may* be applied to the local context, e.g. international laws that may or may not be adopted in practice. We say “may” because the perceived wrongness of corrupt acts may not track the magnitude of the social costs generated [22,25,31] and corruption may be construed as a gift or an earned right by bystanders [32,33].

A rational actor may engage in a corrupt behavior, or find a corrupt behavior permissible, when its perceived net benefits outweigh those of lawful or norm-consistent behavior. However, what are the relevant benefits and costs? The standard approach recognizes biases in corrupt behavior that favor kin and social partners (nepotism and cronyism; e.g. [3]), but the origin of these preferences is usually not examined [34]. Instead, these biases have been explained as reflecting ease of recruiting family member co-conspirators and lower likelihood of detection

by authorities [35,36]. This exclusive focus on gains for an individual actor conflates self-interest with an actor's preferences to support kin and maintain reciprocal relationships [37]. Preferences to support kin may be a feature of an evolved human psychology that generates benefits for self and kin, optimizing biological fitness even if generating costs for non-kin [38,39].

Favoring group members can also directly benefit an actor's fitness by enabling others to return those favors via reciprocity [40,41]. One reason to favor group members is the need to buffer risk and uncertainty in resource access, though additional motivations may include gaining information access, political clout, or mates. The unpredictability of food resources is a defining characteristic of traditional human subsistence strategies that requires buffering amongst individuals to reduce food insecurity [42–45]. Even with the introduction of market-related options for risk management (e.g. insurance, savings, government-funded disaster relief), investing in and harvesting one's networks of information and exchange remains crucial [46–48]. An actor's access to potential social partners, and the resources they provide, can be damaged by the generation of harms, especially if these costs can be traced to the actor herself [49]. In both small-scale [50] and large-scale societies [51], sharing partners and allies are at a premium [52]. Actors with reputations for in-group stinginess [45] or who generate harms are not preferred as social partners [53,54]. An actor need not explicitly consider the consequences of her behavior for valued others, but only behave *as if* she were considering both her own welfare and theirs [55]. Her other-regarding behavior may be steered by psychological mechanisms favored by natural selection, including

emotions such as shame and pride [56] and the ability to empathize with others' emotions [57]. Increased exposure to out-group members (e.g., via globalization) could also increase preferences to exhibit fairness toward a larger number of individuals (cosmopolitan attitudes [58]). Our predictions apply with equal force to actors with cosmopolitan attitudes: when an actor can form partnerships with a larger number of people (e.g., when she is integrated in a social network), she may feel more empathy toward these individuals [59] and cooperate more with them [58,60]. In sum, we should expect people to be sensitive to costs and benefits that affect their own fitness interests (or proxies for fitness, such as wealth and status) and that of their kin, actual and potential social partners [61,62].

The individuals whom an actor positively values as potential social partners, which include strangers, are likely to be those with whom she identifies. Having a superordinate group identity (e.g., identifying with one's region or nation [63], or even the globe [59]) increases the likelihood that an actor values members of groups that are otherwise out-groups for her, such as ethnic groups or religious groups. Indeed, even in small-scale societies, the potential to reap valuable gains from trade, coalition formation, and risk management often transcends the otherwise high transaction costs of interactions between ethnic and religious groups [64,65]. We thus treat the scope of an actor's superordinate identity as a proxy for the scope of individuals whom she considers to be potential social partners.

As aforementioned, those who cannot locally access needed resources may seek more contact with a larger scope of individuals than those who already have access [65–67]. However, this logic may not extend to individuals in the most dire of

situations: those with the lowest incomes and the poorest health may have a short time horizon and be less likely to weigh the well-being of out-group members heavily. The opportunity cost of lost partnerships only increases in situations of resource scarcity (e.g. due to a lack of government institutions), as individuals place an even higher premium on reliable social partners [68].

We suggest that the larger an actor's scope of positively valued individuals, the more people's welfare she will have to weigh before generating harms they must absorb; in turn, the larger the scope of her positive valuation, the less likely she will be to find corruption permissible. In this paper, we test whether proxies for a larger scope of positive valuation – the size of one's primary geographic identity and the number of groups to which one belongs – can account for variation in corruption permissibility above and beyond that captured by more traditional predictors of corruption from the literature. We explore these predictions using individual-level data from the World Values Survey and European Values Study (hereafter, WVS refers to both). While country-level data are frequently used in research on corruption, country-level corruption indices are not necessarily good predictors of individual-level behavior [69,70]. Further, by employing a large cross-national data set, we gain additional insight into propensity to engage in corruption across a variety of social, political, and economic contexts. We operationalize corruption as someone accepting a bribe in the course of their duties, a potential proxy for a participant's own willingness to accept a bribe. Existing studies have shown that a number of country-level variables are correlated with country-level corruption, including objective religious and ethnic heterogeneity, economic inequality, and

political freedom. We control for these factors, as well as country-level corruption itself (as measured by the perceptions of businesspeople and academics), as the context within which individual actors decide whether or not a corrupt act is permissible. Because confidence in the police and civil services, belief in God, household dependency (as number of children), level of education, and participant age and sex are uncorrelated with superordinate group size yet could affect a participant's motivation to condone corruption, we include these variables in all models. We explore the role of a lack of resource access (as proxied by a summary measure of household income, satisfaction with finances, and subjective health), as lack of access may increase the potential benefits of resource access via additional network connections.

4.1.2 HYPOTHESES AND PREDICTIONS

We test the hypothesis **(H1)** that an actor who positively values a larger group of people as actual or potential social partners (i.e. has a larger superordinate group) will be less likely to find corrupt acts permissible. Though we cannot determine who a participant envisioned as affected by these harms when deciding whether it was permissible to accept a bribe, we suggest that all else equal, permissibility will decline as superordinate group size increases. We operationalize this as follows:

> **(P1.1)** Participants whose primary identity is at a larger geographic scale will find corruption to be less justifiable than participants whose identity is more local in scale.

(P1.2) Participants who belong to more civic, social and activity groups will find corruption to be less justifiable than participants with fewer memberships in these groups.

(H2) Corruption permissibility should be lower among those for whom the net benefits from additional partnerships are greater. We predict that:

(P2) Participants who stand to gain benefits from additional resource access (i.e. who do not have high levels of subjective or objectively measured income, or good health) will be less likely to find corruption permissible.

4.2 METHODS

To explore the relationship between a participant's superordinate group size and corruption permissibility, we use data from the World Values Survey (www.worldvaluessurvey.org) and European Values Study (www.europeanvaluesstudy.eu). We control for variables important in the corruption literature that may constrain the availability or benefits of additional social partnerships, or that may influence corruption permissibility via paths other than those hypothesized here, using individual-level data from WVS and country-level data compiled from the United Nations, the World Bank, Freedom House, and Transparency International.

4.2.1 CORRUPTION PERMISSIBILITY

To gauge corruption permissibility, we adopted a measure of bribery permissibility from the WVS. The present paper uses WVS data from 91 countries collected

between 1981 and 2009 (n=399,376). Analyses are limited to the subsamples for which observations were available on all variables; sample sizes (ranging from 5785 to 80,390) are reported with model estimates.

To gauge whether participants find corruption permissible, we employ a WVS question asking participants to indicate whether "someone accepting a bribe in the course of their duties" would always, sometimes, or never be justified. Participants' responses were recorded on a ten point Likert scale, with 1 indicating that accepting a bribe was never justifiable. Because 74% of participants responded that corruption was never justifiable, to increase statistical power we collapsed all other responses into a single category, creating a binary (0="never," 1="at least sometimes") measure of corruption permissibility.

4.2.2 Superordinate Group Size: Primary Geographic Identity and Number of Group Memberships

We adopt two measures of superordinate group size from the WVS. The first addresses participants' primary geographic identity. This was a forced choice question: participants were asked, "To which of these geographic groups would you say you belong first of all?" They were allowed to choose between five levels of scale: local, region, country, continent, and world. In the full WVS sample, the majority picked "local" (41%) or "country" (34%) while only 10% each chose "continent" or "world". Because such a small number selected "continent" or "world," we combined the two into a single category. The concept of local, regional, and country level identity was translated similarly in all surveys, however "continent" was

not consistently translated in different areas of the world. In South America, for example, participants were asked whether they saw themselves as members of Mercosur or the Latin American community, depending on the country.

Our second measure of superordinate group size is a summary measure of group memberships. We counted the number of organizations to which a survey participant belonged (similar to [71]). Participants were asked about membership in 15 different groups, including local political movements, human rights movements, sports clubs, and religious groups. Only 45% of participants who responded belonged to any of those groups, which suggests a limitation in the use of these questions: there are likely organizations other than political, athletic, religious, and human rights groups to which participants belong. Very few individuals belonged to a large number of groups; to avoid the influence of outliers we capped the number of group memberships at two standard deviations above the mean (4.31). Further, because of differences in questions asked in different countries and across different years, only 133,711 of the 399,376 participants who responded to the bribery permissibility question answered questions about group membership, limiting the sample size for models that include this measure. We ran models including number of group memberships and models including primary geographic identity separately because of this sample size limitation.

4.2.3 Resource Access: A Summary Measure

Per our predictions, other variables that may affect corruption permissibility include income, satisfaction with household finances, and subjective health, as a decline in

each may increase the magnitude of benefits to be gained via risk buffering. We include both objective income and subjective financial situation because purchasing power and perceived need may be independent predictors of corrupt behavior. Income is an integer rank from 1-11 that is country-specific, such that participants with 11 have among the highest incomes in a country. Subjective income, how a participant compares her household income to what she wishes to earn, can provide additional information about a participant's perceived shortfalls. Participants were asked whether they were satisfied with their household finances on a scale of 1-10, with 10 as most satisfied. Participants rated their subjective health on a scale of 1-5, with 5 representing "very good" health.

4.2.4 Individual-Level Controls

We control for other individual-level variables that may affect corruption permissibility, independently of having a larger superordinate group. Three variables identified by previous research on corruption are included, as well as four potential confounders. We control for belief in God using the same question that Atkinson and Bourratt [72] found to predict corruption acceptance in a WVS sample; they suggest that belief in a vigilant, omniscient God can help enforce cooperative behavior, a hypothesis supported by priming research [73,74]. Previous work has demonstrated that the functioning of government services, particularly the (bribe-free) enforcement provided by police, increases the likelihood of detection and punishment for corrupt acts. In our analysis, we combined the two questions probing confidence in two government services that can curb corruption, police and in civil services, into one

summary variable: we reverse coded these variables so that confidence was measured on a scale from 1-4, where 1 was "[no confidence] at all" and 4 was "a great deal of confidence." We then centered the summary variable at zero. Several studies using WVS data have suggested that women are less corrupt than men [75] because "women will be less likely to sacrifice the common good for personal (material) gain" [76]. Men also tend to be less generous in Dictator Games, economic experiments that tap participant altruism and fairness [77,78]. We control for sex in our analyses accordingly. In all models, we control for age, education, and household dependency. Age may affect corruption permissibility independently of cohort, education, and employment effects [79]. Education increases exposure to a larger scope of individuals, but depending on the context of exposure, valuation for these individuals can be either boosted or lowered. Level of education was measured using a country-specific rank: participants with the lowest educational attainment in the country were coded as 1, while those with the highest were coded as 3. Number of children is a proxy for household dependency, which may diminish the effect of increased income on bribery permissibility. The distribution of number of children was negatively skewed, so we rounded all participants above 2 SD of the mean, 5.29 children, down to 5.29. Finally, we include the population size of a participant’s town as a robusticity check. The population of a participant’s town is an integer scale, with 1 being a town with a population of 2,000 or less and 8 being a population of 500,000 or more. Because town population was unavailable for many participants, we used this variable only as a check to avoid limiting sample size.

In an effort to situate one of our results, we also conducted exploratory analyses of the predictors of having a regional geographic identity. As we suggested in the Introduction, the relationship between kin biases and corruption permissibility [1,15] may be a function of an actor's scope of valuation; as such, we explored whether a participant's geographic identity (here, regional identity) was a correlate of their kin biases. As a proxy for kin biases, we include a question asking participants whether "more emphasis on family life" would be a good, neutral, or bad change to their way of life. We check whether profit motive is related to a regional identity, as profit motive has explained tolerance of corrupt behavior in some laboratory experiments (e.g. [80]). As a proxy for profit motive, we include whether participants believe "less emphasis on money and material possessions" would be a good, neutral, or bad change to their way of life. Finally, we examine whether participants with regional identities value more respect for authority figures, as respect for authority may decrease a participant's likelihood of engaging in acts that harm others [81] and may be correlated with a regional identity, as those who identify with their region may be marginalized members of a nation and less bound to the national government [82]. As a proxy for respect for authorities, we include whether participants believe "greater respect for authority" would be a good, neutral, or bad change to their way of life.

4.2.5 Country-Level Variables

Models including country-level variables are reported in the Supporting Information (S1 and S2 Tables; S1 and S3 Figs), as are the methods for these variables (S1

Appendix). We employed United Nations census data as a measure of objective, country-level religious and ethnic heterogeneity; World Bank measures of country population size, population density, and Gini coefficient; Freedom House's Freedom in the World Political Rights Index; and Transparency International's Corruption Perceptions Index. We also adopted the World Bank's classification of countries into world regions, which we include in models reported in the main text.

4.2.6 Statistical Methods

All models were fit using the R statistical package version 3.1.3 [83]. Using logistic regressions with logit links, we regressed corruption permissibility on the two hypothesized predictors of interest (primary geographic identity, number of group memberships), individual-level variables (income, satisfaction with household finance, subjective health, education, belief in God, confidence in police and civil services, age, and sex), and, in models reported in the Supporting Information (S1 and S2 Tables; S1 and S3 Figs), country-level variables (religious and ethnic fractionalization or polarization, population size and density, Gini, the FIW political rights index, and the CPI).

To evaluate whether the inclusion of proxies for superordinate group size improved model fit relative to models including only controls, we compared models using Akaike weights. The Akaike Information Criterion (AIC) is a goodness of fit measure that maximizes the likelihood of model fit while penalizing additional parameters. We weighted AIC values from several candidate models to identify the best fit model [84] using qpcR [85].

We predicted that participants whose resource access is low, but not too low, would stand to gain the most from a larger circle of potential social partners. We created a single summary variable to represent the resource access proxies: objective income, subjective income, and subjective health. Principal components analysis on standardized values suggested that, relative to subjective income, subjective health had a loading of 0.88 and objective income a loading of 0.94 on the first component. For the group membership subset, the loadings for subjective health and objective income were 0.82 and 0.98 that of subjective income, respectively. Accordingly, we standardized the three variables and summed them, weighting them according to their relative loadings in each subset. We then inverted the summary measures such that higher values indicate less resource access.

4.2.7 Robusticity Checks

The countries in this data set are not a representative world sample. There are a number of ways to control for potential clustering of residuals driven by the particular set of countries sampled, two of which we employ here. To avoid collinearity issues, both modeling approaches first required that we exclude country-level variables from the model. Because country-level variables had constrained the sample size, the number of observations in models excluding country-level variables was four times the size that of models including country-level variables. We first ran multilevel models by including random intercepts for each country in our models (i.e. using logistic mixed-effect models implemented in lme4; [86]). Second, we fit the same models by including fixed effect country dummies in place of country random

effects. Third, to check for any effect of shared cultural history, we fit fixed effect and random effect models controlling for world region in place of country. All model types provided consistent results for the variables of interest (with the exception of the region models for number of group memberships, as discussed below). Because of the four orders of magnitude increase in sample size when country-level variables were excluded, we focus on fixed effect models with country dummy variables in the text. Models including country-level variables are reported in Supporting Information (S1 and S2 Tables; S1 and S3 Figs).

4.3 RESULTS

Descriptive statistics appear in Tables 1 and 2. Local- and country-level identities were the most common primary geographic identity across countries (41% and 34% of participants respectively). Participants had a mean membership in 1.01 (SD=1.69) groups. Fig 1 and 2 illustrate participants' primary geographic identity (1) and number of group memberships (2) by country. Consistent with findings in the corruption literature, bribery was viewed as more permissible among participants who were male, those who did not believe in God, and those who had lower confidence in police and civil services (Tables 3, 4)

Primary Geographic Identity (P1.1). Participants who report having a larger primary geographic identity will find someone accepting a bribe to be less permissible.

Consistent with P1.1, individuals with a country identity find corruption less permissible than do individuals with a local identity (odds ratio (OR) for country level is 0.89, $p<0.001$). However, contrary to P1.1, those with a regional identity found corruption more permissible than those with a local identity (OR=1.15, $p<0.001$), while those with local and continent or world identities did not differ in their perceived corruption permissibility (continent or world identities OR=0.98, $p=0.46$). The difference in corruption permissibility between those with local and regional identities holds in logistic models with individual-level controls, whether we control for country of residence as a fixed effect or random intercept, include country-level variables instead of country controls, or include a control for the size of the participant's home town (Table 3; Fig 3; S1 Table; S1 Fig).

To determine whether the pattern of this relationship differs among countries, we regressed corruption permissibility on the individual-level variables separately by country. We held local identity at baseline. The 95% confidence intervals for the ORs for regional, country, or continent or world identities did not overlap OR=1 in 24 of 55 countries, suggesting that these countries could be driving the effect. Re-running the full model with these 24 countries excluded dampens the magnitude of the contrasts, but does not change the direction of the effect for participants with local or country identities (regional identity OR=1.07, $p=0.13$; country identity OR=0.96, $p=0.15$; continent or world identity, OR=1.02, $p=0.71$; n=39,328).

For the subset of data for which country-level variables were available, we explored whether different features of a participant's country of residence could be driving the observed effects. We divided this subset into countries below and above

the sample median for Gini coefficient; we then derived parameter estimates separately for countries below the median and for countries above. We repeated this process for absence of political rights (i.e. countries above the median have fewer political rights), perceptions of country-level corruption prevalence, and religious heterogeneity (S2 Fig). Results suggest that the non-linear relationship between primary geographic identity and corruption permissibility may be a product of participants' responses from countries with high economic inequality, few political rights, low perceived corruption at the country level, and low levels of religious heterogeneity. Two countries, Chile and South Africa, both had few political rights, low country-level corruption, and high Gini; together, they represent 38% of the subset for which country-level variables were available. However, excluding them from analyses does not change the pattern of results, again suggesting that the non-linear pattern is not solely a consequence of country of residence.

Number of Group Memberships (P1.2). Participants who belong to a greater number of groups will find someone accepting a bribe to be less permissible. Controlling for country and individual-level variables, contrary to P1.2, we find that every additional group a participant belongs to is associated with a 8% *higher* probability of finding corruption permissible ($p<0.001$), the direction opposite of that predicted (Table 4). This finding is robust to the inclusion of country random intercepts, country-level variables, and the size of the participant's home town (Table 4, S2 Table, S3 Fig), though the use of world region fixed or random effects

in place of country lowers the magnitude of effect (2% higher probability of finding corruption permissible, p=0.05).

Looking at within-country patterns, confidence intervals for the ORs do not overlap OR=1 in seven of the 22 countries in the sample (Fig 4). Participants in these countries were also likely to be members of more groups than participants in other countries (1.40 vs 1.27, t=6.34, df=15,659.05, p<0.001). These countries *do* appear to be driving the effect: once they are removed from the sample, number of group memberships does not predict corruption permissibility in full models with controls (p=0.78). As only two of these seven countries have the full set of country-level variables, we cannot assess whether country characteristics are driving the effect, however the effect is unrelated to that of world region: only two of the seven countries are from the same region (sub-Saharan Africa) and removal of these two nations from the full sample does not replicate the effect (7% higher odds with each group membership, p<0.001, n=20,525).

The two proxies for superordinate group size, primary geographic identity and number of group memberships, are not consistently associated with one another: while participants with a continent or world identity belong to 0.19 more groups on average than those with a regional identity (p<0.001), there is no difference in number of memberships between those with local, regional, or country identities. When the two proxies for superordinate group size are included together in the same model predicting corruption permissibility (limiting the size of the subsample to n=23,090), both geographic identity and group membership variables retain their effect. For each additional group membership, a participant has 8% increased

probability of finding corruption permissible, while participants with regional identities have a 1.14 odds (p<0,01) and participants with country identities a 0.93 odds (p=0.06) of finding corruption permissible relative to participants with local identities; there was no effect of having a continent or world identity for this subset (p=0.69). AIC weights suggest that, for this smaller subsample, the model including both variables provides a better fit (weighted AIC=0.99) than models including only number of group memberships plus controls, only primary geographic identity plus controls, or only controls.

Predicted Determinants of the Net Benefits of Corrupt Behavior*.*

Participants who stand to gain benefits from additional resource access (i.e. who have intermediate levels of subjective or objectively measured income, or health) will be less likely to find corruption permissible.

Contrary to P2, participants with intermediate levels of resource availability were significantly more likely to find corruption permissible than those experiencing resource abundance or shortfall (Fig 5; Tables 3 and 4). This relationship was consistent across models.

4.3.1 Predictors of a Regional Identity: Exploratory Analyses

To explore the consistent, unpredicted relationship between having a regional identity and finding corruption permissible, we tested whether several candidate predictors could account for having a regional identity: kin biases, which have been found to predict corruption previously [1,15] and may trade off with investments in

new social partners; profit motive, which has affected tolerance for corrupt behavior in laboratory experiments (e.g. [80]); and respect for authority, which may decrease behavior costly to others [81] and be less common – at least, for a central, national-level authority – in marginalized regions [82]. Across three of four subsamples, participants who believed that greater respect for authority would be a negative change were significantly more likely to have a regional identity than those who believed it would be a positive change (S3 Table). Likewise, believing that greater emphasis on family life would be a *negative* change in one's life was a positive predictor of having a regional identity across three of the four subsamples.

4.4 Discussion

We hypothesized that the larger an actor's scope of positively valued actual or potential social partners (i.e. the larger her superordinate identity), the less permissible she would find a corrupt act. We suggested that people have an evolved psychology that enables them to weigh the anticipated benefits of a corrupt act for self, kin, and/or social partners, relative to the anticipated costs of generating harms for bystanders that may include an actor's positively valued potential social partners. Consistent with this notion, we posited that actors for whom the costs of generating these harms was amplified – for example, those who could benefit from additional resource access and thus may be concerned with maintaining a good reputation – would be less likely to find corruption permissible.

Overall we found mixed support for our hypotheses. Consistent with prediction, we found a relationship between superordinate identity, measured as

primary geographic identity, and corruption permissibility. Though more complicated than predicted, this relationship was robust across different model specifications: participants who identified most with their region consistently found corruption more permissible than participants with local or country identities. We did not predict that local identity would be consistently associated with less corruption permissibility than regional identity, primarily because the logic of our argument assumed that harms uniformly affect a broad geographic expanse. To attempt to identify characteristics of participants with regional identities that may drive the relationship between a regional identity and corruption permissibility, we explored whether participants who believed kin to be important, exhibited profit motive, and had a lack of respect for authority were more likely to have regional identities. We found that participants who believed greater emphasis on family life and greater respect for authority would be *negative* changes were more likely to have a regional identity. This analysis was only exploratory, but suggests that actors with regional identities may think of themselves as "free agents," less concerned about kin, authorities, and the welfare of others – resulting in higher corruption permissibility – than actors with other superordinate identities.

Contrary to our expectations, participants with a larger number of group memberships, our second proxy for in-group size, were *more* likely to find corruption permissible, though this effect was not robust to controls for world region or the exclusion of the seven countries in which the effect was most pronounced. While we expected participants with less access to resources, but not so little access that their time horizon was especially short, to be less likely to find corruption permissible,

results suggest that participants with intermediate levels of resource access were actually *the most* likely to find corruption permissible. Previous research has established the importance of the size and exclusivity of groups, as well as the degree of overlap between the groups of which a participant can be a member, for predicting levels of trust. Fukuyama [87] suggests that group number and group size may be inversely correlated: the more groups there are available to an actor, the fewer members are likely to be in each. Thus, belonging to more groups may not actually reflect a larger or broader social community. Groups also vary in the extent to which membership expands generalized trust (cf. [71]). Membership in groups that are open-access is related to generalized trust in the US, whereas membership in restricted access groups is not [88]. The most common groups in our sample were religious groups, labor unions, and sports groups, all of which may have restricted membership. Labor unions and sports teams are also groups that may be competitive in nature: any benefits generated by members may be targeted towards a small set of individuals, potentially at a cost to out-group individuals [89,90]. Additionally, similar to Fukuyama's argument about how group size may decrease as group number increases, group memberships will also be less predictive of in-group size if groups are highly overlapping [91,92]: the greater the overlap in group memberships (e.g. if members of religious group A are also members of volunteer organization B and political organization C), the less likely generalized trust is to correlate with the number of group memberships [92]. Because of data limitations, we were unable to estimate size, number, or membership constraints of the groups available to an individual. Another possible explanation for the positive relationship

between group membership and corruption permissibility is that group membership helps improve household welfare by buffering against resource shortfalls [93], thereby diminishing perceived needs. With a reduced need for resource buffering, one might expect less motivation to build additional social partnerships and less concern about harms from corruption impacting others.

4.4.1 Present Contribution in Relation to Past Research

Previous research only indirectly addresses whether positive valuation of others affects participation in and tolerance of corruption. In the social capital literature, Fukuyama [87] identifies public corruption as reflecting “a lower standard of moral behavior” towards strangers (p. 9) because “co-operative norms are [not] operative” (p. 8). Warren [94] draws similar conclusions, observing that corruption results from actors targeting reciprocity and trust towards in-group members, generating costs for out-groups who lack the power to counter these harms. Both imply that excluding individuals from cooperation and trust relegates them to out-group status, subject to harms as in-group benefits are generated, but neither connects the withholding of trust and cooperation in the first place to low valuation of these out-group individuals – who may share a superordinate identity with an actor – as potential social partners.

This paper underscores the fact that humans do not value the well-being of a broad scope of other people by default. Some researchers maintain that the human brain can represent relationships with about 150 individuals [95] and that beyond that number, a single value may be used to represent groups of people [52]. Contact

with single individuals from out-groups can enable an actor to expand her scope of positive valuation, increasing the size of her superordinate identity [96]. Our results suggest that encouraging a broad scope of positive valuation may curb corruption and tolerance for corrupt acts. For example, anti-corruption campaign materials that personalize those affected by the harms that corruption generates may be more effective than materials that speak of the social ills generated but provide little additional context.

Our present hypotheses that are motivated by evolutionary logic; though these expectations can be derived directly from consideration of how an actor's valuation of others will affect her decision to engage in corruption, frameworks that consider rational actors as interested in only their own well-being will need modification given evidence of how our evolved preferences impact decision-making. It is unlikely that the mind can calculate *all* benefits and costs of any behavior [97], including corrupt acts. However, a history of natural selection may have favored emotions (and the ability to anticipate the emotions of others) that are sensitive to situational cues, such as those suggesting shared identity or common purpose with others [52,56]. These emotions can therefore motivate actors to consider the welfare of others when engaging in behaviors that confer costs and benefits. For example, contempt for out-group members (and their welfare) [56] might make it easier to support corruption that favors in-groups but harms out-groups, whereas anticipated anger from in-group members who might experience harms [98] could serve to limit corrupt behavior.

Few studies to date have addressed corruption from an evolutionary perspective. Two research groups have modeled how power differentials can lead to elite corruption, both in humans [99] and animals in general [100]. Abdallah and colleagues [101] suggest that centralized punishment, common in state societies, is an evolutionarily unstable strategy for solving public goods provisioning because centralized institutions are susceptible to corruption. Atkinson and Bourrat [72] posit that belief in supernatural punishment makes corruption less permissible, perhaps because "God is watching" and enforcing moral behavior. Newson and Richerson [102] suggest that lowered public corruption encourages state fealty, which may re-direct allegiances from the family and thus contribute to fertility decline.

4.4.2 LIMITATIONS

One limitation of the present study is our inability to examine how survey participants interpret questions about geographic identity, group memberships, generalized trust, and corruption permissibility. To our knowledge, the extent to which survey responses predict propensity to engage in corrupt acts has not been demonstrated. Another open question is how salient and consistent different geographic identities are across countries. For example, the salience of a regional identity may be a function of the political environment [82] and whether people self-select into living in a region because they like it or cannot afford to live elsewhere [103]. Country-specific categories of identity would better capture the relationship between in-group size and corruption permissibility. While WVS data from some countries (such as Colombia) included self-professed membership in different ethnic

categories, these were available only for a minority of countries in the WVS and, as we described above, ethnic category membership may not tell us the scope of an actor's positive valuation. As aforementioned, because of data limitations, we also could not explore who participants thought might be affected by the acceptance of a bribe. It is possible that variable interpretations may underlie some of our reported findings. For example, if participants who identify with marginalized regions interpret the harms generated by corrupt acts as affecting the larger nation, corruption might then be viewed with greater permissibility. However, the permissibility of bribery is likely a conservative proxy of corruption permissibility, as an act such as embezzlement can result in more far-reaching costs. Because of this, we expect the relationship between superordinate identity and corruption permissibility would only increase in magnitude if we adopted a different proxy for corruption permissibility.

As is always the case with cross-sectional survey data, we cannot infer the direction of causality in any of the models presented here. One possible explanation of our results is that past experiences of corruption can both lower perceived corruption permissibility and decrease the scope of positive valuation to the regional level by providing actors with evidence for how others value them. Alternatively, past experiences of corruption may signal to actors that corrupt behavior is status quo, inducing actors to also switch to defection [104], or make an actor feel they are unlikely to caught in a corrupt act [1,21,105]. We attempted to control for past exposures to corrupt behavior by including country-level measures from the Corruption Perceptions Index, but we cannot rule out these alternative explanations.

Because of the necessarily limited scope of the data collected by the WVS, we used country-level data to control for common correlates of corruption – like religious heterogeneity and socioeconomic inequality – which may have better predictive power at a finer grain of geographic scope. Ethnic and religious heterogeneity often differ between different regions of a country (e.g. [106]), as does inequality. The patterns of interaction affected by group membership and inequality on the smaller scale can affect the transmission of cultural norms, which could affect an actor's willingness to be more tolerant of or generous to strangers at larger geographic scales [107,108]. Further, individual-level experiences of heterogeneity depend on the context, such as the way heterogeneity appears in practice (e.g. markets, policy; [16,88,109]). The same is true for socioeconomic inequality (e.g. [110]). While we were able to include a measure of participants' subjective socioeconomic status in our models, we were not able to include a measure of a participant's subjective perception of heterogeneity.

4.4.3 Future Directions

Our results call attention to the predictive power of superordinate group size for corruption permissibility, independent of other established factors. Further work is needed to elucidate the determinants of a larger scope of positive valuation and its relationship to the perceived benefits and costs of a given action for an actor, including perceived harms affecting bystanders and perceived effects on reputation. Though social scientists have extensive data on the nature of repeated interactions, they have only recently given attention to social identity as a trait that impacts

behavior in ways inconsistent with rational choice frameworks (e.g. [111–114]), including how identity affects initial cooperation (e.g. [115–117]). Individual-level data will be crucial for studying these patterns, though much of the existing corruption literature focuses on country-level analyses. Theoretical modeling, ethnographic study, and experiments will be necessary next steps to further explore how an increased scope of positive valuation changes the costs and benefits of an action for an actor.

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Fig 1. Proportion (box height) of participants with each primary geographic identity (box width) across 55 countries. “Cont.+” represents participants with a continent or world identity.

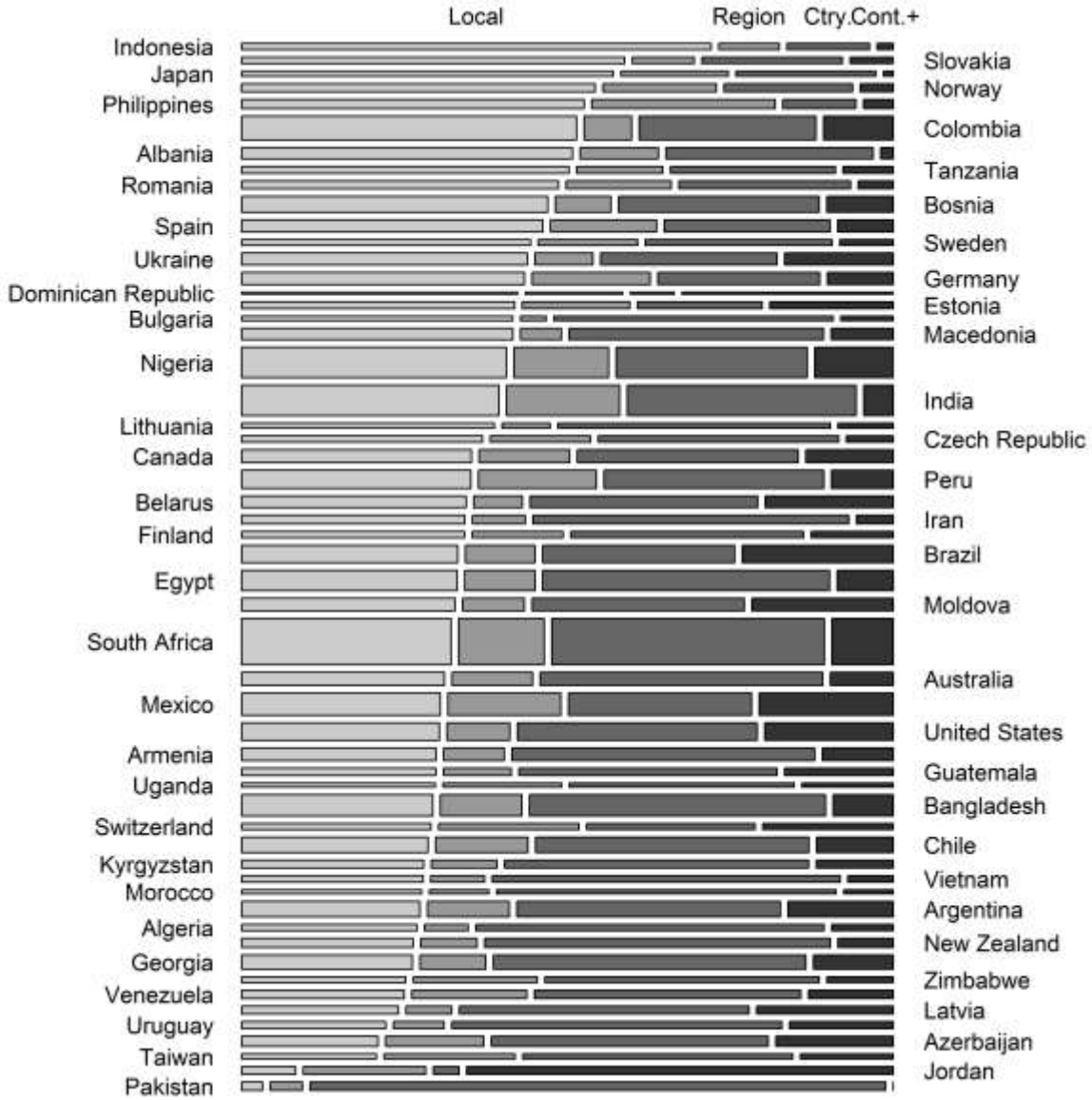

Fig 2. The distribution of participant's number of group identities across 22 countries.

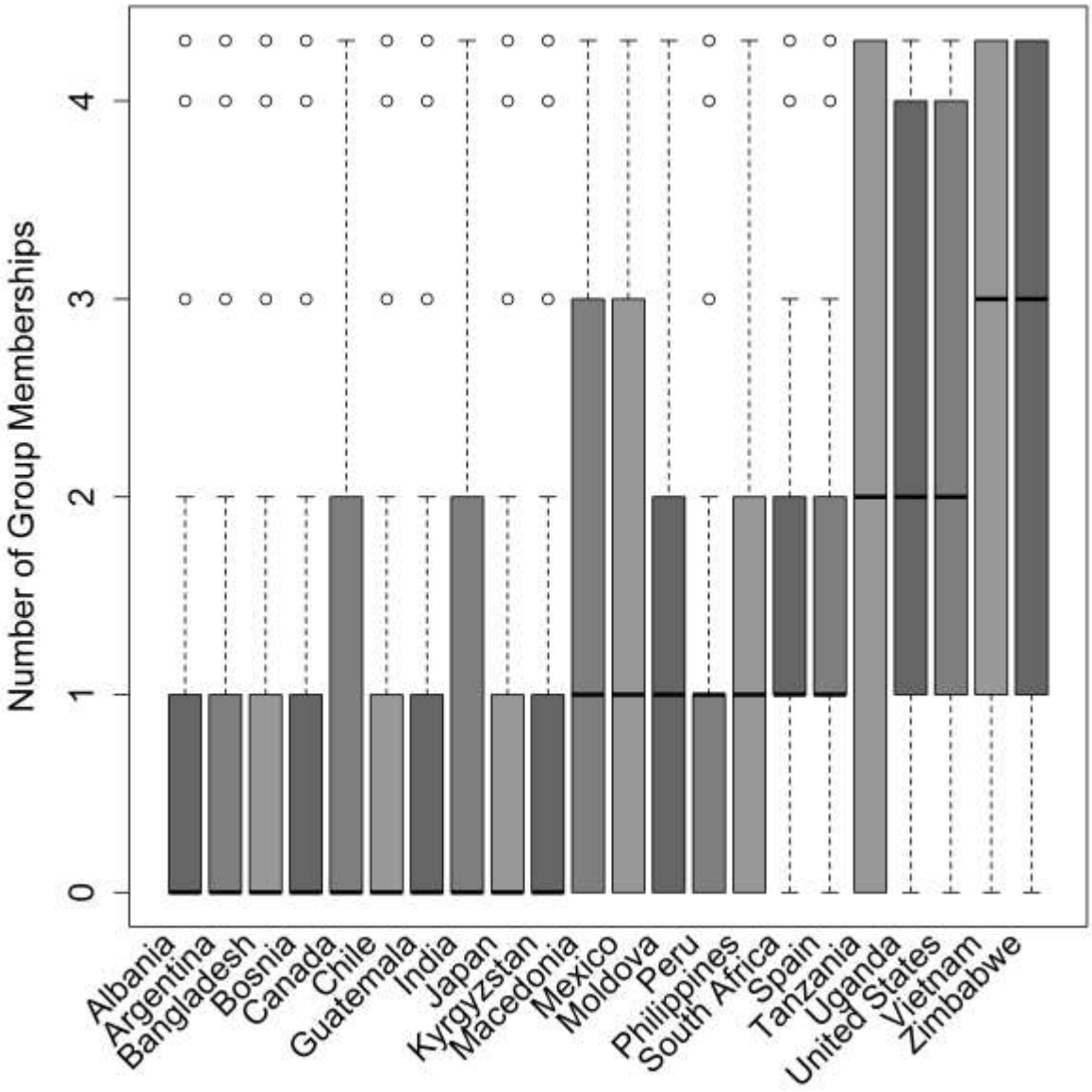

Fig 3. Odds of finding corruption permissible for three levels of primary geographic identity relative to regional identity.

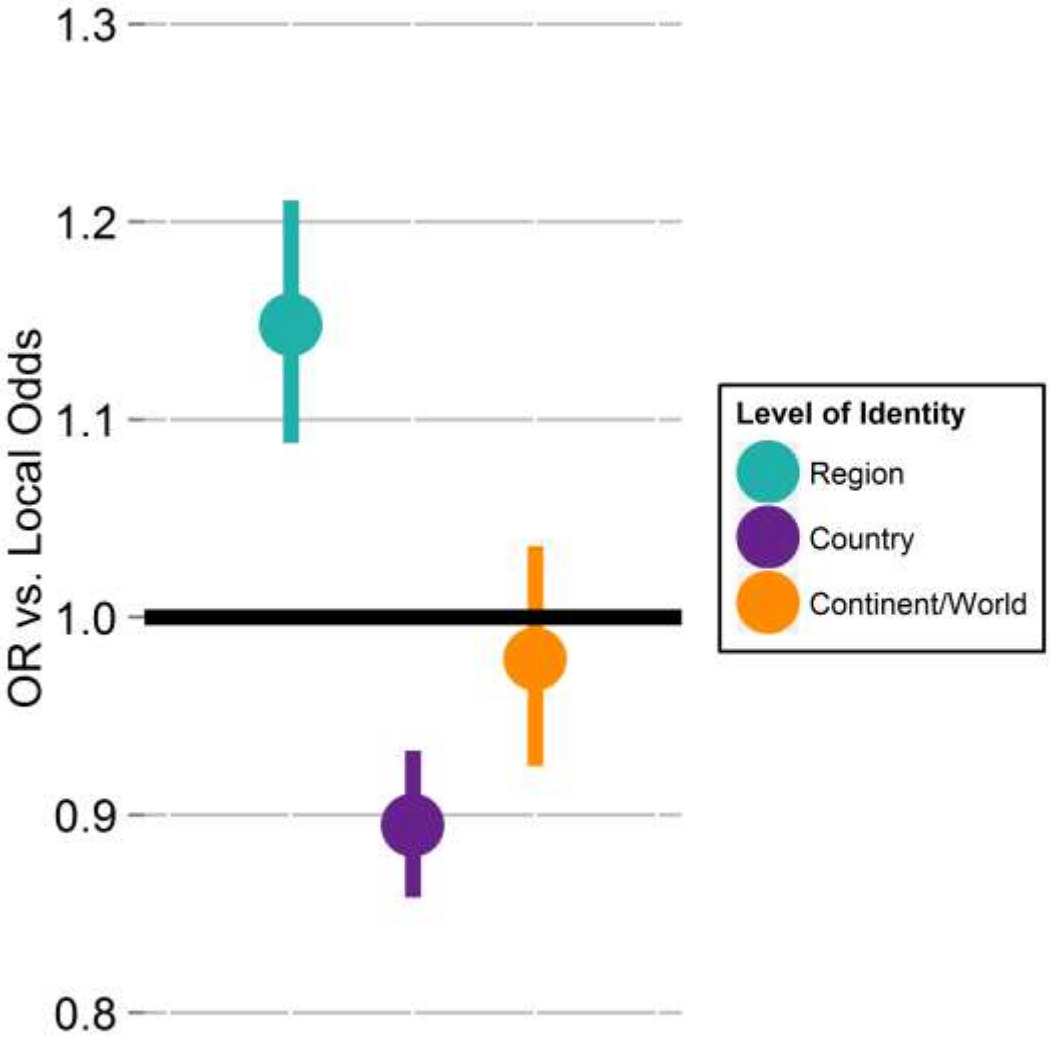

Fig 4. Odds of finding corruption permissible with each additional membership in countries whose 95% CI >0.

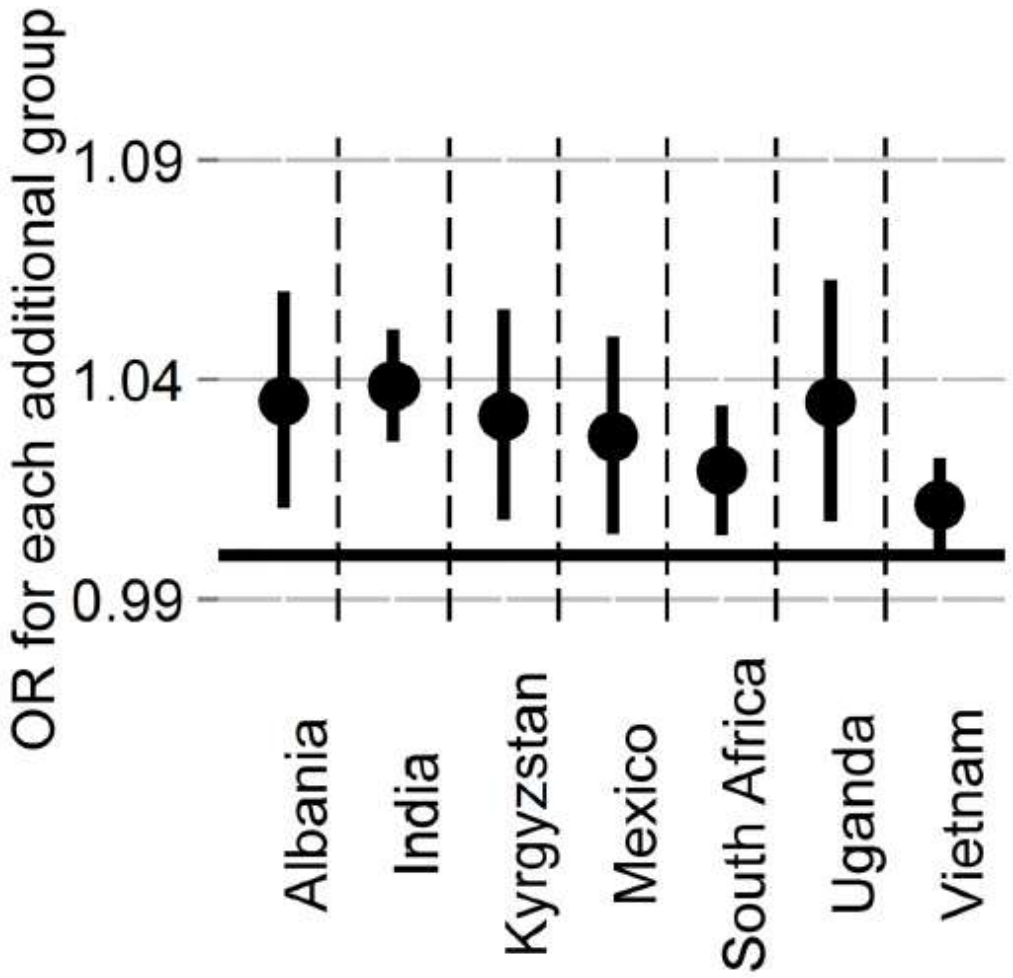

Fig 5. The probability of finding corruption permissible by extent of resource shortfall.

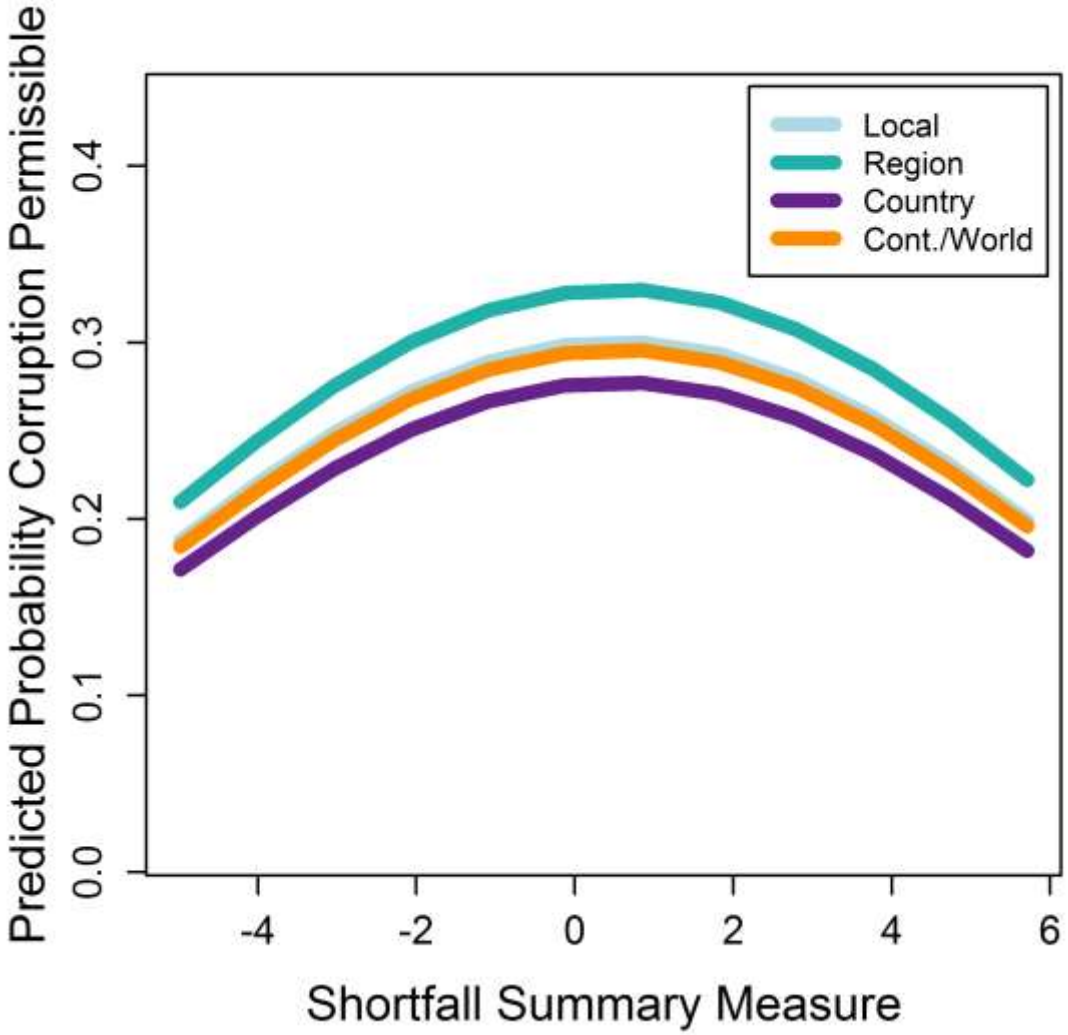

Table 1. Descriptive statistics for continuous variables.

Variable	Mean	Median	SD	Minimum	Maximum	N
Predictor						
Number Group Memberships	1.01	0	1.69	0	4.31	131499
Individual-level Variables						
Subjective Household Income	5.79	6	2.60	1	10	271871
Objective Household Income	4.67	4	2.42	1	11	277865
Subjective Health	3.78	4	0.92	1	5	336387
Number of Kids	1.82	2	1.57	0	5.29	299780
Age	42.09	40	16.71	14	108	373701
Confid. in Police, Civil Service	3.00	3	1.46	0	6	340846
Town Population (integer)	4.76	5	2.52	1	9	272798
Country-level Variables						
Religious	0.48	0.44	0.26	0.01	0.94	165029

Fractionalization						
Religious Polarization	0.53	0.54	0.21	0.02	0.89	165029
Ethnic Fractionalization	0.36	0.32	0.23	0.04	0.93	132331
Ethnic Polarization	0.50	0.49	0.23	0.08	0.94	132331
Average Gini	3.55	3.52	0.25	2.97	4.21	366968
CPI	5.61	6.19	2.38	0.69	10.00	383240
Political Rights Index	2.48	2	1.86	1	7	383240
Log Population Density	4.32	4.40	1.06	1.87	6.67	372526
Log Population Size	16.84	17.04	1.49	13.69	20.07	377153
Year of Interview		1999		1981	2009	383240

Table 2. Descriptive statistics for categorical variables.

Variable	Level 1	Level 2	Level 3	Level 4	N	Interpretation
Predictor						
Primary Geographic Identity	0.41	0.14	0.34	0.10	296554	Level 1 = local, level 4 = cont./world
Individual-level Variables						
Highest Education	0.35	0.44	0.22	---	302548	Level 1 = lowest, level 3 = highest
I Get What I Want	0.65	0.35	---	---	51218	Level 1 = no, level 3 = yes
Believe in God	0.16	0.84	---	---	275959	Level 1 = no, level 2 = yes
Participant Sex	0.48	0.52	---	---	378634	Level 1 = male, level 2 = female

Table 3. Primary geographic identity (baseline = local) and corruption permissibility[1,2].

Variable	Odds Ratio	Std. Error	z value	p value
(Intercept)[3]	3.82	0.07	18.81	<0.001
Region	1.15	0.03	5.05	<0.001
Country	0.89	0.02	-5.27	<0.001
Cont./World	0.98	0.03	-0.74	0.46
Shortfall	1.02	0.01	3.80	<0.001
Shortfall[2]	0.98	0.00	-10.57	<0.001
Education Level 2	0.86	0.02	-6.80	<0.001
Education Level 3	0.77	0.03	-9.41	<0.001
Believes in God	0.84	0.03	-5.49	<0.001
Confid. Police, Govt. Srvc.	0.98	0.01	-3.44	<0.001
Sex: Female	0.85	0.02	-9.11	<0.001
Age	0.98	0.00	-22.99	<0.001
Number of Kids	0.97	0.01	-4.19	<0.001

[1]Models with random country intercepts, country-level variables, or town population size (with country fixed effects) provide highly similar results, and so are not reported. Reported model n = 80,390. Country fixed effects not reported.

[2]AIC selection criteria suggest that the model including primary geographic identity provides a better fit than the model with only controls (weighted $AIC_{in\text{-}group\ size}$ = 1; AIC_{null} = 79,565.87, $AIC_{in\text{-}group\ size}$ = 79,489.08).

[3]The intercept represents participants with regional identities, who had the lowest household resource shortfall, the lowest level of education, reported the lowest confidence in police and civil services, did not believe in God, had no children, were 0 years old, and male.

Table 4. Number of group memberships and corruption permissibility[1,2].

Variable	Odds Ratio	Std. Error	z value	p value
(Intercept)	2.60	0.12	7.93	<0.001
Number of Memberships	1.08	0.01	5.86	<0.001
Shortfall	1.04	0.01	3.62	<0.001
Shortfall^2	0.98	0.00	-5.75	<0.001
Education Level 2	0.80	0.04	-5.44	<0.001
Education Level 3	0.71	0.05	-6.53	<0.001
Believes in God	0.77	0.07	-3.46	<0.001
Confid. Police, Govt. Srvc.	0.97	0.01	-2.85	<0.01
Sex: Female	0.89	0.03	-3.38	<0.001
Age	0.99	0.00	-10.48	<0.001
Number of Children	0.98	0.01	-1.38	0.17

[1]Models with random country intercepts, country-level variables, or town population size (with country fixed effects) provide highly similar results, and so are not reported. Reported model n = 23,288.

[2]AIC selection criteria suggest that the model including primary geographic identity provides a better fit than the model with only controls and resource shortfall variables ($AIC_{in\text{-}group\ size}$ = 0.99; AIC_{null} = 22,277.93, $AIC_{in\text{-}group\ size}$ = 22,245.83).

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5. CONCLUSION

This dissertation has sought to place inter-group relationship building among humans in an evolutionary framework. Relative to other primates, humans are highly tolerant of individuals from other groups, and even build relationships with out-group members, though evolutionary-minded researchers have predominantly focused on inter-group competition as a selection pressure among humans. Drawing on existing theory from evolutionary anthropology, evolutionary psychology, social psychology, and development and behavioral economics, we suggest instead that humans are strategically parochial (or rather perhaps strategically non-parochial), valuing out-group members as potential social partners when there are net benefits to doing so. This dissertation has particularly focused on two strategic socioeconomic motivations underlying out-group relationship building: non-local resource access and buffering resource shortfall. Each is expected to boost the net benefits of out-group relationships. Further, we explored whether higher valuation curbs willingness to generate costs affecting out-group members, an area of research with numerous potential policy implications.

We have provided some answers to the following questions, posed in the introductory chapter:

When should an actor invest in out-group relationships? We hypothesized that actors should value candidate out-group cooperative partners more highly when there are larger benefits to non-local resource access, whereas an actor's degree of need and the quality of her existing network connections may affect both out-group and in-group valuation. Using a non-anonymous economic

game, surveys, and ethnographic interviews conducted among three populations of lowland Bolivian horticulturalists, we found that participants who had a lower subjective socioeconomic status – that is, those who believed they had less money and market items relative to other people in their community – were more likely to be generous toward out-group members. We suggest that this generosity may be motivated by a desire to obtain non-local resource access via relationships with out-group members. However, we note that alternative explanations exist. For example, only Tsimane' participants who had a greater investment in market items were significantly less likely to give to out-group members. We suggest this may be due to discrimination suffered by the Tsimane' in market towns. One measure of a participant's existing social network support decreased generosity toward out-group members, while another boosted generosity toward *in*-group members. These results suggest that out-group valuation among these three populations, as proxied by generosity in an economic game, is sensitive to resource access and available social support, though the nature of the resources and social support alter the effect.

What qualities should an actor seek in a candidate out-group cooperative partner? In addition to the individual qualities that guide in-group partner choice, such as characteristics associated with cooperative outcomes, we hypothesized that perceived qualities of the group would affect an actor's choice of out-group partners; specifically, we suggested that group qualities associated with resource access and treatment of out-group members should feature in out-group partner choice. Using the same data described above, we found that a donor was more likely to send money to recipients who she perceived to be "good people."

Furthermore, donors were also more generous toward recipients if they perceived the recipient's group as having access to market and political resources. Together, these results suggest that both group and individual characteristics feature in partner choice among out-group strangers. However, as for the above study, not all proxies for the variables of interest equally affected out-group valuation.

How might out-group valuation curb the generation of externalities?

When an actor stands to gain from out-group relationships, her valuation should affect both her generosity toward prospective cooperative partners, as tested above, and her willingness to *avoid* generating costs impacting them. Accordingly, we suggested that actors with a larger scope of valued candidate partners would be less likely to condone corrupt acts, as they should be more sensitive to the potential reputational fallout that could hurt their prospects with these candidate partners. To address this possibility, we used data collected by the World Values Survey and European Values Study among 55 countries, treating the scope of a participant's superordinate identity as a proxy for the scope of her valued potential partners. We found that individuals who primarily identified with their country or a larger area were less likely to find corruption permissible than those who identified primarily with their region – but those who identified with their locality, the smallest scope of identity, *also* found corruption less permissible than those with regional identities. Exploratory analyses suggest that individuals who identify with their region may consider themselves "free agents" – they are more likely to not espouse obedience to authority or the importance of family than individuals with other identities – and thus may attend less to negative outcomes for others. Furthermore, contrary to the

patterns of generosity described for Bolivian horticulturalists, participants with the largest and smallest degree of resource shortfalls were the least likely to find corruption permissible. This study suffers from a number of limitations, but suggests that superordinate identity does affect willingness to generate costs for others.

Taken together, these studies offer an alternative perspective on a large literature on inter-group relationships. Like many social psychologists, we suggest that inter-group relationships, that is, relationships between individuals from different groups, form conditionally, based on expected mutual net benefits. We suggest that an understanding of the human evolutionary past – characterized by resource shortfalls at varying geographic scales and the importance of non-local resources – can provide insight into why the potential for cooperative gain and differences in resource access impact the likelihood of inter-group relationship building. This ecologically and socially "rational" behavior is also consistent with a large body of work in development economics and behavioral economics, such as research on the predictors of cross-community collective action failure (e.g., Varughese and Ostrom, 2001; Habyarimana et al., 2007; Waring and Bell, 2013); we reframe the predictors of between-group tolerance or between-group collaboration as inputs to a psychology shaped by human evolution, which in turn affects decision-making. From this alternative perspective, we can make informed predictions about when actors may value out-group members and act accordingly – and when low out-group valuation may lead to costly social outcomes, such as corruption.

The present studies also have implications for the evolutionary social sciences. In an area of study where parochial behavior has been at the forefront of

research on inter-group behavior for two decades, the tide is only recently beginning to change in favor of a focus on strategic inter-group tolerance. To this vanguard of research, which includes work on the evolved cognition of ethnicity and its various inputs (Moya and Boyd, 2015), the role of institutions in smoothing resource access and limiting inter-group competition (Hruschka et al., 2014), and between-group differences in resource access and consequent chronic stress (Boyer et al., 2015), we add theory on the conditions that may favor inter-group relationship building. Further, our approach contributes to approaches to cultural evolution: it suggests that inter-group relationships may have frequently enabled between-group cultural transmission (e.g., Ross and Atkinson, 2016) and that the parochialism central to some models of cultural group selection may not have been as common as has been implicitly assumed (e.g., Koopmans and Rebers, 2009).

As this dissertation represents the beginning of my research program on inter-group relationship building, the present conclusions are limited in some respects. First, Bolivian data were necessarily cross-sectional. While we were able to control for some participant characteristics that may affect self-selection into out-group relationships (e.g., personality, education), others were more difficult to capture (e.g., does out-group valuation encourage mobility, or does mobility increase out-group valuation?). The limitation of cross-sectional data did not permit me to explore the role of institutional effects on out-group valuation, if any. For example, increased exposure to market institutions that enforce fairness could increase valuation for strangers, as they are legally constrained to not generate harms for the actor in market exchanges (Henrich et al., 2010). Another round of

data collection is planned and will enable insight into changes in out-group valuation (e.g., does increased mobility predict a positive net change in out-group valuation?). The World Values Survey and European Values Study data featured in Chapter 4 were likewise cross-sectional and collected with little to no context about participant interpretations of these questions (e.g., who was affected by the corrupt behavior mentioned in the survey?). With a collaborator, I am now experimentally testing the predictions from that chapter.

Second, the variables in models presented here are measures inspired by a number of disciplines and research traditions; it is an outstanding question as to whether these variables, which often had different effects in our models, are measuring similar constructs. For example, I drew on Style of Life scales (e.g., Bindon et al., 1997; Dressler et al., 1998; Snodgrass et al., 2006), the components of which I believed may affect out-group valuation via different routes – for example, market penetration may affect the extent to which out-group relationships may provide net benefits, while passive exposure to out-groups via television may increase perceived social closeness. I have organized a group of collaborators to identify a common toolkit for measuring economic and social change; we plan to employ this toolkit to characterize the effects economic and social changes have on health and behavior across various populations.

In sum, this dissertation re-frames existing research on inter-group interactions in a way that furthers the scientific study of human sociality, particularly by emphasizing the plasticity of inter-group competition, tolerance, and relationship building. It underscores the importance of understanding our evolved psychology,

and the relevant inputs to that psychology, even when conducting research in an ever-changing world. It also offers a crucial piece to a new wave of research in human behavior – when *should* people build out-group relationships? – a wave that promises to impact the evolutionary social sciences in the years to come.

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A1. Supplementary information: Risk-buffering and resource access shape valuation of out-group and in-group strangers

Table of Contents

Supplementary Methods 1 – Additional ethnographic details

The Mosetén and Tsimane' are two of the 36 *pueblos indígenas* recognized by the Plurinational State of Bolivia. The two populations have recognized territories (*Tierras Comunitarias de Origen*) on either side of a range of mountains separating the Beni Department from the La Paz Department of Bolivia. Historically the two populations intermarried and had highly similar languages and practices – together, the Mosetén and Tsimane' languages are a linguistic isolate known as Mosetenan [1] – but the Mosetén were missionized a century earlier [2]. Catholic Franciscan clergy established schools for the Mosetén and, by the end of the 20th century, had helped fund the paving of roads connecting the area to the market town, enabling extensive cash cropping and logging over the last three decades. The Mosetén have increasingly intermarried with non-Mosetén (Quechua and Aymara speakers), who then settled in the Mosetén territory; approximately half of all households in the communities sampled include one non-Mosetén adult member. While all Mosetenes speak fluent Spanish, the dominant language in Bolivia, only 14% of Tsimane' participants speak Spanish fluently. Evangelical New Tribes and Catholic Redemptorist missionaries began work with the Tsimane' in the early 1950s. Dirt roads were constructed in 1975 but have reached few communities; many Tsimane' continue to rely on river travel, which has curbed market penetration. Today the majority of Tsimane' communities have schools, but roughly one third were constructed only in the last decade. The Tsimane' remain predominantly endogamous: when intermarriage does occur, the Tsimane' tend to marry lowland ethnic groups living in or near Tsimane' territory. Poor preservation in the region

limits our ability to estimate how long the Mosetén and Tsimane' have lived in this area [3], but haplotype data suggest that they are more closely related to populations in the Andes than other lowland populations [4].

A third population is a multicultural (*intercultural*) community located at the boundary of Mosetén territory in the Beni River Valley (the community is here called "Intercultural"). The Mosetén historically lived in the area, joined in the mid-20th century by Trinitarios searching for the promised land (*la tierra santa*). In the 1960s, a government-sponsored colonization project relocated Aymara speakers from the Andes to the Intercultural area. In response, most Mosetén and Trinitario families moved farther upriver. Many Aymara speakers ultimately returned to the Andes, but a small consortium of families who remained in the area – Aymaras, Trinitarios, and immigrants from the Beni – secured funds for a road to the local market town in 1975 and founded Intercultural in 1979. In the last four decades, Intercultural has grown to a population of 1100 as residents have immigrated both from nearby communities and distant regions for the favorable growing climate and soils or the now-dwindling logging industry. Intercultural participants were predominantly Aymara (59%) and Quechua (18%), the two most populous indigenous groups in Bolivia.

Supplementary Methods 2 – Additional details about sampling and checking game comprehension

Tsimane' interviews were conducted in the Tsimane' language with the help of a research assistant, Mosetén and Interculturales interviews in Spanish by the

researcher. Tsimane' interviews were translated from Spanish to Tsimane' and back-translated until concepts were conveyed consistently in both languages. Interviews were conducted in two parts across two different days. An attempt was made to sample one adult from each household in each community, with an equal number of male and female participants. Individuals who engaged in more wage labor or sold more produce may have been less likely to be at home than other members of the community; to compensate for this, households whose members were absent were re-visited at regular intervals in an attempt to interview these individuals. Instructions for the economic game were given at the beginning of the second interview using example individual recipients (cartoon faces named Juan, Carlos, and Patricia) and U.S. pennies in place of *bolivianos* (*Bs*). To ascertain participant understanding, two possible allocations were demonstrated and participants were asked to tell the researcher how much each group or individual would receive in each circumstance. The researcher proceeded only if a participant correctly reported the amounts; if they did not, the researcher repeated the instructions for the experiment and demonstrated a third allocation. Participants were compensated with household gifts equivalent in value to one hour's wages for each interview.

Supplementary Methods 3 – Popular market possessions as assessed during pilot ethnographic research

- Mosetén and Interculturales: Cars/trucks, TVs, satellites, stores or small restaurants, refrigerators or freezers, cell phones, chainsaws, string trimmers.

- Tsimane': Outboard motors, TVs, cell phones, chainsaws.

Supplementary Methods 4 – Food security questionnaire as adapted from [5] for use among Bolivian horticulturalists

Scoring: Responding "always" to a given question was given a score of 1, "never" a score of 0, and sometimes a score of 0.5. Scores were summed across questions.

1. In the last 12 months, how frequently did you think the food in your household would run out before you could get more? Always, sometimes, or never?

(Spanish) *En los últimos 12 meses, con qué frecuencia pensabas que la comida/los viveres de tu casa va a acabar antes de podrías sacar más? Siempre, a veces, o nunca?*

(Tsimane') *Oij yomodye' jiyaques, jun buty quim' ca dyijyim paj qui moyam jibitidyes aca'yadyes mi aty räi' ya, janas qui buty daque mdyijyica' mi mo'ra jibitidyes mi a aty jam bura' jam dami? Räjcan, are' jämdye'ya', are' jam jam yiri'?*

2. In the last 12 months, how frequently did the food in your household run out and you could not get more? Always, sometimes, or never?

En los últimos 12 meses, con qué frecuencia acabó la comida/los viveres de tu casa y no podías sacar más? Siempre, a veces, o nunca?

Oij yomodye' jiyaques, jun buty quim' aty räi' jibitidyes aca'ya'dyes mi, aty jam jun buyi quim daĉan dam dyem? Räjcan, are' jämdye'ya', are' jam jam yiri'?

3. In the last 12 months, how frequently could you not provide a complete diet for your household? Always, sometimes, or never?

En los últimos 12 meses, con qué frecuencia no podías sacar comida completa/viveres completos para tu casa?

Oij yómodye' jiyaques, aty buty quim jam cuts jibiti'dyes aca'ya'dyes mi? Räjcan, are' jämdye'ya', are' jam jam yiri'?

4. In the last 12 months, how frequently did your household only have a few kinds of inexpensive food or food that was not tasty because you could not get more? Always, sometimes, or never?

En los últimos 12 meses, con qué frecuencia tenía tu casa solamente unos tipos de comida/viveres barata o comida/viveres de mal sabor porque no podías sacar más? Siempre había comida buena? Siempre, a veces, o nunca?

Oij yomodye' jiyaques, jedye ca momo mo'ya aca'ya' mi, are' mo' dyi' momo' jibitidyes mi? Räjcan, are' jämdye'ya', are' jam jam yiri'?

Supplementary Methods 5 – Additional variables included in analyses

Actors more prone to risk may be more likely to engage in potentially costly initial generosity toward out-groups [6], but those who discount the future may invest more in the self or in existing relationships rather than new ones [7]; as such, we used four questions to measure participants' risk proneness, one of which also gauges temporal discounting ([8]; Supplementary Methods 6). We also controlled for Agreeableness, which is a predictor of prosocial behavior in economic games[9], and Extraversion, which increases likelihood of exploration and forming new social

relationships[10] (see Supplementary Methods 7). We controlled for frequency of church attendance in the past month, as attendance could increase in-group favoritism [11] or increase the likelihood that participants felt their actions might be observed by an omniscient god [12]. Sex differences in generosity and cooperativeness are prevalent [13] and cohort effects on trust have been reported [14], so we included both sex and age in all models. Education increases exposure to information about out-groups, whether positive or negative in content; also, participants seeking additional resources through out-groups may build their human capital to attain access. Because of these possibilities, we controlled for a participant's highest level of schooling. Mate search may increase out-group exposure, although it is not consistently associated with marital status in the Bolivian context; we include marital status as an imperfect potential predictor of out-group valuation.

Supplementary Methods 6 – Stimulating and instrumental risk taking questionnaire adapted from [8] for brevity and use among Bolivian horticulturalists

Scoring: Items were scored on a five point scale, with "true" responses scored as 5 and "false" scored as 1. Scores were summed across questions.

1. You take risks only if it is necessary to achieve something. True, almost true, somewhat true, almost false, or false?

(Spanish) *Tomas riesgo solamente si es necesaria para lograr algo. Verdadero, casi verdadero, intermedio, casi falso, o falso?*

(Tsimane') *Me tsan anic carij midyes miqui nac anic jemoñe si' mi tupuj me'jetaque' mi. Anic me' o me' o dam' momo o jam o jam yirity?*

2. You do not like to do things whose results depend too much on chance. If something depends a lot on chance, you do not do it. True, almost true, somewhat true, almost false, or false?

No quieres hacer cosas cuyos resultados dependen demasiado mucho en la suerte. Si algo depende mucho en la suerte, no lo haces. Verdadero, casi verdadero, intermedio, casi falso, o falso?

Tupuj dyäcje mi mo carijtaqui mi jam juiya mujucha tuyin bijodye jeñej mo' in cätidye in metsam mo'ya' tupudye jam qui nac jämi' ya in. Anic me' o me' o dam' momo o jam o jam yirity?

3. Do you prefer work for a larger wage that can end any day more than stable work with a smaller wage, for example, contract work that does not pay you well? True, almost true, somewhat true, almost false, or false?

Prefieres más un trabajo por un sueldo más grande que se puede terminar cualquier día o un trabajo estable con un sueldo más pequeño, por ejemplo, un trabajo con contracto que no te paga bien? El primero, el segundo, o los dos por igual?

Ma'je' buty mi yiris carijtacdye yirity tum yaitacdye jämtyi, jam cavin räi'si' mo tacya chime moya carijtacdye damsi yaitacdye, ejemplo carijtacdye contrato in?

4. To achieve in life, you need to take risks. True, almost true, somewhat true, almost false, or false?

Para lograr algo en esta vida, necesitas tomar riesgos. Verdadero, casi verdadero, intermedio, casi falso, o falso?

Paj qui jäm' joij ve juijya' mi jemoñe buty mi me'je metsan' carij midyes. Anic me' o me' o dam' momo o jam o jam yirity?

Supplementary Methods 7. Personality inventories adapted from [15] for brevity and use among Bolivian horticulturalists

Scoring: Items were scored on a five point scale, with "true" responses scored as 5 and "false" scored as 1. Scores were summed across questions.

- **Agreeableness**

1. You do not want to help other people if helping them will disadvantage you. If it will cost you, you will not help others. True, almost true, somewhat true, almost false, or false?

No quieres ayudar a otras personas si esa ayuda lleva desventajas para ti. Si hay un gasto para ti, no vas a ayudarles. Verdadero, casi verdadero, intermedio, casi falso, o falso?

Jam adac ma'je notacsi yoctyi muntyi in, mo qui nam notacdye' mi jam jäm juijya midyes. Anic me' o me' o dam' momo o jam o jam yirity?

2. You like to be generous without expecting a service in return. True, almost true, somewhat true, almost false, or false?

Te gusta ser generoso sin esperar un servicio a cambio. Verdadero, casi verdadero, intermedio, casi falso, o falso?

Ma'je buty mi pajqui so'macsity jedye' mi, jam bisem yoctyis notacdye. Anic me' o me' o dam' momo o jam o jam yirity?

3. Your well-being is more important to you than the problems of other people. True, almost true, somewhat true, almost false, or false?

Tu bienestar es más importante a ti como los problemas de otras personas. Verdadero, casi verdadero, intermedio, casi falso, o falso?

Mo' jäm'jodye' anic buty jemonac cui dyes midyes mi, jam jeñej mu in carijsistumtyi' yoctyi muntyi' in. Anic me' o me' o dam' momo o jam o jam yirity?

4. You would help other people even if you have serious problems of your own. True, almost true, somewhat true, almost false, or false?

Todavía ayudes a otra gente aunque tienes tus propios problemas graves. Verdadero, casi verdadero, intermedio, casi falso, o falso?

Taca' buty nótacsi yoctyi' muntyi' mi, me'tsan' mis mo'ya' cui'si' carijsis anic are'sis. Anic me' o me' o dam' momo o jam o jam yirity?

- **Extraversion**

1. When you are together with a lot of people, you prefer to be apart from them. True, almost true, somewhat true, almost false, or false?

Cuando tú estás junto a muchas personas prefieres que quedarte fuera de ellos. Verdadero, casi verdadero, intermedio, casi falso, o falso?

Me' juijya mi mu'ya yiri'ya daityiya muntyi' in, tupuj buty jäquive bu'yi mi jorajyayeban mu in ya in. Anic me' o me' o dam' momo o jam o jam yirity?

2. You feel better when there are a lot of people around you. True, almost true, somewhat true, almost false, or false?

Sientes mejor cuando hay muchas personas cerca de ti. Verdadero, casi verdadero, intermedio, casi falso, o falso?

Jäm' cuti mi me' mu'ya' dai' muntyi' in tyeijya juijya in. Anic me' o me' o dam' momo o jam o jam yirity?

3. You feel better when you are alone. True, almost true, somewhat true, almost false, or false?

Sientes mejor cuando estás solo. Verdadero, casi verdadero, intermedio, casi falso, o falso?

Jämyi buty mi yirity dyety juijyam. Anic me' o me' o dam' momo o jam o jam yirity?

4. You always have fun meeting new people. True, almost true, somewhat true, almost false, or false?

Siempre te diviertes a conocer personas nuevas. Verdadero, casi verdadero, intermedio, casi falso, o falso?

Räjĉan buty ma'jotacsi mi quimdyem atysijtyi' muntyi' in. Anic me' o me' o dam' momo o jam o jam yirity?

Supplementary Methods 8 – Description of supplemental data

A csv file of the data used in these analyses is available as part of the supplementary materials. To protect participant identity, participant PIDs are false, community names are excluded, and participant ages are rounded to the nearest decade (e.g., ages 25-34 appear as age 30). Outliers have not been removed, except for variables included in the shortfall summary variable as was necessary to

calculate these values (i.e., number of children, food security; see Table S1 for details about outlier removal).

Supplementary Table 1. Descriptive statistics on the full sample.

Variable	Mean	SD	Median	Min	Max	N[4]	% level 1	% level 2	% level 3
Avg. to out-group	2.19	1.40	2.67	0	5.31	157			
Avg. to in-group	2.95	1.56	3	0	7	168			
Money kept	5.47	5.77	3	0	21	198			
Existing non-local resource access									
Income last month[1]	-0.01	0.99	-0.30	-2.40	3.44	217			
Value of market items[1]	0.02	0.99	-0.31	-1.13	2.27	217			
log subjective SES	1.04	0.69	1.10	0.00	2.30	217			
No traditional labor	---	---	1	---	---	198	0.60	0.40	
Need									
Shortfall summary	0.03	1.20	-0.03	-2.45	3.16	217			
Food insecurity[2]	1.45	0.84	1.5	0	3	217			
No. children in home[2]	2.59	1.87	2	0	7	217			
Produce/income below normal[2]	---	---	2	---	---	217	0.37	0.49	0.14
Recent illness	---	---	1	---	---	217	0.84	0.16	
Existing network support									
Can borrow from past comms.	---	---	2	---	---	217	0.17	0.37	0.47
Can stay in past comm.	---	---	2	---	---	217	0.34	0.66	
Past exposure									
No negative stereotypes	---	---	1	---	---	49	0.53	0.47	
Knew focal out-group as child	---	---	1	---	---	157	0.91	0.09	
Parents knew out-group	---	---	1	---	---	157	0.93	0.07	
Hours TV/movies[1]	0.01	1.01	-0.38	-0.78	3.15	217			
Cities/towns visited[1]	0.01	1.01	-0.34	-1.01	3.14	217			

Places lived	3.20	1.90	3	0	8	217			
Additional variables									
Share name with recipient	---	---	2	---	---	217	0.37	0.63	
Risk proneness	7.57	2.73	8	0	12	217			
Agreeableness	7.58	3.34	8	0	16	217			
Extraversion	6.08	2.52	6	0	13	217			
Sex: Male	---	---	2	---	---	217	0.50	0.50	
Age[3]	22.24	14.34	21	0	67	217			
Married	---	---	2	---	---	217	0.13	0.87	
Years schooling	6.68	4.49	6	0	16	215			
Times to church/mo.	1.91	1.79	2	0	5	220			
Population	---	---	2	---	---	217	0.35	0.33	0.32

[1]Variables z-scored. [2]Variables which form the shortfall summary measure is constructed. [3]Centered at zero (i.e., an age of 18 has a value of 0). [4]Includes participants presented with recipients from intermediate groups (members of groups in position 3; see Supplementary Figure 1) in the economic game, though these participants are excluded from analysis.

Supplementary Table 2. Parameter estimates for out-group and in-group giving, including controls.

	Out-group				In-group			
Variable	**Post. mean**	**Lower 95%**	**Upper 95%**	**p value**	**Post. mean**	**Lower 95%**	**Upper 95%**	**p value**
Intercept	2.13	-0.32	4.50	0.07	0.06	-2.29	2.37	0.96
Existing non-local resource access								
Income last month[1]	0.06	-0.18	0.30	0.65	0.14	-0.18	0.47	0.40
Value of market items[1]	-0.03	-0.31	0.27	0.85	0.17	-0.17	0.53	0.32
log subjective SES	-0.33	-0.70	0.01	0.07	0.14	-0.29	0.59	0.52
Past exposure								
Hours TV/movies[1]	0.23	-0.05	0.49	0.10	0.03	-0.28	0.35	0.83
Cities/towns visited[1]	0.09	-0.17	0.38	0.50	-0.22	-0.55	0.11	0.19
Places lived	0.21	0.05	0.36	0.01	-0.03	-0.22	0.15	0.73
Existing network support								
Can borrow from one past comm.	-0.30	-1.10	0.47	0.45	0.31	-0.59	1.21	0.51
Can borrow from two past comms.	-0.42	-1.18	0.30	0.26	1.05	0.13	1.89	0.02
Can stay in past comm.	-0.05	-0.58	0.49	0.85	0.30	-0.34	0.96	0.37
No traditional labor	-0.52	-1.01	-0.01	0.04	-0.19	-0.80	0.38	0.52
Need								
Shortfall summary	-0.05	-0.25	0.17	0.67	-0.13	-0.38	0.13	0.33
Recent illness	-0.90	-1.52	-0.26	0.00	0.54	-0.24	1.35	0.18
Additional variables								
Share name with recipient	0.09	-0.41	0.59	0.74	0.48	-0.12	1.10	0.12
Risk proneness	0.00	-0.08	0.08	0.99	0.06	-0.04	0.16	0.25
Agreeableness	0.04	-0.04	0.12	0.34	0.04	-0.06	0.13	0.45
Extraversion	-0.02	-0.11	0.08	0.74	0.02	-0.09	0.14	0.72
Sex: Male	-0.25	-0.79	0.26	0.34	0.15	-0.50	0.78	0.64

Age^2	-0.01	-0.03	0.01	0.36	0.01	-0.01	0.04	0.27
Married	-0.02	-0.66	0.65	0.94	0.68	-0.16	1.56	0.12
Years schooling	-0.03	-0.10	0.04	0.41	0.01	-0.08	0.09	0.86
Times to church/mo.	0.04	-0.09	0.17	0.56	0.09	-0.07	0.24	0.26

Both models control for survey version, which was counterbalanced. Out-group sample size=157, effective sample size (i.e., number of samples from the posterior distribution)=27,000; DIC=532.17. In-group sample size=133, effective sample size=26,510; DIC=513.60. [1]Variables z-scored. [2]Age is centered at age 18.

Supplementary Table 3. Parameter estimates for money kept for the self, including controls.

	Self			
Variable	**Post. mean**	**Lower 95%**	**Upper 95%**	**p value**
Intercept	14.56	6.10	22.45	0.00
Existing non-local resource access				
Income last month[1]	-0.45	-1.49	0.58	0.40
Value of market items[1]	-0.43	-1.62	0.80	0.48
log subjective SES	0.60	-0.93	2.12	0.44
Past exposure				
Hours TV/movies[1]	-1.06	-2.18	0.03	0.06
Cities/towns visited[1]	0.17	-1.01	1.37	0.78
Places lived	-0.62	-1.27	0.01	0.06
Existing network support				
Can borrow from one past comm.	-0.58	-3.84	2.73	0.73
Can borrow from two past comms.	-2.20	-5.27	1.03	0.17
Can stay in past comm.	-0.91	-3.26	1.41	0.45
No traditional labor	1.87	-0.19	4.08	0.08
Need				
Shortfall summary	0.54	-0.37	1.43	0.24
Recent illness	0.91	-1.85	3.63	0.52
Additional variables				
Share name with recipient	-1.69	-3.97	0.41	0.13
Risk proneness	-0.10	-0.44	0.26	0.58
Agreeableness	-0.23	-0.55	0.11	0.17
Extraversion	-0.03	-0.43	0.37	0.90
Sex: Male	0.69	-1.63	2.94	0.55

Age^2	-0.03	-0.11	0.06	0.52
Married	-1.21	-4.09	1.67	0.40
Years schooling	0.02	-0.31	0.33	0.90
Times to church/mo.	-0.40	-0.96	0.17	0.16

Model controls for survey version, which was counterbalanced. Sample size=157, effective sample size=27,000; DIC=1015.26. [1]Variables z-scored. [2]Age is centered at age 18.

Supplementary Table 4. Parameter estimates for out-group giving by population, including controls. Percentile intervals omitted due to space constraints.

	Tsimane'		Mosetén		Interculturales	
Variable	**Post. mean**	**p value**	**Post. mean**	**p value**	**Post. mean**	**p value**
Intercept	1.77	0.45	1.91	0.15	1.50	0.38
Existing non-local resource access						
Income last month[1]	0.10	0.85	0.12	0.54	-0.12	0.55
Value of market items[1]	-2.72	0.00	0.12	0.59	-0.08	0.70
log subjective SES	-0.28	0.53	-0.47	0.13	-0.05	0.90
Past exposure						
Hours TV/movies[1]	3.45	0.03	0.26	0.19	0.22	0.30
Cities/towns visited[1]	0.48	0.77	0.16	0.45	-0.17	0.44
Places lived	-0.01	0.97	0.20	0.09	0.15	0.31
Existing network support						
Can borrow from one past comm.	-0.46	0.52	0.81	0.02	-0.37	0.37
Can borrow from two past	-0.66	0.39	---	---	---	---

comms.						
Can stay in past comm.	0.06	0.92	0.20	0.66	-0.45	0.36
No traditional labor	-1.03	0.13	-0.68	0.11		
Need						
Shortfall summary	0.00	1.00	-0.07	0.64	-0.23	0.26
Recent illness	---	---	-0.38	0.38	-0.28	0.57
Additional variables						
Share name with recipient	1.44	0.07	-0.12	0.75	0.37	0.47
Risk proneness	0.05	0.63	0.00	0.99	0.04	0.60
Agreeableness	-0.04	0.71	0.06	0.34	0.09	0.21
Extraversion	0.05	0.69	-0.02	0.80	0.04	0.74
Sex: Male	-1.07	0.15	0.27	0.50	0.70	0.27
Age^2	0.02	0.50	-0.01	0.75	-0.01	0.43
Married	---	---	---	---	-0.21	0.69
Years schooling	-0.02	0.89	-0.02	0.75	-0.04	0.51
Times to church/mo.	0.07	0.63	-0.08	0.53	0.26	0.08

Categorical variables excluded when number of individuals at each level was too small in a given population. Survey version is excluded from all three models due to issues with collinearity. Being able to borrow from past communities is binned into two categories – no communities and one community in one bin, two communities in the other – for the Mosetén and Interculturales. Tsimane' sample size=47, effective sample size=27,000; DIC=199.31. Mosetén sample

size=52, effective sample size=27,000; DIC=180.08. Intercultural sample size=51, effective sample size=27,403; DIC=190.16. [1]Variables z-scored. [2]Age is centered at age 18.

Supplementary Table 5. Parameter estimates for out-group giving, in-group giving, and money kept for the self for the subsample for which stereotype data were available. Percentile intervals omitted due to space constraints.

	Out-group		In-group		Self	
Variable	**Post. mean**	**p value**	**Post. mean**	**p value**	**Post. mean**	**p value**
Intercept	1.12	0.15	4.47	0.00	4.50	0.22
Existing non-local resource access						
log subjective SES	-0.58	0.13	-0.57	0.28	3.94	0.03
Past exposure						
Hours TV/movies[1]	0.54	0.09	-0.01	0.97	-0.95	0.51
Places lived	0.22	0.10	0.17	0.36	-1.45	0.02
No negative out-group stereotype	-0.09	0.84	-0.16	0.81	-0.05	0.99
Existing network support						
No traditional labor	-0.23	0.59	-0.10	0.87	2.07	0.31
Need						
Recent illness	-0.68	0.14	1.35	0.07	-2.52	0.27

Only variables which were significant in models reported above were included in these models, to preserve degrees of freedom given small sample sizes. Both models control for survey version, which was counter-balanced. Out-group sample size=44, effective sample size=27,652; DIC=150.52. In-group sample size=40, effective sample size=27,715; DIC=171.42. Money kept for self sample size=44, effective sample size=27,000, DIC=298.60. Model including stereotypes provides a worse fit than model excluding stereotypes (DIC=150.51 vs DIC=148.16). [1]Variable z-scored.

Supplementary Table 6. Parameter estimates for out-group giving by whether the participant wished to share their name or remain anonymous, including controls.

	Non-anonymous				Anonymous			
Variable	**Post. mean**	**Lower 95%**	**Upper 95%**	**p value**	**Post. mean**	**Lower 95%**	**Upper 95%**	**p value**
Intercept	2.90	0.61	5.08	0.01	2.33	-1.04	5.70	0.17
Existing non-local resource access								
Income last month[1]	0.03	-0.28	0.33	0.87	-0.17	-0.72	0.37	0.54
Value of market items[1]	0.20	-0.17	0.57	0.30	0.16	-0.42	0.74	0.57
log subjective SES	-0.38	-0.82	0.04	0.08	-0.70	-1.55	0.14	0.10
Past exposure								
Hours TV/movies[1]	0.13	-0.22	0.49	0.47	0.43	-0.18	1.05	0.17
Cities/towns visited[1]	0.38	-0.01	0.75	0.05	-0.22	-0.75	0.30	0.39
Places lived	0.18	-0.02	0.36	0.07	0.41	0.12	0.69	0.01
Existing network support								
Can borrow from one past comm.	-0.61	-1.54	0.33	0.20	0.61	-0.42	1.70	0.24
Can borrow from two past comms.	-0.55	-1.42	0.33	0.22	---	---	---	---
Can stay in past comm.	0.07	-0.65	0.86	0.85	-0.52	-1.52	0.48	0.30

No traditional labor	-0.49	-1.10	0.12	0.12	-0.43	-1.48	0.62	0.41
Need								
Shortfall summary	-0.13	-0.39	0.13	0.33	-0.11	-0.65	0.45	0.70
Recent illness	-1.02	-1.81	-0.19	0.01	-0.40	-1.83	1.08	0.58
Additional variables								
Risk proneness	-0.03	-0.13	0.06	0.49	-0.10	-0.30	0.10	0.31
Agreeableness	0.02	-0.08	0.12	0.64	-0.01	-0.20	0.19	0.89
Extraversion	-0.07	-0.18	0.05	0.23	0.10	-0.14	0.33	0.39
Sex: Male	-0.33	-1.00	0.38	0.34	0.15	-1.09	1.43	0.81
Age^2	-0.01	-0.03	0.02	0.59	-0.02	-0.07	0.03	0.38
Married	-0.03	-0.88	0.85	0.95	---	---	---	---
Years schooling	0.02	-0.08	0.12	0.69	-0.05	-0.18	0.08	0.45
Times to church/mo.	0.00	-0.17	0.16	0.98	0.28	-0.02	0.60	0.08

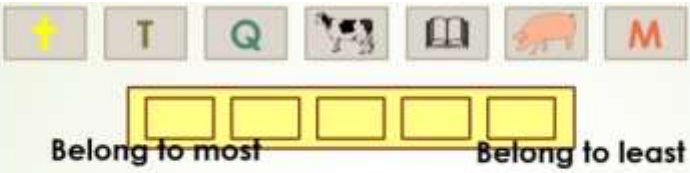
Categorical variables excluded when number of individuals at each level was too small in a given population. Survey version is excluded from the anonymous model. Being able to borrow from past communities is binned into two categories – no communities and one community in one bin, two communities in the other – for the anonymous subset. Non-anonymous sample size=101, effective sample size=27,000, DIC=368.21. Anonymous sample size=49, effective sample size=27,000; DIC=194.73. [1]Variables z-scored.

Supplementary Table 7. Adjustments for outliers and heteroscedasticity.

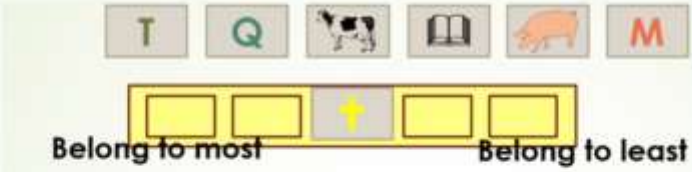
Variable	Adjustment for Statistical Purposes
Number of children living in the home	Values above 97.5 %ile rounded to 97.5 %ile
Net household income	
Places visited	
Value of market items owned	
Hours of TV or movies watched in last week	
Years of school	
Risk proneness	
Times attended church in last month	
Food insecurity	
Market items, z-scored	
Subjective SES	Logged to reduce heteroscedasticity

Supplementary Figure 1. Participants sorted cards representing local ethnic groups, churches, and work cooperatives on a scale from “groups I belong to most” to “groups I belong to least”; the yellow scale was oriented in front of the participant such that the rectangle for “groups I belong to most” was closest to him or her and the rectangle for “groups I belong to least” was farthest away. Participants had to sort all the cards on the scale, but could leave as many or as few in each rectangle as they wished. The figure below shows sorting in stages as the participant places the cards in the rectangles. The number of groups in the card sort was determined by the number of locally salient groups: 9 for the Tsimane’, 10 for the Mosetén, and 12 for the Interculturales. Some are religious organizations (e.g., Catholics are a cross, Nazarenes are a Bible), some are ethnic groups (e.g., Tsimane’ are a T, Quechua are a Q), and some are work cooperatives (e.g., the dairy cooperative has a cow, the pig farming cooperative has a pig). We classified groups placed in the two rectangles closest to the participant as in-group, those placed in the two rectangles farthest from the participant as out-group, and those in the middle rectangle as intermediate. Participant comprehension was ascertained before data were collected. Cow and pig images courtesy of johnny_automatic and tuxwrench (https://openclipart.org/detail/388/cow; https://openclipart.org/detail/216216/piggy).

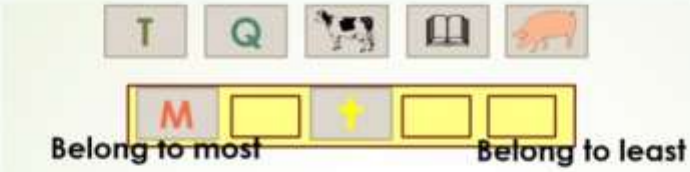
1


T
Q
M
Belong to most
Belong to least

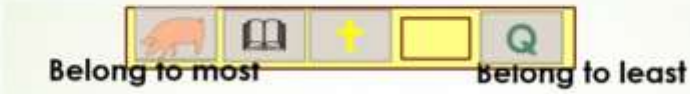
2


T
Q
M
Belong to most
Belong to least

3


T
Q
M
Belong to most
Belong to least

4


Q
Belong to most
Belong to least

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A2. SUPPLEMENTARY INFORMATION: WHEN TO DIVERSIFY, AND WITH WHOM? CHOOSING PARTNERS AMONG OUT-GROUP STRANGERS IN LOWLAND BOLIVIA

Supplementary Methods 1 – Additional ethnographic details

By the turn of the 21st century, international aid and the Catholic clergy had constructed roads reaching the Mosetén communities, with the help of local communities. Community members now have access to electricity, cell service, running (non-potable) water, and organized transportation to the local market town. The Mosetén have increasingly intermarried with Quechua and Aymara speakers, who have settled in the Mosetén territory. Tsimane' communities, on the other hand, have very little infrastructure and access to resources. Evangelical New Tribes and Catholic Redemptorist missionaries began work with the Tsimane in the mid-20th century. Roads were constructed beginning in 1974 but are poorly maintained and reach few communities; many Tsimane' households rely predominantly on river travel. In the study communities, there is no access to electricity, reliable cell service, running water, or organized (river) transport. Today the majority of Tsimane' communities have schools, but roughly one third were constructed only in the last decade.

Intercultural was founded by colonists. In the 1960s, a government-sponsored colonization project relocated Aymara speakers from the Andes to the Intercultural area, where some lowland families were living. Together, these households secured funds for a road to the local market town in 1975, established a school, and founded Intercultural in 1979. Interculturales have access to electricity, cell service, running water, and organized transport to the local town, with cars coming and going more often than seen among the Mosetén.

Supplementary Methods 2 – Sampling strategy, counterbalancing and randomization, comprehension checks

Tsimane' interviews were conducted in the Tsimane' language with the help of a research assistant, Mosetén and Interculturales interviews in Spanish by the researcher. Tsimane' interviews were translated from Spanish to Tsimane' and back-translated until concepts were conveyed consistently in both languages. The order of different sections was counterbalanced across six versions of the interview; questions within each section were randomized. Interviews were conducted in two parts across two different days. An attempt was made to sample one adult from each household in each community, with an equal number of male and female participants. Individuals who engaged in more wage labor or sold more produce may have been less likely to be at home than other members of the community; to compensate for this, households whose members were absent were re-visited at regular intervals in an attempt to interview these individuals. Instructions for the economic game were given at the beginning of the second interview using example individual recipients (cartoon faces named Juan, Carlos, and Patricia) and U.S. pennies in place of *bolivianos* (*Bs*). To ascertain participant understanding, two possible allocations were demonstrated and participants were asked to tell the researcher how much each group or individual would receive in each circumstance. The researcher proceeded only if a participant correctly reported the amounts; if they did not, the researcher repeated the instructions for the experiment and demonstrated a third allocation. Participants were compensated with household gifts equivalent in value to one hour's wages for each interview.

Supplementary Methods 3 – Additional variables

Donor resource access. Participants' access to sufficient basic household resources (e.g., regular harvests) was measured as self-reported food security (Supplementary Methods 4), personal illness lasting three days or more in the past month, dependency (number of children living in the home), and whether production and earnings during the previous month were the same, higher, or lower than normative for the household. A summary measure of food security, dependency, and normal income/production was constructed by including all three in a principal components analysis and extracting the first component (variance explained=47.3%). Recent illness did not load on this factor and is thus considered separately.

Aspects of participants' material style of life (Bindon, Knight, Dressler, & Crews, 1997), including subjective socioeconomic status relative to others in their community (Adler, Epel, Castellazzo, & Ickovics, 2000), were obtained by interview. Household net income was calculated from participants' self-reported earnings and expenditures on debts and wages over the last month. Participants also identified the quantity of popular market possessions owned by their household (Supplementary Methods 5). Current price was used to ascribe dollar amounts to market possessions. Because a participant's comparison of herself to others in her community may affect whether she believes she can access more resources elsewhere (Dressler, Balieiro, & dos Santos, 1998), net income and dollar amount invested in market possessions were converted to z-scores at the sample level.

These three measures load together in a principal components analysis, but had differing effects in a previous paper (Pisor & Gurven, n.d.); as such, we included each of these three variables as separate predictors in each model. A fourth variable is less a proxy for household integration to the market (i.e., it does not load on the aforementioned principal component) but rather an indicator of alternative production strategies. Participants were asked if they engaged in *ayni* – traditional cooperative labor often used to harvest rice –in the previous year.

Social network support. To capture whether participants had existing social connections that could buffer shortfalls affecting their local community, participants were asked whether they could stay with a family outside their local community (i.e., in their natal community or in the local market town) during a hypothetical flood affecting their household. Whether participants could ask someone from a family outside their local community for a loan of B100 (1.5 to 2 days' wages) mattered in past analyses (Pisor & Gurven, n.d.), however this measure could not be incorporated here due to issues with collinearity.

Personality and risk. Actors who are higher on Agreeableness (as defined by the HEXACO model) are more likely to be cooperative while those higher on Extraversion more likely to build more social alliances (Ashton & Lee, 2007; Denissen & Penke, 2008; Nettle, 2006). Risk aversion may cut both ways: ability to avoid risk and delay reward could prevent initial investment in new relationships with complete strangers, while on the other hand forging new relationships with high quality partners could reflect a long-term strategy (ibid). As such, we include Agreeableness, Extraversion (Denissen & Penke, 2008), and risk aversion

(Zaleskiewicz, 2001) in all models; questions subsets used in analyses appear in Supplementary Methods 6.

Other controls. We controlled for frequency of church attendance in the past month, as attendance could increase in-group favoritism (Sosis & Ruffle, 2003) or increase the likelihood that participants felt their actions might be observed by an omniscient god (Shariff & Norenzayan, 2007). Sex differences in generosity and cooperativeness are prevalent (Balliet, Li, Macfarlan, & Van Vugt, 2011) and cohort effects on trust have been reported (Putnam, 1995), so we included both sex and age in all models. Education increases exposure to information about out-groups, whether positive or negative in content; also, participants seeking additional resources through out-groups may build their human capital to attain access. Because of these possibilities, we controlled for a participant's highest level of schooling. Mate search may increase out-group exposure, although it is not consistently associated with marital status in the Bolivian context; however, marital status had no effect and caused collinearity in some models, so it is excluded from the analyses reported here.

Supplementary Methods 4 – Food security questionnaire as adapted from (Bickel, Nord, Price, Hamilton, & Cook, 2000)

Scoring: Responding "always" to a given question was given a score of 1, "never" a score of 0, and "sometimes" a score of 0.5. Scores were summed across questions.

1. In the last 12 months, how frequently did you think the food in your household would run out before you could get more? Always, sometimes, or never?

(Spanish) *En los últimos 12 meses, con qué frecuencia pensabas que la comida/los viveres de tu casa va a acabar antes de podrías sacar más? Siempre, a veces, o nunca?*

(Tsimane') *Oij yomodye' jiyaques, jun buty quim' ca dyijyim paj qui moyam jibitidyes aca'yadyes mi aty räi' ya, janas qui buty daque mdyijyica' mi mo'ra jibitidyes mi a aty jam bura' jam dami? Räjcan, are' jämdye'ya', are' jam jam yiri'?*

2. In the last 12 months, how frequently did the food in your household run out and you could not get more? Always, sometimes, or never?

En los últimos 12 meses, con qué frecuencia acabó la comida/los viveres de tu casa y no podías sacar más? Siempre, a veces, o nunca?

Oij yomodye' jiyaques, jun buty quim' aty räi' jibitidyes aca'ya'dyes mi, aty jam jun buyi quim dacân dam dyem? Räjcan, are' jämdye'ya', are' jam jam yiri'?

3. In the last 12 months, how frequently could you not provide a complete diet for your household? Always, sometimes, or never?

En los últimos 12 meses, con qué frecuencia no podías sacar comida completa/viveres completos para tu casa?

Oij yómodye' jiyaques, aty buty quim jam cuts jibiti'dyes aca'ya'dyes mi? Räjcan, are' jämdye'ya', are' jam jam yiri'?

4. In the last 12 months, how frequently did your household only have a few kinds of inexpensive food or food that was not tasty because you could not get more? Always, sometimes, or never?

En los últimos 12 meses, con qué frecuencia tenía tu casa solamente unos tipos de comida/viveres barata o comida/viveres de mal sabor porque no podías sacar más? Siempre había comida buena? Siempre, a veces, o nunca?

Oij yomodye' jiyaques, jedye ca momo mo'ya aca'ya' mi, are' mo' dyi' momo' jibitidyes mi? Räjcan, are' jämdye'ya', are' jam jam yiri'?

Supplementary Methods 5 – Popular market possessions as assessed during pilot ethnographic research

- Mosetén and Interculturales: Cars/trucks, TVs, satellites, stores or small restaurants, refrigerators or freezers, cell phones, chainsaws, string trimmers.
- Tsimane': Outboard motors, TVs, cell phones, chainsaws.

Supplementary Methods 6 – Personality and risk measures

Scoring: Items were scored on a five point scale, with "true" responses scored as 5 and "false" scored as 1. Scores were summed across questions.

- **Risk, adapted from (Zaleskiewicz, 2001)**

1. You take risks only if it is necessary to achieve something. True, almost true, somewhat true, almost false, or false?

(Spanish) *Tomas riesgo solamente si es necesaria para lograr algo. Verdadero, casi verdadero, intermedio, casi falso, o falso?*

(Tsimane') *Me tsan anic carij midyes miqui nac anic jemoñe si' mi tupuj me'jetaque' mi. Anic me' o me' o dam' momo o jam o jam yirity?*

2. You do not like to do things whose results depend too much on chance. If something depends a lot on chance, you do not do it. True, almost true, somewhat true, almost false, or false?

No quieres hacer cosas cuyos resultados dependen demasiado mucho en la suerte. Si algo depende mucho en la suerte, no lo haces. Verdadero, casi verdadero, intermedio, casi falso, o falso?

Tupuj dyäcje mi mo carijtaqui mi jam juiya mujucha tuyin bijodye jeñej mo' in cätidye in metsam mo'ya' tupudye jam qui nac jämi' ya in. Anic me' o me' o dam' momo o jam o jam yirity?

3. Do you prefer work for a larger wage that can end any day more than stable work with a smaller wage, for example, contract work that does not pay you well? True, almost true, somewhat true, almost false, or false?

Prefieres más un trabajo por un sueldo más grande que se puede terminar cualquier día o un trabajo estable con un sueldo más pequeño, por ejemplo, un trabajo con contracto que no te paga bien? El primero, el segundo, o los dos por igual?

Ma'je' buty mi yiris carijtacdye yirity tum yaitacdye jämtyi, jam cavin räi'si' mo tacya chime moya carijtacdye damsi yaitacdye, ejemplo carijtacdye contrato in?

4. To achieve in life, you need to take risks. True, almost true, somewhat true, almost false, or false?

Para lograr algo en esta vida, necesitas tomar riesgos. Verdadero, casi verdadero, intermedio, casi falso, o falso?

Paj qui jäm' joij ve juijya' mi jemoñe buty mi me'je metsan' carij midyes. Anic me' o me' o dam' momo o jam o jam yirity?

- **Agreeableness, adapted from (Denissen & Penke, 2008)**

1. You do not want to help other people if helping them will disadvantage you. If it will cost you, you will not help others. True, almost true, somewhat true, almost false, or false?

No quieres ayudar a otras personas si esa ayuda lleva desventajas para ti. Si hay un gasto para ti, no vas a ayudarles. Verdadero, casi verdadero, intermedio, casi falso, o falso?

Jam adac ma'je notacsi yoctyi muntyi in, mo qui nam notacdye' mi jam jäm juijya midyes. Anic me' o me' o dam' momo o jam o jam yirity?

2. You like to be generous without expecting a service in return. True, almost true, somewhat true, almost false, or false?

Te gusta ser generoso sin esperar un servicio a cambio. Verdadero, casi verdadero, intermedio, casi falso, o falso?

Ma'je buty mi pajqui so'macsity jedye' mi, jam bisem yoctyis notacdye. Anic me' o me' o dam' momo o jam o jam yirity?

3. Your well-being is more important to you than the problems of other people. True, almost true, somewhat true, almost false, or false?

Tu bienestar es más importante a ti como los problemas de otras personas. Verdadero, casi verdadero, intermedio, casi falso, o falso?

Mo' jäm'jodye' anic buty jemonac cui dyes midyes mi, jam jeñej mu in carijsistumtyi' yoctyi muntyi' in. Anic me' o me' o dam' momo o jam o jam yirity?

4. You would help other people even if you have serious problems of your own. True, almost true, somewhat true, almost false, or false?

Todavía ayudes a otra gente aunque tienes tus propios problemas graves. Verdadero, casi verdadero, intermedio, casi falso, o falso?

Taca' buty nótacsi yoctyi' muntyi' mi, me'tsan' mis mo'ya' cui'si' carijsis anic are'sis. Anic me' o me' o dam' momo o jam o jam yirity?

- **Extraversion, adapted from (Denissen & Penke, 2008)**

1. When you are together with a lot of people, you prefer to be apart from them. True, almost true, somewhat true, almost false, or false?

Cuando tú estás junto a muchas personas prefieres que quedarte fuera de ellos. Verdadero, casi verdadero, intermedio, casi falso, o falso?

Me' juijya mi mu'ya yiri'ya daityiya muntyi' in, tupuj buty jäquive bu'yi mi jorajyayeban mu in ya in. Anic me' o me' o dam' momo o jam o jam yirity?

2. You feel better when there are a lot of people around you. True, almost true, somewhat true, almost false, or false?

Sientes mejor cuando hay muchas personas cerca de ti. Verdadero, casi verdadero, intermedio, casi falso, o falso?

Jäm' cuti mi me' mu'ya' dai' muntyi' in tyeijya juijya in. Anic me' o me' o dam' momo o jam o jam yirity?

3. You feel better when you are alone. True, almost true, somewhat true, almost false, or false?

Sientes mejor cuando estás solo. Verdadero, casi verdadero, intermedio, casi falso, o falso?

Jämyi buty mi yirity dyety juijyam. Anic me' o me' o dam' momo o jam o jam yirity?

4. You always have fun meeting new people. True, almost true, somewhat true, almost false, or false?

Siempre te diviertes a conocer personas nuevas. Verdadero, casi verdadero, intermedio, casi falso, o falso?

Räjĉan buty ma'jotacsi mi quimdyem atysijtyi' muntyi' in. Anic me' o me' o dam' momo o jam o jam yirity?

Supplementary Table 1a. Descriptive statistics for continuous variables at the sample level.

Variables	Mean	SD	Minimum	Maximum	N***	N****
Donor ethnic grp. % size	0.57	0.29	0.02	0.94	492	---
Donor relig. grp. % size	0.54	0.25	0.07	0.83	495	---
Log ratio recip. to donor ethnic grp. size	-4.16	2.61	-6.91	1.04	246	---
Log ratio recip. to donor relig. grp. size	-1.09	1.23	-2.34	2.34	249	---
No. places lived	3.21	1.91	0.00	8.00	492	157
*No. places visited**	0.00	0.96	-1.04	3.12	492	157
*Hours of TV per week**	-0.01	0.96	-0.81	3.14	495	158
Consensus "goodness"	1.45	0.33	0.00	2.00	486	---
Consensus wealth	1.58	0.36	0.00	3.00	487	---
Consensus friendship interest	0.48	0.22	0.00	1.00	487	---
Consensus willingness to trust	1.30	0.34	0.00	2.00	487	---
*Net household income**	-0.10	0.92	-2.25	3.58	495	158
*Market items owned**	0.01	1.01	-1.16	2.55	495	158
log Subjective SES	1.04	0.70	0.00	2.30	495	158
Shortfall summary	-0.02	1.21	-2.40	2.79	495	158
Agreeableness	8.22	3.35	0.00	17.00	495	158
Extraversion	6.20	2.51	0.00	13.00	495	158
Risk aversion	7.39	2.95	0.00	12.00	495	158
*Age***	22.27	14.14	0.00	67.00	495	158
Years of school	6.89	4.42	0.00	16.00	492	157
Times attends chuch per mo.	1.85	1.77	0.00	5.00	495	158
Bolivianos allocated	2.21	1.81	0.00	8.72	474	---

*z-scored at the sample level. **Centered at age 18; for example, the mean age of the sample, 40.27, is reported as 22.27 above. ***Number of observations, as in number of candidate recipients. ****Total number of donors.

Supplementary Table 1b. Descriptive statistics for categorical variables at the sample level.

Variables	Level 1	Level 2	Level 3	Level 4	N*	N	Descriptions
Benefits	414 (84%)	81 (16%)			495	158	1=other, 2=resources
Costs	369 (75%)	48 (10%)	36 (7%)	42 (8%)	495	158	1=other, 2=competition, 3=no MI, 4=none
Parents knew out-group	444 (94%)	30 (6%)			474	155	1=no, 2=yes
Perceived "goodness"	79 (17%)	105 (23%)	282 (61%)		466	149	1=bad person, 2=a little good, 3=good person
Perceived wealth	48 (10%)	169 (37%)	245 (53%)		462	147	1=no money, 2=some money, 3=money
Interest in friendship	274 (55%)	221 (45%)			495	158	1=not interested, 2=interested
Willingness to trust	111 (23%)	103 (22%)	260 (55%)		474	151	1=would not trust, 2=could trust a little, 3=could trust
Lodging during flood	141 (28%)	354 (72%)			495	158	1=no, 2=yes
No traditional labor	294 (59%)	201 (41%)			495	158	1=yes, traditional labor, 2=no traditional labor
Recent illness	411 (83%)	84 (17%)			495	158	1=no, 2=yes
Sex: male	228 (46%)	267 (54%)			495	158	1=no, 2=yes
Shared name	159 (32%)	336 (68%)			495	158	1=no, 2=yes
Population	168 (34%)	180 (36%)	147 (30%)		495	158	1=Intercultural, 2=Mosetén, 3=Tsimane'

*Number of observations.

Supplementary Table 2a. Descriptive statistics for continuous variables among the Interculturales.

Variables	Mean	SD	Minimum	Maximum	N***	N
Donor ethnic grp. % size	0.51	0.22	0.02	0.64	168	---
Donor relig. grp. % size	0.38	0.09	0.18	0.43	168	---
Log ratio recip. to donor ethnic grp. size	-6.38	1.85	-6.91	0.00	78	---
Log ratio recip. to donor relig. grp. size	0.08	0.27	-0.07	0.88	90	---
No. places lived	3.84	1.51	1.00	8.00	168	53
*No. places visited**	0.44	1.15	-1.04	3.12	168	53
*Hours of TV per week**	0.10	1.04	-0.81	3.14	168	53
Consensus "goodness"	1.54	0.24	0.58	2.00	165	---
Consensus wealth	1.55	0.30	0.78	2.18	165	---
Consensus friendship interest	0.54	0.18	0.14	1.00	165	---
Consensus willingness to trust	1.38	0.27	0.58	2.00	165	---
*Net household income**	-0.10	1.07	-2.25	3.58	168	53
*Market items owned**	0.47	1.14	-1.02	2.55	168	53
log Subjective SES	0.90	0.65	0.00	1.95	168	53
Shortfall summary	-0.56	1.02	-2.40	1.75	168	53
Agreeableness	7.30	3.01	1.00	15.00	168	53
Extraversion	6.18	2.40	1.00	12.00	168	53
Risk aversion	7.30	2.55	0.00	12.00	168	53
*Age***	26.23	15.38	2.00	63.00	168	53
Years of school	8.21	4.11	0.00	15.00	168	53
Times attends church per mo.	1.43	1.78	0.00	5.00	168	53
Bolivianos allocated	2.76	1.69	0.00	8.72	159	52

*z-scored at the sample level. **Centered at age 18. ***Number of observations.

Supplementary Table 2b. Descriptive statistics for categorical variables among the Interculturales.

Variables	Level 1	Level 2	Level 3	Level 4	N*	N	Descriptions
Benefits	150	18			168	53	1=other, 2=resources
Costs	132	6	27	3	168	53	1=other, 2=competition, 3=no MI, 4=none
Parents knew out-group	150	9			159	52	1=no, 2=yes
Perceived "goodness"	18	35	104		157	50	1=bad person, 2=a little good, 3=good person
Perceived wealth	10	51	92		153	48	1=no money, 2=some money, 3=money
Interest in friendship	72	96			168	53	1=not interested, 2=interested
Willingness to trust	38	39	85		162	51	1=would not trust, 2=could trust a little, 3=could trust
Lodging during flood	54	114			168	53	1=no, 2=yes
No traditional labor	63	105			168	53	1=yes, traditional labor, 2=no traditional labor
Recent illness	153	15			168	53	1=no, 2=yes
Sex: male	57	111			168	53	1=no, 2=yes
Shared name	69	99			168	53	1=no, 2=yes

*Number of observations.

Supplementary Table 3a. Descriptive statistics for continuous variables among the Mosetén.

Variables	Mean	SD	Minimum	Maximum	N***	N
Donor ethnic grp. % size	0.37	0.16	0.04	0.48	180	---
Donor relig. grp. % size	0.71	0.26	0.08	0.83	180	---
Log ratio recip. to donor ethnic grp. size	-1.64	0.95	-3.01	1.04	108	---
Log ratio recip. to donor relig. grp. size	-1.67	1.42	-2.34	2.34	72	---
No. places lived	3.97	1.83	1.00	8.00	180	56
*No. places visited**	0.02	0.93	-1.04	3.12	180	56
*Hours of TV per week**	0.45	0.94	-0.81	3.14	180	56
Consensus "goodness"	1.57	0.25	0.75	2.00	175	---
Consensus wealth	1.68	0.41	0.00	3.00	176	---
Consensus friendship interest	0.56	0.24	0.00	1.00	176	---
Consensus willingness to trust	1.44	0.33	0.50	2.00	176	---
*Net household income**	0.10	1.03	-1.28	3.58	180	56
*Market items owned**	0.14	0.99	-1.17	2.40	180	56
log Subjective SES	1.12	0.77	0.00	2.30	180	56
Shortfall summary	-0.19	1.13	-2.40	2.78	180	56
Agreeableness	7.42	2.84	1.00	13.00	180	56
Extraversion	6.18	2.65	1.00	13.00	180	56
Risk aversion	6.90	3.25	0.00	12.00	180	56
*Age***	19.93	11.09	2.00	46.00	180	56
Years of school	8.73	3.86	1.00	16.00	180	56
Times attends chuch per mo.	1.97	1.62	0.00	5.00	180	56
Bolivianos allocated	2.59	1.47	0.00	8.72	168	54

*z-scored at the sample level. **Centered at age 18. ***Number of observations.

Supplementary Table 3b. Descriptive statistics for categorical variables among the Mosetén.

Variables	Level 1	Level 2	Level 3	Level 4	N	N	Descriptions
Benefits	147	33			180	56	1=other, 2=resources
Costs	123	21	3	33	180	56	1=other, 2=competition, 3=no MI, 4=none
Parents knew out-group	162	6			168	54	1=no, 2=yes
Perceived "goodness"	12	37	125		174	54	1=bad person, 2=a little good, 3=good person
Perceived wealth	9	54	111		174	54	1=no money, 2=some money, 3=money
Interest in friendship	78	102			180	56	1=not interested, 2=interested
Willingness to trust	25	29	123		177	55	1=would not trust, 2=could trust a little, 3=could trust
Lodging during flood	42	138			180	56	1=no, 2=yes
No traditional labor	126	54			180	56	1=yes, traditional labor, 2=no traditional labor
Recent illness	132	48			180	56	1=no, 2=yes
Sex: male	108	72			180	56	1=no, 2=yes
Shared name	60	120			180	56	1=no, 2=yes

*Number of observations.

Supplementary Table 4a. Descriptive statistics for continuous variables among the Tsimane'.

Variables	Mean	SD	Minimum	Maximum	N***	N
Donor ethnic grp. % size	0.90	0.18	0.03	0.94	144	---
Donor relig. grp. % size	0.50	0.23	0.07	0.68	147	---
Log ratio recip. to donor ethnic grp. size	-5.81	1.11	-6.91	-4.71	60	---
Log ratio recip. to donor relig. grp. size	-1.82	0.59	-2.30	0.00	87	---
No. places lived	1.54	1.29	0.00	5.00	144	48
*No. places visited**	-0.53	0.26	-1.04	0.49	144	48
*Hours of TV per week**	-0.71	0.18	-0.81	-0.13	147	49
Consensus "goodness"	1.21	0.37	0.00	1.76	146	---
Consensus wealth	1.49	0.31	0.33	3.00	146	---
Consensus friendship interest	0.33	0.14	0.00	0.55	146	---
Consensus willingness to trust	1.05	0.30	0.00	1.45	146	---
*Net household income**	-0.35	0.31	-0.56	0.71	147	49
*Market items owned**	-0.65	0.33	-1.16	-0.08	147	49
log Subjective SES	1.09	0.67	0.00	2.20	147	49
Shortfall summary	0.81	1.05	-2.04	2.73	147	49
Agreeableness	10.24	3.46	0.00	17.00	147	49
Extraversion	6.24	2.46	0.00	12.00	147	49
Risk aversion	8.10	2.88	0.00	12.00	147	49
*Age***	20.61	15.08	0.00	67.00	147	49
Years of school	3.04	2.77	0.00	12.00	144	48
Times attends church per mo.	2.18	1.87	0.00	5.00	147	49
Bolivianos allocated	1.23	1.89	0.00	8.72	147	49

*z-scored at the sample level. **Centered at age 18. ***Number of observations.

Supplementary Table 4b. Descriptive statistics for categorical variables among the Tsimane'.

Variables	Level 1	Level 2	Level 3	Level 4	N	N	Descriptions
Benefits	117	30			147	49	1=other, 2=resources
Costs	114	21	6	6	147	49	1=other, 2=competition, 3=no MI, 4=none
Parents knew out-group	132	15			147	49	1=no, 2=yes
Perceived "goodness"	49	33	53		135	45	1=bad person, 2=a little good, 3=good person
Perceived wealth	29	64	42		135	45	1=no money, 2=some money, 3=money
Interest in friendship	124	23			147	49	1=not interested, 2=interested
Willingness to trust	48	35	52		135	45	1=would not trust, 2=could trust a little, 3=could trust
Lodging during flood	45	102			147	49	1=no, 2=yes
No traditional labor	105	42			147	49	1=yes, traditional labor, 2=no traditional labor
Recent illness	126	21			147	49	1=no, 2=yes
Sex: male	63	84			147	49	1=no, 2=yes
Shared name	30	117			147	49	1=no, 2=yes

Supplementary Table 5. Average *bolivianos* allocated to an out-group candidate recipient by predictor variable.

Variables	Level 1 Mean (SD)	Level 2 Mean (SD)	Level 3 Mean (SD)	Level 4 Mean (SD)	N*	N	Descriptions
Benefits	2.20 (1.78)	2.16 (1.83)			418	142	1=other, 2=resources
Costs	2.21 (1.84)	1.44 (1.34)	2.77 (2.83)	2.31 (1.05)	418	142	1=other, 2=competition, 3=no MI, 4=none
Parents knew focal out-group	2.25 (1.80)	1.39 (1.43)			418	142	1=no, 2=yes
Lodging during flood	2.38 (1.75)	2.11 (1.80)			418	142	1=no, 2=yes
No traditional labor	2.26 (1.71)	2.09 (1.90)			418	142	1=yes, traditional labor, 2=no traditional labor
Recent illness	2.32 (1.84)	1.61 (1.36)			418	142	1=no, 2=yes
Sex: male	2.04 (1.71)	2.32 (1.84)			418	142	1=no, 2=yes
Shared name	2.25 (1.69)	2.16 (1.83)			418	142	1=no, 2=yes
Population	2.78 (1.70)	2.47 (1.39)	1.23 (1.89)		418	142	1=Intercultural, 2=Mosetén, 3=Tsimane'

Supplementary Table 6. Predicted amounts given to out-group members among participants who differentiated, controlling for mean given to in-group recipients.

	Estimate	S.E.	p value
(Intercept)	3.33	1.75	0.06
A little good	0.23	0.50	0.65
Good person	0.90	0.45	0.05
Has some money	1.15	0.51	0.02
Has money	0.44	0.50	0.38
Donor ethnic grp. % size	-0.71	0.99	0.48
Donor relig. grp. % size	-0.85	0.90	0.35
Benefits: Resources	1.73	0.57	0.00
Parents knew out-group	-2.17	0.73	0.01
No. places lived	-0.02	0.14	0.91
*No. places visited**	0.27	0.21	0.21
*Hours of TV per week**	0.00	0.18	0.99
Lodging during flood	-0.19	0.47	0.69
*Net household income**	0.18	0.17	0.29
*Market items owned**	-0.01	0.25	0.96
log Subjective SES	-0.27	0.27	0.32
No traditional labor	-0.11	0.38	0.78
Shortfall summary	-0.13	0.19	0.52
Recent illness	-0.28	0.63	0.66
Agreeableness	0.00	0.06	0.96
Extraversion	0.07	0.08	0.43
Risk aversion	-0.01	0.06	0.84
*Age***	0.02	0.02	0.25
Years of school	0.05	0.07	0.47
Sex: male	-0.73	0.45	0.11
Times attends church per mo.	0.12	0.13	0.39
Shared name with recips.	-0.41	0.47	0.38
Mean amt. to I-G recips.	-0.45	0.19	0.02

AIC=757.36. Number of observations=174. Number of participants=58. *z-scored at the sample level. **Centered at age 18.

Supplementary Table 7. Predicted amounts given to out-group members among participants who differentiated, with recipient consensus “goodness” and wealth as predictors.

	Estimate	S.E.	p value
(Intercept)	2.73	1.47	0.07
Consensus "goodness"	0.47	0.46	0.30
Consensus wealth	0.72	0.38	0.06
Donor ethnic grp. % size	-1.18	0.82	0.16
Donor relig. grp. % size	-0.30	0.71	0.68
Benefits: Resources	0.57	0.41	0.17
Parents knew out-group	-1.01	0.71	0.16
No. places lived	0.03	0.11	0.81
*No. places visited**	0.17	0.20	0.40
*Hours of TV per week**	0.05	0.18	0.78
Lodging during flood	-0.39	0.37	0.30
*Net household income**	0.07	0.16	0.66
*Market items owned**	0.17	0.19	0.39
log Subjective SES	-0.48	0.23	0.04
No traditional labor	-0.25	0.34	0.47
Shortfall summary	-0.16	0.16	0.31
Recent illness	-0.79	0.51	0.13
Agreeableness	-0.01	0.05	0.91
Extraversion	-0.01	0.07	0.88
Risk aversion	0.04	0.06	0.46
*Age***	-0.01	0.01	0.50
Years of school	-0.04	0.06	0.48
Sex: male	-0.09	0.40	0.83
Times attends church per mo.	0.08	0.10	0.43
Shared name with recips.	0.06	0.39	0.87

AIC=1046.04. Number of observations=216. Number of participants=72. *z-scored at the sample level. **Centered at age 18.

Supplementary Table 8a. Predicted amounts given to out-group members among participants who differentiated, with interest in friendship as a predictor

	Estimate	S.E.	p value
(Intercept)	3.80	1.41	0.01
Interest in friendship	0.10	0.32	0.76
Has some money	0.66	0.50	0.19
Has money	-0.27	0.49	0.58
Donor ethnic grp. % size	-1.31	0.86	0.14
Donor relig. grp. % size	-0.53	0.70	0.45
Benefits: Resources	0.88	0.43	0.04
Parents knew out-group	-1.30	0.73	0.08
No. places lived	-0.02	0.11	0.83
*No. places visited**	0.17	0.19	0.38
*Hours of TV per week**	-0.06	0.17	0.70
Lodging during flood	-0.27	0.39	0.48
*Net household income**	0.07	0.15	0.64
*Market items owned**	0.13	0.19	0.52
log Subjective SES	-0.42	0.23	0.08
No traditional labor	-0.39	0.35	0.27
Shortfall summary	-0.09	0.16	0.61
Recent illness	-0.51	0.52	0.33
Agreeableness	0.00	0.05	0.96
Extraversion	0.01	0.07	0.86
Risk aversion	0.03	0.06	0.57
*Age***	0.00	0.02	0.82
Years of school	0.03	0.06	0.64
Sex: male	-0.16	0.41	0.70
Times attends church per mo.	0.02	0.11	0.83
Shared name with recips.	0.06	0.39	0.88

AIC=982.61. Number of observations=219. Number of participants=73. *z-scored at the sample level. **Centered at age 18.

Supplementary Table 8b. Predicted amounts given to out-group members among participants who differentiated, with willingness to trust as a predictor.

	Estimate	S.E.	p value
(Intercept)	3.79	1.44	0.01
Could trust a little	0.00	0.47	0.99
Could trust	0.35	0.44	0.42
Has some money	0.56	0.51	0.28
Has money	-0.34	0.50	0.49
Donor ethnic grp. % size	-1.16	0.87	0.19
Donor relig. grp. % size	-0.71	0.70	0.32
Benefits: Resources	0.88	0.43	0.05
Parents knew out-group	-1.37	0.73	0.07
No. places lived	-0.05	0.11	0.65
*No. places visited**	0.21	0.19	0.27
*Hours of TV per week**	-0.08	0.17	0.62
Lodging during flood	-0.28	0.39	0.48
*Net household income**	0.11	0.15	0.45
*Market items owned**	0.14	0.19	0.48
log Subjective SES	-0.43	0.23	0.07
No traditional labor	-0.44	0.35	0.21
Shortfall summary	-0.08	0.16	0.65
Recent illness	-0.41	0.51	0.43
Agreeableness	-0.01	0.05	0.87
Extraversion	0.03	0.07	0.65
Risk aversion	0.02	0.06	0.68
*Age***	0.00	0.02	0.77
Years of school	0.05	0.06	0.48
Sex: male	-0.14	0.41	0.73
Times attends church per mo.	0.03	0.11	0.82
Shared name with recips.	-0.03	0.40	0.94

AIC=983.19. Number of observations=219. Number of participants=73. *z-scored at the sample level. **Centered at age 18.

Supplementary Table 9. Predicted amounts given to out-group members among **all** participants

	Estimate	S.E.	p value
(Intercept)	2.93	0.86	0.00
Could trust a little	0.01	0.25	0.96
Could trust	0.52	0.21	0.02
Has some money	0.60	0.26	0.02
Has money	0.13	0.26	0.61
Donor ethnic grp. % size	-0.77	0.46	0.10
Donor relig. grp. % size	-0.28	0.45	0.53
Benefits: Resources	0.60	0.31	0.06
Costs: Competition	-0.86	0.37	0.02
Costs: No market access	0.14	0.40	0.72
Costs: None	-0.40	0.38	0.30
Parents knew out-group	-1.13	0.43	0.01
No. places lived	0.18	0.06	0.01
*No. places visited**	0.12	0.12	0.29
*Hours of TV per week**	0.14	0.11	0.21
Lodging during flood	0.11	0.11	0.32
*Net household income**	0.05	0.11	0.66
*Market items owned**	-0.35	0.15	0.02
log Subjective SES	-0.35	0.23	0.12
No traditional labor	-0.46	0.21	0.03
Shortfall summary	-0.16	0.09	0.09
Recent illness	-0.89	0.28	0.00
Agreeableness	0.01	0.03	0.83
Extraversion	-0.02	0.04	0.64
Risk aversion	0.00	0.03	0.95
Age	0.00	0.01	0.91
Years of school	-0.02	0.03	0.41
Sex: male	-0.09	0.23	0.71
Times attends church per mo.	0.05	0.06	0.46
Shared name with recips.	0.07	0.22	0.74

AIC=1847.12. Number of observations=462. Number of participants=157. *z-scored at the sample level. **Centered at age 18.

Supplementary Table 10. Predicted amounts given to out-group members among **all** participants, controlling for mean given to in-group recipients

	Estimate	S.E.	p value
(Intercept)	1.66	1.09	0.13
Could trust a little	0.13	0.25	0.60
Could trust	0.61	0.22	0.01
Has some money	1.03	0.29	0.00
Has money	0.56	0.29	0.05
*Donor ethnic grp. % size**	-0.57	0.53	0.28
*Donor relig. grp. % size**	-0.19	0.55	0.73
Benefits: Resources	0.41	0.36	0.26
Costs: Competition	-0.39	0.52	0.45
Costs: No market access	0.41	0.44	0.35
Costs: None	-0.16	0.46	0.72
Parents knew out-group	-0.66	0.50	0.19
No. places lived	0.26	0.08	0.00
*No. places visited***	0.05	0.14	0.70
*Hours of TV per week***	0.15	0.12	0.22
Lodging during flood	0.09	0.13	0.52
*Net household income***	0.00	0.15	0.98
*Market items owned***	-0.31	0.19	0.12
log Subjective SES	-0.19	0.29	0.52
No traditional labor	-0.53	0.25	0.04
Shortfall summary	-0.07	0.12	0.57
Recent illness	-1.11	0.34	0.00
Agreeableness	0.04	0.04	0.40
Extraversion	-0.05	0.05	0.30
Risk aversion	-0.02	0.05	0.65
Age	0.00	0.01	0.71
Years of school	-0.02	0.04	0.51
Sex: male	-0.20	0.27	0.46
Times attends church per mo.	0.02	0.08	0.83
Shared name with recips.	0.22	0.26	0.40
Mean amt. to I-G recips.	0.04	0.10	0.71

AIC=1345.61. Number of observations=354. Number of participants=118.

Supplementary Table 11a. Predicted amounts given to out-group members among all participants, including ratio of recipient to donor ethnic group size

	Estimate	S.E.	p value
(Intercept)	0.88	1.28	0.49
Could trust a little	0.26	0.42	0.54
Could trust	0.69	0.35	0.05
Has some money	1.29	0.43	0.00
Has money	0.42	0.43	0.33
log ratio recip. to donor grp. size, ***ethnic***	-0.07	0.07	0.37
Benefits: Resources	0.19	0.33	0.57
Parents knew out-group	-0.94	0.65	0.15
No. places lived	0.13	0.09	0.19
*No. places visited**	0.03	0.20	0.90
*Hours of TV per week**	0.35	0.16	0.03
Lodging during flood	0.22	0.17	0.21
*Net household income**	-0.02	0.16	0.90
*Market items owned**	-0.13	0.22	0.56
log Subjective SES	-0.66	0.38	0.09
No traditional labor	-0.11	0.35	0.76
Shortfall summary	0.03	0.14	0.82
Recent illness	-1.14	0.46	0.02
Agreeableness	0.03	0.05	0.59
Extraversion	0.02	0.06	0.73
Risk aversion	-0.02	0.05	0.67
*Age***	0.01	0.01	0.59
Years of school	0.03	0.05	0.57
Sex: male	-0.28	0.42	0.50
Times attends church per mo.	-0.03	0.10	0.74
Shared name with recips.	0.32	0.30	0.30

AIC=885.92. Number of observations=216. Number of participants=72.

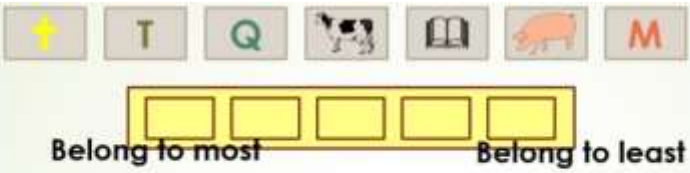
Supplementary Table 11b. Predicted amounts given to out-group members among all participants, including ratio of recipient to donor religious group size

	Estimate	S.E.	p value
(Intercept)	2.38	1.08	0.03
Could trust a little	0.18	0.32	0.57
Could trust	0.68	0.28	0.02
Has some money	0.05	0.37	0.90
Has money	-0.10	0.36	0.79
log ratio recip. to donor grp. size, ***religious***	0.09	0.14	0.51
Benefits: Resources	1.61	1.05	0.13
Parents knew out-group	-0.68	0.50	0.18
No. places lived	0.26	0.10	0.01
*No. places visited**	-0.01	0.17	0.97
*Hours of TV per week**	-0.23	0.15	0.14
Lodging during flood	0.32	0.14	0.02
*Net household income**	-0.04	0.19	0.82
*Market items owned**	-0.33	0.23	0.16
log Subjective SES	0.37	0.35	0.30
No traditional labor	-0.53	0.31	0.09
Shortfall summary	-0.17	0.14	0.22
Recent illness	-0.31	0.36	0.39
Agreeableness	-0.05	0.05	0.35
Extraversion	-0.07	0.07	0.27
Risk aversion	-0.07	0.06	0.25
*Age***	0.02	0.01	0.08
Years of school	-0.03	0.04	0.48
Sex: male	0.15	0.32	0.63
Times attends church per mo.	0.06	0.08	0.43
Shared name with recips.	-0.39	0.36	0.28

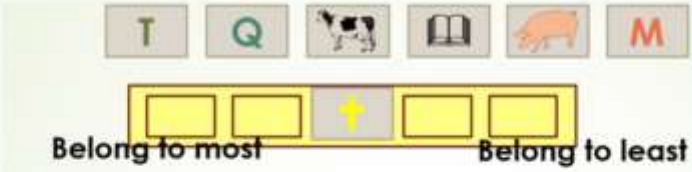
AIC=824.83. Number of observations=210. Number of participants=70.

Supplementary Figure 1. Participants sorted cards representing local ethnic groups, churches, and work cooperatives on a scale from “groups I belong to most” to “groups I belong to least”; the yellow scale was oriented in front of the participant such that the rectangle for “groups I belong to most” was closest to him or her and the rectangle for “groups I belong to least” was furthest away. Participants had to sort all the cards on the scale, but could leave as many or as few in each rectangle as they wished. The figure below shows sorting in stages as the participant places the cards in the rectangles. The number of groups in the card sort was determined by the number of locally salient groups: 9 for the Tsimane’, 10 for the Mosetén, and 12 for the Interculturales. Some are religious organizations (e.g., Catholics are a cross, Nazarenes are a Bible), some are ethnic groups (e.g., Tsimane’ are a T, Quechua are a Q), and some are work cooperatives (e.g., the dairy cooperative has a cow, the pig farming cooperative has a pig). We classified groups placed in the two rectangles closest to the participant as in-group, those placed in the two rectangles farthest from the participant as out-group, and those in the middle rectangle as intermediate. Cow and pig images courtesy of johnny_automatic and tuxwrench (https://openclipart.org/detail/388/cow; https://openclipart.org/detail/216216/piggy).

1


T
Q
M
Belong to most
Belong to least

2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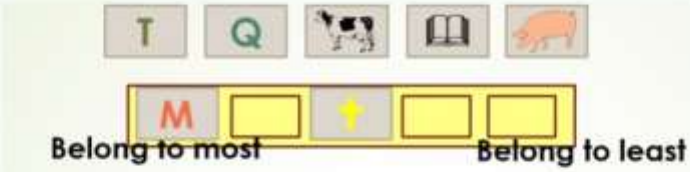
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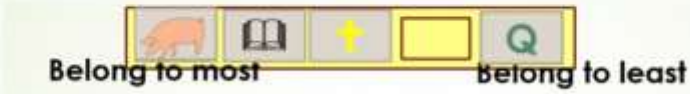
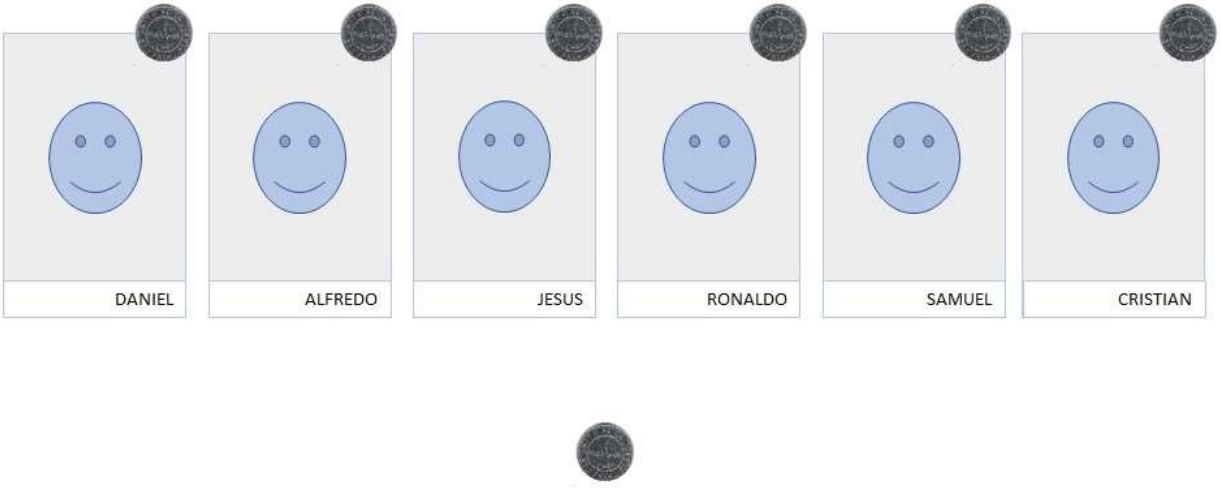

Q
Belong to most
Belong to least

Supplementary Figure 2. Photos of six candidate recipients, all past participants in the experiment, were arrayed on a table for the game. (To maintain participant confidentiality, we use cartoons here.) All past participants were eligible as recipients in these games, unless they did not wish to participate in this aspect of the study. The three men on the left are participants who identify with one ethnic or religious group, the three on the right with another. Whether out-group members appeared on the left or right was counterbalanced across participants.



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A3. Supplementary information: Corruption and the other(s): Scope of superordinate identity matters for corruption permissibility

1 Country-Level Controls

1.1 United Nations Ethnic and Religious Census Data

As a measure of objective, country-level religious and ethnic heterogeneity, we employ census data compiled by the United Nations (http://unstats.un.org/unsd/demographic/sconcerns/popchar/popchar2.htm). Subjective, individual-level perceptions of heterogeneity were not available from WVS (see Discussion).

To capture the diversity of religions in a given country, we used two methods. First, we adopt the fractionalization index used by Mauro [1], as well as many subsequent authors [e.g. 2,3]. The equation for religious fractionalization is

$$Fractionalization_j = 1 - \sum_{i=1}^{N} s_{ij}^2$$

where s_{ij} represents the relative share of group i (i=1, …,N) in country j. A fractionalization measure of 0 represents maximal homogeneity, while a measure of 1 indicates maximal diversity. We calculated religious fractionalization separately from ethnic fractionalization as the two generate different predictions about government institutions [e.g. ethnic fractionalization predicts less democracy,

whereas religious fractionalization may predict more; 2]. Second, polarization, the degree to which people in a country are distributed equally across multiple groups, predicts levels of conflict [4] and failures of collective action [5], whereas fractionalization by itself does not; this difference may be because polarization reflects discrimination by the dominant group [e.g. 5]. To capture this additional dimension of heterogeneity, we also use the polarization index introduced by Montalvo and Reynol-Querol [4]:

$$Polarization_j = 1 - \sum_{i=1}^{N} \left(\frac{\frac{1}{2} - s_{ij}}{\frac{1}{2}} \right)^2 s_{ij}$$

where s_{ij} again represents the relative share of group i (i=1, …,N) in country j. A polarization value of 0 represents an even distribution of individuals across $N>>2$ groups, and a value of 1 represents the extreme case in which half the population is in one group and the other half in a second group. We again calculated religious and ethnic polarization separately. Although conceptually distinct, the fractionalization and polarization indices are not independent of each other, thus we do not include both in the same model at the same time.

We matched participants' interview data to religious and ethnic heterogeneity information for their country in the year closest to the year of interview. We report results for the subset of participants from countries for which both ethnic and religious heterogeneity data were available (the "religious-ethnic heterogeneity subset"; only 21 of 37 countries reporting religious heterogeneity data also reported ethnic heterogeneity) separately from models including all participants from

countries with religious data and models including all participants from countries with ethnic data.

1.2 World Bank Population Density, Population Size, Gini Index, and World Region Classifications

Because both measures of an expanded in-group, primary geographic identity and number of group memberships, will capture a greater number of in-group members in larger countries, we include country population size as an additional control. Indeed, population density is also potentially important, as opportunities for exposure and interactions with a larger number of people may be more common in more densely living populations. We used both population size and density from the World Bank (http://data.worldbank.org/indicator) matched to interview year for each country. To minimize the effects of extreme values, we binned values of population size and density above and below 2 SD. We further logged density to minimize the influence of large values, as the distribution of densities was negatively skewed.

To control for economic inequality, a predictor of high levels of corruption [6], we include the World Bank's calculation of country-level Gini index, reported on a 0-100 scale. Because Gini data are only occasionally measured in most countries, we calculated the average Gini across the five years leading up to the year of the interview. To avoid the undue influence of several countries with high inequality, we logged Gini in all analyses.

To test the possibility of that shared cultural history causes correlations in responses between countries, we also use the World Bank's classification of countries by regions in some models.

1.3 Freedom House's Freedom in the World Political Rights Index

Freedom in the World (FIW), a report published by Freedom House that includes indices of political and civil rights, measures the presence of democratic practices in a country (http://www.freedomhouse.org/report-types/freedom-world). Government accountability may sway a participant's perspective on corruption permissibility. Because more political rights predict less corruption prevalence at the country level [7] and because of collinearity between the political rights and civil rights indices (r = 0.94), we use only the political rights index. Analysts employed by Freedom House are responsible for assigning countries a score on the political rights index. These scores are based on the following categories: the extent to which citizens in a country can (1) vote as they wish in legitimate elections, (2) run for public office, (3) freely become members of political parties, and (4) vote for accountable representatives. A country can score from 1 to 7, where a country scoring 1 has many political rights and a country scoring 7 has almost none. We matched a participant's interview year with political rights data from the same year.

1.4 Transparency International's Corruption Perceptions Index

Researchers commonly model country-level corruption using Transparency International's Corruption Perceptions Index [CPI; e.g. 7,8,9]. Transparency International has published the CPI annually since 1995 (http://archive.transparency.org/policy_research/surveys_indices/cpi/previous_cpi). The CPI reflects perceptions of bribery, embezzlement, and kickbacks in the public sector of a given country. The score a country receives is an aggregate of independent surveys of businesspeople, international experts, and risk analysts. This score can range from 0 (very corrupt) to 10 (very clean); we reverse-coded the CPI such that corrupt countries received a 10 to better match the scoring system of FIW. The CPI addresses only two of the four components of the corruption complex, public corruption and embezzlement, but it does provide a control for the rates of public corruption at the country level, which can increase or lower perceived corruption permissibility, as well as obfuscate corrupt acts committed by an individual.

We matched participants with CPI data from the year closest to the year of their interview. Because the CPI began in 1995, this would result in a fairly wide gap for individuals who took the WVS in 1981; however, only 12% of participants in the religious-ethnic heterogeneity subsample were interviewed before 1995, and none before 1990, limiting the size of the gap. Further, we believe the value of the CPI's inclusion outweighs this limitation, given the importance of controlling for country-level corruption prevalence.

2 Statistical Methods for Country-Level Variables

Initial analyses revealed high levels of correlation between the seven country-level variables – religious fractionalization, ethnic fractionalization, Gini, population density, population size, the political rights index, and the CPI – and consequent collinearity problems when all were included in the same model. The same was true for religious and ethnic polarization together with the other five variables. To avoid collinearity, we performed a principal components analysis on the seven variables – first with religious and ethnic fractionalization, then with religious and ethnic polarization – for each subset of data. To ensure we summarized at least 80% of the variation in these measures, we extracted the first three components for use in our models. Considering only data from countries for which both religious and ethnic fractionalization data were available, the three components summarize 39%, 27%, and 19% of the variation for the geographic identity subset and 65%, 26%, and 6% for the group membership subset.

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S1 Figure. ORs for regional, country, and continent/world identities vs. local identities across models with country-level variables. Either fractionalization or polarization were used as measures of religious and ethnic heterogeneity. For Ethnic & Religious Fractionalization and Religious & Ethnic Polarization subsamples, n = 20,521; Religious Fractionalization and Religious Polarization subsamples, n = 36,997; Ethnic Fractionalization and Polarization subsamples, n = 30,597.

OR vs. Local Odds
1.4
1.3
1.2
1.1
1.0
0.9
Religious & Ethnic Fractionalization
Religious & Ethnic Polarization
Religious Fractionalization
Ethnic Fractionalization
Religious Polarization
Ethnic Polarization
Level of Identity
Region
Country
Continent/World

S1 Table. Odds of finding corruption permissible by primary geographic identity for the religious-ethnic heterogeneity subset[1,2,3].

Variable	Odds ratio	Std. error	z value	p value
(Intercept)	1.88	0.09	7.20	<0.001
Regional	1.27	0.05	4.58	<0.001
Country	0.95	0.04	--1.25	<0.001
Cont./World	1.10	0.05	1.79	0.07
Shortfall	1.03	0.01	3.27	<0.01
Shortfall^2	0.98	0.00	-5.26	<0.001
Education Level 2	0.68	0.04	-9.64	<0.001
Education Level 3	0.55	0.05	-11.09	<0.001
Believes in God	0.75	0.05	-5.34	<0.001
Confid. Police, Govt. Srvc.	0.95	0.01	-4.15	<0.001
Sex: Female	0.87	0.03	-4.26	<0.001
Age	0.98	0.00	-13.40	<0.001
Number of Kids	0.94	0.01	-5.00	<0.001
Country PC1[4]	1.00	0.01	0.20	0.84
Country PC2	0.92	0.01	-6.69	<0.001
Country PC3	1.12	0.01	7.53	<0.001

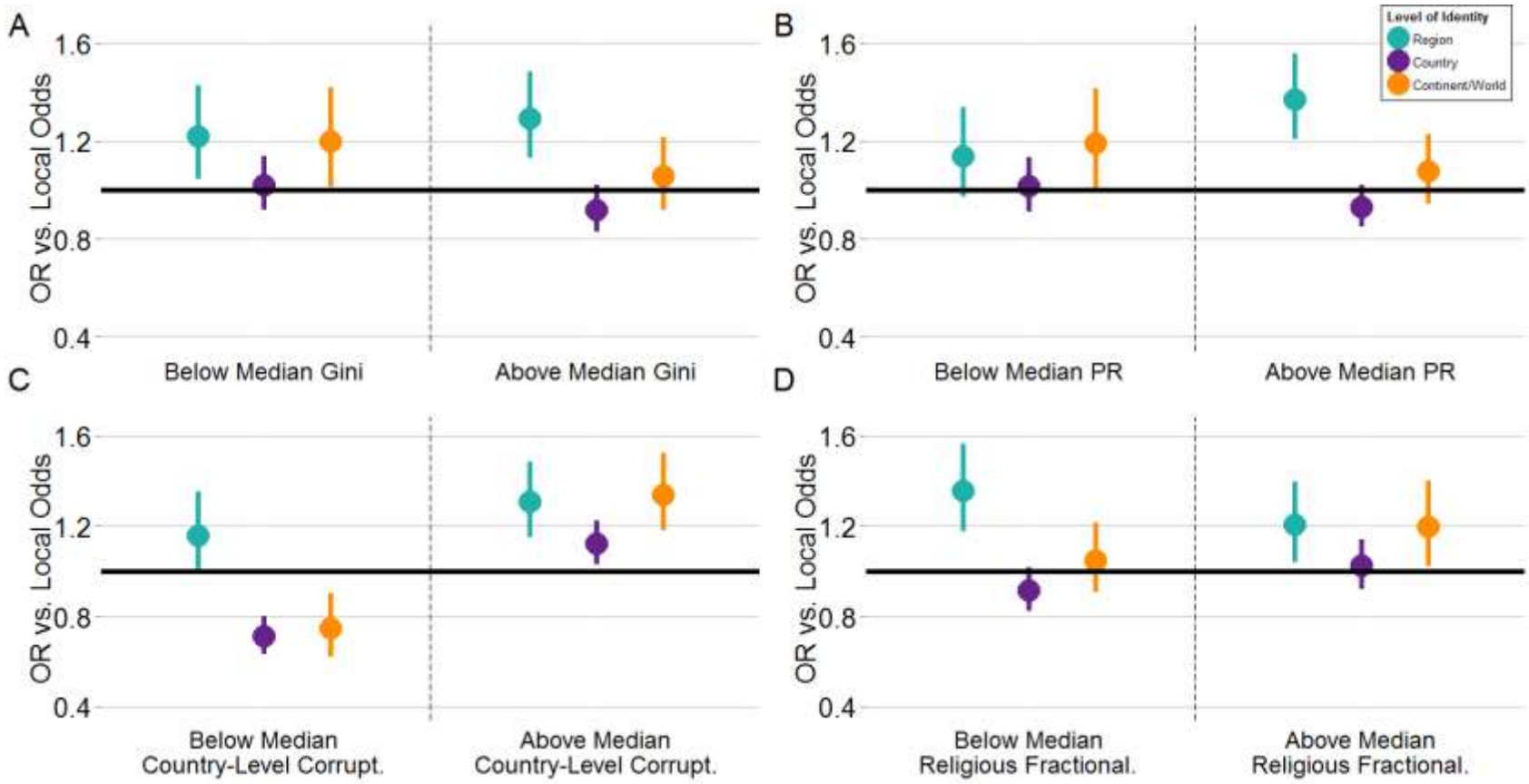
[1]The intercept represents participants with regional identities, who had the lowest household resource abundance, reported the lowest confidence in police and civil services, did not believe in God, had no children, were 0 years old, and male.

[2]Models with random country or continent intercepts, religious fractionalization or polarization models, and ethnic fractionalization or polarization models show very similar results, and so are not reported. Religious and ethnic fractionalization (reported) model n = 20,521. Religious and ethnic fractionalization AIC = 23,026. Religious and ethnic polarization AIC = 23,049.

[3]AIC selection criteria suggest that the model including primary geographic identity provides a better fit than the model with only controls and the resource shortfall summary measure (weighted $AIC_{marginal}$ = 1; AIC_{null} = 23,053, $AIC_{marginal}$ = 23,026.

[4]The higher the value of the first country-level principal component (PC1), the more a participant's home country has a small but dense population, has a low Gini and low religious fractionalization, few political rights, and high corruption. The higher the value for the second (PC2), the more her country has a big, low density population, low political rights, and high Gini, corruption, religious and ethnic fractionalization. The higher the value for the third principal component (PC3), the bigger her country, the higher its political rights, the lower its ethnic and religious fractionalization.

S2 Figure. ORs for countries below and above the sample median for several country-level variables. (A) Gini coefficient, (B) absence of political rights (i.e. above the median means fewer political rights), (C) perceived corruption prevalence, and (D) religious fractionalization. Analyses use the religious & ethnic heterogeneity subsample.



S2 Table. Odds of finding corruption permissible by number of group memberships for the religious-ethnic heterogeneity subset[1,2].

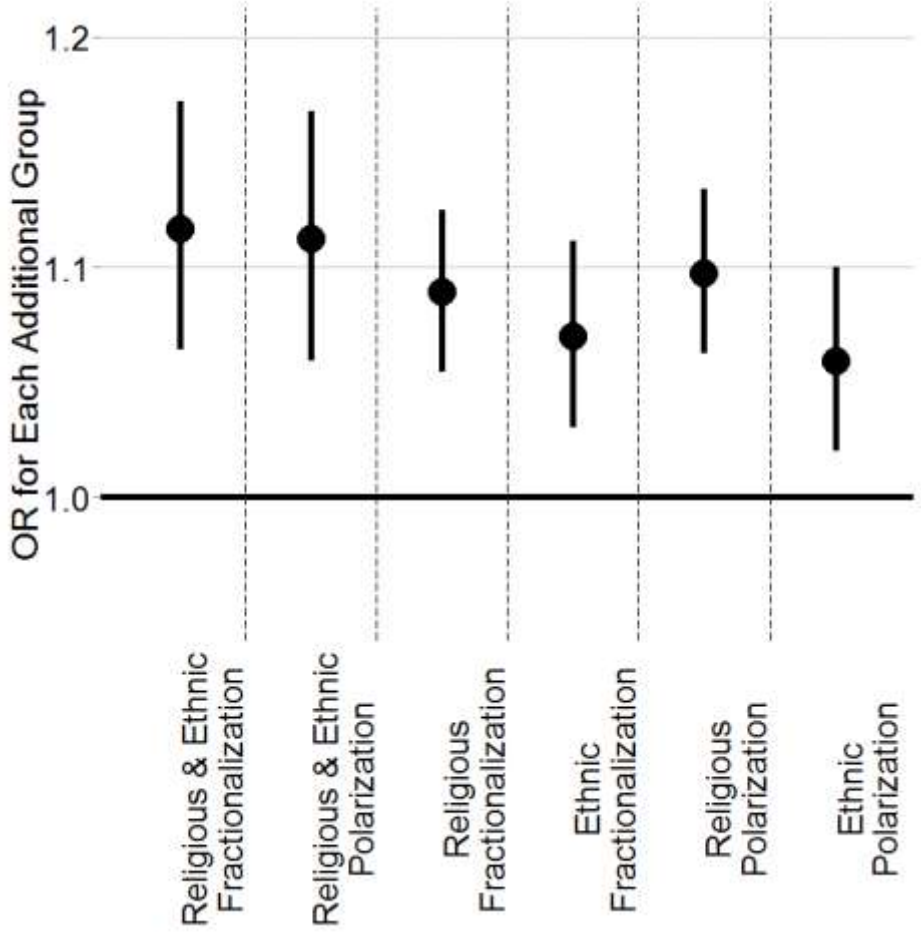
Variable	Odds Ratio	Std. Error	z value	p value
(Intercept)	1.01	0.21	0.03	0.97
Number of Memberships	1.10	0.02	4.10	<0.001
Shortfall	1.07	0.02	3.77	<0.001
Shortfall^2	0.98	0.01	-3.64	<0.001
Education Level 2	0.73	0.08	-3.92	<0.001
Education Level 3	0.56	0.13	-4.57	<0.001
Believes in God	0.74	0.16	-1.84	0.07
Confid. Police, Govt. Srvc.	0.93	0.02	-3.14	<0.01
Sex: Female	1.02	0.06	0.32	0.75
Age	0.99	0.00	-3.45	<0.001
Number of Children	0.95	0.03	-2.19	0.03
Country PC1^3	0.81	0.02	-13.01	<0.001
Country PC2	1.12	0.03	4.65	<0.001
Country PC3	1.23	0.05	4.20	<0.001

[1]Models with random country or continent intercepts, religious fractionalization or polarization models, and ethnic fractionalization or polarization models show very similar results, and so are not reported. Religious and ethnic fractionalization (reported) model n = 5785. Religious and ethnic fractionalization AIC = 6222.30. Religious and ethnic polarization AIC = 6227.49.

[2]AIC selection criteria suggest that the model including primary geographic identity provides a better fit than the model with only controls and the resource shortfall summary measure ($AIC_{marginal}$ = 1; $AIC_{marginal}$ = 6222.30, AIC_{null} = 6235.74).

[3]The higher the value of the first country-level principal component (PC1), the more a participant's home country has a small but dense population, has a low Gini and low religious fractionalization, but high ethnic fractionalization, few political rights, and high corruption. The higher the value for the second (PC2), the more her country has a big, dense population with political rights, but high Gini, corruption, religious and ethnic fractionalization. The higher the value for the third principal component (PC3), the bigger her country, the lower its religious but higher its ethnic fractionalization, the lower its corruption, the higher its Gini, and the fewer its political rights.

S3 Figure. OR with each additional group membership across models with country-level variables. For the Religious & Ethnic Fractionalization and Religious & Ethnic Polarization subsets, n = 5734; Religious Fractionalization and Religious Polarization subsets, n = 10,874; Ethnic Fractionalization and Ethnic Polarization subsets, n = 8562.



S3 Table. Exploratory analysis investigating the relationship between having a regional identity and several predictors. These include the participant's perceptions on whether more emphasis on "family life," less emphasis on "money and material possessions," and more emphasis on "greater respect for authority" would be good, neutral, or bad changes; the first and third hold badness at zero, the second goodness.

	Geog. only[2]		Geog. & group[3]		Country-level vars., geog. only[4]		Country-level vars., geog. & group[5]	
Variable	**Odds ratio**	**p value**	**Odds ratio**	**p value**	**Odds ratio**	**p value**	**Odds ratio**	**p value**
(Intercept)	0.23	0.00	0.26	0.00	0.17	0.00	0.19	0.00
Family Emph: Neutral	0.90	0.17	0.99	0.94	0.89	0.46	0.94	0.83
Family Emph: Good	0.74	0.00	0.73	0.04	0.73	0.02	0.66	0.11
Profit Motive: Neutral	0.94	0.08	0.94	0.32	0.87	0.03	0.94	0.61
Profit Motive: Bad	0.97	0.25	0.94	0.21	0.81	0.00	0.80	0.04
Authority: Neutral	0.93	0.10	0.79	0.00	0.89	0.22	0.61	0.01
Authority: Good	0.92	0.04	0.76	0.00	0.89	0.19	0.62	0.01
Sex: Female	1.01	0.50	0.99	0.76	1.01	0.81	1.03	0.70
Age	1.00	0.00	0.99	0.00	1.00	0.46	0.99	0.06
Number of Kids	1.02	0.01	1.06	0.00	1.02	0.22	1.08	0.03

[1]Models are logistic regressions with regional identity=1. All analyses control for country of residence. [2]Subset including the geographic identity predictor: n=77,376; AIC=59,399. [3]Subset including the geographic identity and group membership predictors: n=22,729, AIC=17,465. [4]Subset including the geographic identity predictor and

country-level variables: n=19,923; AIC=14,288. [5]Subset including the geographic identity and group membership predictors and country-level variables: n=5683, AIC=3900.