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IT MAKES A VILLAGE: CHILD CARE AND PROSOCIALITY

Abstract

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JEL Classification: I15, O15, Z13

Keywords: Dictator game, Reciprocity

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It Makes a Village: Child Care and Prosociality*

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3 March 2023

Abstract

We examine a novel hypothesis that roots human prosociality in the need to elicit and sustain help from others for the purpose of raising children, i.e. allomaternal care. We design an economic experiment to characterize the relationship between allomaternal care and cooperative behavior among a sample of 820 adults in the Solomon Islands. Our results show that receiving help with child care nurtures reciprocity and altruism towards those who provide help. Moreover, help from non-relatives predicts impersonal prosociality toward strangers, suggesting an important foundation for the development of impersonal prosociality. As evidence of a mechanism sustaining the prevalence of allomaternal care, we document large socio-cognitive benefits to children from care by non-relatives, based on daylong vocalizations of 200 children analyzed using a multilingually-trained neural network.

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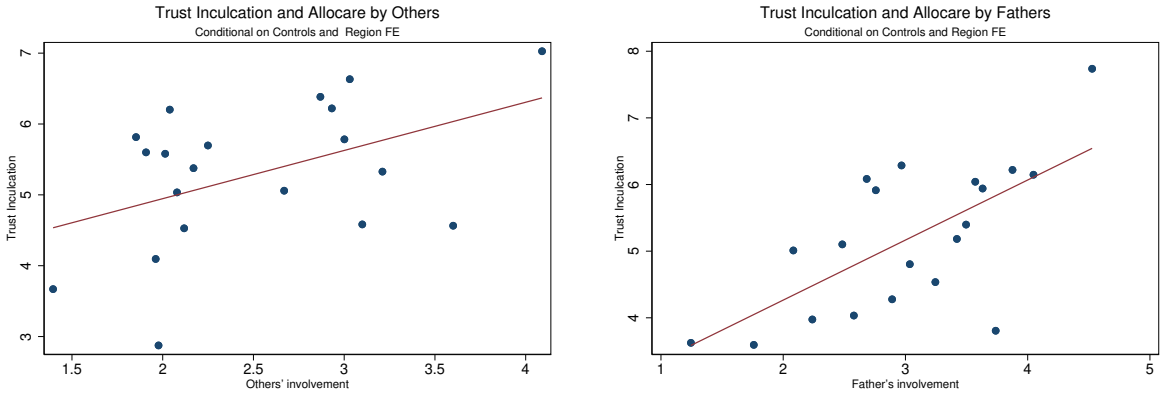
1 Introduction

Humans' exceptional capacities for cooperation (Boyd and Richerson, 2009; Tomasello, 2009; Bowles and Gintis, 2011) are increasingly recognized as the ultimate reason for our distinct cognition, technology, and culture (Gintis et al., 2005; Tomasello and Vaish, 2013; Henrich, 2016). Other-regarding preferences, both pure altruism and punishment of free riders, appear to be critical for enabling human cooperation (Bowles and Gintis, 2011; Burkart et al., 2014). Yet, the nature of cooperation at large-scale and altruism in one-shot anonymous situations is still debated (Fehr and Fischbacher, 2003; Bowles and Gintis, 2011; McCullough, 2020).

A large literature in anthropology, sociology, evolutionary biology and, more recently, economics, roots the plasticity of cooperation and prosociality to variation in kinship structures. In tight kinship structures, individuals interact only with their close relatives and do not extend pro-social inclinations toward those outside their inner kinship circle (Alesina and Giuliano, 2010, 2011, 2014; Alesina et al., 2015). Looser kinship ties, by increasing exposure to outsiders, can foster impartial norms of morality and generalized prosociality, enabling widespread cooperation (Gambetta, 1988; Greif and Tabellini, 2017; Enke, 2019; Schulz et al., 2019; Henrich, 2020).

Previous literature has defined kinship through group-level norms and institutions that regulate social interactions, such as marriage (Schulz et al., 2019), family structure and lineage (Moscona et al., 2017; Enke, 2019; Moscona et al., 2020; Moscona and Seck, 2021), or inheritance (La Ferrara, 2007; BenYishay et al., 2017; La Ferrara and Milazzo, 2017; Lowes, 2022). An arguably even more primal domain of social interactions, and thus a defining feature of kinship, is the social organization of child rearing (Kaplan et al., 2009). Across societies, there is extensive variability in whether and how much different relatives and unrelated individuals are involved in child rearing. For example, fathers provide 1% of child care among the Alyawarre (an Aboriginal Australian people), but nearly 16% among the Aka (of central Africa), while unrelated others provide little help among the Maya, but up to 30% of total care among the Mardu (an Aboriginal Australian people) (Kramer, 2010).

In this paper, we investigate the relationship between the social organization of child care and prosocial preferences. Motivating our analysis, Figure 1 shows a positive relationship between the intensity of care from people other than the mother (henceforth, "allomaternal care") and trust across societies included in the Standard



(a) Allomaternal care (all)

(b) Care from fathers

Figure 1: Correlations: Allomaternal care and trust in the Standard Cross-Cultural Sample (SCCS)

Note: Binned scatterplots of the relationship between societal trust orientation in the SCCS and in panel (a): care of infants by people other than mothers and in panel (b): care of infants by fathers; controlling for region fixed effects (v200 in the SCCS: Africa, Circum-Mediterranean, East Eurasia, Insular Pacific, North America, South America), log mean yearly average rainfall (v1913), log mean annual temperature (v186), mean size of local communities (v63). Care of infants by people other than mothers is measured by question v51 (non-maternal relationships in infancy), and care of infants by fathers by question v53 (role of fathers in infancy) of the SCCS. Measure of societal trust orientation: v335. Source: SCCS (Murdock and White, 1969). See Section A of the Appendix for more information on the SCCS and our empirical analysis.

Cross-Cultural Sample, a dataset describing the socio-cultural practices of pre-colonial ethnic societies worldwide (Murdock and White, 1969).[1] Although the relationship holds controlling for an array of potential geographic and society-level confounders, such cross-societal correlations cannot address the possibility that causality runs in both directions, or that trust and child care practices reflect unobserved factors, including broader socio-economic networks.

We combine a unique experiment with detailed survey data to overcome the empirical challenges associated with group-level comparisons. First, we show that prosociality (namely reciprocity and altruism) toward relatives as well as unrelated individuals is explained by the amount of help with child care they provide. Moreover, allomaternal care quantitatively dominates other measured dimensions of social and economic interactions as a predictor of prosociality. Second, we show that the relationship between allomaternal care and prosociality extends to *impersonal* prosociality towards strangers, specifically when receiving more help with child care from unrelated individuals. We provide evidence that this relationship is sustained by generalized social norms. In the last part of the paper, we focus on a possible mechanism sustaining

[1]We provide more detail on data sources and methods for Figure 1 in Section A of the Appendix.

allomaternal care and show evidence of substantial benefits to children associated with care from unrelated individuals.

Our experiment consists of a series of independent gift-giving choices based on the dictator game, in which participants make incentivized decisions about how much of an initial endowment (equal to SI$40, roughly the average daily GDP per capita) to share between themselves and specific individuals in their network ("receivers" hereafter). We adopt a within-subject design and elicit these choices separately for each receiver, each time with a new endowment, and under two treatment conditions: (i) non-anonymous (the receiver is told who sent the gift), and (ii) anonymous (the receiver is not told who sent the gift) to assess the participant's reciprocity and altruism, respectively. In an exit survey, participants report the amount of help with childcare and other forms of socio-economic, productive, and emotional support that each receiver provides.

We conduct our analysis at the level of a participant-receiver dyad, which enables us to control for both participant and receiver-type (i.e. spouse, mother, sister, etc.) fixed effects. We thus isolate the effect of help with child care on the prosociality of the participant, independent of three sources of potential bias: (i) the genetic or social relatedness of the receiver to the participant (and their child) – which we control for using receiver-type fixed effects; (ii) unobserved characteristics of the participant, such as status or personality, that could influence both how much help a participant receives and their cooperative inclinations – which we account for using participant fixed effects; and (iii) other forms of support the receiver provides to the participant – which we control for using survey measures of risk-sharing, productive, social, emotional, and religious networks.

We implement this experiment among 820 participants in the Solomon Islands, including 631 parents of young children. The Solomon Islands provides a valuable setting to study the mechanism through which the social organization of child rearing influences prosociality. First, the variety and fluidity of post-marital residence and inheritance structures provide variation in the nature and intensity of allomaternal care. For example, 62% of parents in our sample receive help from both paternal and maternal relatives.[2] 80% of parents also receive help from non-relatives, including 74% on a weekly basis or more. Second, the sample population primarily relies on subsis-

[2]84% of parents receive help from maternal relatives (22%, exclusively), 74% receive help from paternal relatives (12%, exclusively) and only 4% receive no help from relatives.

tence horticulture, with nonexistent or limited access to factors that may confound the relationship between allomaternal care and prosociality, such as institutionalized or monetized childcare, widespread formal employment, and markets.[3]

Our results show that both mothers' and fathers' gift-giving in the dictator game is proportional to the amount of help with child care that the receiver provides. After controlling for both participant and receiver-type fixed effects, this relationship remains robust for mothers, highlighting the specific role of allo-*maternal* care in prosocial behavior. Increasing help with care from a few times a month to a few times a week (a 1 SD increase from the mean) corresponds to a 3.8% increase in altruistic giving among mothers, on average. By comparison, other forms of support hardly explain gift-giving in the dictator game and they have no bearing on the relationship between help with child care and prosociality.

We extend our analysis to examine the relationship between allomaternal care and *impersonal* prosociality. Mothers who receive more help with child care from *non-relatives* are significantly more generous toward *strangers*. Neither help with child care provided by relatives, nor any dimension of emotional, risk-sharing, productive or social support is associated with gift-giving to strangers. We also show that in villages where parents receive more help from unrelated individuals, participants are more prosocial towards strangers, even when they do not have children themselves and thus do not directly benefit from help with child care. We interpret this finding as suggestive evidence of the role of social norms. Overall, these findings highlight the role of allomaternal care, particularly from unrelated individuals, in fostering impersonal prosociality, even in one-shot anonymous interactions.

Last, we use a novel measure to illustrate some of the benefits of allomaternal care for children. A large literature in evolutionary biology and anthropology characterizes allomaternal care as critical for human demographic success, explaining both our high fertility rate and high rates of survival to reproductive age (Hrdy, 1999; Kramer, 2010). Allomaternal care also provides a social context in which infants and children who are more skilled at reading intentions and engaging the solicitude of others are more likely to prosper (Bergmüller et al., 2007; Flinn et al., 2007; Snowdon and

[3]Henrich et al. (2010) and Enke (2022) document how prosociality systematically covaries with market development and with community size. The development of markets, industrialization, and formal employment may directly influence prosociality as well as the need for working parents to solicit childcare, which would confound our analysis. This justifies our initial focus on small-scale subsistence communities.

Cronin, 2007; Burkart et al., 2009; Hrdy, 2009; Burkart et al., 2014).[4] We thus expect to observe a range of proximate socio-emotional and cognitive benefits associated with allomaternal care, in particular communication skills.

To test this hypothesis, we recorded daylong vocalizations for 196 children using a cheap and easily scalable hardware solution and then analyzed these recordings using a multilingually-trained neural network (Lavechin et al., 2020). Our approach captures children's natural vocal behavior with minimal interference and is the most appropriate to our context, given the multilingual environment (children in our sample are exposed to one or more of 12 different languages), the age range of the children (6 to 48 months), and the remote field conditions, with no access to electricity or the internet.[5] Previous research shows that child vocalization counts thus estimated correlate with standardized language measures (Gilkerson et al., 2018; Wang et al., 2020), which are the current best infant predictors of academic achievement (Pace et al., 2019).

Our findings point again to the unique and crucial role of caregiving by *non-relatives* as a positive predictor of child vocalizations. The findings are robust to controlling for care provided by the mother, the father, and other relatives of the child, for other forms of support that the mother receives, for other child-level stressors, and for a wide range of mother characteristics, including a proxy for cognitive functions. We address the possibility that our measure of vocalizations may be confounded by crying or distress in two ways. First, we use manual annotations from lab scientists to code the proportion of crying, laughing, canonical (vowel-consonant alternations) and non-canonical vocalizations. Our effect size suggests levels of crying that would be incommensurate with average levels of crying thus coded. Second, we collect biomarkers of stress (cortisol and cortisone) in hair samples from 102 mother-child pairs following a procedure adapted from Wright et al. (2018). Children who receive more care by non-relatives are, if anything, *less* stressed. Although our setting for child-level regressions can only provide correlations, these findings offer supporting evidence for the theory that allomaternal care may have been critical to the evolution of humans' socio-cognitive capacities (Hrdy, 2009). Altogether, such benefits may explain and sustain allomaternal care, which in turn defines the boundaries of

[4]Recent evidence suggests that a capacity for intersubjectivity in childhood is a strong predictor of adult economic success (Fe et al., 2022).

[5]We detail the benefits of our method over existing alternatives in Section 3.3 and here.

prosociality.

Our work offers several contributions to the literature. First, we introduce a conceptual framework to understand the determinants of cooperative behavior, which is novel to economics. Prosociality, in particular impersonal prosociality, is a key determinant of economic efficiency and social cohesion (Zak and Knack, 2001; Algan and Cahuc, 2010), and at the core of the economic and institutional divergence between Western Europe (and its offshoots) and the rest of the world (Greif and Tabellini, 2017; Henrich, 2020). More generally, reciprocity, altruism, and trust are critical to sustain trade and markets in environments of incomplete contracts and asymmetric information (Arrow, 1972; Axelrod and Hamilton, 1981; Gambetta, 1988). Recent papers have made important contributions to improving measures of kinship (Bahrami-Rad et al., 2022) and in providing evidence of the influence of kinship on individual behavior (Lowes, 2021, 2022; Moscona and Seck, 2021). We advance this literature by opening the black box of kinship and focusing on child care practices, an arguably central aspect of kinship structures. Our approach can be interpreted as recovering the exact structure of a specific mechanism behind group-level variation in kinship and prosociality. The link we establish between help with child care by *non-relatives* and prosociality provides a novel mechanism that can explain the negative relationship between the strength of family or kinship ties and impersonal prosociality documented throughout the economics literature (Banfield, 1958; Alesina and Giuliano, 2010, 2011; Ermisch and Gambetta, 2010; Alesina and Giuliano, 2014; Alesina et al., 2015; Enke, 2019; Bahrami-Rad et al., 2022; Schulz, 2022).[6] [7]

Our characterization of socio-cognitive benefits to children speaks to the economic literature relating early life experiences to cognitive and non-cognitive development. This literature has mostly focused either on parental investment in children (see

[6]In particular, the dislocation of kinship-based institutions under the marriage and family policy of the Christian Church has been linked to the evolution of cooperation and growth in Western Europe and in the United States (Greif and Tabellini, 2017; Enke, 2019; Henrich, 2020; Ghosh et al., 2021; Bahrami-Rad et al., 2022; Schulz, 2022). The demise of clans and kinship networks would have pushed parents to seek help with child care from non-relatives, igniting the kind of prosociality we document in this paper.

[7]Another widespread hypothesis has linked the emergence of other-regarding preferences to intergroup competitions (Boyd and Richerson, 2002; Choi and Bowles, 2007; Bowles, 2008). Laboratory experiments with conflict priming and post-war field studies suggest that exposure to conflict is frequently associated with greater prosociality, but mostly confined to one's ingroup (parochialism) (see, among others, Vugt et al. (2007); Yuki and Yokota (2009); Voors et al. (2012); Cassar et al. (2013); Rohner et al. (2013); Bauer et al. (2014); Mironova and Whitt (2021); and Bauer et al. (2016) for a review.)

Attanasio, 2015, for an overview),[8] or on the provision of formal daycare (Cunha and Heckman, 2007; Baker et al., 2008; Heckman, 2013; Heckman et al., 2013; Felfe and Lalive, 2018; Cornelissen and Dustmann, 2019; Bernal et al., 2019; Fort et al., 2020; Attanasio et al., 2022b; Bjorvatn et al., 2022). We expand our focus to a wider network of caregivers, including extended family and unrelated but regular caregivers, and find evidence that is consistent with the literature on the cognitive and non-cognitive benefits of daycare,[9] including prosocial preferences (Cappelen et al., 2020), as well as the hypothesis that care from unrelated individuals promotes socio-cognitive skills for cooperation and communication (Hrdy, 2009).

Finally, we contribute to a large and growing literature in the social sciences on the role of social and economic networks in low-income economies (Breza et al., 2019). Family, acquaintance, friendship, productive and risk-sharing networks are routinely elicited by researchers and policy makers and relied upon to facilitate the take-up and diffusion of important policy tools, such as micro-finance (Banerjee et al., 2013), agricultural technology (Beaman et al., 2021a), entrepreneurship or employment programs (Field et al., 2016; Beaman et al., 2018), public health interventions (Kim et al., 2015) and poverty-alleviation programs (Beaman et al., 2021b). Our finding that help networks in the context of child care supersede other social, emotional, risk-sharing, and productive networks as a source of prosociality and confer important socio-cognitive benefits to children highlight child care networks as a crucial but understudied dimension of social networks.

The rest of the paper is organized as follows. The next section provides additional background on the literature about social systems of child rearing and cooperation. Section 3 presents the experimental design and the data. Section 4 presents the main estimation strategy and shows how allomaternal care fosters prosociality. Section 5

[8]Papers in adjacent disciplines have investigated the role of grandparents (Hawkes et al., 1998; Sear and Mace, 2008; Danielsbacka et al., 2011) and older siblings, in particular sisters (Weisner et al., 1977; Turke, 1988). Consistent with evidence from developmental psychology (e.g. Havron et al. (2019)), a recent study in economics documents better vocabulary and fine motor skills for children with older sisters (rather than brothers) in Kenya (Jakiela et al., 2020), although recent evidence suggests that this result may not be universal (Havron et al., 2022).

[9]Cunha and Heckman (2007); Heckman (2013); Heckman et al. (2013); Attanasio et al. (2022b) and Bjorvatn et al. (2022) document the long-term advantages in cognition, educational achievement, non-cognitive skills and earnings associated with the provision of early daycare among disadvantaged communities in the US, Latin America, and peri-urban areas of Uganda. Felfe and Lalive (2018) and Cornelissen and Dustmann (2019) provide consistent evidence in high-income countries other than the US, although negative effects due to the lower intensity of one-on-one interactions or low service quality are highlighted by Baker et al. (2008); Bernal et al. (2019) and Fort et al. (2020).

discusses the socio-cognitive benefits to children. Section 6 concludes.

2 Background Literature

2.1 Prevalence and benefits of allomaternal care

Social forms of child rearing, in which conspecifics help parents to raise their young, are practiced in 15 to 25% of bird species and 2.5 to 3% or more of mammals (Brown, 1974; Emlen, 1991; Solomon et al., 1997; Burkart et al., 2017). The study of these social systems and their possible implications for human evolution - especially co-operation - are the objects of vast literatures in evolutionary biology, anthropology, psychology, neuroscience and zoology (Clutton-Brock et al., 2001; Burkart et al., 2009; Hrdy, 2009).

Allomaternal care in humans presents several distinct characteristics. Human mothers receive extensive support from a wide variety of helpers known as allomothers (Hrdy, 1999). From adult men - especially fathers - making substantial energetic contributions (Hill and Hurtado, 2009; Kaplan et al., 2009), to grandmothers provisioning critical calories and looking after infants and toddlers (Hawkes et al., 1998), to siblings providing babysitting services, to other related or even unrelated adults, all of these contributors supplement maternal care, allowing mothers to engage in productive activities that benefit the survival of their young (Turke, 1988). Extensive evidence reports that babies are carried, cleaned, soothed, cuddled, protected, and nursed by nonparent adults between 25% and 85% of the time during infancy across essentially all cultures, including foraging cultures, suggesting a universal prevalence of, and substantial variation in, allomaternal care (Hrdy, 2009).

A vast literature has characterized allomaternal care as critical to human demographic success. During the Pleistocene, this parenting system may have permitted hominin females to raise energetically expensive (large brained and slow maturing) offspring without increasing inter-birth intervals, allowing humans to move into new habitats (Hrdy, 1999) and contributing to human demographic expansion (Kramer, 2010). Most field studies of the benefits of allomaternal care on maternal and child outcomes have consequently focused on demographic parameters, in particular infant survival and parents' reproductive success (see Kramer (2010) for a review).

2.2 Allomaternal care and prosociality

There are several motivations to explain why carers engage in allomaternal care. The principal explanation is offered by kin selection theory, whereby an individual's reproductive success (i.e., fitness and inclusive fitness) is enhanced by acts of altruistic behavior that contribute to the reproductive success of relatives (Hamilton, 1964a,b). This motive could explain the involvement of fathers, grandparents and siblings in caring for children related to them (Kaplan et al., 2009; Schacht and Kramer, 2019). The extensive provision of allomaternal care by unrelated individuals is a uniquely human feature and several motives may explain it, for example mutualism, fitness interdependence and reciprocity (Trivers, 1971; Axelrod and Hamilton, 1981; Kramer, 2010).[10][11]

Here, rather than focusing on the motivations for care, we investigate the implications of allomaternal care for reciprocity, altruism and impersonal prosociality. In a social system of child rearing, both mothers and infants need to develop the ability to elicit and maintain care from individuals. Children who are more skilled at reading the intentions and engaging the solicitude of other caregivers would be more likely to prosper. Similarly, mothers who are better able to understand the intentionality of potential caretakers and navigate the complex web of allomaternal care relationships would have higher reproductive success. In this environment, prosociality may have coevolved with shared child care practices through the role of allomaternal care in fostering socio-cognitive and emotional skills that are essential for child survival (Hrdy, 2009). From this framework, we derive our hypotheses for parents' and children's prosociality.

Within economics, a body of literature has documented how individuals with more accurate beliefs about others' intentions are better at engaging in relationships requiring trust (Butler et al., 2016) and how experience of interactions, especially with non-relatives, enhances individual prosociality (Gambetta, 1988; Ermisch and Gambetta, 2010; Alesina and Giuliano, 2010, 2014). From this, we derive the hypothesis that allomaternal care, especially by non-relatives, is associated with increased prosociality among parents, including reciprocity and altruism towards familiar individuals,

[10] In the case of market economies, the provision of help may also be dependent on financial rewards. We abstract from this case as the society we study has no form of institutionalized or monetized childcare.

[11] Recent literature discusses complementary motivations to help, for example those supported by the neurohormonal circuitry that evolved to support parental care (see Marsh (2019) for a review).

as well as generalized prosociality toward strangers.[12]

Among children, we expect to observe a range of proximate socio-emotional and cognitive benefits of allomaternal care, in particular communication skills. To test this, we examine the relationship between care from different caregivers and children's communication skills. Since vocalizations are among the earliest and most robust expressions of infant communication and intersubjectivity (see e.g. Trevarthen (1979)), we focus on this dimension in our analysis.

3 Data

3.1 Sample

We conducted our data collection from June to August 2019 among a sample of 820 participants, living in 44 villages across two provinces, Western and Choiseul, of the Solomon Islands.[13] Like most villages in the Solomon Islands, the villages in our sample are small, coastal lowland communities that depend mainly on subsistence horticulture and fishing for their livelihoods. On average, people work in their gardens a couple of times a week and sell goods in the market less than once a month. In addition, men fish a couple of times a week and women a few times a month. The average village consists of 87 households and 441 people, the majority of whom have no access to grid electricity, running water, or sanitation. Most villages are relatively remote, where the main mode of transport is by ship or outboard canoe, with extremely limited access to roads. The average travel time between villages and the provincial capital is six and half hours and the average travel time to the country's capital city, Honiara, is two and a half days, leaving most communities isolated from major market centers.

Post-marital residence and inheritance structures are remarkably varied in our sample: 26% of villages are "purely" patrilocal, 57% "mostly" patrilocal, and 17% "mostly" matrilocal. Regarding inheritance, 43% of villages have exclusive patrilineal inheritance (through the male line), 11% exclusive matrilineal inheritance, and the remaining 56% have a mixed system. Moreover, patrilocality does not go hand in hand

[12]Suggestive evidence across 15 primate species shows that the extent to which a species engages in allomaternal care is the best predictor of altruistic helping among unrelated adults (Burkart et al., 2014) but no empirical validation has been provided so far among humans.

[13]The Solomon Islands are an archipelago of over 900 islands in Melanesia with a total population of around 700,000 people.

with patrilineal inheritance: only 13% of villages have pure patrilocal residence and patrilineal inheritance. These social systems are also fluid. In "mostly" matrilocal places, as much as 72% of fathers receive weekly (or more) help from their own relatives. Even in "purely" patrilocal villages, most mothers (85%) have their own relatives around who help with childcare (72% on a weekly basis or more). Similar patterns of high access to maternal relatives under (presumably stronger) patrilocal norms have been documented in Bangladesh (Perry, 2017) and among Aboriginal groups in Australia (Hrdy, 1999), suggesting that group-level measures of kinship may hide substantial variation across individuals and highlighting the advantage of our approach.

To construct our sample, we first selected a subset of villages with whom we had an established relationship through previous work (BenYishay et al., 2017; Beath et al., 2018). Upon arriving in a village, we held a meeting with the village elder to introduce the study and obtain consent for our research. Village elders then organized a public meeting with community members who met the specific demographic for our study: individuals and couples between the ages of 18 and 45, and parents to at least one small child between the (target) ages of 18 months and four years. We randomly selected participants via public lottery according to the following criteria: five couples (five women and five men partnered with one another), five single women, and five single men, for a total of 20 participants per village.

3.2 Experiment in the field and survey elicitation of help

To measure prosociality, we implemented a series of dictator games with each adult participant. The dictator games proceeded as follows. Participants were given an endowment of SI$40 ($5 USD at the time of our study, the average daily GDP per capita), which they could keep for themselves or send a portion (or all) of to a receiver.

The main feature of our design was that participants were asked to make gift giving decisions across a menu of receivers, each time with a new endowment of SI$40. The menu of receivers included: a random person in a distant village and a random person in the participant's own village (hereafter, "strangers"), as well as the participant's : spouse, mother, mother-in-law, father, father-in-law, sister, brother, neighbor, and close friend. At the end of the experimental session, one receiver was chosen at random, and the participant's decision was implemented.

Participants were first asked to make each of their gift giving decisions anony-

mously (i.e., the research team would deliver the funds to the receiver, who would not know who sent the money, such that the research team appeared as the sender), and then again non-anonymously (i.e., the research team would deliver the funds to the receiver and tell them who had sent the money). The rationale is that anonymous gifts capture altruism toward the receiver, while non-anonymous gifts capture reciprocity, since the participant's signal of generosity is observed by the receiver. One concern was that anonymity may not be enforced in practice. For example, a husband receiving a payment, even anonymously, may suspect the payment to come from his wife, in the case she was also a participant in the experiment. Several considerations reduce this concern. The inclusion of "strangers" as a potential recipient guaranteed that anybody could be the "stranger" of another participant. Given the small-scale nature of the villages, a participant's husband could also be the brother of another participant. Overall, given these design and field conditions, and given that only one choice per participant was paid out for real, a husband receiving an anonymous payment (in itself a small probability event) could have no certainty as to who had sent that payment, and any attempt at signaling who sent the payment would be cheap talk.[14]

At the end of the dictator games, enumerators conducted a 30-minute survey questionnaire with each participant. The questionnaire elicited basic demographic, social, and economic information for the participant, as well as specific questions about each potential receiver in the dictator game and their relationship with the participant, including measures of economic, productive, and emotional support provided by the receiver to the participant and, because religion is an important part of daily social lives in the Solomon Islands, whether the receiver and the participant go to Church together. These questions were adapted from existing questionnaires on social networks (e.g. Banerjee et al. (2013)). A key innovation was to add questions on the help with child care that the receiver provides to the participant.

The frequency of child care provided by each receiver to the participant is measured as follows: never; less frequently than once a month; more frequently than once a month; once a week; a few times a week; every day, a little bit; or every day, for a large part of the day. In our analysis, we standardize this measure to mean zero,

[14]To go one step further and prevent any disappointment and argument among spouses, we added a random amount to the amount sent in the spousal condition (so no spouse could know exactly how much was sent by the other) and we stressed this during the instructions.

standard deviation one, to interpret relative increases in the amount of help with child care.

We measure emotional support by a question asking how often the participant and the receiver spent time together "to talk about [the participant's] feelings, joys, and sorrows". The answer scale was identical to the one used for the frequency of help with the children. Questions about economic and productive support ask whether the participant would go to the receiver if they needed to borrow: (i) a small amount of money, (ii) a large amount of money (yes/no answers), and (iii) how frequently the receiver helps them with cultivating their garden or goes fishing with them (answer scale identical to the one used for the frequency of help with the children or for emotional support). Answers to the question about whether the participant and receiver go to Church together are either yes or no.

The individual survey elicited basic demographics and time use data for the participant, including the frequency of care provided to their own children, and the frequency of care provided to other people's children (i.e. how much help with child care the participant themselves provide to other people). Since the Solomon Islands experienced episodes of ethnic violence between 1998 and 2003,[15] we also ask participants whether they have ever "witnessed organized violence or warfare with people from another village" (mean: 0.44, s.d.: 0.50).

3.3 Child socio-cognitive and socio-emotional indicators

3.3.1 Child vocalizations

The number of child vocalizations was estimated from child-centered long-form recordings collected using a wearable device, an increasingly used technique in early language development research (Lavechin et al., 2021). In urban conditions, a hardware-software combined solution called LENA is frequently used (Gilkerson et al., 2017; Cunha et al., 2021). LENA was suboptimal for the current approach for two key reasons. First, the lack of electricity and internet connection found in these remote communities meant that the licenses promoted by LENA were inappropriate in this setting. To recover the audio-recordings, one needs to connect the recording device to a computer, have enough power and internet to extract and upload the recording (which is meanwhile stored in a proprietary format) before the recording device

[15]Most of the violence occurred in the main island of Guadalcanal but other provinces, and particularly Western province, also experienced sporadic but intense violence.

can be used again. Second, LENA's software was trained in urban conditions among monolingual American English learners, which raises questions about whether the software would be sufficiently accurate in our population of largely multilingual infants (children in our sample are exposed to one or more of 12 different languages: Avaso, Babatana, Marco, Marovo, Pidjin, Roviana, Senga, Simbo, Sisinga, Ughele, Vaghua, Varisi) growing up in rural conditions.

In our study, the child wore a t-shirt fitted with two small breast-pockets, into which a pair of USB voice recorders was inserted. Two recorders were used because in such field conditions, with high humidity and variable temperatures, some devices stop functioning. The recorder then functioned continuously until the battery ran out, except if extracted from the t-shirt and turned off, which the family could do if they decided to exercise their right of withdrawal from the study, or at the end of the day, when the researcher picked up the equipment. This resulted in 374 recordings for 196 children, lasting on average 6.5 hours (SD 1.95 hours, range 0.48 minutes - 18 hours).

Each recording was then analyzed with a Voice Type Classifier (VTC, Lavechin et al. (2020)), an end-to-end neural network, which for every 10 ms frame returns whether the key child (i.e., the child wearing the recording device) was vocalizing or not. A vocalization is then defined as a sequence of frames where the child vocalizes. VTC was trained with a combination of various child-centered corpora of children aged 0-4 years exposed to one or more of a variety of languages (including Minn, French, Ju—'hoan, Tsimane', English, and several others, in approximate order of data quantity). Importantly, these corpora included children growing up in multilingual settings, as well as languages spoken in the Pacific, with a wide variety of typological characteristics. The multi-corpus training was done to improve the generalizability of the network to unseen data sets. The corpora were divided internally into independent training, developmental, and testing sets. As reported in Lavechin et al. (2020), F-score performance on the test set of this multilingual corpus was 77.3% for recognizing the key child. In addition, that study also reports on performance for a wholly independent, unseen, test set comprised on monolingual English learners, for which LENA performance was also available. In that comparative dataset, LENA's performance for the key child was 54.9%, whereas the VTC scored 25% higher, at 68.7%. We also checked the performance of VTC in a small subset of data analyzed in the present paper. About 87 minutes of audio were annotated by

research assistants who were unfamiliar with the language and the families that were recorded, which may have a negative impact on the accuracy of their annotations, so that performance of VTC is under-estimated. Nonetheless, performance was good, at 62%, and comparable to human-human F-score on the same data (64%).

VTC outputs a text file indicating at which points of the multi-hour recordings the key child vocalized. Following standard practice in the field (Cristia et al., 2020), we counted the number of vocalizations attributed to the key child over the whole recording. We then divided that by the length of the recording, to control for variation in recording length.

Recording young children's vocalizations through wearables is a promising method to assess language development. Long-form recordings have several advantages, including capturing the child's vocal patterns in their natural environment and being able to accumulate a great amount of data easily. However, this also means that the audio recording is harder to process than an audio recording gathered in more manicured and stable conditions. Automatized algorithms attempt to classify child vocalizations into crying, laughing, canonical, and noncanonical, but precision is still a challenge (Schuller et al., 2019; Semenzin et al., 2021). We address the possibility that our vocalization counts confound actual speech and crying in several ways. First, we rely on manual annotations from lab specialists to code the nature of vocalizations in a random subset of our data. In line with established research,[16] cries constitute a small proportion of vocalizations: only 3.20% of the segments corresponded to crying. The majority of segments were speech-like (93.2%), and laughing amounted to a similar proportion to crying (3.01%). Second, we collect a direct measure of child socio-emotional wellbeing based on hormonal biomarkers for stress hormones.

3.3.2 Cortisol and Cortisone

In Western province, only,[17] we invited the selected married participants in each village to provide hair samples for the mother and child, following the procedure adapted from Wright et al. (2018). After all field work was completed, 102 mother-

[16] Among a sample of either children younger than children in our sample (4-18 months) or slightly older children (11–53 months) but who were diagnosed with Angelman syndrome (a genetic disorder causing speech delays and intellectual disability), related research has shown that 72.89% of automatically identified segments were speech-like, 5.23% crying, and 1.65% laughing (Semenzin et al., 2021).

[17] We could not collect hair samples from Choiseul Province for logistical reasons, as our field team had to carry all materials and food on a round-trip around the island and did not have access to any storage solution.

child pairs of hair samples were sent to a laboratory and evaluated for levels of cortisol and cortisone.

We specifically collect hair samples, rather than saliva, to circumvent known issues with collection timing and storage of saliva samples (Pruessner et al., 1997). Levels of cortisol among the children in our sample are, on average, 6 pg/mg, which is commensurate with levels documented in a Dutch sample of similar-age healthy children (de Kruijff et al., 2020).

Levels of cortisol and cortisone provide measures of child socio-emotional wellbeing, and have been used in the literature to study stress and wellbeing responses of children to care environments (Groeneveld et al., 2010). Higher levels of cortisol and cortisone in children have detrimental developmental consequences for child cognitive and health outcomes. They are associated with the over-activation of the hypothalamic pituitary and adrenal glands, which may result in unfavorable developmental consequences, including suppressed immune responses and impairments to brain development (Lupien et al., 1998, 2009). Haushofer et al. (2023) show that increased cortisol is associated with lower prosociality of adults in laboratory settings, although the link has not yet been tested for children.

3.4 Descriptive statistics

3.4.1 Sample statistics

Appendix Table A2 presents the summary statistics for our sample. Half of the participants are women. On average, participants are nearly 31 years old and 77 % have children (N=631). The average age of the target child is 25.18 months, in line with our recruitment protocol, with 2 siblings on average. Slightly less than half of the children are female (48%). On average, participants have three relatives living in the same village.

Only 38% of the participant sample has completed secondary school, reflecting the low educational opportunities for people in the Solomon Islands, while on a test of cognitive ability (Raven's Test), participants answered just over 50% of questions correctly (12.79 out of 24), which is slightly higher than mean scores from samples in other low-income settings (Brouwers et al., 2009).

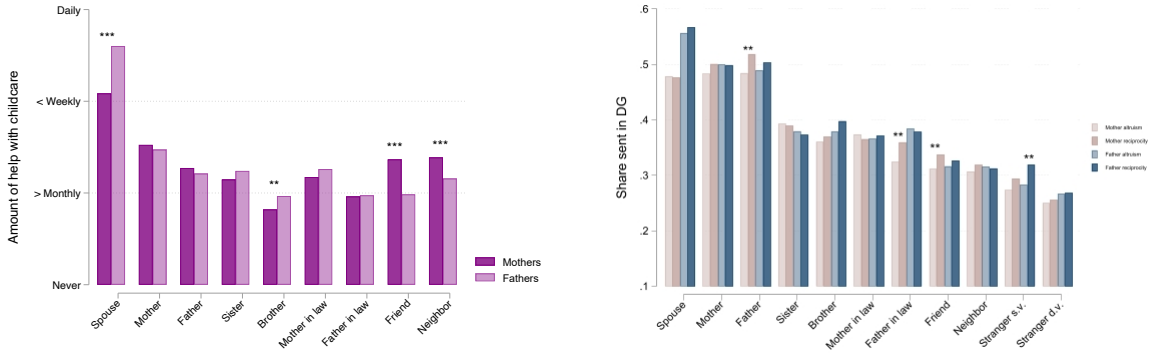
3.4.2 Who helps with child care

The summary statistics further reveal the extent to which help with child care is prevalent in these communities. On average, parents of young children receive some form of help with care from 7.07 different people. In terms of frequent help with care, 52% of participants receive daily help from the spouse and 62% from someone other than their spouse, and a similar proportion of respondents provides care for other people's children.

Our design enables us to capture how much help is provided by different people, relatives and not, as acknowledged by both mothers and fathers. Figure 2(a), based on the statistics reported in Appendix Table A3, illustrates three main patterns. First, help with child care follows genetic relatedness to the child. Parents provide significantly more care than others. Next is the participant's mother (one of the child's grandmothers), who helps once a week on average, followed by the participant's mother-in-law (the other grandmother), father (one of the child's grandfathers) and sister (child's aunt). Last are the participant's brother and father-in-law, who offer the least amount of help (on a less than monthly basis). Second, women provide more help than men - mothers more than fathers, grandmothers more than grandfathers, sisters more than brothers. Third, child care relies substantially on the support offered by unrelated but well-known individuals, namely friends and neighbors. These findings are consistent with a large literature linking help to both genetic and social proximity (Barrett et al., 2002; Kasper and Mulder, 2015).

Patterns are remarkably similar across mothers and fathers, with a few exceptions. Both mothers and fathers report that the main source of care comes from their spouse (nearly every day), but fathers acknowledge more help with care from their wives than mothers acknowledge receiving from their husbands (p-value=0.000). Mothers report more help from friends and neighbors, who help them as much as either grandmother (p-value=0.000 and p-value=0.001, respectively). In other words, fathers rely more on their spouse, while mothers rely more on their friends and neighbors.

In Appendix Table A4, we analyze the determinants of help with child care. The main determinant of help from relatives is the presence of relatives in the village. The intensive margin of productive activities is an important predictor of help received with child care for mothers, but not for fathers. Mothers who work more in their gardens, fish more, or sell more frequently in markets outside of their village receive no extra help from their husbands but receive more help from non-relatives. Another



(a) Amount of help received

(b) Giving in dictator games

Figure 2: Help with care and cooperation in the dictator game

Notes: N=374 mothers and 257 fathers. In panel (a), bars represent the average amount of help with care that participants receive from the individuals in their network reported as: (0) never, (1) less frequently than once a month, (2) more frequently than once a month, (3) once a week, (4) a few times a week, (5) every day, a little bit, or (6) every day, for a large part of the day. Stars represent differences between mothers and fathers (** p-value < 0.05, *** p-value < 0.01). In panel (b), bars represent the average share of the dictator game endowment given to each receiver (each time from a new SI$40 endowment). Stars represent differences between giving in the anonymous (altruism) and non-anonymous conditions (reciprocity) (** p-value < 0.05, *** p-value < 0.01).

interesting pattern is that mothers who receive more help with child care also tend to take care of their own child more frequently. This highlights that in the context of the horticultural societies that we study, with limited involvement in outside economic activities, child care is a social activity. This stands in contrast with industrialized countries, where mothers are generally more socially isolated (Konner, 2017) and where formal childcare substitutes for parental care.

The intensity of help with child care is not predicted by other individual-level characteristics, such as cognitive ability, schooling, or wealth, although for fathers it does. Younger parents receive more help, but the magnitude of this relationship is small.

In Appendix Table A5, we show how help with child care positively correlates with other dimensions of the dyadic relationship between participant and receiver. People who help with child care also tend to provide emotional support, attend the same church, help with garden work and offer financial support. The magnitudes are largest for attending the same church and help with production, and much more modest for large financial support, which is insignificant for fathers. These patterns suggest that help with child care is not perfectly predicted by other dimensions of social and economic support, but that controlling for these other dimensions may be important to isolate the influence of allomaternal care on prosocial preferences.

3.4.3 Altruism and reciprocity towards relatives and others

Appendix Table A2 shows the mean share of the endowment sent in the dictator game, averaged across all receivers. In the anonymous (altruism) rounds, participants shared, on average, 39% of their endowment with receivers, while in the non-anonymous (reciprocity) rounds, they shared slightly more (40%; p-value difference = 0.002).

Figure 2(b) reports the average share of the dictator game endowment given to each receiver, separately for the non-anonymous (reciprocity) and anonymous (altruism) conditions (see the statistics in Appendix Table A6).

Mothers and fathers give the most to their spouse and their own parents, with shares hovering around 50% or more. One notable difference is that men give significantly more to their wives (∼56%) than what they receive from their wives (∼48%). Participants give similar amounts (around 36%-39%) to their own siblings and to their in-laws. Friends, neighbors, and strangers all receive non-negligible shares. Friends and neighbors receive around 32% of the endowment, significantly less than what is given to siblings and in-laws, but significantly more than what strangers receive (around 28% in the same village and 26% in the distant village).[18]

With respect to differences between the non-anonymous (reciprocity) and anonymous (altruism) conditions, we find that reciprocity overall motivates people more than altruism (respective averages: 0.382 vs. 0.372; p-value=0.019)[19]

4 Allomaternal care fosters prosociality

Simple correlations between cooperative behavior in the dictator game and help with child care may be confounded by both the relatedness to the receiver and their child (spouse, relatives,[20] and non-relatives), as well as factors that influence both the amount of help a participant can elicit and their prosocial inclinations (due to status, personality traits, or other unobserved factors). We first discuss how our experimental setup enables us to address these empirical issues and present our results. We

[18]These patterns suggests that genetic relatedness alone cannot explain gift-giving. People are not genetically related to their in-laws, yet they give as much to them as to their own siblings. Genetic relatedness to the child also cannot explain gift-giving, since genetic relatedness to one's child is the same for one's sister or brother and for one's parents (who receive much more).

[19]See Appendix Table A6 for a breakdown by gender and receiver, this difference is statistically significant only in a few cases.

[20]Here, we note that the relatives of one's spouse are technically not relatives, but they are relatives of one's child, so we assimilate them to relatives.

then document how allomaternal care, specifically by non-relatives, corresponds to impersonal prosociality and socio-cognitive outcomes in children.

4.1 Estimation strategy

We estimate the following specification at the level of a participant-receiver dyad in the dictator game, which allows us to exploit within-participant (i) variation in the share of the endowment (y_{irg}) transferred to each receiver (r), as well as variation in the amount of help with child care ($Care_{ir}$) provided to the participant by each specific type of receiver (e.g., spouse, mother, father, mother-in-law, father-in-law, brother, sister, friend or neighbor):

$$y_{irg} = \alpha + \beta_1 Care_{ir} + \beta_2 Care_{ir} * T_g + \delta T_g + X'_{ir}\Gamma + \rho_i + \mu_r + \varepsilon_{irg} \quad (1)$$

where $Care_{ir}$ captures the frequency of help with child care provided by receiver r to participant i, which we standardize to mean zero, standard deviation one.[21] The term T_g is an indicator variable for the non-anonymous (reciprocity) giving condition. We allow the coefficient associated with $Care_{ir}$ to vary across reciprocal and altruistic motives by including an interaction between T_g and $Care_{ir}$. The term X_{ir} is a vector of constructed dyad-specific attributes capturing other dimensions of the relationship between i and r, including risk-sharing, emotional support, and productive help. The variable ρ_i is a vector of participant fixed effects, and μ_r a vector of recipient-type fixed effects. We do not include individual covariates, since ρ_i absorbs all participant-level characteristics.[22] We cluster standard errors at the participant level (ε_{irg}) to address correlation in giving across receivers from a given participant. We initially consider only the sample of parents, and exclude gift-giving to strangers, since they do not provide any care to children.

The direction of causality is implicit in the model, since allomaternal care by different caregivers is pre-determined at the time of our experiment. Moreover, our anonymous treatment removes the possibility that participants may treat transfers strategically so as to elicit more care in the future. However, any raw correlation between $Care_{ri}$ and y_{irg} could still be confounded by a number of factors. First, a

[21] Note that we only observe the amount of help with care that the receiver provides to the participant, and not the amount that the participant provides to the receiver.

[22] While we know the relationship between each participant and each receiver, we did not collect additional covariates on each receiver beyond the elements included in X_{ir}. Our model thus only includes dyad-specific support characteristics and no other covariates.

participant's prosocial inclinations could be systematically correlated with how much help others are willing to provide. Others might be willing to help, for example, because the participant, or their child, are particularly agreeable and prosocial or have higher status. Similarly, more prosocial individuals or those with higher status may be more inclined to transfer higher shares in the dictator game. To address this, the participant fixed effects (ρ_i) in Equation (1) capture any unobservable characteristics of a given participant that may be associated with prosociality and the amount of help with child care they receive.

Second, a certain type of receiver may both provide more help with child care and receive larger gifts in the dictator games for reasons unrelated to any causal relationship between these two variables. Relatives, for example, may both receive a greater share of the endowment in the dictator game and provide more child care exclusively because of their genetic relatedness to the participant and their child. Receiver-type fixed effects (μ_r) capture the specificity of the relationship between a given receiver and the participant (or their child) that could drive both gift-giving and child care provisioning. We include a separate fixed effect for each type of receiver (e.g. spouse, mother, father, mother-in-law, father-in-law, brother, sister, friend, neighbor) and add a separate fixed effect to account for the fact that for 17.6% of the individuals in the sample, the spouse is not the biological parent of the child.

Last, the provision of child care could be systematically correlated with other forms of help that the receiver provides to the participant. We elicit other dimensions of this relationship, including economic, productive, emotional, and social support, and check that our results are robust to accounting for their potential influence on gift-giving by including them as additional controls in X_{ir}. We first discuss how these different dimensions of the dyadic relationship between participant and receiver correlate with each other. We then present our results with and without other dimensions of support as controls.

The parameters of interest in Equation (1) are β_1 and β_2. These coefficients isolate the increase in dictator game transfers associated with additional help received with child care, after controlling for participant fixed effects, the specific type of relationship between participant and receiver (e.g. specific family member, friend), and other dimensions of the relationship between participant and receiver that vary at the dyad level, including the intensity of emotional support or economic risk sharing. When the full set of fixed effects and controls are included, the remaining variation

comes from the fact that some receivers provide more help with child care than others for idiosyncratic reasons unrelated to their genetic or social relatedness to the participant, to the participant's characteristics, or to other dimensions of their relationship to the participant that we capture (e.g. emotional, economic, productive, or attending Church together). For example, the friend of one participant may help more than the friend of another because they like children more. A neighbor may have children similar in age to the participant's children, and hence be more inclined to provide child care than a neighbor without them. A participant's sister may live closer than the sister of another participant, and therefore be more willing to help because visiting is less time-consuming. When all these factors are accounted for, the coefficient β_1 captures the elasticity of dictator game transfers to allomaternal help in terms of altruism (anonymous treatment), while $\beta_1 + \beta_2$ captures the reciprocal return (backward and/or forward signaling reciprocity motive).

Because we only exploit variation in transfers across receivers for a given participant, our design is also insulated from potential confounds such as experimenter effects, social desirability bias, or cognition, which could influence how a particular individual would generally behave in the experimental game.

4.2 Help with child care elicits altruism and reciprocity

Results displayed in Table 1 show that gift giving in the dictator game is positively correlated with help received with child care, both for mothers (Col. 1) and fathers (Col. 6). Columns 2-5 for mothers and 7-10 for fathers add participant and receiver-type fixed effects, first separately and then together. The estimation results of Equation (1) are displayed in Columns 5 and 10, separately for mothers and fathers.

The coefficient associated with help with child care for anonymous transfers (β_1) drops in magnitude between Columns 1 and 2 (mothers), and 6 and 7 (fathers), when we add participant fixed effects, suggesting positive selection into receiving more help with child care for more prosocial individuals. The coefficient β_1 drops by an even larger magnitude when we add receiver-type fixed effects (Columns 3 and 8), especially for fathers. This is unsurprising and reflects the fact that the specific nature of the relationship between participant and receiver determines both how much help each receiver provides and how much the participant gives them. It confirms the descriptive patterns in Figure 2, which shows that specific individuals in the participant's network, for example the participant's mother, systematically

provide more help and receive higher donations. Accounting for receiver-type fixed effects explains away roughly 46.43 to 49.06% of the correlation between help with child care and gift giving for fathers (depending on anonymous or non-anonymous treatment) and 28.95 to 36.67% for mothers.

Accounting for both participant and receiver-type fixed effects (Columns 4 and 9), β_1 and $\beta_1 + \beta_2$ remain statistically significant for mothers, suggesting that help with child care elicits greater prosociality by mothers. These results may, however, be due to the fact that the provision of child care help correlates with other dimensions of support, and that receiving help in any dimension elicits greater prosociality. To address this, we include controls for other dimensions of social, emotional, productive, and economic support in columns 5 and 10. Among these other dimensions of support, only emotional support elicits higher gift giving by mothers, but the magnitude is smaller than the magnitude of the coefficient associated with child care help. Moreover, β_1 and β_2 are unchanged in magnitude.[23] These results suggest that other dimensions of support have no bearing on the relationship between allomaternal care and gift giving by mothers. This highlights the specificity of allo*maternal* care in eliciting prosociality.

Turning to reciprocal and altruistic motives, the positive and statistically significant (p-value < 0.10) coefficient for *Reciprocity* (an indicator for the non-anonymous giving condition) in Table 1 suggests that reciprocity is an important general motive for gift-giving. However, the coefficient associated with the interaction between $Care$ and the anonymous treatment is negative, and at least for women, statistically significant, although small in magnitude, suggesting that eliciting further care may not be the most important motivation behind giving (i.e., gratitude for past help matters, as well).

Overall, the results suggests that receiving help with child care makes mothers more generous. The point estimate suggests that a one standard deviation increase in help with child care (receiving help with care from a few times a month to a few times a week) is associated with a 1.5 percentage point increase in anonymous gift giving, a 3.84% increase at the mean.[24]

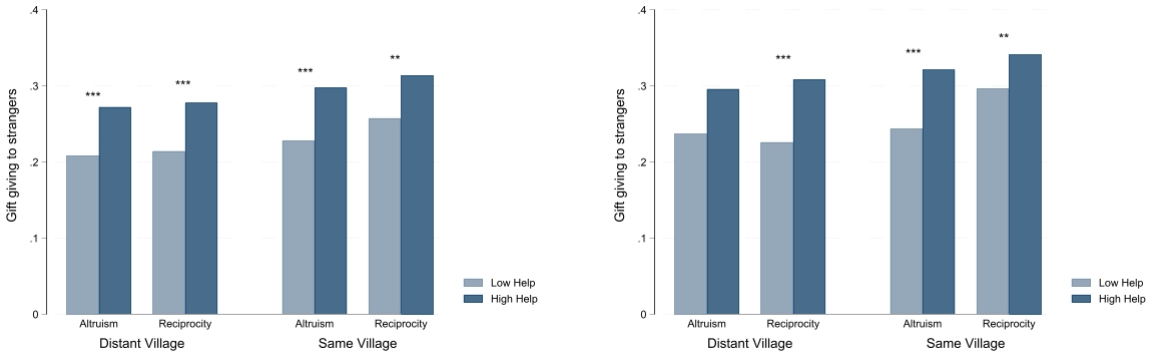
[23]The difference in β_1 across specifications in Columns 4 and 5 is not statistically significantly different from 0 (P-value: 0.30).

[24]The mean anonymous transfer in the dictator game is 0.39 for women.

Table 1: Allomaternal care and cooperation in the dictator game

DV: Share sent in DG	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
			Mothers					Fathers		
Child care	0.038***	0.030***	0.027***	0.015***	0.012**	0.056***	0.045***	0.030***	0.006	0.002
	(0.007)	(0.005)	(0.007)	(0.005)	(0.005)	(0.007)	(0.005)	(0.008)	(0.005)	(0.005)
Reciprocity	0.011*	0.011*	0.011*	0.011*	0.011*	0.008	0.008	0.008	0.008	0.008
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)
Child care X Reciprocity	-0.008*	-0.008*	-0.008*	-0.008*	-0.008*	-0.003	-0.003	-0.003	-0.003	-0.003
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
Small financial support (0/1)					0.013					-0.008
					(0.009)					(0.008)
Large financial support (0/1)					-0.013					0.001
					(0.011)					(0.011)
Help with production					0.002					0.008
					(0.005)					(0.005)
Emotional support					0.008*					-0.002
					(0.004)					(0.005)
Attend same church (0/1)					-0.014					0.011
					(0.010)					(0.015)
Participant FE:	N	Y	N	Y	Y	N	Y	N	Y	Y
Receiver FE:	N	N	Y	Y	Y	N	N	Y	Y	Y
Observations	4702	4702	4702	4702	4680	3530	3530	3530	3530	3522
Mean DV	0.40	0.40	0.40	0.40	0.40	0.41	0.41	0.41	0.41	0.41
SD DV	0.27	0.27	0.27	0.27	0.27	0.26	0.26	0.26	0.26	0.26

* p<0.10, ** p<0.05, *** p<0.01. Unit of observation is a participant-receiver dyad in the dictator game, excluding strangers. Standard errors clustered at the participant level in parentheses. *Child care* is the frequency of help with child care that the receiver provides to the participant, normalized to mean zero, standard deviation one. *Reciprocity* is an indicator variable taking value one for the non-anonymous giving condition.



(a) Mothers

(b) Fathers

Figure 3: Cooperation toward strangers and help with care from non-relatives

Notes: N=374 mothers and 257 fathers. Bars represent the average share of the dictator game endowment given to strangers for mothers and fathers who receive a high amount of help with child care (above median) vs. a low amount of help (below median) from non-relatives (friends and neighbors). *Altruism* represents giving in the anonymous condition and *Reciprocity* represents giving in the non-anonymous condition. Stars represent differences between high and low help (** p-value < 0.05, *** p-value < 0.01).

4.3 Help from non-relatives and cooperation toward strangers

To elucidate the relationship between allomaternal care and *impersonal* cooperation, we turn to the relationship between help with child care that participants receive and their generosity toward strangers (i.e., random person in own village and random person in a distant village). Our experimental design specifies that strangers are not related to the participant, or even known to them, so there is no history of reciprocal relationships. In this case, the distinction between reciprocity and altruism loses some of its importance. In practice, however, given how small the villages in our sample are, a stranger in one's village could be a distant relative or a friend, and a non-anonymous gift may sow the seed of future reciprocation. Therefore, to capture different degrees of social distance, we elicit gift giving to strangers in both the same and distant villages, again both non-anonymously (reciprocity) and anonymously (altruism).

Looking at the raw experimental results, Figure 3 suggests that help with care from non-relatives is correlated with greater cooperation toward strangers. Comparing the shares of the endowment sent to strangers between those who receive high (above median) vs. low (below median) help from non-relatives shows that participants who receive more help from non-relatives demonstrate greater cooperation toward strangers (uncontrolled t-tests shown in Appendix Table A7).

We test these relationships more rigorously in Table 2. We start by limiting the sample to participants (i) in village (v) with children and only keep receivers who are

strangers. We estimate the following equation, separately for mothers and fathers, at the level of a participant-receiver dyad, pooled over all treatment conditions (stranger in the same or distant village (s), and anonymous and non-anonymous giving (g)):

$$y_{ivsg} = \alpha + \sum_{k=1}^{3} \beta_{1k} Care_{ki} + \beta_2 T_{sg} + \sum_{k=1}^{3} \beta_{3k} Care_{ki} * T_{sg} + X_i' \Gamma + \mu_v + \varepsilon_{ivsg} \qquad (2)$$

where y_{ivsg} is the share of the endowment given to stranger s from participant i in village v under giving condition g, and $Care_{ki}$ is the amount of care provided by the spouse, other relatives of the child, and non-relatives (friend, neighbor). In all specifications we interact the treatment conditions T_{sg} (stranger in same vs. distant village; non-anonymous vs. anonymous) with each of the three child care variables to test different motives of cooperation toward strangers: (i) reciprocity (non-anonymous vs. anonymous), and (ii) social distance (same vs. distant village). Because the amount of help with child care does not vary across strangers for a given participant, our specifications cannot include participant fixed effects. We instead include village fixed effects μ_v that account for broad differences in cooperation or child care practices across villages. Additionally, we include a wide range of participant-level controls in X_i, such as age, proxies of the participant's presence of relatives in the village, which is the main predictor of help by relatives, proxies for social status, such as cognitive ability and wealth, which may influence both how much help participants are able to elicit and their generosity toward strangers. For women, work in the gardens and participation in markets are significant predictors of how much allomaternal care they receive. These variables may also systematically correlate with prosocial preferences. We therefore control for the time participants spend working in their horticultural gardens and whether they sell goods in other villages. Given the substantial literature discussing how conflict exposure may affect prosocial preferences (see Bauer et al. (2016) for a review and footnote 7 in Introduction), we also control for exposure to organized violence. Finally, we account in X_i for other forms of social, emotional, productive and economic support provided to the participant.

We first present uncontrolled regressions, and then regressions that include individual covariates and treatment interaction terms. Table 2 shows that help with child care from spouse or from relatives is not associated with generosity towards strangers. For fathers, we observe no statistically significant and robust relationship between any form of help with child care and generosity toward strangers. However,

mothers who receive more help from *non-relatives* are systematically more generous toward strangers. This result holds regardless of possible motives of reciprocity or social distance, as none of the interaction terms are statistically significant at p-value < 0.10. It also holds controlling for a wide array of individual covariates, including how much social, economic, and emotional support the participant receives, proxies for status and wealth, and participation in markets. Again only child care help (from non-relatives) matters: none of the coefficients associated with other forms of support is statistically significant for mothers, they are inconsistent in sign, with some positive (number of Church congregants) and some negative (total help with production), and generally small in magnitude.

Although some of the controls, such as participation in markets, are themselves correlated with allomaternal care from non-relatives and have been described by previous literature as important correlates of prosociality, including the full range of individual-level covariates hardly affects the magnitude of the coefficient associated with allomaternal care from non-relatives. Delta coefficients of an Oster test (displayed at the bottom of Table 2) suggest that the influence of omitted variables would need to be roughly twice as large as the influence of all included controls to explain away the coefficient associated with allomaternal care from non-relatives, with some delta ratios even negative. In terms of magnitude, the results suggest that for mothers, a standard deviation increase in help with care from non-relatives corresponds to a 0.25 s.d. increase in giving to strangers, relative to a mean of 0.27, a 9.26% increase at the mean.

Table A8 in the Appendix displays the coefficients associated with each individual control. For mothers, time spent in the gardens is significantly associated with gift-giving to strangers. The coefficients associated with market participation are not significantly associated with gift giving to strangers. The coefficient associated with witnessing organized violence is negative, and only statistically significant for mothers at the 10% level. The negative sign is consistent with the literature on parochialism and previous results by Cassar et al. (2013) and Rohner et al. (2013), given that we elicit donations specifically to *strangers*. For fathers, the only significant coefficients are those associated with our wealth proxy, performance on a cognitive task, and emotional support. They are all negative, suggesting that men with higher status and more emotional support in their village are less generous towards strangers. We also find that, as expected due to social distance, the coefficients on *Same Village*

indicate that gift giving to strangers in the same village is higher than to strangers in a distant village, both for mothers and fathers.

Finally, to shed some light on group-level effects, we limit our analysis to participants who do not have children, and thus do not directly benefit from the provision of child care. We correlate the share of the endowment that non-parents give to strangers in the dictator game with the average amount of help with child care that parents receive in their village. Appendix Table A9 shows a positive and significant relationship (p-value < 0.05) between impersonal prosociality and village-level help with child care among those who do not directly benefit from child care. The statistically significant interaction term in Column 4 suggests that this relationship is driven by women. These results suggest that impersonal cooperation can be sustained by generalized norms of prosociality that also influence the behavior of those who do not directly benefit from child care help.

The results so far show that help with child care is associated with more reciprocity and altruism, and that help from non-relatives specifically is associated with heightened impersonal prosociality. Overall, this suggests a link between allomaternal care and prosociality, which goes beyond simple reciprocal relationships and generalizes to impersonal interactions. This evidence is consistent with the cross-cultural evidence discussed in the Introduction and provides support for the hypothesis that cooperation is rooted in the social organization of child rearing. Our findings suggest that the capacity for generalized prosociality could have emerged specifically from cooperation with non-relatives over child care, and may help to explain previous findings on the relationship between tight versus loose kinship structures and prosociality.

Table 2: Allomaternal care and cooperation toward strangers

DV: Share sent in DG	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
			Mothers				Fathers	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Care from: Spouse	-0.004	-0.005	-0.004	-0.005	0.005	-0.001	0.019	0.012
	(0.008)	(0.010)	(0.010)	(0.012)	(0.018)	(0.019)	(0.021)	(0.020)
Care from: Relatives of child	-0.014	-0.013	-0.011	-0.009	0.021*	0.021	0.013	0.013
	(0.010)	(0.014)	(0.014)	(0.017)	(0.012)	(0.017)	(0.016)	(0.019)
Care from: Non-relatives	0.024**	0.025**	0.024*	0.025*	0.013	0.019	0.014	0.021
	(0.011)	(0.011)	(0.013)	(0.014)	(0.015)	(0.015)	(0.019)	(0.019)
Same village × Care from: Spouse			0.003	0.003			-0.024	-0.023
			(0.010)	(0.010)			(0.019)	(0.019)
Same village × Care from: Relatives of child			0.009	0.008			0.003	0.005
			(0.009)	(0.009)			(0.015)	(0.015)
Same village × Care from: Non-relatives			-0.005	-0.005			-0.004	-0.006
			(0.008)	(0.008)			(0.016)	(0.015)
Reciprocity × Care from: Spouse			-0.003	-0.003			-0.003	-0.003
			(0.009)	(0.009)			(0.016)	(0.016)
Reciprocity × Care from: Relatives of child			-0.016	-0.016			0.011	0.011
			(0.010)	(0.010)			(0.012)	(0.012)
Reciprocity × Care from: Non-relatives			0.005	0.005			0.003	0.003
			(0.008)	(0.008)			(0.014)	(0.014)
Same village	0.030**	0.030**	0.033**	0.032**	0.034***	0.034***	0.045***	0.044**
	(0.013)	(0.013)	(0.013)	(0.013)	(0.011)	(0.011)	(0.016)	(0.016)
Reciprocity	0.013	0.013	0.010	0.010	0.019	0.019	0.020	0.020
	(0.010)	(0.010)	(0.012)	(0.012)	(0.015)	(0.015)	(0.019)	(0.019)
Emotional support		-0.000		-0.000		-0.031**		-0.031**
		(0.013)		(0.013)		(0.014)		(0.014)
Small financial support		0.005		0.005		0.004		0.004
		(0.012)		(0.012)		(0.015)		(0.015)
Large financial support		-0.009		-0.009		-0.014		-0.014
		(0.010)		(0.010)		(0.013)		(0.013)
Production support		-0.021		-0.021		0.023		0.023
		(0.016)		(0.016)		(0.018)		(0.018)
Church congregants		0.012		0.012		0.014		0.014
		(0.013)		(0.013)		(0.014)		(0.014)
Additional controls:	N	Y	N	Y	N	Y	N	Y
Village FE:	Y	Y	Y	Y	Y	Y	Y	Y
Villages	44	44	44	44	44	44	44	44
Observations	1444	1444	1444	1444	968	968	968	968
R^2	0.247	0.273	0.249	0.274	0.218	0.262	0.220	0.264
δ Care from: Non-relatives		1.73		-2.75		3.79		-2.76
Mean DV	0.27	0.27	0.27	0.27	0.28	0.28	0.28	0.28
SD DV	0.25	0.25	0.25	0.25	0.24	0.24	0.24	0.24

* p<0.10, ** p<0.05, *** p<0.01. Unit of observation is a participant-receiver dyad in the dictator game, restricted to strangers, only. All estimates include village fixed effects. Additional controls include log of participant's age, cognitive ability, number of relatives living in the village, ownership of consumer durables, and whether the participant ever witnessed inter-village violence. *Care* variables represent the amount of help with child care that each group provides to the participant standardized to mean zero, standard deviation one. *Reciprocity* is an indicator variable taking value one for the non-anonymous giving condition. *Support* variables represent the total amount of support, for each type of support as described in the main text, received from the various individuals in a participant's network, normalized to mean zero, standard deviation one. Standard errors clustered at the village level in parentheses. The coefficients δ are calculated using the *psacalc* function in Stata assuming an R-max $= 1.3 * R^2$ and represent the proportional degree of selection on unobservables needed to overturn the estimated effects. Missing observations imputed to the sample mean for control variables and all estimates include indicator variables for missing observations.

5 Allomaternal care and socio-cognitive benefits to children

We now investigate whether allomaternal care is associated with socio-cognitive benefits to children. The presence of such correlation would offer some supporting, although indirect, evidence for the idea that an important mechanism for the relationship between allomaternal care and prosociality may have been through the role of allomaternal care in permitting the emergence of distinctively human social capacities.

We focus on language, a unique human social characteristic. We calibrate measures of child socio-cognitive development based on the number of child vocalizations estimated from child-centered long-form recordings collected from 196 children using a wearable recording devices (Lavechin et al., 2021). We analyze recordings using a multilingually-trained, neural network that outperforms other software alternatives (Lavechin et al., 2020).

We regress child vocalization counts on the amount of care that the child receives from various people, including their mother, father, other relatives (grandparents, aunts and uncles), and non-relatives (friends and neighbors).[25] We include village fixed effects to account for broad geographic, cultural, and linguistic differences across villages that could influence child outcomes. We include child-level controls, such as age, which influence vocalizations, and gender, as well proxies of other child-level stressors, such as BMI, total number of children in the household, and whether the mother's spouse is the child's biological father, which could influence child socio-cognitive development and correlate with the amount of care that the child receives from different caregivers (paternal relatives, in particular). We also control for the usual set of mother-level characteristics, such as age, a proxy for cognitive ability, wealth, and the amount of social, emotional, productive, and economic support she receives, as well as the presence of relatives in the village (an important predictor of care by relatives), time spent in gardens and market participation (an important predictor of care by non-relatives) and conflict exposure.

These controls may play an important role in our estimation. Mothers' time spent in gardens and market participation may reduce the time spent with her children and increase the amount of care given by non-relatives. We thus expect the inclusion of

[25] More information on the specification is included in Section C.2 of the Appendix.

these controls to improve the precision of our estimates. Yet, there is also a possibility that some of these controls are endogenous to child socio-cognitive outcomes and allomaternal care. For example, mothers may participate less in markets if finding a friend or neighbor willing to take care of a child is more difficult for a children with low socio-cognitive skills. To address this possibility, we systematically present the results of specifications that include only basic controls (child age and gender, mother age), as well as the full set of controls.

The results displayed in Table 3 show that care from non-relatives is the only robust and consistent predictor of higher child vocalizations. Care from any other caregiver does not consistently correlate with our measure of child socio-cognitive development. Care from the mother is positively associated with vocalizations, care by the father negatively, and care by other relatives of the child inconsistent in sign; but none of the coefficients is statistically significant.

Estimates displayed in Column 4 of Panel A (with minimal controls for child age and gender and mother age) suggest that receiving care by non-relatives on at least a weekly basis is associated with significantly more vocalizations (26.8 per hour, a 12.47% increase at the mean, p-value < 0.10). Parsimoniously controlling for care by different caregivers as we do in Columns 1 to 4 may mask systematic correlations in care by different caregivers. To address this, Column 5 controls for all inputs by different caregivers together. The coefficient associated with care by non-relatives is barely affected, and if anything, increases slightly in magnitude, suggesting that care by non-relatives does not, in our context, fully substitute for care by other caregivers.

Child care provided by non-relatives may also capture other dimensions of maternal support, such as emotional or social support. In specifications displayed in Panel B, we control for all other dimensions of maternal support, as well as the other mother-level controls discussed above. In particular, we control for time spent in gardens and market participation, which are important drivers of help with child care from non-relatives for mothers.

As expected, controlling for the extended set of controls improves the precision of the estimate associated with care by non-relatives. The coefficient suggests that receiving care by non-relatives on at least a weekly basis is associated with 38.17 more vocalizations per hour, a 17.80% increase at the mean, (p-value < 0.05). The estimates displayed in Panel B also reveal that none of the various other dimensions of maternal support is a robust predictor of child socio-cognitive outcomes. This highlights child

care, as opposed to social, emotional, productive, or economic support to the mother, as the driver of the child socio-cognitive benefits we document.[26]

The only other robust predictors of child vocalizations are mother's performance on a cognitive task (p-value < 0.05) and mother's participation in markets (p-value < 0.01). The positive and significant correlation between mother's cognitive ability and child vocalization is consistent with findings on the heritability of cognitive skills (Mollon et al., 2021) and provides a validation of our measure of socio-cognitive development. The result for mother's market participation suggests that such behavior may reflect mothers' non-cognitive skills, which may be partly inherited and predictive of children's socio-cognitive development. Although we observe a weak negative correlation between performance on the cognitive task and market participation (-0.17), the correlation between market participation and emotional support is positive (0.24), suggesting that market participation may indeed partly reflect social skills.[27]

A potential limitation of automated long-form recording data is the possibility that cries, and hence child distress, may be categorized as vocalizations. We address this possibility in two ways. First, given the magnitude of our results and the low average proportion of crying in vocalizations, it is unlikely that our results can be entirely explained by distress. The average proportion of crying in vocalizations coded by lab scientists in a random subset of our data was 3.20%; applying this to the mean vocalization suggests an estimate of 6.88 average crying vocalizations per hour. The coefficient associated with a one standard deviation increase in care by non-relatives hovers around 27-28 additional vocalizations, which would represent a 400% increase in crying if the effect were entirely due to distress, which seems implausibly large. Second, to provide a more direct measure of distress, we collected measures of child emotional wellbeing from hormonal biomarkers for cortisol and cortisone in hair samples of 102 mother-child pairs. The rationale for collecting this data is that unmet children's needs, excessive crying, and distress under the care of others would translate into higher levels of stress.

The results displayed in Appendix Table A11 show that care from non-relatives is

[26] In Appendix Table A10, we also control for the mother's stress hormone, noting that the sample size is reduced to only those children for whom a child-mother hair sample was collected (102 children). The estimates are robust to controlling for mother stress and confirm that care by non-relatives is the only type of care that is positively associated with higher vocalizations. In addition, mother stress is, as could be expected, negatively associated with child vocalizations.

[27] The correlation between performance on the cognitive task and emotional support is itself negative and small in magnitude (-0.10).

Table 3: Allomaternal care and child vocalizations

	(1)	(2)	(3)	(4)	(5)
Panel A: Vocalizations per hour – Basic controls					
Care: Mother (Ln(Hours/week))	3.444				5.258
	(6.562)				(6.813)
Care: Father (daily)		-9.565			-13.309
		(10.163)			(10.701)
Care: Other relatives of child (weekly or more)			8.404		9.675
			(31.318)		(33.789)
Care: Non-relatives (weekly or more)				26.803*	28.620*
				(14.633)	(14.612)
Panel B: Vocalizations per hour – Extended controls					
Care: Mother (Ln(Hours/week))	6.455				7.678
	(5.510)				(5.742)
Care: Father (daily)		-6.276			-9.563
		(8.847)			(8.718)
Care: Other relatives of child (weekly or more)			6.040		5.305
			(29.617)		(32.411)
Care: Non-relatives (weekly or more)				38.171**	38.909**
				(16.697)	(16.719)
Mother's cognitive ability	1.804**	1.903**	1.923**	1.966**	1.893**
	(0.867)	(0.932)	(0.886)	(0.891)	(0.832)
Consumer durables	1.578	1.257	0.719	0.772	1.976
	(4.485)	(4.576)	(4.224)	(4.794)	(4.291)
Emotional support	-11.232	-10.662	-11.484	-13.877*	-13.011*
	(7.461)	(7.326)	(7.642)	(7.600)	(7.634)
Small financial support	3.149	1.878	2.686	5.732	5.141
	(6.583)	(7.120)	(6.696)	(6.850)	(7.150)
Large financial support	-8.530	-7.866	-7.377	-9.767	-10.727
	(8.030)	(8.223)	(8.306)	(8.235)	(8.119)
Production support	2.264	3.381	2.366	1.740	2.284
	(7.427)	(7.738)	(7.301)	(7.469)	(7.277)
Church congregants	4.641	2.835	2.910	-0.585	0.354
	(8.716)	(8.728)	(9.052)	(9.579)	(9.124)
Witness violence (0/1)	-5.851	-6.800	-7.792	-2.380	0.135
	(12.448)	(12.226)	(12.360)	(13.932)	(14.158)
Time in gardens	6.702	7.863	7.808	9.750	9.048
	(9.939)	(10.168)	(9.876)	(10.038)	(9.763)
Time selling in other village	16.656***	16.464***	16.383***	16.635***	17.186***
	(5.323)	(5.151)	(5.235)	(5.103)	(5.218)
USB FE:	Y	Y	Y	Y	Y
Village FE:	Y	Y	Y	Y	Y
Observations	374	374	374	374	374
Mean DV	214.94	214.94	214.94	214.94	214.94
SD DV	87.90	87.90	87.90	87.90	87.90

* p<0.10, ** p<0.05, *** p<0.01. Unit of observation is a child recording. *Care* variables are indicators for whether the child receives care at the frequency indicated. All estimates include a fixed effect for the USB recording device and village fixed effects, and control the child's ln(age), gender, and mother's ln(age). Panel B includes the following additional controls: child BMI, whether the mother's spouse is the biological father of the child, total number of children in the household, and the following controls for the mother: cognitive ability, number of consumer durables owned, amount of time spent working in the gardens, amount of time spent selling goods in another village, whether she has witnessed inter-village violence, and the amount of various forms of support (i.e., small and large financial, help with production, emotional support, and attend the same church) that she receives from all individuals in her network. Support variables and time working in gardens and selling goods normalized to mean zero, standard deviation one. Standard errors in parentheses, two-way clustered for village and USB recording device. Missing observations imputed for control variables and all estimates include indicator variables for missing observations of control variables.

associated with *lower* levels of stress hormones, cortisone and cortisol, in children.[28] The coefficient remains negative, but loses significance, when the full set of extended controls is included. The result that care by non-relatives is, if anything, negatively associated with child stress suggests that our vocalization result is unlikely to be driven by cries. Given that higher levels of cortisol and cortisone are associated with impaired brain development in children (Lupien et al., 1998, 2009) and, for adults in laboratory settings, increased cortisol is associated with lower prosociality (Haushofer et al., 2023), the result that care by non-relatives is negatively associated with child stress suggests potential socio-emotional benefits that go beyond the socio-cognitive benefits that we document.

6 Discussion and Conclusion

This work provides novel empirical evidence of a positive relationship between allomaternal care, especially by non-relatives, and prosociality, and uses a novel measure of vocalizations analyzed using a multilingually-trained neural network to document the socio-cognitive benefits that such care bestows on children.

Our experimental evidence produces a precise calibration of the relationship between various dimensions of help and prosociality and supports the hypothesis that help with child care uniquely predicts reciprocity and altruism, not just toward relatives and other network members, but toward strangers as well, suggesting a specific foundation for the development of impersonal prosociality. We find that help with child care by non-relatives is associated with enhanced prosociality toward strangers, highlighting the specificity of allomaternal care by non-relatives as a crux of impersonal prosociality. Our analysis provides a new mechanism that can explain the negative relationship between the strength of family and kinship ties and cooperative behavior that was initially observed in an ethnography of the Italian village of Montegrano (Banfield, 1958) and whose negative consequences for economic and political development have been established by several studies (Alesina and Giuliano, 2011, 2014; Alesina et al., 2015; Enke, 2019; Bahrami-Rad et al., 2022; Schulz, 2022).

Our framework, focusing on the need to elicit and maintain cooperation for the purpose of child rearing, and our findings, showing enhanced prosociality with greater

[28]The results also show that mother stress is, as expected, positively correlated with child stress. More information on the empirical specifications used to generate these results is included in Section C.2 of the Appendix.

allomaternal care, can be seen as complementary to the more widespread hypothesis in the literature which roots prosociality in intergroup conflict. Although the role of gender has been somewhat overlooked in asexual models of representative agents (Choi and Bowles, 2007; Bowles, 2008), other strands of the social sciences literature have characterized the so-called "male warrior hypothesis" as principally predictive of male psychology (Vugt et al., 2007; Yuki and Yokota, 2009; McDonald et al., 2012). By contrast, our results are primarily predictive of women's prosociality.

A potential explanation for why our results hold more strongly for women lies in gender differences in network formation and use. Despite similarities across genders in who helps with child care, with both parents receiving similar help from genetic relatives of the child, there are also important differences. In particular, mothers rely a lot more on non-relatives to take care of children compared with fathers (while fathers rely relatively more on their spouse). This more acute need for mothers to elicit and maintain networks of unrelated carers for the purpose of taking care of their children has important implications for the gendered economic returns to networks. The economic literature on social networks has described how women's social networks are, compared with men's, generally more stable, composed of a greater proportion of strong relative to weak links, and less responsive to information about the likely monetary returns to a link (see, e.g., Yang et al., 2019; Friebel et al., 2021). In economic contexts like job search, weak links are often more useful: acquaintances' greater ability to provide novel information outweighs their lesser motivation to provide support and help (see Granovetter (1973) and Beaman et al. (2018) for empirical evidence). Conversely, in contexts like child care, the greater motivation and commitment of stronger links matters more than their ability to provide information.

The characteristics of child care help network that we describe in this paper are also directly tied to female labor. Even in the context of small-scale horticultural societies that we study, care by non-relatives is particularly important for women who work more in their gardens or spend more time selling goods in markets outside of their village. Fostering these networks may thus not only matter for prosociality, they may also free women's ability to work outside the home.

Finally, our work provides a new mechanism and interpretation of the findings that, compared with exclusive care by parents, the provision of daycare is associated with long-term advantages in cognition, educational achievement, non-cognitive skills, earnings, and social preferences (Cunha and Heckman, 2007; Heckman, 2013; Cappe-

len et al., 2020; Attanasio et al., 2022a,b; Bjorvatn et al., 2022). We document that care by unrelated individuals promotes language development in children, a crucial socio-cognitive skill for cooperation and communication. A more careful examination of the allomaternal care hypothesis combined with experimental manipulation of the type of child care provision is an important and promising area for future research. Our findings are relevant for the design of early childhood and parenting interventions, which should consider and potentially leverage networks of unrelated acquaintances who provide regular care to children without necessarily substituting for maternal care, such as mothers' groups.

Overall, our findings about the importance of caregiving networks, over and beyond other social, emotional, productive and risk-sharing networks, as a foundation of prosociality and determinant of child human capital suggest that these networks are a promising new avenue to promote a number of policy interventions targeting women and children, in particular early childhood education, female empowerment, and female labor force participation programs.

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Online Appendix:

It Makes a Village: Child Care and Prosociality

Cassar, Cristia, Grosjean, and Walker

A Evidence from the Standard Cross-Cultural Sample

The Standard Cross-Cultural Sample (SCCS; Murdock and White (1969)) contains detailed information on 186 cultural societies across the world that were originally selected from a list of 1,265 societies in the Ethnographic Atlas (EA). The goal of the SCCS is to represent the cultural diversity of human societies, which range from now extinct civilizations to contemporary hunter-gatherers. These societies are considered largely independent of one another and arguably representative of mutually distinct cultures (Murdock and White, 1969).

Information on child care practices is available for a subset of the societies in the SCCS. To match the age range of children included in our sample, we focus on the question on the role of non-maternal relations in infancy (v51, N=162). Answers are coded from 1 to 6, with 1 capturing care "almost exclusively by mother" (in 5 societies: Azande, Callinago, Fon, Konso, and Kwoma), 5 describing societies in which the care by mothers is "minor but significant" (in 2 societies: Alorese and Irish) and 6 capturing mothers having a minimal role "except nursing" (in 1 society: Ancient Rome, a single outlier that we exclude from our analysis, although our results are insensitive to including it). Roughly half of societies have "almost exclusively" or "principally mothers" involved in infancy.

The SCCS includes a specific question on the role of fathers. We focus on the question on the role of fathers in infancy (v53, N=150). This question is coded from "distant" (in 8 societies) to "regularly close" (in 3 societies: Trobianders, Maori, and Nambicuara), with the mode of the distribution consisting in "occasionally close contact" (72 societies).

Figure B1 maps the distribution of responses to these two questions across the world. Involvement of others in infancy is highest in the Insular Pacific region (mean of v53: 3.5, P-value difference in means with rest of the world: 0.003) and lowest in the Circum Mediterrean area (mean: 2.5). Involvement by fathers shows less distinct geographic patterns. It is highest on average in the Insular Pacific regional area (mean: 2.66) but not statistically significantly different from the rest of the world (P-value difference in means: 0.27), and lowest in the Americas (2.43).

The SCCS also includes information on the importance of inculcating trust in children (v335, N=138, scale of 1 to 10, mean: 5.15, s.d.: 2.23), which we leverage as a proxy for prosocial norms. Figure B1 overlays the quantiles of this variable with the prevalence of allomaternal care across the world. Inculcation of trust is most important in East Eurasia (mean: 6.16), followed by Africa (5.5) and the Insular Pacific (5.35), and lowest in the Circum-Mediterranean region (mean: 3.88).

The maps in Figure B1 show positive geographic correlations between the importance given by a society to the inculcation of trust in children and help with child care, either allomaternal (panel (a)) or specifically paternal (panel (b)). As shown in Figure 1 and Appendix Table A1, these correlations prove statistically robust, even

when accounting for broad differences across regions and differences across societies in terms of climatic conditions and community size, as well as underlying variation in the epoch at which these societies were observed.

In Figure 1 in Introduction of the main paper, we examined the correlation between prosocial orientation and the prevalence of allocare by others and by fathers in the SCCS. Each panel in Figure 1 plots the conditional expectation function of societal trust orientation conditional on allomaternal care provision in infancy by others (Panel a) and specifically by fathers (Panel b), controlling for region fixed effects (v200 in the SCCS: Africa, Circum-Mediterranean, East Eurasia, Insular Pacific, North America, South America), log mean yearly average rainfall (v1913), log mean annual temperature (v186), and mean size of local communities (v63), which could influence both child care arrangements and social preferences.

In other words, we estimate the following multivariate OLS regressions at the level of a society (s) in the SCCS:

$$Trust_{sr} = \alpha_1 + X'_{sr}\Gamma_1 + \delta_{1r} + \varepsilon_{1sr} \tag{3}$$

$$CareInfancy_{ksr} = \alpha_{2k} + X'_{sr}\Gamma_{2k} + \delta_{2kr} + \varepsilon_{2ksr} \tag{4}$$

where $Trust_{sr}$ is the average trust orientation of society s in region r, and $CareInfancy_{ksr}$ for $k = 1, 2$ measures, alternatively, the involvement of others ($k = 1$) and of fathers ($k = 2$) in infancy. X_{sr} is a vector of society-level characteristics that could be correlated both with child care practices and with societal trust orientation, such as climatic conditions or community size; and δ_r is a set of regional area fixed effects.

Figure 1 plots the mean estimated residuals $\varepsilon_1 sr$ against, alternatively, the mean estimated residuals ε_{21sr} (Panel (a)) and the mean estimated residuals ε_{22sr} (Panel (b)), averaged in equal-sized bins. The Figure also displays the best linear fit line, constructed from an OLS regression of the y-residuals $\varepsilon_1 sr$ on the x-residuals ε_{21sr} (Panel (a)) or ε_{22sr} (Panel (b)). The slope of the fit line matches the coefficient of the following multivariate OLS regression:

$$Trust_{sr} = \alpha + \beta CareInfancy_{ksr} + X'_{sr}\Gamma + \delta_r + \varepsilon_{sr} \tag{5}$$

of societal trust orientation on the corresponding $CareInfancy_{ksr}$ variable for $k = 1, 2$, controlling for the same set of controls and fixed effects as in equations (3) and (4).

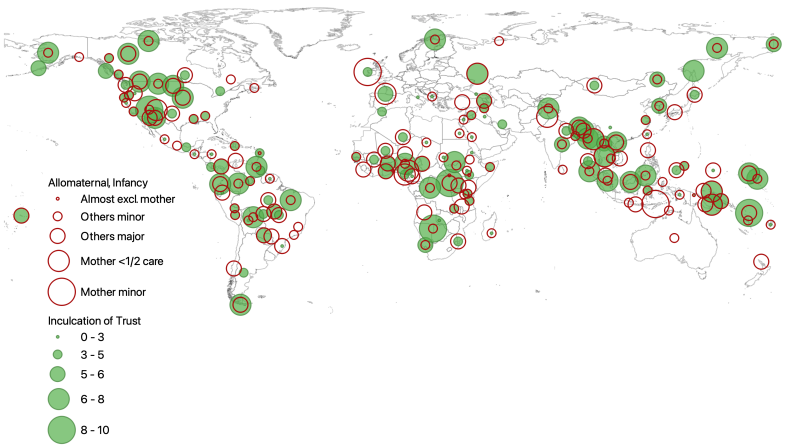
The figures and regression results displayed in Table A1 indicate a strong and positive correlation between allomaternal care and trust across societies.

To address potential criticisms of the SCCS related to the underlying variation in

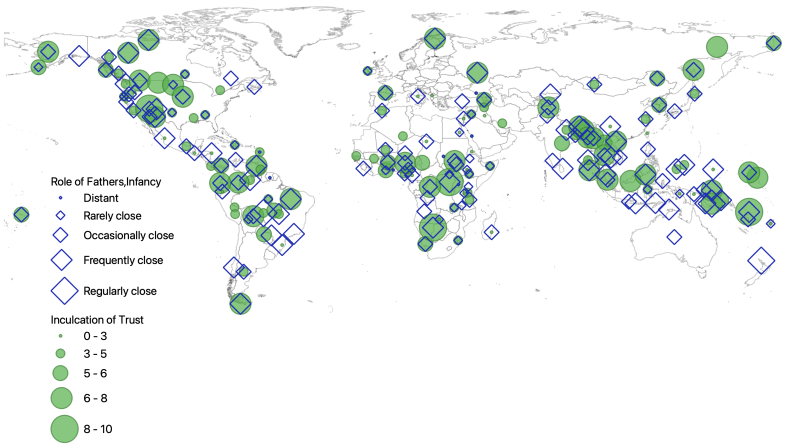
the time at which each society was observed and in the timing of publication of the different ethnographies and documents used to assemble the SCCS, we also present in Table A1 the results of specifications in which we additionally include in X_{sr} the date at which the society was observed (variable *focyear*), and the publication date of the study dealing with a given society (*v802*).[29]

Controlling for region fixed effects δ_r, climatic conditions, and community size, the point estimates suggests that a one unit increase in allomaternal care (e.g. going from "almost exclusively mothers" to others having a "minor role", or from a "minor role" of others to a "major role") is associated with a 0.68 unit increase in the importance of inculcating trust, a 12.85% increase at the mean. The coefficient is statistically significant at the 5% level. A one unit increase in care by fathers e.g. going from "rarely" to "occasionally" close or from "occasionally" to "frequently" close) is associated with a 0.90 unit increase in the importance of inculcating trust, a 17.40% increase at the mean. The coefficient is statistically significant at the 1% level. These estimates, which correspond to the estimates obtained from estimating equation (5), are displayed in Columns 2 and 5 Table A1. Estimates in Columns 3 and 6, which additionally control for the date at which a society was observed and for the ethnography's publication date, are very similar. So are uncontrolled estimates in Columns 1 and 4.

[29]For missing values of *v802*, we impute 0 values and include a an indicator variable for missing observations as an additional regressor in X_{sr}.



(a) Inculcation of trust and allocare from others



(b) Inculcation of trust and care from fathers

Figure B1: Allocare and trust in the Standard Cross-Cultural Sample (SCCS)

Notes: Allocare question come from questions v51 and v53 in the SCCS. Trust questions come from question v335 in the SCCS: importance of inculcation of trust in childhood. The Figure maps the quantiles of the distribution of this variable across the world. Source: SSCS (Murdock and White, 1969).

Table A1: Societal trust in the SCCS and Allomaternal care

	Societal Trust Orientation in the SCCS					
	(1)	(2)	(3)	(4)	(5)	(6)
Care by Others	0.703**	0.680**	0.677**			
	(0.283)	(0.286)	(0.294)			
Care by Fathers				0.965***	0.901***	0.901***
				(0.234)	(0.255)	(0.255)
Regional Area Fixed Effects	N	Y	Y	N	Y	Y
Geographic Controls	N	Y	Y	N	Y	Y
Community Size	N	Y	Y	N	Y	Y
Dates Pub.	N	N	Y	N	N	Y
R-squared	0.05	0.14	0.15	0.13	0.19	0.19
Observations	121	121	121	114	114	114
Mean DepVar	5.29	5.29	5.29	5.17	5.17	5.17
Sd DepVar	2.25	2.25	2.25	2.32	2.32	2.32

Notes: An observation is a society in the SCCS. Columns 2, 3, 5 and 6 report OLS estimates of Equation 5. Columns 1 and 2 report OLS estimates of Equation 5 without including X_{sr} or δ_r in the estimation. Robust standard errors are reported in parentheses (*** p<0.01, ** p<0.05, * p<0.10).

B Appendix Tables

Table A2: Summary statistics

	N	Mean	SD	Min	Max
Participant information					
Female	820	0.52	0.50	0.00	1.00
Age	817	30.85	7.83	16.00	54.00
Has children	820	0.77	0.42	0.00	1.00
Completed secondary school	820	0.38	0.49	0.00	1.00
Cognitive (Raven's test score)	820	12.79	6.32	0.00	24.00
Works in garden a couple times a week	820	0.75	0.44	0.00	1.00
Fishes a couple times a week	820	0.46	0.50	0.00	1.00
Number of own relatives in village	820	2.96	2.64	0.00	15.00
Provides allocare to others	631	0.61	0.49	0.00	1.00
Number of own children	631	2.92	1.74	1.00	11.00
Cares for own children daily	631	0.71	0.45	0.00	1.00
Total number of allocarers	631	7.07	2.72	0.00	14.00
Daily allocare from spouse	631	0.52	0.50	0.00	1.00
Daily allocare (excl spouse)	631	0.62	0.49	0.00	1.00
Witness violence	819	0.47	0.50	0.00	1.00
Share sent in DG (Altruism)	818	0.39	0.18	0.00	1.00
Share sent in DG (Reciprocity)	818	0.40	0.18	0.00	1.00
Child information					
Age (months)	193	25.27	9.06	6.00	48.00
Female	194	0.48	0.50	0.00	1.00
Mother's partner not the biological father	193	0.17	0.38	0.00	1.00
Vocalizations (per hour)	196	217.04	83.80	45.64	530.50
Cortisol (pg/mg)	102	6.06	5.23	0.08	27.40
Cortisone (pg/mg)	102	23.10	15.57	1.91	101.70

Table A3: Help with child care

	Mothers (1)	Fathers (2)	Overall (3)	p-value (1) vs. (2)
Spouse	4.115	5.209	4.606	**0.000**
s.e.	(0.075)	(0.057)	(0.054)	
N	305	249	554	
Mother	2.977	2.884	2.940	0.605
s.e.	(0.118)	(0.132)	(0.088)	
N	307	207	514	
Father	2.428	2.429	2.429	0.994
s.e.	(0.128)	(0.153)	(0.098)	
N	250	156	406	
Sister	2.262	2.518	2.367	0.122
s.e.	(0.108)	(0.123)	(0.081)	
N	325	226	551	
Brother	1.596	1.912	1.726	**0.038**
s.e.	(0.096)	(0.119)	(0.075)	
N	342	238	580	
Mother in law	2.226	2.528	2.366	0.118
s.e.	(0.132)	(0.141)	(0.096)	
N	226	197	423	
Father in law	1.808	2.044	1.924	0.272
s.e.	(0.151)	(0.151)	(0.107)	
N	167	160	327	
Friend	2.752	1.996	2.434	**0.000**
s.e.	(0.100)	(0.120)	(0.079)	
N	331	240	571	
Neighbor	2.821	2.320	2.617	**0.001**
s.e.	(0.095)	(0.122)	(0.076)	
N	336	231	567	

Entries represent average amount of help with care provided by named individual ranked as: (0) never, (1) less frequently than once a month, (2)more frequently than once a month, (3) once a week, (4) a few times a week, (5) every day, a little bit, or (6) every day, for a large part of the day. Standard errors in parentheses. T-tests p-values of differences between mothers and fathers averages.

Table A4: Determinants of allomaternal care

	(1) Ln(age)	(2) Cognitive	(3) Wealth	(4) School	(5) # Kids	(6) Kin in vill	(7) Care own	(8) Allo others	(9) Gardens	(10) Fishing	(11) Market	(12) Violence
Panel A: Mothers												
Total amount of help with child care												
Child care	-0.051***	0.039	0.051	-0.024	-0.141	0.685***	0.168***	0.057	0.158***	0.186***	0.168***	0.007
	(0.010)	(0.284)	(0.076)	(0.022)	(0.090)	(0.167)	(0.061)	(0.055)	(0.056)	(0.052)	(0.043)	(0.026)
Total amount of help with child care from spouse												
Child care from spouse	-0.025**	0.270	-0.023	0.031	-0.066	-0.008	0.103	-0.019	0.033	-0.087	0.081	-0.006
	(0.012)	(0.417)	(0.083)	(0.028)	(0.099)	(0.167)	(0.067)	(0.053)	(0.047)	(0.069)	(0.057)	(0.028)
Total amount of help with child care from relatives of child												
Child care from relatives	-0.061***	0.226	0.052	-0.007	-0.336***	0.914***	0.124**	0.023	0.091	0.180***	0.090**	0.018
	(0.010)	(0.291)	(0.080)	(0.023)	(0.091)	(0.138)	(0.057)	(0.053)	(0.063)	(0.047)	(0.044)	(0.024)
Total amount of help with child care from non-relatives												
Child care from non-relatives	-0.016	-0.134	0.007	-0.034	0.069	0.203	0.163***	0.164***	0.142**	0.129**	0.202***	0.003
	(0.013)	(0.279)	(0.079)	(0.021)	(0.083)	(0.147)	(0.053)	(0.048)	(0.068)	(0.060)	(0.047)	(0.030)
Observations	372	373	373	373	373	373	373	373	373	373	372	373
Panel B: Fathers												
Total amount of help with child care												
Child care	-0.066***	-0.573	0.017	0.019	-0.277**	0.694***	0.217**	0.201***	0.036	0.032	0.049	0.035
	(0.012)	(0.389)	(0.087)	(0.031)	(0.122)	(0.199)	(0.086)	(0.064)	(0.074)	(0.052)	(0.062)	(0.036)
Total amount of help with child care from spouse												
Child care from spouse	-0.019	-0.465	-0.087	0.067	0.058	0.118	0.182	-0.005	0.016	0.105	-0.140	-0.041
	(0.020)	(0.540)	(0.122)	(0.048)	(0.149)	(0.218)	(0.135)	(0.096)	(0.074)	(0.085)	(0.087)	(0.047)
Total amount of help with child care from relatives of child												
Child care from relatives	-0.060***	-0.163	-0.062	0.023	-0.300**	0.829***	0.131*	0.171**	0.045	0.019	0.061	0.019
	(0.012)	(0.445)	(0.085)	(0.024)	(0.118)	(0.182)	(0.067)	(0.066)	(0.067)	(0.051)	(0.060)	(0.033)
Total amount of help with child care from non-relatives												
Child care from non-relatives	-0.054***	-0.998**	0.219**	-0.002	-0.224	0.090	0.192**	0.193***	-0.007	0.031	0.032	0.076*
	(0.013)	(0.397)	(0.086)	(0.037)	(0.139)	(0.204)	(0.075)	(0.060)	(0.068)	(0.054)	(0.060)	(0.039)
Village FE:	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	
Observations	253	255	255	255	255	255	255	255	255	255	255	255

* p<0.10, ** p<0.05, *** p<0.01. Unit of observation is a participant who has children. All estimates control for village fixed effects and cluster standard errors at the village level in parentheses. Child care variables normalized to mean zero, standard deviation one.

Table A5: Correlations between allomaternal care and other forms of support

DV: Amount of help with care	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
			Mothers					Fathers		
Small financial support (0/1)	0.375***					0.197***				
	(0.048)					(0.057)				
Large financial support (0/1)		0.125**					-0.007			
		(0.057)					(0.070)			
Help with production			0.462***					0.414***		
			(0.024)					(0.029)		
Emotional support				0.272***					0.288***	
				(0.026)					(0.028)	
Attend same church (0/1)					0.738***					0.713***
					(0.073)					(0.075)
Participant FE:	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Receiver FE:	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Observations	2347	2347	2347	2345	2342	1764	1764	1764	1764	1760

* p<0.10, ** p<0.05, *** p<0.01. Unit of observation is a participant-receiver dyad in the dictator game, excluding strangers. Standard errors clustered at the participant level in parentheses. Amount of help with child care, production, and emotional support standardized to mean zero, standard deviation one.

Table A6: Dictator game giving in anonymous (Altruism) and non-anonymous (Reciprocity) conditions, by mothers and fathers

	Mothers			Fathers				
	Altruism (1)	Reciprocity (2)	Paired t-test (1)vs.(2) p-value	Altruism (3)	Reciprocity (4)	Paired t-test (3)vs.(4) p-value	Altruism (1)vs.(3) p-value	Reciprocity (2)vs.(4) p-value
Spouse	0.48	0.478	0.840	0.557	0.567	0.495	**0.001**	**0.000**
	(0.016)	(0.017)	N=292	(0.017)	(0.017)	N=238		
Mother	0.483	0.501	0.211	0.5	0.499	0.943	0.492	0.936
	(0.016)	(0.017)	N=295	(0.019)	(0.019)	N=206		
Father	0.484	0.519	**0.034**	0.49	0.503	0.390	0.858	0.596
	(0.018)	(0.019)	N=241	(0.022)	(0.022)	N=168		
Sister	0.389	0.387	0.895	0.38	0.374	0.575	0.672	0.519
	(0.014)	(0.014)	N=323	(0.015)	(0.014)	N=220		
Brother	0.362	0.371	0.421	0.38	0.398	0.150	0.375	0.182
	(0.013)	(0.014)	N=325	(0.016)	(0.015)	N=229		
Mother in law	0.374	0.365	0.570	0.366	0.371	0.757	0.764	0.818
	(0.018)	(0.018)	N=208	(0.018)	(0.018)	N=198		
Father in law	0.324	0.36	**0.024**	0.384	0.378	0.737	**0.040**	0.522
	(0.020)	(0.021)	N=178	(0.021)	(0.020)	N=160		
Friend	0.315	0.339	**0.018**	0.315	0.324	0.360	0.974	0.455
	(0.013)	(0.013)	N=324	(0.013)	(0.014)	N=233		
Neighbor	0.309	0.321	0.327	0.316	0.314	0.830	0.700	0.739
	(0.013)	(0.013)	N=319	(0.014)	(0.014)	N=223		
Stranger same village	0.273	0.294	0.083	0.283	0.319	**0.013**	0.610	0.191
	(0.012)	(0.012)	N=362	(0.014)	(0.015)	N=249		
Stranger distant village	0.25	0.256	0.639	0.267	0.268	0.947	0.430	0.559
	(0.014)	(0.013)	N=360	(0.016)	(0.017)	N=235		

Entries represent average share of endowment transferred to each receiver under anonymous (Altruism) and non-anomymous (Reciprocity) conditions. Standard errors in parentheses. Paired t-test p-values for testing differences between conditions by sender. Independent samples t-test p-values for testing differences between sexes, within condition.

Table A7: Dictator game giving to strangers, by help from non-relatives (low, high), non-anonymous (reciprocity) and anonymous (altruism) conditions, and type of stranger, for mothers and fathers

		Mothers			Fathers		
	Help from non-relatives	Altruism (1)	Reciprocity (2)	Paired t-test (1)vs.(2) p-value	Altruism (3)	Reciprocity (4)	Paired t-test (3)vs.(4) p-value
Stranger distant village	Low help	0.204	0.211	0.687	0.250	0.230	0.315
		(0.018)	(0.018)	N=181	(0.021)	(0.020)	N=141
	High help	0.296	0.300	0.799	0.293	0.324	0.241
		(0.020)	(0.020)	N=179	(0.025)	(0.027)	N=94
	t-test p-value (low) vs. (high)	**0.001**	**0.001**		0.203	**0.005**	
Stranger same village	Low help	0.232	0.264	0.068	0.252	0.290	0.026
		(0.017)	(0.017)	N=184	(0.018)	(0.018)	N=150
	High help	0.316	0.326	0.557	0.331	0.364	0.206
		(0.017)	(0.018)	N=178	(0.023)	(0.023)	N=99
	t-test p-value (low) vs. (high)	**0.001**	**0.012**		**0.007**	**0.013**	

Entries represent average share of endowment transferred by help (low, high) under anonymous (altruism) and non-anomymous (reciprocity) conditions. Standard errors in parentheses. Paired t-test p-values for differences between conditions. Independent samples t-test p-values for differences between levels of help.

Table A8: Allomaternal care and cooperation toward strangers (full controls)

DV: Share sent in DG	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
		Mothers				Fathers		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Care from: Spouse	-0.004	-0.005	-0.004	-0.005	0.005	-0.001	0.019	0.012
	(0.008)	(0.010)	(0.010)	(0.012)	(0.018)	(0.019)	(0.021)	(0.020)
Care from: Relatives of child	-0.014	-0.013	-0.011	-0.009	0.021*	0.021	0.013	0.013
	(0.010)	(0.014)	(0.014)	(0.017)	(0.012)	(0.017)	(0.016)	(0.019)
Care from: Non-relatives	0.024**	0.025**	0.024*	0.025*	0.013	0.019	0.014	0.021
	(0.011)	(0.011)	(0.013)	(0.014)	(0.015)	(0.015)	(0.019)	(0.019)
Same village × Care from: Spouse			0.003	0.003			-0.024	-0.023
			(0.010)	(0.010)			(0.019)	(0.019)
Same village × Care from: Relatives of child			0.009	0.008			0.003	0.005
			(0.009)	(0.009)			(0.015)	(0.015)
Same village × Care from: Non-relatives			-0.005	-0.005			-0.004	-0.006
			(0.008)	(0.008)			(0.016)	(0.015)
Reciprocity × Care from: Spouse			-0.003	-0.003			-0.003	-0.003
			(0.009)	(0.009)			(0.016)	(0.016)
Reciprocity × Care from: Relatives of child			-0.016	-0.016			0.011	0.011
			(0.010)	(0.010)			(0.012)	(0.012)
Reciprocity × Care from: Non-relatives			0.005	0.005			0.003	0.003
			(0.008)	(0.008)			(0.014)	(0.014)
Same village	0.030**	0.030**	0.033**	0.032**	0.034***	0.034***	0.045***	0.044**
	(0.013)	(0.013)	(0.013)	(0.013)	(0.011)	(0.011)	(0.016)	(0.016)
Reciprocity	0.013	0.013	0.010	0.010	0.019	0.019	0.020	0.020
	(0.010)	(0.010)	(0.012)	(0.012)	(0.015)	(0.015)	(0.019)	(0.019)
Emotional support		-0.000		-0.000		-0.031**		-0.031**
		(0.013)		(0.013)		(0.014)		(0.014)
Small financial support		0.005		0.005		0.004		0.004
		(0.012)		(0.012)		(0.015)		(0.015)
Large financial support		-0.009		-0.009		-0.014		-0.014
		(0.010)		(0.010)		(0.013)		(0.013)
Production support		-0.021		-0.021		0.023		0.023
		(0.016)		(0.016)		(0.018)		(0.018)
Church congregants		0.012		0.012		0.014		0.014
		(0.013)		(0.013)		(0.014)		(0.014)
Ln(age)		-0.032		-0.032		0.108		0.108
		(0.042)		(0.042)		(0.071)		(0.071)
Cognitive ability		-0.019		-0.019		-0.035***		-0.035***
		(0.013)		(0.013)		(0.011)		(0.011)
Consumer durables		-0.011		-0.011		-0.028*		-0.028*
		(0.010)		(0.010)		(0.016)		(0.016)
Number of relatives in village		0.004		0.004		-0.000		-0.000
		(0.005)		(0.005)		(0.005)		(0.005)
Time in gardens		0.029***		0.029***		-0.022		-0.022
		(0.009)		(0.009)		(0.016)		(0.016)
Time selling in other village		-0.007		-0.007		0.001		0.001
		(0.012)		(0.012)		(0.012)		(0.012)
Witness violence (0/1)		-0.042*		-0.042*		-0.016		-0.016
		(0.021)		(0.021)		(0.029)		(0.029)
Village FE:	Y	Y	Y	Y	Y	Y	Y	Y
Villages	44	44	44	44	44	44	44	44
Observations	1444	1444	1444	1444	968	968	968	968
R^2	0.247	0.273	0.249	0.274	0.218	0.262	0.220	0.264
δ Care from: Non-relatives		1.73		-2.75		3.79		-2.76
Mean DV	0.27	0.27	0.27	0.27	0.28	0.28	0.28	0.28
SD DV	0.25	0.25	0.25	0.25	0.24	0.24	0.24	0.24

* p<0.10, ** p<0.05, *** p<0.01. Unit of observation is a participant-receiver dyad in the dictator game, restricted to strangers, only. All estimates include village fixed effects. Additional controls include log of participant's age, cognitive ability, number of relatives living in the village, ownership of consumer durables, and whether the participant ever witnessed inter-village violence. *Care* variables represent the amount of help with child care that each group provides to the participant standardized to mean zero, standard deviation one. *Reciprocity* is an indicator variable taking value one for the non-anonymous giving condition. Support variables represent the total amount of support received from the various individuals in a participant's network, normalized to mean zero, standard deviation one. Standard errors clustered at the village level in parentheses. The coefficients δ are calculated using the *psacalc* function in Stata assuming an R-max $= 1.3 * R^2$ and represent the proportional degree of selection on unobservables needed to overturn the estimated effects. Missing observations imputed to the sample mean for control variables and all estimates include indicator variables for missing observations.

Table A9: Allomaternal care and cooperation toward strangers (people without children

DV: Share sent in DG	(1)	(2)	(3)	(4)
Child care	0.022**	0.024**		
	(0.010)	(0.011)		
Women × Child care		-0.006		
		(0.015)		
Child care from non-relatives			0.004	-0.012
			(0.010)	(0.013)
Women × Child care from non-relatives				0.039**
				(0.017)
Women	-0.018	-0.017	-0.017	-0.020
	(0.020)	(0.020)	(0.020)	(0.020)
Same village	0.044**	0.044**	0.043**	0.044**
	(0.017)	(0.017)	(0.018)	(0.017)
Reciprocity	0.013	0.013	0.013	0.013
	(0.017)	(0.017)	(0.017)	(0.017)
Receiver FE:	Y	Y	Y	Y
Observations	710	710	710	710
Mean DV	0.30	0.30	0.30	0.30
SD DV	0.23	0.23	0.23	0.23

* p<0.10, ** p<0.05, *** p<0.01. Unit of observation is a participant-receiver dyad in the dictator game, restricted to strangers. Participant sample is restricted to participants who do not have children. All estimates control for a province fixed effect, as well as whether the stranger is from a distant village and whether the transfer was anonymous (altruism) or non-anonymous (reciprocity). *Child care* represents the average amount of help with child care that parents receive in the participant's village, standardized to mean zero, standard deviation one. *Reciprocity* is an indicator variable taking value one for the non-anonymous giving condition. Robust standard errors in parentheses.

Table A10: Robustness: Allomaternal care and child vocalizations, controlling for mother stress

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Panel A: Vocalizations per hour – Cortisol									
Care: Mother (Ln(Hours/week))	11.581	-1.975							-0.169
	(9.610)	(10.727)							(11.778)
Care: Father (daily)			4.279	11.970					12.196
			(12.873)	(15.223)					(16.338)
Care: Other relatives of child (weekly or more)					-40.079	-39.942			-42.207
					(23.882)	(27.485)			(31.737)
Care: Non-relatives (weekly or more)							48.974*	64.244*	66.063*
							(27.788)	(32.456)	(33.346)
Ln(Mother's cortisol)	-8.014	-9.723	-7.741	-10.667	-7.767	-9.757	-10.050	-11.396	-12.469
	(10.695)	(12.489)	(10.154)	(12.017)	(10.556)	(12.508)	(10.700)	(11.327)	(10.663)
Panel B: Vocalizations per hour – Cortisone									
Care: Mother (Ln(Hours/week))	8.495	-5.477							-4.229
	(8.220)	(9.771)							(11.272)
Care: Father (daily)			9.744	16.349					17.078
			(14.194)	(15.876)					(16.621)
Care: Other relatives of child (weekly or more)					-35.770	-32.249			-35.620
					(22.295)	(27.173)			(32.686)
Care: Non-relatives (weekly or more)							50.436*	58.975*	58.919*
							(26.026)	(30.112)	(31.746)
Ln(Mother's cortisone)	-41.991***	-33.092***	-43.925***	-33.810***	-42.608***	-31.459***	-44.378***	-30.247***	-31.489***
	(8.343)	(9.197)	(8.912)	(9.663)	(8.305)	(9.549)	(9.583)	(9.639)	(8.771)
Extended controls:	N	Y	N	Y	N	Y	N	Y	Y
USB FE:	Y	Y	Y	Y	Y	Y	Y	Y	Y
Village FE:	Y	Y	Y	Y	Y	Y	Y	Y	Y
Observations	193	193	193	193	193	193	193	193	193

* p<0.10, ** p<0.05, *** p<0.01. Unit of observation is a child recording, restricted to the sample of children for whom cortisol and cortisone measures are available for the mother. *Care* variables are indicators for whether the child receives care at the frequency indicated. All estimates include a fixed effect for the USB recording device and village fixed effects, and control the child's ln(age), gender, and mother's ln(age). Extended controls includes: child BMI, whether the mother's spouse is the biological father of the child, total number of children in the household, and the following controls for the mother: cognitive ability, number of consumer durables owned, amount of time spent working in the gardens, amount of time spent selling goods in another village, whether she has witnessed inter-village violence, and the amount of various forms of support (i.e., small and large financial, help with production, emotional support, and attend the same church) that she receives from all individuals in her network. Support variables and time working in gardens and selling goods normalized to mean zero, standard deviation one. Standard errors in parentheses, two-way clustered for village and USB recording device. Missing observations imputed for control variables and all estimates include indicator variables for missing observations of control variables.

Table A11: Robustness: Allomaternal care and child stress

	(1)	(2)	(3)	(4)	(5)
Panel A: ln(Cortisol) – Basic controls					
Care: Mother (Ln(Hours/week))	-0.036				-0.080
	(0.172)				(0.166)
Care: Father (daily)		-0.604*			-0.570*
		(0.337)			(0.329)
Care: Other relatives of child (weekly or more)			-0.172		-0.320
			(0.379)		(0.411)
Care: Non-relatives (weekly or more)				-0.662**	-0.607**
				(0.273)	(0.260)
Panel B: ln(Cortisol) – Extended controls					
Care: Mother (Ln(Hours/week))	-0.101				-0.073
	(0.113)				(0.125)
Care: Father (daily)		-0.458			-0.489
		(0.284)			(0.311)
Care: Other relatives of child (weekly or more)			-0.259		-0.410
			(0.250)		(0.297)
Care: Non-relatives (weekly or more)				-0.196	-0.275
				(0.288)	(0.322)
Ln(Mother's cortisol)	0.364*	0.410**	0.359*	0.370*	0.419**
	(0.188)	(0.175)	(0.183)	(0.186)	(0.185)
Panel C: ln(Cortisone) – Basic controls					
Care: Mother (Ln(Hours/week))	-0.028				-0.039
	(0.128)				(0.129)
Care: Father (daily)		0.116			0.153
		(0.167)			(0.168)
Care: Other relatives of child (weekly or more)			0.162		0.161
			(0.341)		(0.350)
Care: Non-relatives (weekly or more)				-0.316**	-0.345**
				(0.137)	(0.148)
Panel D: ln(Cortisone) – Extended controls					
Care: Mother (Ln(Hours/week))	-0.042				-0.068
	(0.109)				(0.114)
Care: Father (daily)		0.281*			0.312*
		(0.153)			(0.168)
Care: Other relatives of child (weekly or more)			0.154		0.202
			(0.320)		(0.323)
Care: Non-relatives (weekly or more)				-0.166	-0.129
				(0.200)	(0.198)
Ln(Mother's cortisone)	0.160*	0.128	0.158*	0.166*	0.121
	(0.087)	(0.089)	(0.084)	(0.089)	(0.086)
Village FE:	Y	Y	Y	Y	Y
Observations	102	102	102	102	102

* p<0.10, ** p<0.05, *** p<0.01. Unit of observation is a child. *Care* variables are indicators for whether the child receives care at the frequency indicated. All estimates include village fixed effects, and control for the child's ln(age), gender, and mother's ln(age). Panels B and D include the following additional controls: child BMI, whether the mother's spouse is the biological father of the child, total number of children in the household, and the following controls for the mother: cognitive ability, number of consumer durables owned, amount of time spent working in the gardens, amount of time spent selling goods in another village, whether she has witnessed inter-village violence, and the amount of various forms of support (i.e., small and large financial, help with production, emotional support, and attend the same church) that she receives from all individuals in her network. Standard errors in parentheses clustered at the village level. Missing observations imputed for control variables and all estimates include indicator variables for missing observations of control variables.

C Empirical specifications for summary figures and child-level regressions

C.1 Summary figures for help with child care and dictator game giving

To construct Figure 2, we limit the sample to participants with children (N=631). In panel (a), we calculate the average amount of reported help with child care from each individual in the participant's network (spouse, mother, father, sister, brother, mother-in-law, father-in-law, friend, neighbor). We conduct t-tests for differences in means between mothers' and fathers' reported help with child care, separately for each individual in their network, and report stars, which correspond to p-values, above the bars.

In panel (b) of Figure 2 we calculate the average share sent in the dictator game, both anonymously (altruism) and non-anonymously (reciprocity), to each individual in the participant's network, including strangers. We conduct t-tests for differences in altruism vs. reciprocity, for mothers and fathers separately, and report stars, which correspond to p-values, above the bars.

C.2 Regressions for child socio-cognitive and socio-emotional benefits

Our sample of child vocalizations includes 196 children. Because each child had 2 USB devices, most children have 2 observations of vocalizations. There are 18 children for whom only 1 recording is available, therefore the total sample of child recordings is N=374.

We estimate the following equation at the level of a child-recording (cr), and include controls for the mother (m) and the amount of child care provided by various relatives and non-relatives (k):

$$y_{cr} = \alpha + \sum_{k=1}^{4} \beta_k Care_{kc} + X'_{cm}\Gamma + \psi_r + \mu_v + \varepsilon_{cr} \tag{6}$$

where y_{cr} is the number of vocalizations per hour by child c on USB recording device r. We first introduce the amount of care from various relatives and non-relatives ($Care_{kc}$) separately to avoid potential issues with multicollinearity across care from different people, and then together. In all specifications, we control for the child's ln(age) and gender, as well as the mother's ln(age) in X_{cm}. We then include an extended set of controls in X_{cm}, as described in the main text: chid BMI, total number of children in the household, whether the mother's spouse is the child's biological father, the usual set of mother-level characteristics: proxy for cognitive ability, wealth, social, emotional, productive, and economic support, as well as presence of relatives in the village, time spent in gardens and participation in market, and conflict exposure. We

include a fixed effect for the USB device (ψ_r) to account for systematic patterns in measurement from specific USBs, as well as village fixed effects (μ_v) to account for unobservable factors that influence care and child speech at the village level. We two-way cluster standard errors by village and USB.

Our sample of child-mother pairs for whom cortisol and cortisone were measured consists of N=102 children. We estimate the following equation at the level of the child (c), and include controls for the mother (m) and the amount of child care provided by various relatives and non-relatives (k):

$$y_c = \alpha + \sum_{k=1}^{4} \beta_k Care_{kc} + X'_{cm}\Gamma + \mu_v + \varepsilon_c \tag{7}$$

where y_c is the natural log of the child's hormone level and $Care_{kc}$ is the amount of care provided by various relatives and non-relatives, including: (i) the mother (log of hours per week); (ii) biological father (indicator equal to 1 if care provided on a daily basis); (iii) other relatives of the child, including the maternal and paternal grandparents, as well as the brother and sister of the mother (indicator equal to 1 if care provided on a weekly or more frequent basis); and (iv) non-relatives (indicator equal to 1 if care provided on a weekly or more frequent basis). We first introduce the amount of care from various relatives and non-relatives separately to avoid potential issues with multicollinearity across care from different people, and then together. In all specifications, we control for the child's ln(age) and gender, as well as the mother's ln(age) in X_{cm}, and then include the set of extended controls described above, as well as mother's stress. We include village fixed effects to account for unobservable factors at the village level that influence both child care and child stress. We cluster standard errors at the village level.