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# Nuclear Family Conflict and Cooperation among Tsimane' Forager-Horticulturalists of Bolivia

Jonathan Stieglitz

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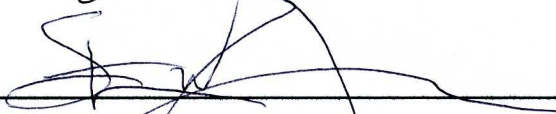
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**NUCLEAR FAMILY CONFLICT AND COOPERATION AMONG  
TSIMANE' FORAGER-HORTICULTURALISTS OF BOLIVIA**

**BY**

**JONATHAN STIEGLITZ**

B.S., Anthropology and Philosophy, Rutgers University, 2003  
M.S., Anthropology, The University of New Mexico, 2006

DISSERTATION

Submitted in Partial Fulfillment of the  
Requirements for the Degree of

**Doctor of Philosophy  
Anthropology**

The University of New Mexico  
Albuquerque, New Mexico

**December, 2009**

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## **DEDICATION**

*To my parents, for always embracing my intellectual curiosity and creating an atmosphere conducive to the pursuit of knowledge.*

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**ABSTRACT**

Household production is the result of inputs from a variety of members, each of whom contains overlapping but non-identical interests. This dissertation explores the conditions under which the division of labor and the allocation of household resources precipitates parent-offspring and spousal conflict. This broad goal is addressed through three specific goals: 1) to identify factors affecting variation in the likelihood of task delegation to children and resistance toward performing delegated tasks; 2) to understand how variation in household labor demand influences children's time allocation, considering ways in which behavioral manipulation might compromise the child's future prospects; and 3) to understand the causes and consequences of men's diverted investment in offspring. Common to each of these issues is the recognition that individuals often face a trade-off between investing in ego- versus family-directed pursuits, and that the costs and benefits of familial investment will change in response to specific individual and familial circumstances. Taken together, results show that at times self-interest pervades relations of even the closest of kin. This highlights a need for the development of models of family behavior that incorporate children and parents as effective decision-makers capable of influencing outcomes with respect to converging and diverging goals.

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## CHAPTER 1: INTRODUCTION

The family is an organizational feature found in every culture (Brown, 1991). Close kin are distinguished from more distant kin through language and nepotistic behavior, linking individuals in nuclear families characterized by a division of labor. Indeed, anthropological research on the family from a life history perspective often focuses on outcomes of collaborative familial pursuits (e.g., food consumption through sharing, time allocation to production). Considerably less attention has been given to the process of how individuals actually decide which activities to engage in on a daily basis and how best to allocate time and resources given overlapping but non-identical interests of household members. Since collaborative activities can involve disputes until an outcome is observed, exploring the conditions under which those disputes arise will shed light on the causes of diverging interests between close kin and provide a broader and more realistic understanding of human family dynamics.

The overarching goal of this dissertation is to explore the conditions under which the division of labor and the allocation of household resources results in parent-offspring and spousal conflict. This broad goal is addressed through three specific goals: 1) to identify factors affecting variation in the likelihood of task delegation to children and resistance toward performing delegated tasks; 2) to understand how variation in household labor demand influences children's time allocation, considering ways in which behavioral manipulation might compromise the child's future prospects; and 3) to understand the causes and consequences of men's diverted investment in offspring. Common to each of these issues is the recognition that individuals often face a trade-off between investing in ego- versus family-directed pursuits, and that the costs and benefits of familial investment will change in response to specific individual and familial circumstances.

### *Human Life History and Intrafamilial Division of Labor*

Several features of hunter-gatherer lifeways are responsible for the pervasiveness of the division of labor by age and sex. First, human infants are highly altricial and require almost constant attention and care throughout the first few years of life. The need

for such care lowers the efficiency of foraging mothers (Hurtado et al., 1992). Because offspring remain nutritionally dependent until their late teens, adults into their 50s must provide for several dependents of different ages simultaneously. Even at ages of peak production, adults are unable to provision families by themselves due to the compound net demands of offspring (Gurven and Walker, 2006; Lee and Kramer, 2002). To help offset these consumption requirements parents rely on contributions from older co-resident children and other kin, increasing the benefits of resource sharing to enhance economic efficiency. This places a premium on establishing residential networks composed of nuclear and extended kin to facilitate labor and resource exchange.

Another feature promoting a division of labor concerns the varied composition of forager diets and food acquisition strategies. A complement of lipids, proteins, and carbohydrates are necessary for growth, maintenance, and reproduction. Plant diets are high in carbohydrates but lack many essential micronutrients and are low in fats and proteins. Fats and proteins are usually harder to acquire and more valuable in the sense that they significantly constrain brain growth, immune function development, and female fecundity (e.g., Frisch, 1987). Women in forager-horticulturalist societies often express complaints to husbands over insufficient quantities of meat or fish in the household; such remarks over shortages of cultigens or other edible plant or vegetable products are relatively unusual.

Food acquisition strategies should target a combination of carbohydrates, proteins, fats, and micronutrients for optimal somatic functioning. Because nutrients are found in different foods, forager diets must be diverse. Humans utilize a variety of techniques to obtain such foods, each of which requires different levels of skill and strength. Foods that are difficult to acquire comprise a substantial portion of the diet in many forager societies (Kaplan et al., 2000), raising the payoffs to investment in learning and contributing to the long period of offspring dependency. While certain tasks require greater levels of size rather than skill to attain adult-level productivity (e.g., Bird and Bliege Bird, 2002; Tucker and Young, 2005), hunting proficiency increases long after strength declines. The fact that peak hunting return rates are achieved about 20 years



following peaks in strength and time allocation to hunting indicates that substantial time investments are necessary to achieve the greater future returns.

Given that multiple food acquisition strategies are required to meet consumption demands, and given that some strategies entail large investments in specific knowledge providing increasing future returns, household members will specialize in different types of familial investment to maximize efficiency. Even if household members were identical in their intrinsic abilities, specialization through the division of complementary forms of labor will maximize production by increasing efficiency of task performance and utilizing economies of scale (Becker, 1991). Individuals will specialize in tasks for which they have a comparative advantage, and time allocation will reflect differences between household members in levels of skill and strength (Gurven and Kaplan, 2006). Children are therefore expected to substitute for parental labor while parents engage in work that youngsters do not yet have the necessary skills and/or strength to perform. Due to the importance of investment in skill acquisition for future productivity, children will also engage in non-productive activities such as play that are safer and impart more skills than would time spent working due to small body size. When the child's labor is required, "the level of responsibility assigned to children is a facultative adaptation...although it is always compatible with play (Konner 2005:62)."

### ***Evolutionary Theory and Family Conflict***

Parents and offspring have different interests with respect to the allocation of resources used for reproduction. All else equal, parents are equally related to all children and selected to balance resource allocation among current and future offspring. The child, however, is only partially related to siblings but fully related to itself and is therefore selected to solicit parental investment at the expense of its siblings (Trivers, 1974). Recent behavioral and physiological evidence suggests that children indeed attempt to garner limited parental resources at the expense of siblings (Fouts et al., 2005; Haig, 2002; McDade, 2001). Of course, all is rarely equal and biasing investment in one child at the expense of others will yield greater fitness returns to the parent in certain ecological circumstances (Borgerhoff Mulder, 1998; Cronk, 2000; Quinlan, 2006). These

exceptions highlight the fact that selection has favored parental strategies less concerned with the interests of a particular child and more concerned with maximizing returns on investment to the parent.

In traditional societies, childhood is characterized by the solicitation of investment but also by increases in time allocation to work and efficiency as skills are acquired and strength increases with age. Parent-offspring conflict theory implies that parents and children will disagree over the degree of altruism exhibited by children toward siblings. Manifestations of discord are likely to include disputes over household labor allocation because the child's labor directly influences household resource availability and thus parental fitness. This leads to the following general hypotheses:

H1. Parent-offspring conflict is more likely to occur over productive tasks that have fewer positive effects on parental fitness.

H2. Family labor demand will be positively associated with the degree of parental manipulation of the child's time.

These hypotheses are a useful heuristic device. However, a detailed consideration of the costs and benefits of familial investment and how they change over time is required to incorporate converging and diverging interests that will influence the extent of parent-offspring conflict over the allocation of labor. From an empirical standpoint, the difficulty lies in isolating the window in which altruistic optima differ given relatedness asymmetries between parent and child and between siblings.

Short-term benefits of the child's labor include the provisioning of resources/care that increases the probability of survival of the focal child and/or that of its relatives. Long-term benefits of the child's labor include skills acquired during task performance that will increase future productivity. Short-term costs of the child's labor include foregone production from other work, energy expenditure, and potential safety risks incurred during task performance (e.g., snakebites or heat exhaustion from garden labor). Long-term costs of the child's labor include the inability to acquire other skills. Tasks

minimizing costs and maximizing benefits will be favored from both the parent and child's perspective and therefore minimize conflict. These include safe, low exertion activities that simultaneously benefit kin and facilitate relevant skill acquisition. This likely explains the pervasiveness of allomaternal investment in traditional societies by older sisters. Under specific circumstances, however, conflict will be expected when the benefits of the child's labor exceed the costs from the parent's perspective but not the child's. The costs and benefits of kin-directed altruism to the child and its parents will therefore be a major influence regarding children's decisions over which activities to engage in on a daily basis and the parent's decisions regarding how best to structure the child's time.

Spouses also have different reproductive interests due to asymmetries in parental investment (Trivers, 1972). Among sexually reproducing species females produce more energetically expensive gametes and almost always invest greater amounts of time and energy in offspring than males. Female reproductive success is limited by access to resources critical for reproduction whereas male reproductive success is constrained by access to fertile females. Among most mammals, male investment in reproduction is limited to mating effort rather than parenting effort. Unlike most mammals, humans form long-term pair bonds characterized by high levels of investment from males in the energetics of reproduction. Explanations for such investment have focused on whether the fitness payoffs of men's resource acquisition and distribution strategies represent mating or parenting effort (reviewed in Gurven and Hill, 2009). The great variation observed within and across cultures in levels of men's mating and parenting effort in similar familial circumstances suggests that decisions underlying household resource allocation are the result of a complex negotiation process between spouses that varies in response to local ecology.

### ***Models of Household Decision-making***

How can we reconcile ego-based approaches to the study of human behavior with the reality that humans make decisions in a broader cooperative context? Two general views have emerged in economics, which differ in the extent to which they recognize

conflicting preferences of family members. According to the common preference view the family is a single decision-making unit. Production of individual family members is pooled, whether by consensus or the dominance of a single individual. Behavior is thus governed by the family's total production rather than the production of any household member. This model implies that resource use is independent of the producer's identity or the individual controlling resource allocation. In other words, an increase in the ability to direct production for personal rather than familial gain is not expected to alter resource distribution. Purely selfish individuals will act altruistically because it is in their best interests to do so (Becker, 1991) and the scant empirical attention paid to divergent preferences is given theoretical justification.

Yet the pervasiveness of harmful family relations across cultures suggests that family behavior can be highly inefficient. Another general view stresses that spouses have divergent interests that require negotiation (children are generally not included as decision-makers). A series of bargaining models have been proposed which vary in their outcomes in the absence of spousal agreement and include divorce or some noncooperative outcome within marriage (reviewed in Lundberg and Pollak, 1996). Unlike the common preference view, there is no appeal to the assumption of income pooling in these classes of models. As a result, differential control of resources by husbands and wives will influence family behavior if this control affects the value of alternatives to marital cooperation.

Few anthropological studies have employed bargaining models to investigate spousal dynamics. There is evidence that inequalities in bargaining power increase the risk of intimate partner violence against women, which might serve to restrict the wife's options outside of marriage (Holland Jones and Ferguson, 2009) or facilitate resource flows to the husband from the wife's family following marriage (Bloch and Rao, 2002). Gurven et al. (2009) find little consistent evidence that leverage influences the trade-off to men of investing in ego- versus family-directed pursuits, but note the confound in their operationalization of bargaining power (relative mate value) and work effort.

No attempt is made here to apply such models to the study of spousal relations. Instead we utilize the insight from evolutionary and micro-economic theory that divergent

spousal interests over the proper use of family resources will increase the risk of employing coercive tactics. This leads to the following general hypothesis:

H3. Spousal violence against women is the result of men's redistribution of familial resources to enhance fertility at the expense of investment in offspring.

### ***Structure of the Dissertation***

This dissertation is organized as follows. The ethnographic setting is introduced in chapter two. In chapter three, parent-offspring conflict over the allocation of household labor is examined. Chapter four addresses the effect of variation in household labor demand on children's time use and explores implications of these findings with respect to collaborative and conflictive kin dynamics. In chapter five, the relationship between household demography, spousal conflict, resource allocation, and violence against women is considered. A summary of findings and conclusion is presented in chapter six.

## CHAPTER 2: THE ETHNOGRAPHIC SETTING

### *Introduction*

Fieldwork for this dissertation was conducted by a team of researchers in 10 Tsimane' communities from 2002 to 2008. Data analyzed in chapter three were collected by JS and three Tsimane' research assistants in Cedral, Chacal, Puerto Triumfo, and Misión Fatima; data analyzed in chapter four were collected by JS and eight other investigators in Aperecico, Cuverene, Cosincho, Munday, Tacuaral del Matto, and Jamanchi Uno; finally, data analyzed in chapter five were collected by JS and another Tsimane' research assistant in the Beni Biosphere Reserve.

The Tsimane' are a natural fertility population of forager-farmers inhabiting the rainforests and savannas located between the towns of San Borja and San Ignacio de Moxos in the Beni department of central lowland Bolivia. Published census estimates range from 6,351 (INE, 2003) to about 7,130 (VAIPO, 1998). Tsimane' territory spans roughly 1.35 million hectares (CIDDEBENI, 1990) yielding a population density of 0.47 – 0.53 individuals/km<sup>2</sup>. About 60 villages are dispersed along the banks of the Maniqui River, and another 30 or so communities are settled along the headwaters of the Cuverene, Matto, Yacuma, Apere, and Sécure rivers. Villages vary in their exposure to the market economy and range in size from roughly 60 to 400 individuals.

### *History*

Very little is known about the Tsimane' prior to the arrival of Europeans in the 16<sup>th</sup> century. There is evidence that tropical forest chiefdoms existed within their territory (Denevan, 1966). It is unclear, however, whether the Tsimane' adhered to this political system. The Tsimane' experienced first contact with Europeans during brief forays by the Spanish into their region, but due to relatively severe living conditions Europeans refrained from establishing long-term settlements in the area until the 17<sup>th</sup> century.

A Franciscan priest named Gregorio de Bolivar first tried, unsuccessfully, to convert the Tsimane' to Catholicism in 1621 (Chiccon, 1992). In 1668 Jesuits settled in present-day Beni and established over 25 missions throughout the region over the next

several decades, including San Francisco de Borja in 1693. Now known as San Borja, the town contains a population of nearly 20,000 and provides Tsimane' with access to market goods and a headquarters for the *Gran Consejo*, the main political association of the Tsimane'. While the Jesuits were more successful than their Franciscan counterparts at establishing long-term settlements in the region, they were ultimately expelled from Bolivia in 1767 and failed to permanently sedentize the Tsimane'. Those Tsimane' who were converted by the Jesuits in the 17<sup>th</sup> century later developed into a related ethnic group known as the Mosen (Aldazabal, 1988). Metraux (1948) alludes to the Tsimane' under various names such as the Chimanisa, Chumano, and Nawazi-Moñtji, similarly noting their close association to the Mosen. There is currently co-residence and some intermarriage between the Tsimane' and Mosen, particularly in communities in the Pilon Lajas Reserve, and each group considers the other as a relative. Furthermore, Tsimane' and Mosen form a linguistic group in the Awaruna family that shares a similar vocabulary and is isolated from other lowland Bolivian or South American language families (Byron, 2003; Reyes-Garcia, 2001).

Bolivia was granted independence from Spain in 1825. The department of Beni was founded 17 years later in an attempt to develop the region and encourage its integration with the remainder of the country. Migration into the region rapidly increased toward the end of the 19<sup>th</sup> century when economic pursuits arose from the extraction of natural resources that included rubber, vanilla, and cocoa. While indigenous peoples throughout Beni and other parts of South America were exploited for their labor, particularly as rubber tappers, the Tsimane' were not greatly involved in such activities. This was primarily due to a paucity of rubber trees within their territory coupled with the dispersed settlement patterns of the Tsimane', precluding foreigners to easily recruit laborers (Chiccon, 1992).

The rapid population increases in the region beginning in the 1880s resulted in a greater demand for beef which then spurred the growth of cattle ranching. After the rubber boom ended in 1912, ranching became the major industry in Beni and continues to be the chief economic activity for those living around San Borja today. Rising beef prices throughout Bolivia in the 1940s, the establishment of air transport in Beni to help meet

national demands for meat soon afterward, and agrarian reform laws enacted in 1953 encouraging development of Bolivia's tropical lowlands, jointly made cattle ranching a lucrative and enduring pursuit (Reyes-Garcia, 2001). The creation of roadways in the mid-1970s that linked Beni to Bolivia's larger cities helped sustain the already burgeoning ranching industry while attracting loggers, farmers, and other businessmen who continue to provide a sporadic source of wage labor for the Tsimane'.

The economic and political events of the 20<sup>th</sup> century that had lasting impacts on the region were accompanied by religious changes. In the 1950s, Catholic missionaries returned to Beni and created a Redemptorist mission at Cara Cara that was later moved farther up the Maniqui River and renamed Misión Fatima. A few unsuccessful attempts were made by Father Martin Bauer to develop the economy of the area mainly through cattle ranching and cash-cropping of coffee and cocoa. Father Bauer also created a health post and school, but his death in 1997 ended the mission's influence outside of Fatima and the surrounding villages.

Around the same time that Redemptorists began to establish a presence in the territory, Evangelical New Tribes missionaries also started forging relationships with the Tsimane'. Formerly known as the Summer Institute of Linguistics, this organization has translated the Bible into Tsimane' and many other indigenous languages across Latin America. Among the Tsimane', the New Tribes Mission is responsible for training bilingual Spanish-Tsimane' teachers and health promoters, developing a thorough Tsimane' dictionary and orthography in Spanish and English that is used by anthropologists, and helping the Tsimane' establish the *Gran Consejo* governing body in 1989 (Ellis and Gonzalo, 1998). The current headquarters of the New Tribes missionaries in the region, HOREB, is located just outside central San Borja and serves the Tsimane' community by providing medical care and food, and broadcasting daily religious and secular radio programs in the Tsimane' language.

### ***Environment and Economy***

The Tsimane' inhabit the Ballivian and Yacuma provinces of Beni in the Amazon basin. Their territory stretches from the Andean foothills northeast to the Moxos, ranging in habitat from wet to moist sub-tropical and gallery forests, some of which are adjacent



to savannas. Elevation varies from 150 to 500 meters above sea level, which affects soil quality and the diversity and distribution of flora in the region (Reyes-Garcia, 2001). The climate can be categorized into “wet” (November to April) and “dry” (May to October) seasons, but there is a fair amount of variation in rainfall within the seasons. The average annual temperature is 26° Celsius.

Major horticultural crops include plantains (*pe're*), sweet manioc (*o'yi*), corn (*tara*), and rice (*arosh*). Rice is the only cultigen with substantial market value. Tsimane' often sell rice by the *quintal* (~46 kg) in San Borja following the wet season harvest. Unlike corn, manioc, and rice, whose availability is determined by seasonal cycles, plantains are harvested throughout the entire year. Plantains are the major carbohydrate staple but corn and manioc also play important dietary and social roles. The latter two are usually consumed in the form of fermented homemade beer (*shocdye'*) at intimate or communal gatherings. Alternatively, corn and manioc may be ground into a fine flour and eaten raw or baked into flat bread.

Minor crops include sugar cane, coffee, onion, squash, watermelon, chocolate, mango, peanut, garlic, hot pepper, potato, and various citrus fruits, many of which were introduced by Jesuit missionaries upon arrival to the region. The Tsimane' also grow several species of medicinal and other plants in house gardens used for fishing, dyes and fibers, treating illnesses, and as contraceptives. Tobacco and coca are sometimes grown for recreational purposes, as well as for occasional bartering with loggers or merchants.

The Tsimane' remove brush and fell trees using steel machetes and axes during the dry season, usually clearing an area ranging from 0.1 to 1.5 hectares. Households in villages located closer to market towns deforest more land than their more remote counterparts (Vadez et al., 2004). Once undergrowth is removed and trees are felled, the field is left to dry for several weeks before burning begins. Once burned, fields are partially cleared and then planted. Weeding generally takes place a couple of times prior to the harvesting season. After one or two seasons of cultivation, a plot is left fallow. For any given household, this method of cultivation results in a number of plots under different stages of use and condition. Rice and corn are usually the first to be planted, followed by manioc, plantains, and some other minor crops mentioned above.

Men play the largest role in preparing fields. Adult women and children often help in chopping brush and burning, but the task of felling trees is almost exclusively done by men. Once fields are planted they are left to be watered by rain. Tsimane' women participate more in the harvesting of crops and their processing, often receiving assistance from children of both sexes.

Reliance on foods gathered from the forest varies throughout the year as different fruits come into season. Edible forest fruits include several species of palm fruit, *pacay*, honey, and wild cacao. The Tsimane' also use a suite of forest plants for house construction (mainly *cajtafa* or *shuru*), tool manufacture, craft production, jewelry, and medicines.

Villages vary in access to major rivers, but fish plays an important role in Tsimane' subsistence (especially during the dry season). Unlike hunting which is almost always performed by men, fishing is practiced by men, women, and children. The Tsimane' utilize numerous tools and tactics to acquire fish, including hook and line, bow and arrow, machetes, fishing nets or *mosquiteros*, and poisons during communal barbasco events. This latter technique appears to provide the highest return rates across all types of fishing, but the Beni Biosphere Reserve has recently pressured the Tsimane' into restricting their use of barbasco in the Maniqui River due to fish depletion. Two of the most commonly caught fish are *sábalo* (*Prochilodus nigricans*) and *benton* (*Hoplias malabaricus*).

Hunting is the main source of protein and is performed in open savannas, gallery forests, and forested islands formed during the wet season. Time allocation to hunting increases during the wet season. Men usually leave the community alone or in small groups of two or three early in the morning and return late in the afternoon. Night hunting with flashlights is also fairly common. Sometimes larger parties, including women and children, accompany men on hunting, fishing, and gathering treks into the forest spanning several days. Informal comparisons of the distances men travel to hunt suggest that communities located closer to market towns have experienced drastic declines in surrounding game densities. During our 2005 field season in the market-integrated village of Tacuaral del Matto, men almost never left the community to hunt on

foot. Instead they used bicycles and often spent over 12 hours outside of the village. In contrast, it was not uncommon for men living in the Beni Reserve (where logging is prohibited) to leave on foot at sunrise and return with meat by noon.

In descending order, the most important species taken by total biomass include collared peccary, Brazilian tapir, gray brocket deer, howler monkey, agouti paca, white-faced capuchin monkey, and coatimundi (Gurven et al., 2006). Other species making smaller contributions to the diet are white-lipped peccary, several monkey species (e.g., brown capuchin, squirrel, spider), collared and giant anteaters, tortoises, and seven- and nine-banded armadillos.

Firearms are preferred weapons among hunters, although bows and arrows are still employed in the more remote villages. Older men often prefer using shotguns due to their lesser dependence on acute vision. The use of hunting dogs is also common but varies according to targeted game species. For instance, dogs are useful for tracking certain animals such as agouti paca, but they are considered to be an obstruction for hunting monkeys. Although meat is usually eaten directly after processing and cooking, it is sometimes smoked or preserved with salt.

The Tsimane' also engage in occasional market activity. Prior to the influx of ranchers, loggers, and other businessmen into the Beni region beginning in the late 19<sup>th</sup> century, the Tsimane' earned cash mainly through the sale or exchange of forest goods or cultigens. The manufacture of roofing panels made from *jatata* palm collected in the forest remains an important source of income for Tsimane' inhabiting the middle and upper Maniqui region. Over the past few decades wage labor opportunities have greatly increased with loggers and ranchers, as has the amount of market goods consumed by the Tsimane'. Sugar, salt, clothing, medicines, metal pots, cooking oil, utensils, flour, and school supplies are popular items purchased from itinerant river merchants or during trips to San Borja. Men begin wage labor at around age 15 and a typical daily salary is 25 Bolivianos (about \$3.50 USD).

### *Marriage and Family Relations*

Tsimane' villages are composed of household clusters, each of which typically contains three or four residences of consanguineal and affinal kin. Within each cluster, households cooperate in nearly all economic pursuits and the extended family is the cornerstone of sociality. Tsimane' kinship has been classified as Dravidian, favoring endogamous cross-cousin marriage. While there are no formal rules of post-marital residence, newly married couples often reside near the wife's natal kin for at least a few years. During this time the husband is expected to work with affinal kin in daily subsistence tasks, although bride service is not officially recognized. After several years the couple and their joint children may or may not relocate to live near the husband's relatives.

Although marriages are often facilitated by kin, women do not face divorce restrictions. Tsimane' marriages are stable, with about 20% of unions in our sample resulting in divorce. Mean age of marriage for men and women is 22 and 17, respectively. While there are no restrictions against polygyny, only 9% of men in our sample were married to two women simultaneously. Sororal polygyny constitutes the vast majority of such cases. Similar estimates for ages of marriage and the prevalence of divorce and polygyny among the Tsimane' are reported elsewhere (Winking, 2005; Winking et al., 2007). The Tsimane' do not participate in official wedding ceremonies, but informal gatherings of family members are common to celebrate the affair. At these events large quantities of homemade beer are prepared and domestic chickens or ducks are usually slaughtered for communal consumption.

Spouses engage in extensive cooperation on a daily basis and sex roles are well-defined. Women exert considerable domestic control and are generally responsible for providing childcare, cooking and processing food, cleaning in/around the house, washing clothes, preparing beer, delegating household tasks to children (see chapter three), and weaving bags, floor mats, fans, and baskets. Men acquire game and fish, engage in wage labor, construct houses, and manufacture bows, arrows, and canoes. Both sexes collect forest foods, fetch firewood and water, participate in horticultural labor, and manufacture roof panels using palm leaves.

The complementary relationships between Tsimane' spouses contain their share of conflict. For men, frequent complaints about wives generally regard the timely completion of everyday domestic tasks such as cooking, washing clothes of household members, gathering water/firewood, and making beer. Instead of performing these tasks women are usually engaged in other work or visiting kin. The latter represents another common male complaint (25% of respondents listed wife's visitation of co-resident kin as a frequent cause of conflict without being prompted). Squabbles over visitation of relatives are not confined to co-resident kin – spouses argue over visiting in-laws in other communities to help clear fields, care for newly born children, deliver money for San Borja hospital trips, or other reasons. These arguments undoubtedly underscore larger disputes over residence decisions, especially since women are more favorably treated by husbands when consanguineal kin live in close proximity (see chapter five). Both men and women express reluctance to assist extended kin: 36% of women and 30% of men complained to a spouse in the month prior to interviews over a partner's refusal to help an affine, whether they lived in the same community or not.

Men also express dissatisfaction with the quality of care provided to children. Most childcare complaints are directed at wives for either allowing children to get too dirty (by crawling or eating dirt), or physically punishing disobedient children too severely. Vindictive mother- or sister-in-laws might also spread rumors about a woman treating her children poorly. Unlike husbands' complaints though, such gossip is not usually employed to encourage childcare but rather motivate wives to cooperate with affines (e.g., extending invitations to visit, sharing food, etc.).

Although not one man admitted it during interviews, sexual jealousy likely precipitates a fair number of complaints to wives. Nearly 40% of women stated that a common complaint by husbands concerned illicit relations with a perceived boyfriend or ex-husband (without being prompted). Women also claimed that 17% of all female partner-directed violence occurred because a husband expressed concern over the wife's sexual infidelity (see chapter five). Finally, 43% of men admitted to entertaining thoughts of a wife's sexual misconduct in the year prior to interviews. Whether men's concerns over a partner's extramarital sexual exploits are valid or even sincere, however,

is another question. Of those men who acknowledged having ideas about a wife's affairs, only 13% were actually able to provide a potential lover's name, both of whom were ex-husbands of their wives living in distant communities.

In contrast, 66% of female respondents admitted to entertaining thoughts of a husband's extramarital affairs in the year prior to interviews, with 63% providing names of alleged mistresses. Women frequently accuse men of having girlfriends and complaints over men's lovers in the community, in other villages, and/or in San Borja are common. Oftentimes, the girlfriend in the community (perceived or real) is the wife's eldest unmarried sister, who usually lives in close proximity to the couple.

Other frequent female complaints result from men's inability to provide sufficient quantities of meat or work in fields. Instead of working, men also visit kin but allocate more non-productive time than women to politicking with unrelated individuals and drinking. Men's drinking, especially away from the community, is another common cause of women's complaints since men often squander wages on store-bought liquor. Anecdotal reports of wives hiding money from inebriated husbands wishing to buy alcohol from traveling river merchants are common. The fact that 98% of women expressed at least one complaint to husbands over being inebriated in the month prior to interviews indicates the near ubiquitous nature of the conflict, which often leads to spousal violence (see chapter five).

Another frequent complaint among Tsimane' wives concerns men's village absenteeism due to wage labor. Frustrations stem from a combination of men not fulfilling subsistence roles, feelings of loneliness and fear at night, and women's dislike of in-laws, especially when few consanguineal kin are present. In addition, unlike subsistence work, women are unable to exert control over men's wages and are not always privy to men's earnings. Wives and children often do not accompany men during wage labor stints, which can range from a few days to several weeks without returning to the village. This is not to say that wages are rarely directed toward enhancing familial welfare. Some women express no complaints over a husband's spending habits. In fact, only 14% of women listed men's involvement in wage labor as a frequent source of complaints to husbands (without a prompt). This might not be surprising given the

sporadic nature of wage labor opportunities. However, 88% of women complained in the year prior to interviews over men's community absenteeism from market involvement.

Finally, a number of Tsimane' women express complaints over men's inability or unwillingness to purchase contraceptives from San Borja pharmacies. Such grievances are not expressed on a daily basis but they are nevertheless prevalent: 53% of reproductive-aged women complained to spouses in the year prior to interviews because a husband would or had not purchased contraception despite the wife's pleas otherwise. Most men agree that having children entails quite a burden and when asked why they wish to have fewer children than their ancestors, many respond by saying, "*carij*" or "*cuesta mantener*" (it is hard work). Despite these claims, few men comply with women's requests to purchase contraceptives. Men's common objections include lack of money, ignorance of the appropriate pills or injections to buy (along with a fear of asking), a desire to have more children, and beliefs that contraceptives either do not work, harm the woman's body, and preclude sexual relations with wives.

Despite their numerous complaints, many women refrain from discussing spousal conflicts with others. Words travel fast in Tsimane' communities, and attempts by individuals to intervene on a woman's behalf can lead to more serious problems with a disgruntled husband. For example, a 35 year-old female informant once confided in her mother after receiving a severe beating from her drunken husband for not having food prepared upon his arrival to the house. Within minutes of revealing the complaint, the woman's three adult brothers and father, who happened to be the husband's drinking partners and were also severely intoxicated, arrived with shotguns and machetes to confront the abusive man and demand that he never mistreat his wife again. After apologizing to his wife and in-laws, the husband threatened to kill his wife later that night amid a severe beating if she disclosed their affairs to anyone again. For this reason, this informant refuses to discuss any marital problems to this day.

Compared to spousal disputes, we know much less about conflict between parents and offspring due, in part, to the difficulties of interviewing children about sensitive topics. We can, however, offer some anecdotes. Younger weaned children often cry in response to mothers leaving them with extended family babysitters instead of bringing

them fishing or to the garden to play or work. Resistance to performing delegated tasks also represents a frequent arena of conflict throughout childhood (see chapter three), often causing mothers to castigate or physically punish disobedient children. Rather than complying with parental demands, children generally prefer playing, socializing, completing school assignments, or resting/eating. Parenting styles vary tremendously as well. Whereas some parents claim that physical punishment weakens the child, others do not refrain from providing corporal punishment with hands, sticks, or other available objects.

Entry into adolescence signifies changes in the child's relations with parents. Although levels of household production are increasing, older children also begin spending time searching for potential mates. For boys, this often occurs outside of the community and is combined with wage labor opportunities near other Tsimane' villages. Older girls, in contrast, generally increase visibility by visiting other households and spending time in the village center where others gather for soccer games, parties, church services, or other community events. Several husbands expressed frustrations with wives for failing to properly monitor the activities of older daughters. Parent-offspring conflict over girls marrying too soon and withdrawing assistance from natal households to begin a family is not uncommon. Fathers may express resentment towards an undesired son-in-law by saying that he does not know how to hunt or work a field. Although less frequent, quarrels between parents and older sons occur over the diversion of work effort from the natal household and toward prospective mates and affinal kin instead.

### ***Significance to the Research Design***

On the one hand, anthropologists study subsistence-level societies because their physical and social environments share numerous features with those lifeways characteristic of the majority of human evolutionary history. Such features include kin-based residential groupings with limited privacy and an economy characterized by foraging with little inheritable wealth. On the other hand, contemporary foragers are not isolated and have interacted with "non-traditional" peoples for centuries. These relations continue to foster increasing levels of integration into broader market economies and may consist of trading networks, sporadic wage labor, or exposure to international



development programs. The study of contemporary foragers can therefore offer insights into both the selective pressures that have shaped human psychology, along with the effects of changes in household production, and the control of wealth on family dynamics.

Tsimane' economy and sociality provides opportunities to explore cooperative and conflictive kin relationships in novel ways. Children have the ability to assist families from an early age. Because of the abundance of available productive activities, children often engage in tasks that satisfy personal needs generating fewer kin-directed benefits. This provides an opportunity to examine parent-offspring conflict over household labor allocation. Natural fertility populations are well suited for such studies, as the great variation in family composition and children's economic roles through time provides statistical power to the tests. In addition, the lack of taboo topics of conversation often found in Western societies, combined with the astounding honesty of participants, tremendously facilitates the collection of sensitive information about spousal conflict and violence.

## CHAPTER 3: PARENT-OFFSPRING CONFLICT AND TASK DELEGATION

### *Introduction*

Intrafamilial division of labor is common in all societies, suggesting it plays an essential role in kinship organization (Murdock and Provost, 1973) and human life history (Bird, 1999; Gurven et al. 2009). The nature of familial labor allocation therefore has implications for many theoretical issues spanning the subfields of anthropology as well as other disciplines. In this paper we employ the theory of parent-offspring conflict (Trivers, 1974) to investigate household labor allocation. Parent-offspring conflict theory generates the hypothesis that a parent will manipulate the child's time in a manner that maximizes parental fitness, even if the action is harmful to the particular child. This implies that tasks that have fewer positive effects on parental fitness are more likely to result in conflicts of interest between parent and child. The theory therefore provides a constructive framework for predicting the types of tasks that are more likely to be 1) delegated to children, and 2) resisted by children following delegation. We also consider how family labor demand and task exertion influence parent-offspring conflict by examining changes in the costs and benefits associated with kin-directed altruism.

### *Hamilton's rule and parent-offspring conflict theory*

Selection favors altruism when the fitness benefit (B) to the recipient of the act devalued by the genetic relatedness ( $r$ ) between the recipient and donor of the act is greater than the fitness cost (C) to the actor ( $B > C$ ) (Hamilton, 1964). Kin selection theory implies that parents and children will differ in the degree of optimal levels of kin-directed altruism (Trivers, 1974). From a biological parent's perspective, each child is genetically related to them by the degree 0.5. But among a sibship of children, each child is related to a full sibling by 0.5 but to themselves by 1.0. From the child's perspective, selection will favor kin-directed altruism when the benefits exceed twice the costs. Parents, however, are selected to promote kin-directed altruism as long as the benefits exceed the costs. Conflict is expected when the parent will benefit from the child's altruistic act at a net cost to the child ( $C < B < 2C$ ). Under these circumstances parents are

expected to “train” the child to act more altruistically than the child would act of its own accord through the delegation of labor, and the child is sometimes selected to resist such attempts at manipulation.

Several factors can influence the costs and benefits of household production and thus influence levels of parent-offspring conflict. The degree of physical exertion associated with task performance will increase direct costs to the child. Given relatedness asymmetries, the cost that the parent is willing to exert on the child providing an inclusive fitness benefit is expected to exceed the cost of altruism that the child is willing to bear. However, as bodies grow and the physical costs of task performance decrease, levels of parent-offspring conflict will also diminish. The benefits to the child of on-the-job training will also increase as children grow and can learn more effectively through task performance (Bock 2002b). In addition, as the child begins to make more decisions independently with age, he/she acquires a sense of the proper timing of when and how to appropriately participate in household production and time allocation to work increases without parental direction. This is especially relevant for tasks that the child performs routinely and when responsibilities are well defined. Parental guidance might be necessary regarding chores that the child is not accustomed to performing customarily due, for example, to effects of seasonality on resource availability.

Increasing family labor demand is expected to increase the benefits of kin-directed altruism to parent and child. The value of the child’s labor will increase as the number of recipient (typically younger) siblings grows or parental absence creates a need for the child to serve as a substitute worker. Given relatedness asymmetries, with increasing family labor demands selection will favor a greater willingness on behalf of the parent to manipulate the child’s time since the parent is equally related to all children. However, as the physical costs of task performance decrease with age and the benefits of the child’s labor increase, interests of the parent and child will increasingly converge.

Parent-offspring conflict theory suggests that conflict will result, in part, over appropriate levels of the child’s overall production. Indeed, recent studies suggest that disputes result from differences in perspective between child and parent over the cost-benefit structure of children’s time allocation to productive and non-productive activities

such as schooling (Bock, 2002a). A child might want to spend more time acquiring skills necessary for future productivity, whereas a parent might need the child's labor immediately to support other offspring. Using similar logic, disputes might also result from differences in perspective between child and parent regarding the optimal level of production that primarily benefits the child and fails to significantly benefit kin. This implies that conflict will occur not simply over whether or not children work but also over the type of work performed.

To date, applications of economic models of intergenerational labor allocation in the nuclear family (Becker, 1991; Chayanov, 1966 [1925]) to traditional human subsistence patterns do not consider conflicts of interest resulting from sexual reproduction. Households are viewed as single decision-making entities composed of individuals who agree on how to optimally combine their time and production. This approach, often referred to as the common preference or benevolent dictator model, entails that kin are equally motivated to achieve an efficient division of labor based on their different strength- and skill-dependent abilities (Gurven and Kaplan, 2006; Lee and Kramer, 2002). It is restrictive in the sense that it assumes all resources are shared and that threats of punishing selfish behavior by an altruistic household head are sufficient to induce altruism among selfish individuals (Becker's "Rotten Kid theorem"). However, in addition to critiques of both the Rotten Kid theorem and the common preference model (e.g., Bergstrom 1989, 1996), parent-offspring conflict theory stresses that interests of parents and offspring converge only with respect to maximizing parental fitness. An act enhancing the child's fitness might not have the same effect on the parent, who is concerned with maximizing fitness of all children. This implies that the child's work effort is strategic in the sense that activities primarily benefiting ego are prioritized over activities primarily benefiting the family. Therefore, parents have an incentive to manipulate children's productive behavior.

Despite challenges to the theory of parent-offspring conflict (Altmann, 1980; Barrett and Henzi, 2000; Bateson, 1994; Godfray, 1995; Mock and Forbes, 1992), its predictions have been supported theoretically (Parker and Macnair, 1978) and empirically across a variety of species and contexts (Agarwal et al., 2001; Hager and Johnstone,

2003; Haig, 1993; Pugesek, 1990). Anthropological research into parent-offspring conflict has focused primarily on weaning (Fouts et al., 2005; Maestripieri, 2002; McDade, 2001) due, in part, to widespread reports of infant distress during this transition and because maternal-infant interactions are easily observed. Few studies, however, have explored parent-offspring conflict following weaning despite Trivers's suggestion that conflict is likely to be salient beyond this point in species where PI is crucial to offspring survival and reproduction. The unique human life history pattern of extended childhood and simultaneous PI in multiple offspring of different ages (Gurven and Walker, 2006; Lancaster and Lancaster, 1983) presents a novel avenue to examine parent-offspring conflict following weaning.

Our paper begins to address how changes in the cost-benefit structure of task performance influence levels of parent-offspring conflict. We examine household task delegation because it unambiguously involves an attempt on behalf of the parent to alter the child's activities. We also examine children's resistance toward performing assigned tasks. Refusal to comply immediately following delegation signifies a desire to engage in a preferred alternative activity despite parental requests otherwise.

#### *Previous studies of task delegation*

Anthropologists have long been interested in the effects of task delegation on children's socialization. There is general agreement that task delegation is a means by which parents facilitate on-the-job training for activities critical to sex-specific adult roles. Studies of compliance pressures emphasize that greater parental demands are imposed on children with age for both sexes (Erchak, 1980), and that girls are delegated more responsibilities than boys, especially with respect to domestic work and parenting younger siblings (Barry et al., 1957; Draper, 1975; Draper and Cashdan, 1988; Weisner et al., 1977; Whiting and Edwards, 1973). Boys, on the other hand, receive more pressure to be self-reliant and are afforded more time to play and wander without adult supervision. Sex differences in task assignment might influence children's future willingness to engage in kin-directed altruism (Ember, 1973; Munroe et al., 1984; Whiting and Whiting, 1971).

Other studies highlight ecological factors affecting variation in the frequency of task delegation. Positive correlations are reported between compliance pressures on children and adult (particularly maternal) subsistence involvement within and across cultures (Barry et al., 1959; Brown, 1973; Draper and Cashdan, 1988; Munroe and Munroe, 1977; Whiting and Whiting, 1975). Parent-offspring labor substitution is particularly helpful to alleviate the burden of raising multiple dependents on parents, since offspring altriciality renders high-quality, direct childcare incompatible with many subsistence activities (Bove et al., 2002; Hames, 1988; Hurtado et al., 1992; Kramer, 2005; Turke, 1988).

In accordance with the common preference model, the above-referenced studies generally view work force integration as beneficial to parent and child. Children's short-term production contributes to familial welfare and might simultaneously increase future productivity through skill acquisition during task performance. But because of the paucity of research into decision-making processes underlying household labor, it remains unclear which productive tasks children are more likely to engage in independently, which tasks are more likely to be delegated, and which tasks are more likely to be met with resistance following delegation.

#### *Hypothesis and predictions regarding parent-offspring conflict over labor*

Age is hypothesized to have a negative effect on the probability of delegation and resistance due to increasing returns of on-the-job training and a decrease in the physical cost of task performance as children grow. A main effect of both father's village absenteeism and number of younger siblings is hypothesized to increase the probability of delegation and resistance due to the greater willingness on behalf of the parent to manipulate the child's time as labor demand increases given relatedness asymmetries. An interaction between number of younger siblings and age is predicted to lower the probability of delegation and resistance due to the decreasing physical cost of task performance and greater inclusive fitness benefits. Degree of physical exertion associated with task performance is hypothesized to increase the probability of delegation and resistance. Finally, reduced conflict over labor allocation is expected as paternal absence

increases the value of the child's labor, particularly with respect to strength-intensive, family-directed tasks.

Asymmetries in relatedness between parents and offspring suggest that the optimal mixture of time to production primarily benefiting the child and the family will differ for parents and children. All else equal, a child is expected to bias work effort toward productive activities yielding benefits to ego. While benefits may be material (e.g., calories) or non-material (e.g., knowledge of animal behavior), a crucial feature of such productive tasks is that kin-directed benefits are byproducts. Consider the contrast between collecting fruit and clearing a field. Fruit collection satisfies caloric needs for the child and is unlikely to result in significant provisioning of kin since fruits are often consumed on site and contribute no more than about 5% of energy in the modern forager diet (Kaplan et al., 2000). Field clearance, in contrast, results in few immediate benefits to the child, and the calories obtained from a harvest are more equitably distributed among kin over time. Therefore, field clearance is likely to have a greater positive effect on parental fitness than fruit collection.

More generally, this reasoning leads to the hypothesis that parent-offspring conflict is more likely to occur over productive tasks that have fewer positive effects on parental fitness; that is, when the child is the primary beneficiary and can reap most or all benefits from task performance. This hypothesis generates the following predictions: tasks primarily benefiting the child are less likely to be delegated because children are more likely to perform them of their own accord; tasks primarily benefiting the family are more likely to be delegated because children are less likely to perform them of their own accord; once delegated, tasks primarily benefiting the child are less likely to be met with resistance; and once delegated, tasks primarily benefiting the family are more likely to be met with resistance.

## ***Methods***

### *The study population*

The Tsimane' are forager-farmers inhabiting the rainforests and savannas in the Beni department of central lowland Bolivia. Published census estimates range from

6,351 (INE, 2003) to 7,130 (VAIPO, 1998). The majority of villages are located along the Maniqui River, but many communities are situated in the interior forest, near market towns, or adjacent to other rivers. For this study data were collected sporadically from 2006 to 2008 in four communities: Cedral, Chacal, Puerto Triunfo, and Misión Fatima. The first three villages are located in the lower Maniqui region within the Beni Biosphere Reserve, a protected area of roughly 1,350 km<sup>2</sup> home to many Tsimane' and other Bolivians. The fourth village, which is located in the upper Maniqui region and houses a Catholic Redemptorist mission, has a population approximating that of the three Biosphere communities combined (n = 528 individuals, 2008 census).

The Tsimane' economy is similar to that of other lowland South American horticulturalists and consists of swidden horticulture, fishing, hunting, and collecting forest items. From an early age children engage in family-oriented production (e.g., garden labor, household chores, care of younger siblings). Because of the abundance of available productive activities, children often engage in tasks that satisfy personal caloric or other needs with fewer kin-directed benefits. Some examples include roasting plantains for individual consumption, fishing or manufacturing fishing items (e.g., hook and line), and washing or sewing one's clothing. On occasion, children accompany fathers while hunting, which results in few material benefits but facilitates skill acquisition.

Tsimane' women are the principal task assigners, accounting for 77% of all delegated chores in our sample. Fathers, in contrast, delegated only 8% of tasks. This discrepancy is largely due to the fact that women spend more time parenting and in camp than men (Winking et al., In press) and therefore have more opportunities to delegate work. Other noteworthy task delegators by kinship category included grandparents and older sisters, each accounting for 5% of all assigned chores.

#### *Task delegation interview*

Interviews were conducted in all but one month of the year to obtain a representative sample of household economic decision-making across wet and dry seasons. Interviews included a list of 54 tasks that Tsimane' children perform regularly



based on observations and analyses of time allocation data. Participants (usually mothers) were asked whether the focal co-resident child performed each of the 54 tasks during the previous day, along with the number of times the task was completed. Once a list of the previous day's chores was obtained, we asked whether the child was asked to perform each task (*jutete*) or whether it was performed of the child's own accord (*cui'si ya dyijyedye*). If a task was delegated, we asked if the child complied immediately (*se'vaqui cavintum*) or refused to do so (*jam mâ'je' se'vaqui*). If resistance was evident, we asked which activity the child engaged in immediately following resistance toward delegated task performance. A flowchart of the interview is shown in Figure 3.1.

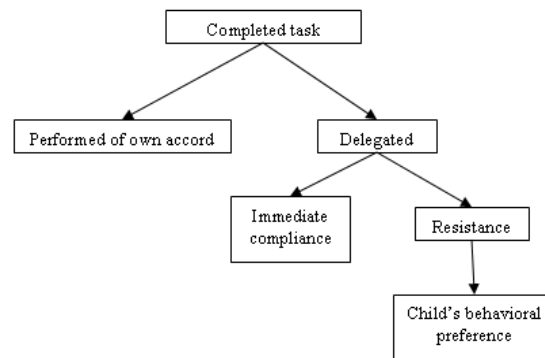


Figure 3.1. A flowchart of the task delegation interview

### Data analysis

The generalized estimating equations (GEE) method was used to model the probability of task delegation and children's resistance toward performing delegated tasks. GEE modeling permits data analysis of correlated, repeated measures on the same individuals over time. All analyses specify a binary distribution and exchangeable correlation structure. Dichotomous dependent variables include whether a task was delegated, and whether the child exhibited resistance toward delegated task performance (1 = yes, 0 = no).

To address the hypothesis that parent-offspring conflict is more likely to occur over tasks that have fewer positive effects on parental fitness, we run separate models

regressing both the probability of delegation and resistance on task type, a categorical variable where 1 equals the specific task (hunt, fish, etc.) and 0 equals all other tasks. Controls include sex and age, which is estimated using demographic data (see Gurven et al., 2007 for methodology). We include an additional control, father's village absenteeism, for analyses in which the probability of delegation is the dependent variable because father absence has been shown to influence children's time allocation (Bock, 2002; Bock and Johnson, 2004), presumably increasing the likelihood of task delegation. Father absenteeism is a continuous variable determined by the father's self-reported number of days away from the community during the sample year.

Productive activities were categorized based on whether benefits of task performance are realized more exclusively by the child or are more equitably directed toward kin (Table 3.1). We recognize that this categorization likely obscures important characteristics of tasks in which both the child and family benefit. Hunting or fishing, for example, can simultaneously result in skill acquisition for the child and kin provisioning. We would expect less parent-offspring conflict over productive tasks in which the primary beneficiary is ambiguous. But for the purposes of evaluating parent-offspring conflict theory, we assume that the child primarily benefits from tasks in which the main beneficiary is ambiguous since kin-directed altruism is not a necessary component of task performance.

Table 3.1. Task categorization by primary beneficiary of performance

<b>Primary beneficiary</b>		<b>Task type</b>	
<b>Child</b>	<i>Food process</i>	Roast plantains/tend fire	
	<i>Food acquisition</i>	Forage	
		Fish	
		Hunt	
<i>Other chores</i>	Sew Manufacture foraging items Wash clothes		
<b>Family</b>	<i>Food process</i>	Process rice Make chicha (homemade beer)	
		<i>Food acquisition</i>	Garden
	<i>Other chores</i>	Clean house Get wood/water Animal care Wash plates Construct house	
		<i>Sibcare</i>	All forms

Results are presented as log odds (B) of an outcome or as odds ratios (OR). An OR greater than 1 indicates that an outcome is more likely with each higher level of the predictor, and an OR less than 1 indicates that an outcome is less likely with each higher level of the predictor.

### **Results**

The sample consisted of 177 children aged 4 to 18 from 66 families. The mean number of completed tasks and days sampled per child was 44.6 (SD = 27.04) and 3.82 (SD = 0.9), respectively.

#### *Task delegation*

The probability of a task being delegated decreases with age (B = -0.058,  $p < 0.001$ ; see Figure 3.2). While the sex difference observed in early childhood is not significant, girls aged 16+ are more likely to be delegated a task than similarly-aged boys ( $\chi^2 = 3.91$ ,  $df = 1$ ,  $p = 0.048$ ), possibly indicating heightened conflict between parents and nubile daughters over the timing of family formation. A detailed breakdown of the frequency of task delegation by activity category and age is displayed in Tables 3.2 (boys) and 3.3 (girls).

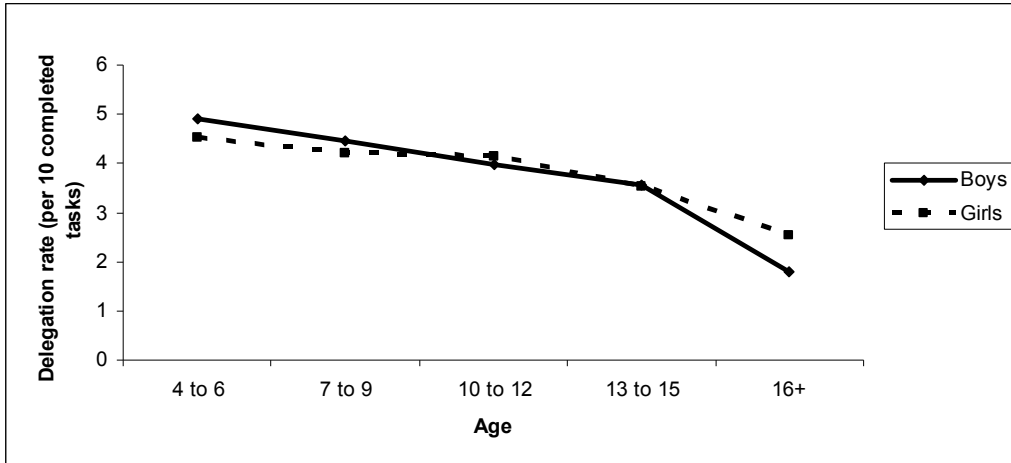


Figure 3.2. Task delegation frequency by age and sex

Table 3.2. Task delegation frequency by activity category and age: Boys

Primary beneficiary	Task type	Number of tasks completed (Proportion delegated)					
		Ages 4 to 8 (n=39)	Ages 9 to 13 (n=34)	Ages 14+ (n=20)	Total (n=93)		
Child	<i>Food process</i>	Roast plantains	332 (0.12)	305 (0.1)	135 (0.04)	772 (0.1)	
		<i>Food acquisition</i>	Forage	34 (0.18)	41 (0.32)	3 (0.0)	78 (0.24)
	Fish		17 (0.29)	33 (0.42)	26 (0.19)	76 (0.32)	
	Hunt		2 (1.0)	6 (0.5)	7 (0.43)	15 (0.53)	
	<i>Other chores</i>	Sew	2 (0.0)	19 (0.0)	8 (0.0)	29 (0.0)	
		Manufacture foraging items	4 (0.0)	9 (0.33)	2 (0.5)	15 (0.27)	
		Wash clothes	9 (0.33)	32 (0.16)	29 (0.03)	70 (0.13)	
	Family	<i>Food process</i>	Process rice	10 (0.3)	27 (0.33)	24 (0.38)	61 (0.34)
			Make chicha	2 (0.0)	1 (0.0)	2 (0.0)	5 (0.0)
		<i>Food acquisition</i>	Garden	62 (0.53)	74 (0.76)	52 (0.6)	188 (0.64)
<i>Other chores</i>			Clean house	11 (0.36)	9 (0.78)	1 (0.0)	21 (0.52)
		Get wood/water	175 (0.76)	205 (0.81)	99 (0.48)	479 (0.72)	
		Animal care	92 (0.43)	81 (0.49)	19 (0.37)	192 (0.45)	
		Wash plates	89 (0.46)	115 (0.37)	36 (0.19)	240 (0.38)	
		Construct house	5 (1.0)	21 (0.33)	9 (0.67)	35 (0.51)	
<i>Sibcare</i>		All forms	506 (0.59)	346 (0.49)	97 (0.29)	949 (0.52)	

Table 3.3. Task delegation frequency by activity category and age: Girls

Primary beneficiary	Task type	Number of tasks completed (Proportion delegated)			Total (n=84)		
		Ages 4 to 8 (n=38)	Ages 9 to 13 (n=30)	Ages 14+ (n=16)			
Child	<i>Food process</i>	Roast plantains	355 (0.15)	365 (0.29)	202 (0.19)	922 (0.21)	
		<i>Food acquisition</i>	Forage	35 (0.2)	36 (0.14)	13 (0.0)	84 (0.14)
	Fish		10 (0.4)	19 (0.47)	5 (0.2)	34 (0.41)	
	Hunt		0 (0.0)	3 (0.67)	1 (1.0)	4 (0.75)	
	<i>Other chores</i>	Sew	10 (0.1)	39 (0.0)	17 (0.18)	66 (0.06)	
		Manufacture foraging items	2 (0.5)	3 (0.33)	0 (0.0)	5 (0.4)	
		Wash clothes	19 (0.37)	60 (0.22)	37 (0.11)	116 (0.21)	
	Family	<i>Food process</i>	Process rice	15 (0.47)	91 (0.31)	72 (0.24)	178 (0.29)
			Make chicha	6 (0.33)	16 (0.56)	4 (0.75)	26 (0.54)
<i>Food acquisition</i>		Garden	29 (0.38)	73 (0.56)	50 (0.52)	152 (0.51)	
		<i>Other chores</i>	Clean house	15 (0.6)	38 (0.66)	25 (0.28)	78 (0.53)
Get wood/water			219 (0.71)	338 (0.6)	175 (0.37)	732 (0.58)	
Animal care			93 (0.29)	82 (0.32)	38 (0.45)	213 (0.33)	
Wash plates			134 (0.61)	171 (0.54)	117 (0.41)	422 (0.53)	
Construct house			6 (1.0)	6 (0.5)	6 (0.83)	18 (0.78)	
<i>Sibcare</i>		All forms	651 (0.52)	711 (0.37)	258 (0.27)	1620 (0.41)	

Contrasting macro-categories of tasks by primary beneficiary shows that frequency of delegation is greater for food acquisition and domestic chores in which benefits are more equitably directed toward kin, regardless of sex (Figures 3.3 and 3.4). These differences persist with age. Also noteworthy is the fact that the rate of delegation

for sibcare exceeds that of food acquisition and domestic chores that primarily benefit the child for both sexes across age categories.

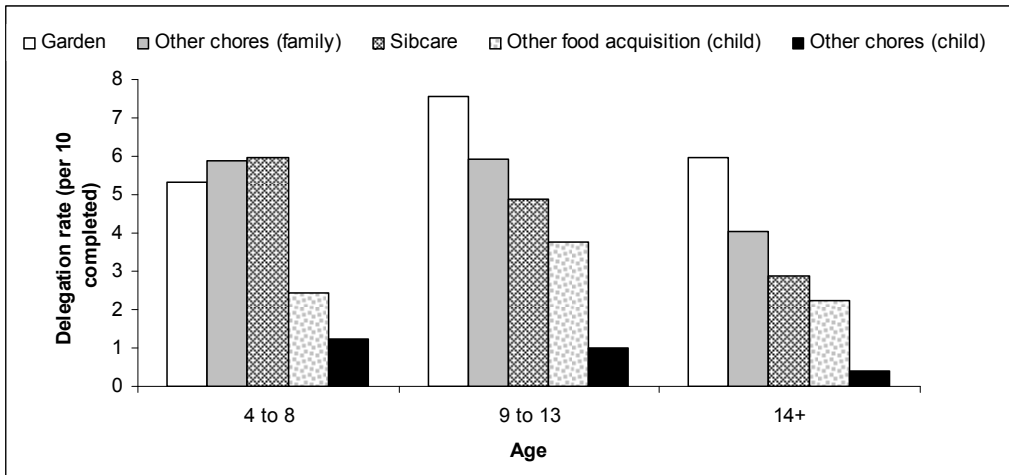


Figure 3.3. Task delegation frequency by activity category and age: Boys

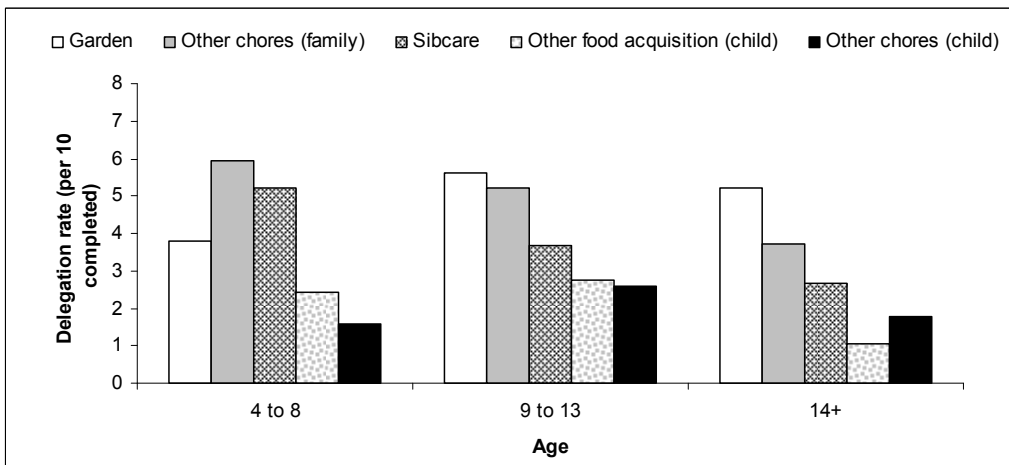


Figure 3.4. Task delegation frequency by activity category and age: Girls

The probability of a task being delegated declines with age controlling for other factors (Table 3.4), indicating the increasing returns to independent task performance due to greater body size. As hypothesized, the two proxies of family labor demand, number of co-resident younger siblings (controlling for number of older siblings) and father’s village absenteeism, positively predict the probability of task delegation. This suggests greater parent-offspring conflict since the parent must exert greater structure on the

child's time even as inclusive fitness benefits to the child increase. As children age, however, an increase in the number of younger siblings significantly lowers the probability of delegation, indicating a decrease in parent-offspring conflict as fitness interests converge and the child experiences fewer costs and greater benefits from task performance. Finally, tasks that require higher levels of physical exertion are significantly more likely to be delegated, suggesting that parents are willing to inflict greater physical costs than the child is willing to bear in order to facilitate kin-directed altruism.

*Table 3.4. General estimating equations (GEE) analysis of effect of age, family labor demand, and degree of task exertion on the probability of delegation (n = 7,895 tasks, 177 children, 3,173 delegated tasks)*

<b>Parameter</b>	<b>B</b>	<b>SE</b>	<b>Wald <math>\chi^2</math></b>	<b>p</b>
Intercept	-0.374	0.32	1.36	0.244
Age	-0.049	0.029	2.942	0.086
Sex = male	0.029	0.118	0.062	0.804
Number of co-resident younger siblings	0.332	0.113	8.7	0.003
Number of co-resident older siblings	-0.177	0.046	14.656	<0.001
Father's village absenteeism	0.021	0.004	29.837	<0.001
Physical exertion = high	1.121	0.096	135.985	<0.001
Number of co-resident younger siblings*Age	-0.032	0.009	11.614	0.001

The summary of GEE analyses modeling the probability of delegation as a function of task type is presented in Table 3.5. Support for the prediction that tasks primarily benefiting the child are less likely to be delegated entail odds ratios less than 1. Of the eight independent tests, five are significant and in the predicted direction. Contrary to prediction, hunting is more likely to be delegated than other tasks controlling for age, sex, and father absenteeism, but the effect is marginally significant. This suggests that parents delegate tasks seldom performed as a way to encourage skill development and is consistent with Tsimane' mothers' expressed desires to create apprenticeship opportunities for adolescent boys to learn hunting techniques from fathers. To lower the probability of making a type I error, we use a modified Bonferroni



adjustment and find that all five tests in the predicted direction retain their significance. None of the tests are significant and in the opposite direction after modifying alpha levels.

Support for the prediction that tasks primarily benefiting the family are more likely to be delegated entail odds ratios greater than 1. Of the nine independent tests, six are significant and in the predicted direction. Both tests that run counter to prediction are not significant. After using a modified Bonferroni adjustment, three of the six tests in the predicted direction retain their significance.

*Table 3.5. Summary of GEE analyses of effect of task type on the probability of delegation. Controls for each model include age, sex, and, father's village absenteeism (n = 7,895 tasks, 177 children, 3,173 delegated tasks)*

Primary beneficiary	Task type	N completed (N delegated)	Probability of delegation			
			Odds ratio	Direction	p	
<b>Child</b>	<i>Food process</i> Roast plantains <sup>1</sup>	1694 (271)	0.205	Predicted	<0.001 <sup>†</sup>	
	<i>Food acquisition</i>	Forage	162 (31)	0.391	Predicted	<0.001 <sup>†</sup>
		Fish	110 (38)	0.868	Predicted	0.557
		Hunt	19 (11)	2.109	Opposite	0.077
	<i>Other chores</i>	Sew	95 (4)	0.062	Predicted	0.001 <sup>†</sup>
		Manufacture foraging items	20 (6)	0.357	Predicted	0.202
		Wash clothes	186 (33)	0.373	Predicted	<0.001 <sup>†</sup>
<i>All tasks where main beneficiary=child</i>		2286 (394)	0.202	Predicted	<0.001 <sup>†</sup>	
<b>Family</b>	<i>Food process</i>	Process rice	239 (73)	0.823	Opposite	0.266
		Make chicha	31 (14)	1.318	Predicted	0.478
	<i>Food acquisition</i>	Garden	340 (198)	2.366	Predicted	<0.001 <sup>†</sup>
	<i>Other chores</i>	Clean house	99 (52)	1.697	Predicted	0.023
		Get wood/water	1211 (771)	3.32	Predicted	<0.001 <sup>†</sup>
		Animal care	405 (157)	0.958	Opposite	0.76
		Wash plates	662 (314)	1.426	Predicted	0.001 <sup>†</sup>
		Construct house	53 (32)	2.073	Predicted	0.06
	<i>Sibcare</i>	All forms	2569 (1168)	1.282	Predicted	0.009

<sup>1</sup> Valid parameter estimates and standard errors could not be computed with inclusion of a sex term so it was omitted.

<sup>†</sup> Significance retained following modified Bonferroni adjustment

Controlling for age, family labor demand, and degree of task exertion, the probability of delegation strongly decreases if the child is the primary beneficiary of task performance (Table 3.6). As paternal absence increases, the probability of being

delegated a strength-intensive task decreases suggesting reduced conflict over labor allocation since children independently respond to household need when the value of labor increases. This response would be particularly beneficial if children biased labor toward family directed tasks. Indeed, we find that as paternal absence increases, the probability of being delegated a horticultural task is marginally lower than the baseline of ego-directed food acquisition tasks (Table 3.7). Furthermore, relative to ego-directed food processing tasks we find that the probability of being delegated family-directed food processing tasks is marginally lower as paternal absence increases (Table 3.8).

*Table 3.6. GEE analysis of effect of age, family labor demand, degree of task exertion, and primary beneficiary of task performance on the probability of delegation (n = 7,895 tasks, 177 children, 3,173 delegated tasks)*

<b>Parameter</b>	<b>B</b>	<b>SE</b>	<b>Wald <math>\chi^2</math></b>	<b>p</b>
Intercept	-0.32	0.381	0.705	0.401
Age	-0.03	0.035	0.734	0.392
Number of co-resident younger siblings	0.411	0.171	5.814	0.016
Number of co-resident older siblings	-0.098	0.056	3.102	0.078
Father's village absenteeism	0.023	0.005	22.38	<0.001
Primary beneficiary = child	-1.441	0.122	139.163	<0.001
Physical exertion = high	1.093	0.165	43.877	<0.001
Number of co-resident younger siblings*Age	-0.041	0.015	7.635	0.006
Physical exertion = high* Father's village absenteeism	-0.012	0.006	3.972	0.046

*Table 3.7. GEE analysis of effect of father absenteeism on the probability of being delegated a horticultural task (n = 631 food acquisition tasks, 152 children, 278 delegated tasks)*

<b>Parameter</b>	<b>B</b>	<b>SE</b>	<b>Wald <math>\chi^2</math></b>	<b>p</b>
Intercept	-2.125	0.506	17.667	<0.001
Age	0.03	0.034	0.795	0.373
Sex = male	0.408	0.234	3.044	0.081
Father's village absenteeism	0.033	0.014	5.208	0.022
Food acquisition task = horticulture	1.794	0.405	19.603	<0.001
Food acquisition task = horticulture* Father's village absenteeism	-0.029	0.017	2.986	0.084

Table 3.8. GEE analysis of effect of father absenteeism on the probability of being delegated a family food processing task ( $n = 1,964$  food processing tasks, 176 children, 358 delegated tasks)

Parameter	B	SE	Wald $\chi^2$	$p$
Intercept	-1.813	0.405	20.081	<0.001
Age	0.009	0.029	0.087	0.768
Sex = male	-0.633	0.225	7.904	0.005
Father's village absenteeism	0.011	0.009	1.405	0.236
Food processing task = family	1.947	0.423	21.208	<0.001
Food processing task = family* Father's village absenteeism	-0.026	0.015	2.992	0.084

### Resistance toward performing delegated tasks

The probability of resistance toward performing delegated tasks decreases with age, although the effect is not significant ( $B = -0.031$ ,  $p = 0.128$ ; see Figure 3.5). This is due to the almost linear increase in girls' resistance frequency until mid-adolescence. Controlling for age and age squared, boys are more likely to resist performing delegated tasks than girls ( $OR = 1.41$ ,  $p = 0.029$ , sex = male). Inclusion of a sex by age interaction term indicates that the increase in age has a marginally greater negative effect on the likelihood of resistance for boys than girls ( $B = -0.075$ ,  $p = 0.064$ , sex=male\*age). These results suggest that differences in rates of maturation and the timing of energy allocation to reproduction should be considered in assessing the physical costs of task performance by sex.

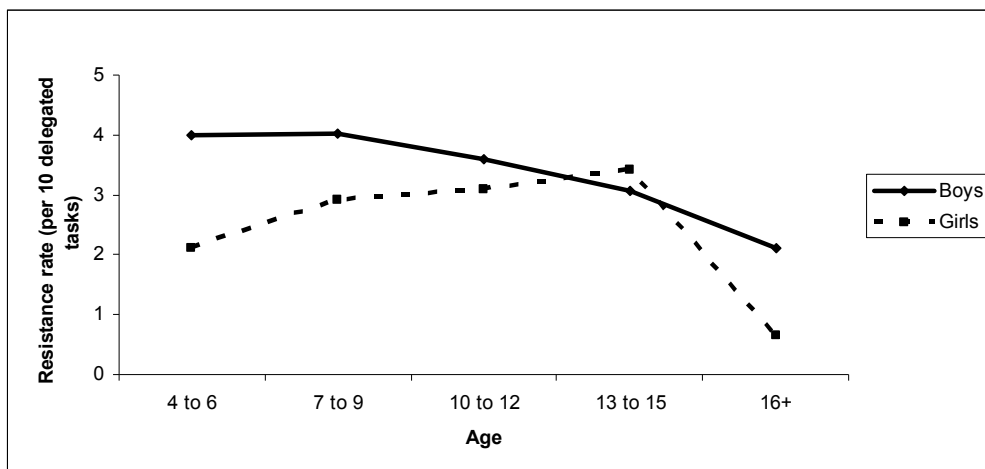


Figure 3.5. Frequency of resistance toward performing delegated tasks by age and sex

Play represents children’s major preferred alternative to performing delegated work in early childhood, prompting nearly 90% of resistance events for children aged 4 to 6 (Figures 3.6 and 3.7). A shift from prioritizing play to socialization at the expense of immediate delegated task performance is increasingly evident with age for both sexes. For adolescent girls, idle activities including resting and eating are equally or more important than socializing, which possibly points to the importance of fat deposition prior to girls’ entry into the marriage market. This preference coincides with the peak in resistance rate for girls.

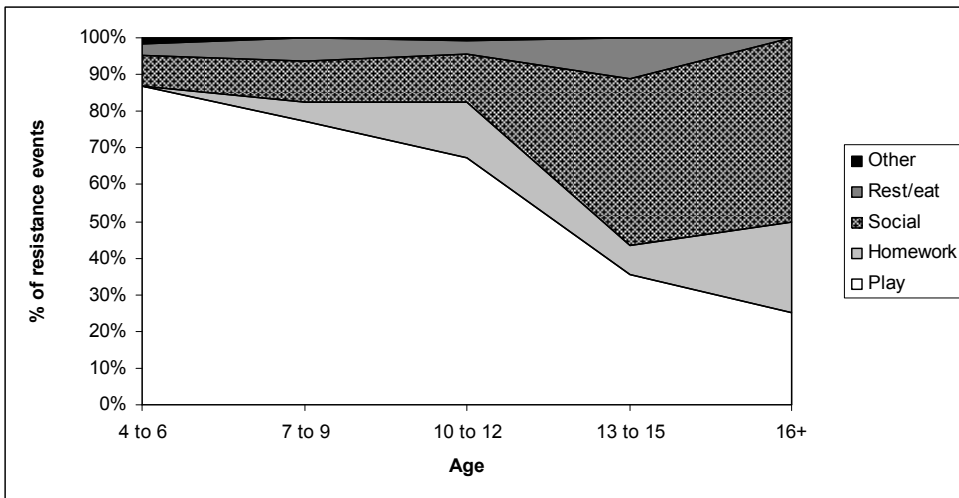


Figure 3.6. Preferred alternatives to performing delegated work by age: Boys

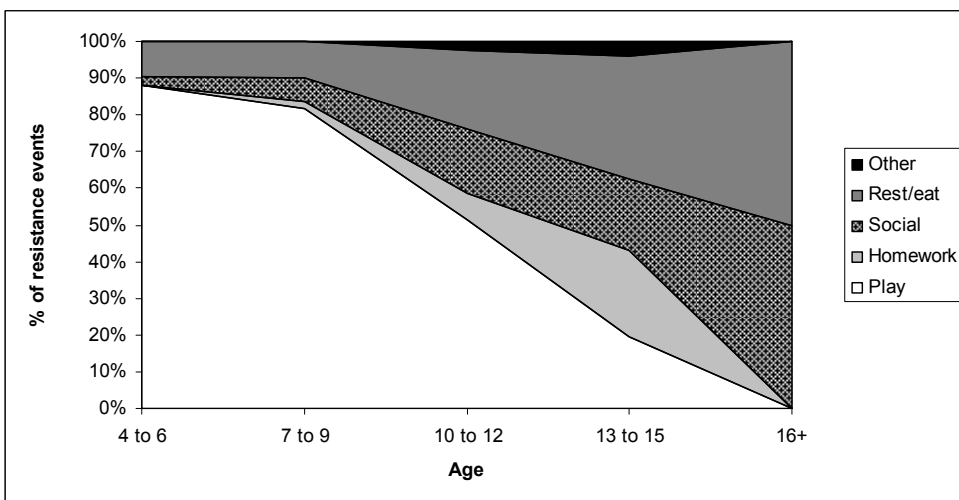


Figure 3.7. Preferred alternatives to performing delegated work by age: Girls

Contrasting macro-categories of delegated tasks by primary beneficiary shows that frequency of resistance is greater for food acquisition tasks in which benefits are more equitably distributed among kin, regardless of sex (Figures 3.8 and 3.9). For domestic tasks, the pattern is less clear and might reflect the small sample of delegated chores primarily benefiting the child, particularly for boys aged 9 – 13 and 14 – 18 (n = 37 and 7 delegated tasks, respectively).

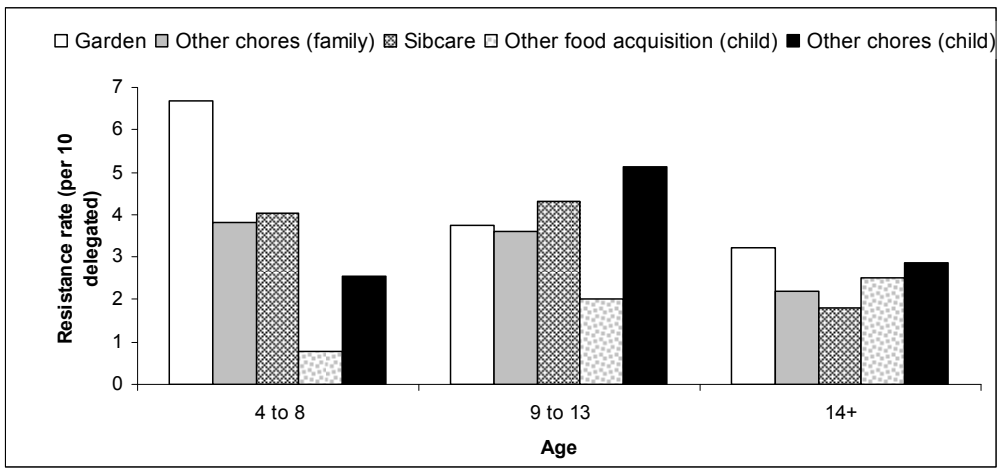


Figure 3.8. Frequency of resistance by activity category and age: Boys



Figure 3.9. Frequency of resistance by activity category and age: Girls

The effects of family labor demand proxies on the probability of resistance are somewhat inconsistent (Table 3.9). As hypothesized, number of co-resident younger siblings positively predicts the probability of resistance, suggesting heightened parent-offspring conflict over optimal levels of familial investment when more kin can benefit from the child’s labor. However, the effect of father’s village absenteeism is in the opposite direction as predicted but not significant. Given the above finding that paternal absence increases the likelihood of family-directed labor substitution without delegation, we might not expect an increase in conflict if the labor shortage places a premium on increased efficiency of all household members. As children age, an increase in the number of younger siblings marginally lowers the probability of resistance, again indicating decreasing levels of conflict as physical costs decline, benefits accrue from on-the-job training, and the inclusive fitness benefits increase. Finally, tasks that require higher levels of physical exertion are more likely to be resisted. This indicates that children indeed respond to increasing costs by attempting to defer involvement in physically demanding labor, and provides further evidence that parental desires to maximize household efficiency are not always congruent with the child’s self interests (and vice versa).

*Table 3.9. GEE analysis of effect of age, family labor demand, and degree of task exertion on the probability of resistance following delegation (n = 3,173 delegated tasks, 169 children, 1,010 resistance events)*

<b>Parameter</b>	<b>B</b>	<b>SE</b>	<b>Wald <math>\chi^2</math></b>	<b>p</b>
Intercept	-0.632	0.377	2.807	0.094
Age	-0.044	0.038	1.337	0.247
Sex = male	0.322	0.158	4.152	0.042
Number of co-resident younger siblings	0.36	0.15	5.759	0.016
Number of co-resident older siblings	-0.136	0.065	4.338	0.037
Father’s village absenteeism	-0.007	0.006	1.341	0.247
Physical exertion = high	0.327	0.123	7.052	0.008
Number of co-resident younger siblings*Age	-0.022	0.013	3.125	0.077

The summary of GEE analyses modeling the probability of resistance toward performing delegated work as a function of task type is presented in Table 3.10. Support

for the prediction that delegated tasks primarily benefiting the child are less likely to be met with resistance entail odds ratios less than 1. Of the seven independent tests for which valid standard errors can be computed, three are in the predicted direction and either significant or marginally significant. Contrary to prediction, washing clothes is more likely to be resisted than other delegated tasks controlling for age and sex, but the effect is not significant. None of the tests in the predicted direction retain significance after using a modified Bonferroni adjustment.

Support for the prediction that delegated tasks primarily benefiting the family are more likely to be met with resistance entail odds ratios greater than 1. Of the nine independent tests, three are in the predicted direction and either significant or marginally significant. With the exception of domestic animal care, all tests that run counter to prediction are not significant. Once again, none of the tests in the predicted (or opposing) direction retain significance after using a modified Bonferroni adjustment. The predicted effect of primary beneficiary on the probability of resistance remains marginally significant after controlling for age, sex, sibship composition, and degree of task exertion (Table 3.11).

Table 3.10. Summary of GEE analyses of effect of task type on the probability of resistance following delegation. Controls for each model include age and sex ( $n = 3,173$  delegated tasks, 169 children, 1,010 resistance events)

Primary beneficiary	Task type	N resisted	Probability of resistance			
			Odds ratio	Direction	$p$	
Child	Food process	Roast plantains	74	0.677	Predicted	0.162
	Food acquisition	Forage	4	0.327	Predicted	0.02
		Fish	7	0.347	Predicted	0.087
		Hunt	1	0.201	Predicted	0.157
	Other chores	Sew <sup>1</sup>	0	--	--	--
		Manufacture foraging items	2	1.044	Equivocal	0.958
		Wash clothes	15	1.631	Opposite	0.111
	All tasks where main beneficiary=child		103	0.628	Predicted	0.036
Family	Food process	Process rice	22	1.089	Predicted	0.77
		Make chicha	1	0.191	Opposite	0.154
	Food acquisition	Garden	72	1.373	Predicted	0.082
		Other chores	Clean house	25	2.075	Predicted
	Get wood/water		270	1.419	Predicted	0.006
	Animal care		38	0.647	Opposite	0.056
	Wash plates		92	0.886	Opposite	0.504
	Construct house		7	0.635	Opposite	0.212
	Sibcare	All forms	380	0.937	Opposite	0.593

<sup>1</sup>Valid parameter estimates and standard errors could not be computed due to the low observed frequency of resistance following delegation.

Table 3.11. GEE analysis of effect of primary beneficiary of task performance on the probability of resistance following delegation ( $n = 3,173$  delegated tasks, 169 children, 1,010 resistance events)

Parameter	B	SE	Wald $\chi^2$	$p$
Intercept	-0.238	0.307	0.6	0.439
Age	-0.086	0.029	9.052	0.003
Sex = male	0.34	0.164	4.314	0.038
Number of co-resident younger siblings	0.089	0.055	2.603	0.107
Number of co-resident older siblings	-0.148	0.066	5.085	0.024
Primary beneficiary = child	-0.413	0.222	3.464	0.063
Physical exertion = high	0.288	0.122	5.584	0.018



## *Discussion*

We offer a novel approach to evaluating Trivers's (1974) theory of parent-offspring conflict by examining task delegation and resistance toward performing assigned tasks. Consistent with the theory, our results suggest that parents are selected to manipulate the child's behavior in ways that maximize parental fitness, even at a cost to the child. Tsimane' children are less likely to be delegated tasks primarily benefiting ego, and more likely to be delegated tasks primarily benefiting the family. Once delegated, we find some evidence that tasks primarily benefiting ego are less likely to be met with resistance, whereas tasks primarily benefiting the family are more likely to be met with resistance. These results are consistent with the hypothesis that parent-offspring conflict is more likely to occur over productive activities which have lower positive effects on parental fitness; namely, when the child is the primary beneficiary of task performance and fewer kin benefit from such labor.

Our findings are also consistent with reported attitudinal differences between performing "self-care" (e.g., making one's bed) and "family-care" (e.g., setting the table) tasks in industrialized settings. Compared to self-care tasks, children report a greater willingness to both assign family-care tasks to others and to request payment for performing family-care tasks (Warton and Goodnow, 1991). This suggests not only sibling conflict over the allocation of family-care tasks, but also that resistance toward performing family-care tasks is more likely to occur without direct compensation.

Consideration of the interaction between the varying costs and benefits of altruism allows for investigation into the dynamic nature of parent-child relations. The extent of parent-offspring conflict is constrained by a complex interaction between the child's increasing size and ability with age and the inclusive fitness benefits resulting from greater labor demand and converging interests with respect to increasing household efficiency.

By viewing task delegation as a manifestation of parent-offspring conflict, our approach differs from that of many anthropologists investigating children's socialization. We agree that delegated task performance can be beneficial for the child by fostering discipline, responsibility, a cooperative attitude, and adult competence through on-the-job

training (e.g., Whiting and Whiting 1975). However, a primary interest here is to investigate types of labor that are more likely to result in conflict stemming from differences in perspective between child and parent over the optimal mixture of production directed mainly toward ego and kin. These differences can trigger attempts by parents to alter children's behaviors in ways that might be sub-optimal from the child's perspective. We have attempted to show that task delegation represents one such attempt at behavioral manipulation precluding children from satisfying self-interests. Parent-offspring conflict theory can account for weak or inconsistent sex differences in delegation frequency for tasks exhibiting a strong sexual division of labor. For example, Tsimane' boys are delegated more sibcare tasks than girls from ages 4 to 8 ( $\chi^2 = 6.33$ ,  $df = 1$ ,  $p = 0.012$ ) and 9 to 13 ( $\chi^2 = 13.87$ ,  $df = 1$ ,  $p < 0.001$ ) despite the fact that Tsimane' fathers provide much less direct care than mothers (Winking et al., In press). The hypothesis that task delegation is preparatory for adult competence cannot account for this result.

Self-directed production is one way that children can accommodate self-interests. Another way is to engage in non-productive activities that are presumably safer and impart more skills that will increase future productivity than would time spent in production due to small body size. Play, for example, enhances sensorimotor and cognitive abilities among youngsters in many species (Bekoff and Byers, 1998; Pellegrini and Bjorklund, 2004; Smith, 1982), and prepares children for adult subsistence roles (Bock and Johnson 2004). The importance of non-productive activities in development has implications for understanding parent-offspring conflict over labor allocation. Forms of labor that are more compatible with involvement in non-productive activities may result in less conflict, even if the family is the primary beneficiary. Tasks of short duration, close proximity to playmates, and/or requiring relatively low levels of concentration for competent performance might not substantially interfere with involvement in preferred non-productive alternatives including play and socializing (Figures 3.6 and 3.7). This might help explain why the direction of estimates of the probability of resistance toward performing delegated tasks runs counter to prediction for several family-oriented tasks such as making chicha, animal care, washing plates, and

sibcare (see lower half of Table 3.10). Consistent with this view, these family-oriented tasks are less likely to be delegated (OR = 0.54,  $p < 0.001$ , controlling for age, sex, and father's village absenteeism) and resisted than other family-oriented tasks following delegation (OR = 0.66,  $p = 0.001$ , controlling for age and sex).

Finally, this study poses a direct challenge to the common preference model, which suggests that individuals allocate work effort without consideration of the primary beneficiary of task performance. Focusing on the household rather than the individual as the unit of analysis severely limits our understanding of family dynamics with respect to resource distribution and the intergenerational division of labor. The importance of incorporating individual interests into existing models of family economic decision-making is becoming increasingly clear not only among social scientists but also in the international development community (Alderman et al., 1995). An understanding of the conditions under which conflict occurs over labor allocation from an evolutionary perspective can inform public policy initiatives directed at improving the well-being of every household member through attempts to minimize conflict. Encouraging children to perform household tasks that simultaneously facilitate relevant skill acquisition, for example, is one potential way to achieve this.

## CHAPTER 4: LABOR DEMAND, CHILDREN'S TIME USE, AND IMPLICATIONS FOR FAMILY CONFLICT AND COOPERATION

### *Introduction*

A growing body of research suggests that household labor demand influences children's time use and has implications for understanding collaborative and conflictive kin dynamics. While evolutionary theory recognizes that parents and children will disagree over optimal levels of children's kin-directed altruism, current models of intergenerational time allocation in the family ignore conflicts of interest stemming from sexual reproduction (Gurven and Kaplan, 2006; Lee and Kramer, 2002). In this paper we examine how number of co-resident younger siblings – an indicator of household labor demand – affects children's time allocation to productive activities primarily benefitting the child and the family, as well as to non-productive activities. We evaluate the hypothesis that parents will manipulate the child's time in a way that maximizes parental fitness by focusing on behaviors that vary in the extent to which they offset the cost to parents of rearing offspring. Due to a combination of children's capacities to assist in family production, along with overlapping periods of dependence between co-resident siblings, we propose that a source of family conflict is over the optimal division of a child's time between ego- and family-directed pursuits. We consider how behavioral manipulation of the child's time might compromise familial and peer relations.

### *Intrafamilial conflict over children's time use*

Parents and children have different interests with respect to the division of household resources (Trivers, 1974). Parents are equally related to all children and therefore selected to balance resource allocations among current and future offspring. The child, however, is only partially related to siblings yet fully related to itself. Given these asymmetries in relatedness, intrafamilial conflict is expected over optimal levels of parental resource allocation and kin-directed altruism exhibited by the child. Indeed, mounting behavioral and physiological evidence suggests that children attempt to garner limited parental resources at the expense of siblings (e.g., Fouts et al., 2005; Haig, 2002).

Yet the extent to which increasing household labor demand influences manipulation of the child's time by parents to encourage kin-directed altruism is less clear.

Given the broad range of opportunities to engage in production in societies practicing subsistence horticulture and agriculture, a child's labor strongly influences household resource availability. Children can substitute for parental labor while parents engage in work that youngsters do not yet have the necessary skills and/or strength to perform (Bock, 2002a, b). Alternatively, siblings can substitute for one another's labor, assuming that they are equally capable of performing a task and that one child's labor frees another child to engage in alternative activities (*ibid*). Intergenerational labor substitution redistributes the cost to parents of raising multiple dependents of different ages. Positive empirical associations between presence of co-resident subadult helpers and child growth (Hadley, 2005; Stinson, 1980) and mother's completed fertility (Turke, 1988; but see Hames and Draper, 2004) support the notion that children's production increases parental fitness (for a review see Kramer, 2005).

A child's productive time is used to lower parental subsidy required for the focal child, the child's co-resident siblings, or some combination of the two. From the parent's perspective, this combination should be such that the point where the marginal fitness increase from an additional unit of time spent in kin-directed production would be less than the benefit to the parent of spending that time in ego-directed production. From the child's perspective, diminishing returns to kin-directed production are reached earlier because benefits to siblings are devalued due to relatedness asymmetries. A simplifying assumption here is that ego- and family-directed production are mutually exclusive, which applies to some productive activities (e.g., cooking for self) more than others (e.g., harvesting rice). Despite this oversimplification, the dichotomy is useful for illustrating that productive activities have differential effects on enhancing parental fitness based on the primary beneficiary of task performance. These differential effects are expected to influence variation in the structuring of children's time as household labor demand increases and more kin can benefit from family-directed production.

In addition to production, childhood is characterized by considerable time allocation to "non-productive" or leisure activities, such as play, social visitation, and

idling (i.e., socializing with and grooming peers, receiving care, inspecting objects, resting, any other non-work behavior requiring minimal physical exertion). These activities are presumably safer and impart more skills (social or work-related) that will increase future productivity than would time spent working due to small body size. Play, for example, enhances sensorimotor and cognitive abilities among youngsters in many species (Bekoff and Byers, 1998; Pellegrini and Smith, 1998; Smith, 1982) and prepares the child for adult subsistence tasks (Bock and Johnson, 2004). Visitation is an investment in the child's social capital by contributing to the maintenance of reciprocal sharing networks. Idle activities facilitate growth through energy conservation and likewise foster investment in the child's social capital when combined with direct interaction or close spatial proximity to peers. Social grooming and co-resting are ways that nonhuman primates (especially females) form intimate, lasting bonds that can enhance fitness (Silk et al., 2003).

A fundamental trade-off with respect to the child's time allocation to non-productive activities is that it aids in skill/strength acquisition and thus increases future returns but entails opportunity costs in terms of foregone production (Bird and Bliege Bird, 2002; Bock, 2002a, b; Kaplan, 1996). This trade-off is faced not only by the child but also by parents seeking to maximize returns on investment through the management of each co-resident child's time allocation. Recent work suggests that conflict might result from differences in perspective between child and parent over the cost-benefit structure of time allocation to productive and non-productive activities such as schooling (Bock, 2002a). A child might want to spend more time acquiring skills necessary for future productivity, whereas a parent might need the child's labor immediately to support other offspring.

#### *Children's responses to increasing household labor demand*

Chayanov (1966 [1925]) first demonstrated that variation in the family's age-sex structure affects variation in labor requirements and production. Specifically, low consumer-worker ratios lead to the expectation of low work levels and vice versa. This framework has been applied extensively to examine effects of demographic changes as

children enter and leave the natal household on overall family production (e.g., Chibnik, 1984; Durrenberger, 1980) and children's production in particular (Munroe et al., 1984).

In a rare application of Chayanov's model using empirical data among Maya agriculturalists, Lee and Kramer (2002) show that children's labor supply is necessary to subsidize parental reproduction, particularly in the later childbearing years. At first glance, this would appear to support the argument that high fertility is an adaptive response to increasing household labor demand in pre-demographic transition societies (Cain, 1977; Caldwell, 1982). However, careful analyses show that net wealth flows downward from parents to offspring and from grandparents to grandoffspring (Kaplan, 1994; Kaplan et al., 2009; Lee and Kramer, 2002). Due to the paucity of research into children's resource transfers, the extent to which a child lowers parental subsidy required for co-resident siblings remains unclear. Nevertheless, the conclusion that older children offset a substantial percentage of the consumption demands of younger siblings suggests that children's work is biased toward family- rather than ego-directed production. But the question remains, to what extent is the child's time allocation a result of parental manipulation, how might manipulation be harmful to the child, and how might the child attempt to counter manipulative attempts?

#### *Life history theory and household labor allocation*

Fertility has the greatest direct effect on an organism's fitness. All else equal, an increase in fertility increases fitness. Two fundamental trade-offs influence natural selection on fertility (Charnov, 1993; Lessells, 1991; Roff, 1992; Stearns, 1992). The first trade-off is between present and future reproduction. By growing, an organism increases its rate of future energy acquisition, and that energy can then be allocated toward reproduction. Organisms therefore generally have a juvenile phase characterized by zero fertility until they attain a size where energy allocated toward reproduction has a greater positive effect on fitness than continued growth. The second trade-off is between quantity and quality of offspring, where quality is defined as investment directly impacting offspring survival and reproduction. Natural selection is expected to result in

parental investment strategies that maximize the number of reproducing descendants (Smith and Fretwell, 1974).

Building upon these insights, Kaplan and colleagues (e.g., Gurven and Kaplan, 2006; Kaplan, 1996; Kaplan et al., 2000) have recently proposed the embodied capital theory of human life history evolution. This framework treats processes of growth, development, and maintenance as investments in stock of growth-based or experience-based embodied capital. Physical traits including size, strength, and coordination represent growth-based embodied capital, whereas cognitive traits like memory and specific skills and knowledge represent experience-based embodied capital. Energy allocation to maintenance can likewise be considered an investment in embodied capital since these attributes generally decrease with age. We can therefore conceptualize the present-future reproductive trade-off as optimal investments in personal embodied capital versus reproduction, and the quantity-quality trade-off as optimal investments in the embodied capital of offspring versus their number.

Benefits generated by the child from any given productive activity will vary in their effect on parental fitness through the ability to invest in embodied capital of the entire sibship. Compared to ego-directed productive activities, benefits generated from family-directed productive activities are more equitably distributed among kin over time. The child cannot monopolize returns from task performance to invest in personal embodied capital at the expense of investment in growth-based embodied capital of siblings. As a result, variance in effects on parental fitness across family-directed productive tasks is relatively low.

Ego-directed productive activities, however, yield greater variance in their effect on parental fitness across tasks. Kin-directed altruism is a byproduct, not a necessary component, of ego-directed task performance. Therefore, for some ego-directed tasks the child *can* monopolize benefits to invest in personal embodied capital at the expense of investment in growth-based embodied capital of siblings. For example, children's hunting is primarily an investment in skill acquisition. From a preliminary sample of 74 Tsimane' children aged 7 to 18 that attempted to hunt, over 50% were unsuccessful and nearly 25% produced nothing despite hunting for over 10 total hours during the sample



period (median number of days sampled = 59, unpublished data). Yet when successful, calories are used to provision at least one household member (and sometimes many). Other ego-directed productive tasks, however, do not generate byproduct material benefits used to invest in embodied capital of kin. Contrast hunting with manufacturing a necklace or sewing one's clothing. In the latter examples, a parent has little ability to use the benefits of task performance to invest in embodied capital of other offspring.

### *Hypotheses and predictions*

The child's time allocation is of interest to parents because activities vary in their effects on parental fitness. Benefits of the child's labor include investment in growth-based embodied capital of the focal child and/or siblings, and investment in personal experience-based embodied capital during task performance (on-the-job training). Costs of the child's labor include foregone production from other work and the inability to acquire other skills (Bock, 2002a, b). Parent-offspring conflict theory generates the hypothesis that a parent will manipulate the child's time in a manner that maximizes parental fitness (Trivers, 1974). Parent-offspring conflict is more likely to occur over ego- as opposed to family-directed production since the former yields fewer benefits used to invest in embodied capital of the entire sibship. When labor demands are relatively small, benefits of time allocation to family-directed production may rarely surpass those to ego-directed production or leisure from either the child's or parent's perspective. In theory, parent-offspring conflict over the child's time will be absent in families with only-children due to the absence of relatedness asymmetries (assuming that the parent can no longer reproduce).

This leads to the hypothesis that as family labor demands increase, a parent will increasingly manipulate the child's time in a manner that maximizes investment in embodied capital of the entire sibship. This hypothesis generates the following predictions: 1) time allocation to ego-directed production generating fewer benefits used to invest in growth-based embodied capital of offspring will decrease with number of younger siblings; 2) time allocation to family-directed production will increase with

number of younger siblings; and 3) time allocation to non-productive activities will decrease with number of younger siblings.

Finally, we develop and preliminarily test the hypothesis that increases in family labor demand result in greater parent-offspring conflict over optimal levels of children's kin-directed altruism. If children's time allocation is indeed the result of manipulation to maximize parental fitness, even at the expense of a particular child, then we might expect the child to counter manipulative attempts by lowering the risk of task delegation. A subsequent decrease in time allocation to family-directed production would enable the child to engage in more ego-directed pursuits facilitating investment in personal embodied capital. In the study population, mothers assign the vast majority of tasks and are more likely to delegate family-directed rather than ego-directed tasks (Stieglitz et al., n.d.). As a result, we predict that time spent in close proximity to the mother while the child is not working will decrease with number of younger siblings.

## ***Methods***

### *The ethnographic setting*

The Tsimane' are forager-farmers inhabiting the rainforests and savannas located between the towns of San Borja and San Ignacio de Moxos in the Beni department of central lowland Bolivia. The majority of villages are dispersed along the banks of the Maniqui River, but a substantial number of communities are also settled beside the Cuverene, Matto, Yacuma, Apere, and Sécure rivers. Villages vary in exposure to the market economy, range in size from roughly 10 to 100 households, and are composed of residential clusters of extended families.

Children have numerous opportunities to assist families from an early age. Examples of common productive activities include harvesting cultigens, fishing, collecting fruit, gathering water/firewood, processing foods, and weaving (bags, mats, fans, etc). Opportunities for wage labor with loggers and ranchers are sporadic and males begin such activities at around age 15. Schools exist in about two-thirds of communities and were present in four of the six sampled villages. Children start attending school by age five and continue until their mid-teens. When children are not in school or assisting

kin, they are often playing in mixed-age and sex groups, visiting other households, or otherwise interacting with peers. Play typically involves manipulating objects, chasing others, “playing house,” or climbing trees. Boys also frequently shoot miniature arrows with bows fashioned for target practice. Many children (and adults) play soccer on a daily basis too. This represents one of the few competitive and rule-governed forms of recreation.

Play represents younger children’s preferred alternative to performing delegated work (see chapter three). A shift from prioritizing play to socialization and other idle activities at the expense of delegated task performance is increasingly evident with age for both sexes. Among adolescent girls, resting and eating are equally or more important than socializing, possibly indicating the importance of fat deposition prior to girls’ entry into the marriage market. Disputes between parents and adolescent daughters over marrying early and withdrawing assistance from the natal household are not uncommon. Although less frequent, quarrels between parents and older sons occur over the diversion of work effort from the natal household and toward prospective mates/affinal kin instead. Bride service is not officially recognized, but the husband is generally expected to work with affines in daily subsistence tasks during the first few years of marriage.

#### *Time allocation*

Time allocation data were collected in the communities of Aperecito, Cuverene, Munday, and Cosincho between June 2002 and June 2003 and in Tacuaral del Matto and Jamanchi Uno throughout 2005. Residential clusters were sampled randomly without replacement from 7:00 a.m. to 7:00 p.m. during three-hour time blocks in 2002 to 2003 and two-hour time blocks in 2005. The activity, location, and social partners of each individual present in the cluster were recorded every 30 minutes. Social partners were defined as individuals either within two meters or directly socializing with the focal individual. If someone was not present during the scan, a relative was asked about the individual’s activity and location.

To eliminate confounds in the relationship between household composition and time allocation due to the presence of more distant kin (e.g., half siblings), only children

residing with biological parents and full siblings are included in analyses. Visitors to clusters are also excluded from the risk set because their motives for being present might differ from those living in the cluster. In addition, we excluded scans in which children were accompanying kin, on overnight trips away from the village, or in wage labor.

Productive activities were aggregated to examine variation in time allocation to ego- and family-directed production as household labor demand increases. Since individuals could be coded as engaging in two activities simultaneously, one could theoretically spend 100% of the time in ego- and family-directed production. Hunting, fishing, and collecting fruit were classified as ego-directed food acquisition because kin-directed caloric benefits are not a necessary component of task performance. Manufacture and washing clothes were classified as ego-directed domestic work, even though the recipient of each activity was unknown (wives are usually responsible for washing clothing of husbands and children; see results section for a justification of manufacture). Horticultural labor, sibcare, and all other domestic tasks (e.g., cleaning house, processing rice, gathering firewood/water) were classified as family-directed production. Non-productive activities were aggregated into two categories, idling and visitation of households outside the residential cluster. We do not include play in analyses because younger siblings are often indirect objects of children's play and because play with younger siblings can be considered a form of direct sibcare. This would obscure the hypothesized relationships between household labor demand and time allocation to non-productive activities.

#### *Age and sibship composition*

From 2002 to 2005, over 300 interviews were conducted by MG in the sample communities as part of a larger project on Tsimane' life history and health. Birth years and genealogies were assigned based on a combination of established systematic methods (Blurton Jones et al., 2002; Hill and Hurtado, 1996; Howell, 1979). These include using known ages from written accounts, relative age lists, dated events, photo comparisons of people with known ages, and cross-validation of information from independent

interviews of kin. Methods are described at length elsewhere (Gurven et al., 2007). From these data we determined ages and household composition.

### *Data analysis*

We used the generalized estimating equations (GEE) method to test for the effects of number of younger siblings on children's time allocation to productive and non-productive activities. This method provides a way to analyze correlated dependent variables arising from repeated measures, controlling for each individual. All analyses use a binary distribution, exchangeable correlation structure, report parameter estimates as logit estimates, and use a dichotomous behavioral variable as the response (e.g., sibcare, yes or no). Analyses were performed in SPSS 16.0.

## **Results**

### *Descriptives*

The sample consisted of 17,708 observational scans of 274 children yielding a mean of 64.63 scans per child and a mean age of 9.9. The mean number of co-resident younger full siblings is 2.7 (SD = 1.7, minimum = 0, maximum = 8), and the mean number of co-resident older full siblings is 1.6 (SD = 1.5, minimum = 0, maximum = 7). Multicollinearity between age, number of younger siblings, and number of older siblings warrants some concern given fairly strong intercorrelations (e.g.,  $r_{\text{age, \# younger siblings}} = 0.54$ ,  $p < 0.001$ ). To address this issue we conducted a weighted least squares regression of each variable on the other two (weighted by number of scans per child). For example, age was regressed on number of younger siblings and number of older siblings. We then examined the tolerance, or proportion of variance in each variable that is not accounted for by the other variables. Tolerance values from the three regressions ranged from 0.7 to 0.84 and it was considered reasonable to include all three variables in subsequent GEE analyses.

Table 4.1 displays time allocation to work and selected non-productive activities by age and sex. During early childhood boys balance work effort between domestic tasks and food acquisition, concentrating on the latter with age. Girls focus mostly on domestic

work with greater time devoted to sibcare and food production with age. Children specialize in work that facilitates on-the-job training for sex-specific adult roles, resulting in boys spending more time in ego-directed production ( $\chi^2 = 82.26$ ,  $df = 1$ ,  $p < 0.001$ ; also see Figures 4.1 and 4.2<sup>1</sup>). Boys spend significantly more time hunting, fishing, and collecting forest foods, whereas girls spend more time in sibcare and family-directed domestic tasks. No significant sex difference emerges with respect to time spent in horticultural labor. Time allocation to play and social visitation is significantly greater among boys, while girls spend more time in idle activities.

*Table 4.1. Time allocation (proportion of time) to selected activities by age and sex*

<i>Activity</i>	<b>Age 4 to 8</b>		<b>Age 9 to 13</b>		<b>Age 14 to 18</b>		<b>Total</b>	
	<i>Males</i>	<i>Females</i>	<i>Males</i>	<i>Females</i>	<i>Males</i>	<i>Females</i>	<i>Males</i>	<i>Females</i>
Hunt	<0.01	0.0	0.02	<0.01	0.05	0.01	0.02	<0.01
Fish	0.04	0.03	0.13	0.05	0.1	0.05	0.08	0.04
Forage	0.01	0.01	0.02	0.01	0.01	0.02	0.01	0.01
Garden	0.02	0.02	0.05	0.05	0.09	0.08	0.04	0.04
Sibcare	0.01	0.03	0.01	0.07	<0.01	0.06	0.01	0.05
Domestic work	0.1	0.1	0.11	0.19	0.14	0.3	0.11	0.18
Play	0.29	0.23	0.19	0.11	0.08	0.03	0.21	0.14
Idle	0.29	0.38	0.23	0.27	0.24	0.27	0.26	0.31
Visit	0.05	0.05	0.07	0.06	0.09	0.03	0.06	0.05

<sup>1</sup> Food processing scans in which the primary beneficiary is ambiguous are omitted from the risk set.

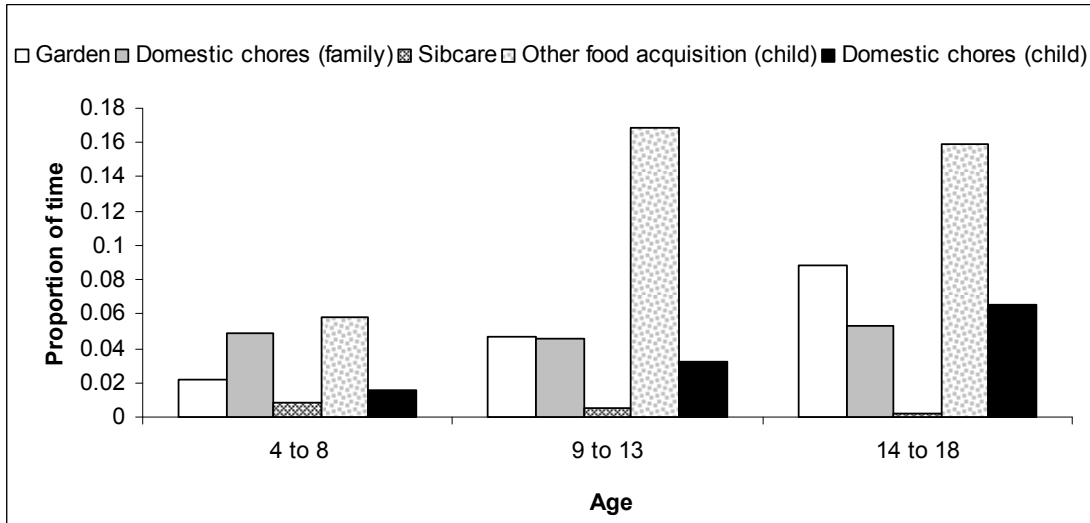


Figure 4.1. Time allocation to work by category and age: Boys



Figure 4.2. Time allocation to work by category and age: Girls

#### Time allocation to ego- and family-directed production

The probability of working increases with number of younger siblings controlling for age, sex, number of older siblings, and community but the effect is not significant (Table 4.2). Removing scans in which children were visiting does not change the effect of number of younger siblings ( $B = 0.032, p = 0.261$  using the same controls). To examine whether children bias time allocation toward ego- versus family-directed production as household labor demand increases, we first regressed number of younger

siblings on the probability of engaging in labor primarily benefitting the child. As shown in table 4.3, children do not significantly increase time allocation to hunting, all ego-directed food acquisition, or all ego-directed work as number of younger siblings increases. In contrast, the probability of engaging in manufacture significantly decreases with number of younger siblings. Converting the logit estimates into probabilities (using sample means for controls) shows that children without co-resident younger siblings are three times more likely to engage in manufacture than children with five younger siblings (3% versus 1%). Of all manufacturing scans in which the direct object was specified, nearly 50% included items for recreational use lacking immediate kin-directed benefits (e.g., miniature bows/arrows, slingshots, necklaces, rings, toys). For the remainder of scans, the recipient of the manufactured object was unknown (e.g., woven bags, fans).

*Table 4.2. General estimating equations (GEE) analysis of the effect of number of younger siblings on the probability of working (n = 17,708 scans, 274 children)*

<b>Parameter</b>	<b>B</b>	<b>SE</b>	<b>Wald <math>\chi^2</math></b>	<b>p</b>
Intercept	-1.75	0.181	93.179	<0.001
Age	0.108	0.011	93.262	<0.001
Sex = male	-0.265	0.071	13.977	<0.001
Number of co-resident younger full siblings	0.043	0.029	2.224	0.136
Number of co-resident older full siblings	-0.046	0.028	2.827	0.093
Community			1.458	0.227



Table 4.3. GEE analysis of the effect of number of younger siblings on the probability of engaging in selected ego-directed work ( $n = 17,708$  scans, 274 children)

Parameter	Hunting		All ego-directed food acquisition		Manufacture		All ego-directed work <sup>1</sup>	
	B	<i>p</i>	B	<i>p</i>	B	<i>p</i>	B	<i>p</i>
Intercept	-9.026	<0.001	-2.899	<0.001	-4.943	<0.001	-2.707	<0.001
Age	0.201	<0.001	0.048	0.019	0.169	<0.001	0.089	<0.001
Sex = male	1.664	0.001	0.732	<0.001	-0.324	0.035	0.355	0.002
Number of co-resident younger full siblings	0.118	0.112	0.064	0.156	-0.113	0.024	0.015	0.686
Number of co-resident older full siblings	-0.172	0.279	-0.18	0.001	-0.123	0.067	-0.173	<0.001
Community		0.035		0.06		0.464		0.354

<sup>1</sup> Food processing scans in which the primary beneficiary of task performance is ambiguous are omitted from the risk set. The analysis includes 16,942 scans for 274 children.

Compared to time allocation to ego-directed production, number of younger siblings has more robust effects on time spent in family-directed production. The probability of engaging in horticultural labor significantly increases with number of younger siblings (Table 4.4). Children without co-resident younger siblings were over two times less likely to engage in horticultural labor than children with five younger siblings (4% versus 10%, using sample means for controls). In addition, the probability of providing sibcare marginally increases with number of younger siblings. Unlike all ego-directed work, the probability of engaging in all family-directed work significantly increases with number of younger siblings controlling for other factors (Table 4.4; also see Figure 4.3).

These results highlight a shift in children’s activity budgets toward engaging in tasks providing greater kin-directed gains when more dependent siblings can benefit. This is despite the fact that time allocation to certain forms of horticultural labor and sibcare might not exhibit monotonic increases with number of younger siblings since multiple individuals simultaneously benefit from the same activity (e.g., field clearance, tending children). Indeed, many family-directed domestic tasks (e.g., house construction, making chicha, etc.) provide non-depreciable or “umbrella” benefits, which might help explain why the probability of engaging in family-directed domestic work does not

increase with number of younger siblings ( $B = -0.022$ ,  $p = 0.505$ , controlling for age, sex, number of older siblings, and community).

Table 4.4. GEE analysis of the effect of number of younger siblings on the probability of engaging in selected family-directed work ( $n = 17,708$  scans, 274 children)

Parameter	Garden		Sibcare <sup>1</sup>		All family-directed work <sup>2</sup>	
	B	p	B	p	B	p
Intercept	-4.963	<0.001	-5.263	<0.001	-2.63	<0.001
Age	0.15	<0.001	0.502	<0.001	0.092	<0.001
Age <sup>2</sup>	--	--	-0.023	<0.001	--	--
Sex = male	0.068	0.679	-2.076	<0.001	-0.732	<0.001
Number of co-resident younger full siblings	0.173	0.002	0.129	0.073	0.072	0.018
Number of co-resident older full siblings	0.233	0.002	-0.146	0.111	0.043	0.228
Community		<0.001		0.503		0.48

<sup>1</sup> Scans in which children were not directly observed are omitted from the risk set ( $n = 8,828$  scans, 250 children).

<sup>2</sup> Food processing scans in which the primary beneficiary of task performance is ambiguous are omitted from the risk set ( $n = 16,960$  scans, 274 children).

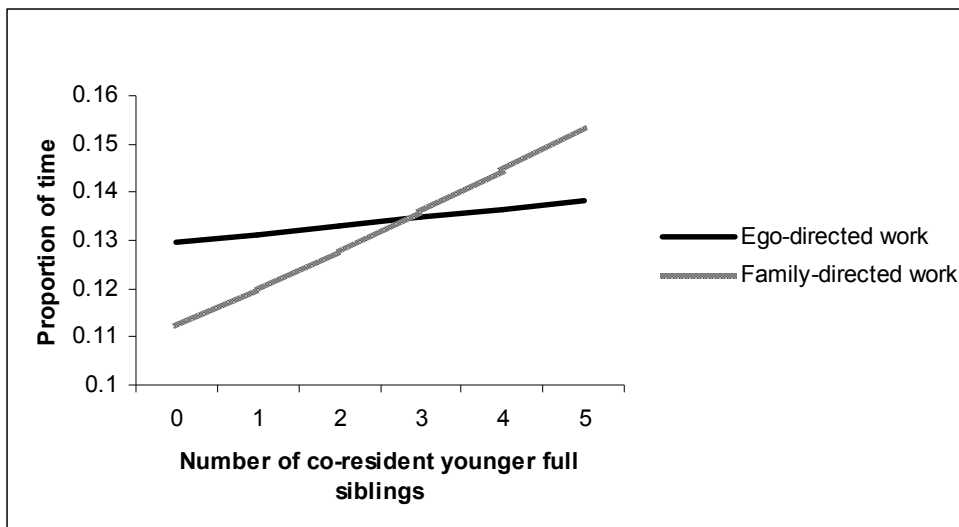


Figure 4.3. Projected proportion of time spent working by number of younger siblings and primary beneficiary of task performance (using sample means for controls)

*Time allocation to leisure and in close proximity to mother*

To further explore whether children bias activity budgets as family labor demand increases, we regressed number of younger siblings on the probability of engaging in selected leisure activities. As predicted, the probability of engaging in idle activities significantly decreases with number of younger siblings (Table 4.5). Children without co-resident younger siblings were 1.3 times more likely to be idling than children with five younger siblings (36% versus 28% using sample means for controls). In addition, time spent in social visitation significantly declines with number of younger siblings, such that children without co-resident younger siblings were over 1.5 times more likely to visit households outside of the residential cluster than children with five younger siblings (8% versus 5% using sample means for controls). Removing scans in which children were engaged in horticultural labor or sibcare does not drastically change the effect of number of younger siblings ( $B = -0.065$ ,  $p = 0.066$  using the same controls with idle as the dependent variable;  $B = -0.102$ ,  $p = 0.025$  using the same controls with visit as the dependent variable).

*Table 4.5. GEE analysis of the effect of number of younger siblings on the probability of engaging in selected leisure (n = 17,708 scans, 274 children)*

Parameter	Idle		Visiting	
	B	p	B	p
Intercept	-0.141	0.562	-2.449	<0.001
Age	-0.026	0.061	0.027	0.195
Sex = male	-0.202	0.009	0.103	0.512
Number of co-resident younger full siblings	-0.076	0.036	-0.111	0.014
Number of co-resident older full siblings	-0.024	0.438	-0.222	<0.001
Community		0.072		0.786

These results, coupled with the fact that children are more likely to engage in family-directed production at the expense of ego-directed production as household labor demand increases, suggest manipulation of the child’s time by the parent. To test the hypothesis that increases in family labor demand result in greater parent-offspring conflict

over optimal levels of children’s kin-directed altruism, we regressed number of younger siblings on the probability of being directly observed in close proximity to the mother while not working. Indeed, restricting the risk set to observations in which both the mother and child were in/around the house, number of younger siblings significantly lowers the probability of being in close proximity to the mother controlling for other factors (Table 4.6). Converting the logit estimates into probabilities using sample means for controls shows that children without co-resident younger siblings were 1.4 times more likely to be in close proximity to the mother compared to children with five co-resident younger siblings (48% versus 34%). Removing scans where children were receiving care does not change the significance of the effect of number of younger siblings ( $B = -0.116$ ,  $p < 0.001$ ).

*Table 4.6. GEE analysis of the effect of number of younger siblings on the probability of being observed in close proximity to the mother in/around the house while not working (n = 6,095 scans, 234 children)*

<b>Parameter</b>	<b>B</b>	<b>SE</b>	<b>Wald <math>\chi^2</math></b>	<b>p</b>
Intercept	0.057	0.169	0.115	0.734
Age	0.009	0.012	0.505	0.477
Sex = male	-0.316	0.081	15.048	<0.001
Number of co-resident younger full siblings	-0.115	0.032	13.383	<0.001
Number of co-resident older full siblings	-0.025	0.027	0.889	0.346
Community			27.512	<0.001

### ***Discussion***

Tsimane’ boys and girls engage in similar forms of household production in early childhood and specialize in complementary tasks with age. Time allocation to overall and family-directed production is significantly greater among girls, whereas time allocation to ego-directed production is greater among boys. These sex differences in labor allocation reflect investment in personal experience-based embodied capital necessary to achieve adult competence.

In a species characterized by prolonged offspring dependence, simultaneous investment in multiple offspring of different ages, and allomaternal assistance from older

children, parent-offspring conflict is likely to occur at times other than weaning (Bateson, 1994). Our results suggest that parents leverage children's time in order to maximize parental fitness. As household labor demand increases children exhibit a tendency to increase production, but only with respect to kin-directed tasks. Number of younger siblings positively predicts time spent in garden labor, sibcare, and all forms of family-directed production. Such activities offset the cost of childcare to parents by generating benefits (energy, child protection, etc.) used to invest in growth-based embodied capital of the entire sibship.

Effects of increasing labor demand on time allocation to ego-directed production are less consistent. On the one hand, ego-directed production has a lower positive effect on parental fitness than family-directed production because fewer kin benefit from such labor. However, across different ego-directed productive tasks, the degree to which a child can reap all or most benefits from task performance to invest in personal embodied capital at the expense of investment in growth-based embodied capital of siblings will vary. Despite primarily being an investment in personal embodied capital, ego-directed food acquisition can generate byproduct benefits used to invest in growth-based embodied capital of offspring. We therefore might not expect these activities to run wholly counter to parental interests, especially since the child simultaneously accumulates skills critical to achieving adult competence during task performance. We find that time allocation to hunting and all forms of ego-directed food acquisition increases with number of younger siblings but the effect is not significant. In contrast, time allocation to manufacture significantly declines with number of younger siblings. This indicates that ego-directed productive activities heavily weighted against generating byproduct kin-directed benefits are devalued from the parent's perspective. Taken together, these results are consistent with the hypothesis that parents manipulate the child's time in a manner that maximizes investment in embodied capital of the entire sibship.

Analyses of children's time allocation to non-productive activities as a function of household labor demand provides further evidence in support of this hypothesis. Parents are especially likely to devalue forms of leisure in which the benefits obtained are used to invest in the child's embodied capital at the expense of investment in other offspring (as

opposed to playing with younger siblings). Indeed, we find that number of younger siblings negatively predicts time allocation to social visitation and idle behaviors that include grooming, socializing with, and eating/resting in close proximity to peers. This indicates that children in families with greater labor demands might experience compromised peer relations due to a lower frequency of peer interaction. While the extent to which reduced childhood leisure opportunities impact long-term social competence is an open question, the importance of stable peer relations in enhancing conflict resolution skills, a sense of intimacy and empathy, and self-esteem among children in modern societies is well established (Franco and Levitt, 1998). Our results suggest that manipulation of the child's behavior to maximize parental fitness might have a deleterious longitudinal psychosocial effect on the child.

The hypothesis that the frequency of parent-child interaction decreases due, in part, to the child's desire to avoid delegated work has been suggested previously (Draper, 1975; Draper and Cashdan, 1988). Such work focused on effects of the transition from a foraging to a sedentary lifestyle on parent-child social interactions among the !Kung. Patterns of frequent adult-child interactions in the foraging !Kung transformed into sedentary children's preferences to engage with peers rather than adults, presumably because sedentary children were delegated work more frequently.

We suggest a refinement to this hypothesis. Our model limits this line of reasoning to delegated family-directed work in which the child cannot reap all/most benefits to invest in personal embodied capital at the expense of investment in growth-based embodied capital of siblings. We therefore restate the hypothesis as follows: increases in family labor demand result in greater parent-offspring conflict over optimal levels of children's kin-directed altruism. As a preliminary test of this hypothesis, we find that number of younger co-resident siblings negatively predicts time spent in close proximity to the mother controlling for other factors. If parental manipulation of the child's time entails engaging in sub-optimal levels of kin-directed production from the child's perspective, then maternal avoidance might represent an attempt to combat behavioral manipulation by lowering the risk of task delegation and creating opportunities to engage in ego-directed pursuits (productive or non-productive). This suggests that

parental manipulation of the child's behavior has negative consequences for the child's relations among both peers and kin.

It is not immediately clear as to whether children are independently responding to household need or if they are doing so under the influence of parental direction. While it is likely a combination of both, this study provides further evidence that decisions regarding children's time allocation reflect a trade-off between productive and non-productive activities that varies with household labor demand (Bock, 2002a, b; Bock and Johnson, 2004; Stieglitz et al., n.d.). Of course, household need is only one factor influencing variation in children's time allocation and a more complete understanding would require examination of socioecological and individual factors. For example, children's relative productivity across seasons (Blurton Jones et al., 1994; Kaplan, 1997) or child characteristics may interact with household need to influence variation in the management of time allocation. Are children from families with higher dependency ratios given fewer opportunities to invest in personal embodied capital during times when children can substantially invest in growth-based embodied capital of siblings (e.g., the rice harvest)? Do children living with distant kin or unrelated individuals receive greater pressure to engage in family-directed production as household labor demand increases?

Because these tests were observational, causality cannot be directly inferred and alternative explanations must be considered. For example, it might be that children from families with greater labor demands are more industrious, yielding a spurious association between number of younger siblings and time allocation to family-directed production and leisure. This would confound the hypothesized relationship between household labor demand and manipulation of the child's time to maximize parental fitness. But the fact that number of younger siblings does not predict time allocation to all forms of work suggests otherwise (Table 4.2). It also might be that the lower frequency of mother-child interaction in families with greater labor demand is not the result of greater parent-offspring conflict over behavioral manipulation. Less frequent mother-child interaction, whether initiated by the child or the mother, might help ensure that the mother's work proceeds unobstructed (Munroe and Munroe, 1977). However, the probability of being directly observed in close proximity to the mother actually increases if the mother is

parenting a sibling ( $B = 0.394$ ,  $p < 0.001$ , parenting = yes) and is not associated with the mother's involvement in food processing ( $B = 0.059$ ,  $p = 0.259$ , food processing = yes) controlling for age, sex, and community.

Overall, increasing household labor demand appears to have a substantial impact on the behavior of children—decisions that might be made independently or on their behalf. Regardless, it is clear that such decisions can ultimately lead to varying outcomes in the adult lives of children through birth-order effects on personality (Beer and Horn, 2000; Healey and Ellis, 2007; Sulloway, 1996). Furthermore, the varying potential for parent-offspring conflict beyond weaning that is predicted by evolutionary theory presents an exciting area for exploration. For instance, how does such conflict affect the quality of parent-offspring relationships or adult personalities? Are there interactions between children's individual characteristics and household composition that predict disobedience or delinquency? Are these factors associated with the likelihood of abuse or neglect? Clearly, an evolutionary framework has much to offer the field of family studies, a research area that has a long history yet little mention of Darwinian theory.



## CHAPTER 5: SPOUSAL VIOLENCE AND PATERNAL DISINVESTMENT

### *Introduction*

Spousal violence is the most common form of family violence (Levinson, 1989). A recent WHO study in 10 countries reported a lifetime prevalence of partner violence against women ranging from 13 – 61% and an annual prevalence varying between 3 – 29% (Garcia-Moreno et al., 2006). In the United States over 7,000,000 women in marriage or common law partnership were estimated to be physically abused by partners in 2005 (using recomputed rates in Straus, 2005; US Census Bureau 2006). In addition to blunt trauma, health consequences for abused women include gynecological problems, adverse pregnancy outcomes, depression, anxiety, and posttraumatic stress disorder (see Heise et al., 1994a and references therein). Children of abused women also exhibit low birth weight and higher early mortality (Jejeebhoy, 1998; Murphy et al., 2001). Spousal violence raises public health and human rights concerns worldwide, yet few detailed studies of spousal conflict in small-scale, non-industrialized societies exist.

Our paper incorporates cultural and evolutionary approaches to the study of spousal violence in a relatively egalitarian, kin-based society of forager-farmers undergoing rapid acculturation. Quantitative studies of spousal abuse are biased toward samples from industrialized settings where most violence occurs behind closed doors. While biomedical and social scientists have stressed the importance of collecting systematic information on spousal violence in non-Western countries (e.g., Erchak, 1984; Heise et al., 1994b; Koenig et al., 2003), no study to our knowledge has quantitatively examined violence against women in a society with limited residential privacy, little inheritable wealth, and low variance in socioeconomic status and education.

The paper is organized as follows. The next section summarizes previous studies of spousal violence. Subsequently, we present a path model for predicting the frequency of violence against married Tsimane' women. We then introduce the ethnographic setting, our methodology, and present the results. We conclude with a discussion of the major motivation behind men's use of violence in marriage.

### *Cultural studies of spousal violence*

Early work (Lester, 1980; Levinson, 1989) emphasizes positive correlations between frequency of spousal violence and degree of power asymmetry between the sexes, usually defined as marital restrictions imposed upon women and men's control of wealth. These and other studies highlight historical relationships between patriarchal institutions and violence against women (e.g., Yllö, 1984). In societies lacking centralized legal and political systems, ideology and traditional practices reify men's dominance and use of force to control women. For example, among Lusi-Kaliai horticulturalists of Papua New Guinea, men discipline wives through beatings if women draw blood while punishing children or fail to perform domestic responsibilities (Counts, 1999). Violent reprisals by husbands and other kin following women's resistance to arranged marriages have also been documented (McDowell, 1999; Shostak, 1981).

Other studies highlight individual risk factors for women experiencing partner violence. These include young age of either spouse (e.g., Jejeebhoy and Cook, 1997; Kim and Cho, 1992; Naved and Persson, 2005), and husband's substance abuse (Fawole et al., 2005; Hoffman et al., 1994; Rao, 1997), controlling behaviors (Garcia-Moreno et al., 2006), adherence to traditional norms limiting gender equality (Hollander, 2005; Koenig et al., 2006), involvement in extramarital affairs (Hollander 2005) and sexual jealousy (e.g., Buss, 2000; Counts et al., 1999; Daly and Wilson, 1988; Figueredo and McCloskey, 1993; Shackelford et al., 2005). Most epidemiological studies, however, only report associations and lack a cogent theoretical framework.

In contrast to those characteristics precipitating men's violence against married women are factors providing protective effects, such as matrilineal or extended family residence (Counts et al., 1999; Erchak, 1984; Figueredo et al., 2001; Whiting and Whiting, 1975), higher levels of education of either spouse (Jejeebhoy and Cook, 1997; Koenig et al., 2003; Straus et al., 1980), and higher socioeconomic status of the couple (Hoffman et al., 1994; Jejeebhoy and Cook, 1997; Kim and Cho, 1992; Koenig et al., 2003). While the presence of genetic children also stabilizes marital relations in traditional and modern societies in terms of lowering rates of divorce and men's extramarital affairs (Anderson et al., 2007; Winking et al., 2007), the extent to which

joint dependent offspring presence influences the frequency of spousal violence remains unclear.

### *Evolutionary studies of spousal conflict and violence*

Among sexually reproducing species, males and females have conflicting reproductive interests and asymmetries in parental investment (Trivers, 1972). Females produce larger, more energetically expensive gametes and almost always invest greater amounts of time and energy in offspring than males. Female reproductive success is limited by access to resources critical for reproduction whereas male reproductive success is constrained by access to fertile females. Among most mammals, male investment in reproduction is limited to courtship and copulation (i.e. mating effort), rather than provisioning and care (i.e. parenting effort). Mating opportunities may be obtained by successful courtship or through coercive means involving aggression. Sexual coercion may increase the likelihood that a female will mate with an aggressive male, or lower the probability that a female will mate with rival males (Smuts, 1992). Among chimpanzees, sexual coercion appears to be the primary motivation underlying male aggression towards females (Muller et al., 2009).

Unlike most other primates, humans form long-term pair bonds characterized by high levels of male investment. Human infants are highly altricial and require almost constant attention and care throughout the first few years of life. The need for such care lowers the efficiency of foraging mothers (Hurtado et al., 1992). Offspring remain nutritionally dependent until their late teens among hunter-gatherers and agriculturalists (Kaplan, 1994; Kramer, 2005) and so adults into their 50s must provide for several dependents of different ages simultaneously (Gurven and Walker, 2006; Lancaster and Lancaster, 1983; Lee and Kramer, 2002).

Two prominent explanations have been proposed for the relatively high levels of human male investment in offspring (reviewed in Winking et al., 2007). One view, sometimes referred to as the mating effort model of marriage, proposes that men marry to gain and maintain access to women's fertility rather than enhance offspring quality. According to this view, men could more efficiently provision families by targeting lower

variance resources that are not widely shared (e.g., palm starch, small game). The fact that men pursue large game suggests that foraging men aim not to invest in offspring but rather to gain social and mating benefits through costly signals of hunting prowess and meat sharing. Another view, often referred to as the provisioning model of marriage, proposes that men marry because marriage facilitates a sexual division of labor and the provisioning of biparental care. According to this view, the greater paternity confidence resulting from sexually exclusive partnership enables men to direct investment in their own children. Given the substantial costs to parents of rearing children, marriage increases the payoffs to economic specialization in which men focus on hunting and other productive activities and women concentrate on childcare and economic tasks compatible with childcare. The need to support multiple dependent offspring increases returns to continued investment in the marital union and reduces temptations to mate desertion well beyond the reproductive years for both sexes. Individuals that divorce and remarry during the period of shared parental investment face conflicts of interest with new spouses over resource allocation. These potential conflicts increase the benefits of spouses staying together and having all or most of their children together. Investigation of the conditions under which men strive to obtain fertility benefits at the expense of familial investment can be used to test predictions of the two models of marriage and shed light on situations increasing the risk of spousal conflict and violence against women.

Given the relatively high levels of human male parental investment, sexual jealousy and concerns over paternity have been proposed as important factors motivating violence or hostility against women (Burch and Gallup Jr., 2000; Chagnon, 1992; Daly and Wilson, 1988; Goetz, 2008). Although men and women report a similar intensity of jealous emotions during recalls of potential infidelity (Shackelford et al., 2000), men are more consistently concerned with sexual infidelity by their partners while women are more concerned over emotional infidelity (Buss, 2000). This sex difference is consistent with an evolved male psychology attuned to the potential loss of paternity, and an evolved female psychology attuned to cues of diverted investment from offspring.

Humans lived as hunter-gatherers for most of evolutionary history. The study of modern foragers can offer insights into the selective pressures that shaped the evolved

psychology generating men's physically abusive behaviors towards women without confounds found in modern societies (e.g., greater variance in education and wealth, residential privacy and isolation from natal kin, etc.). At the same time, however, the Tsimane' and most subsistence-level societies worldwide continue to experience greater levels of assimilation into broader market economies. These local transformations provide a means to explore the effects of changes in household production and control of wealth due to men's village absenteeism from wage labor on spousal conflict and violence.

### *Strategic use of violence*

Despite the collaborative nature of human pair bonds, interests of husbands and wives will not coincide under all circumstances. There is room for much conflict of interest within cooperative unions (Bird, 1999; Gurven et al., In press), often resulting from failure of one partner to meet the expectations of the other, differences in perceptions of what those expectations should be, and conflicts over suspected infidelities. The use of violence by husbands can therefore be viewed as a "strategy" employed by some men to control women's behaviors. Control need not be limited to the reproductive domain, as in preventing or punishing sexual infidelity; violence may be used to influence behavioral outcomes in any domain, so that a wife is more likely to defer to her husband's immediate goals, while setting a precedent for future deference.

Any circumstances where spousal interests diverge resulting in different opinions over the proper use of family resources may invite coercive tactics. We would expect one partner's desires to enhance fitness at the expense of the welfare of other household members to be a major source of conflict, raising the risk of spousal violence. An example of potentially divergent interests occurs when a spouse invests in offspring from another partner, either from a previous or polygynous marriage. Manifestations of conflict and violence between parents and step-children (e.g., Daly and Wilson, 1988; Flinn, 1988), between partners with children from previous relationships (Daly et al., 1993, 1997), and involving co-wives and polygynously married husbands (Jankowiak et al., 2005) are well documented.

Another example of conflicting spousal interests occurs through the pursuit of extramarital affairs, either directly or indirectly through investment in status that might improve one's chances of obtaining future extramarital partners. Among the study population, access to and reliance on market goods is increasing and women rarely earn wages. Money represents a scarce yet fungible resource that is seldom saved and can easily be squandered by men to increase reproductive success and status. Resources invested in the pursuit of extramarital affairs are unavailable for investment in the family. As a result, men face a trade-off between investment in offspring within marriage and the fertility benefits of extramarital affairs. We refer to the suite of men's behaviors facilitating resource diversions from the family as paternal disinvestment.

Despite the use of violence as a potentially effective means of coercion, there are great costs to spousal abuse that should restrict its occurrence among a social species engaging in long-term unions. These include bodily injury to the aggressor if violence provokes retaliation by the wife or disgruntled affinal kin. Spousal abuse could also result in divorce and the loss of future reproductive opportunities with a wife. Even if the wife remains committed to an abusive partner due, for example, to constraints on alternative mate choice or costs of leaving due to children's vulnerabilities, violence contributes to marital strife. This, in turn, could lead women to reduce work effort or inadequately perform tasks as a means of protest, even if doing so results in more violence. Finally, in societies where behavioral visibility is high due to the existence of closely-spaced, extended family houses lacking walls, perpetrators of violence may experience reputational damage, which could negatively impact the aggressor's involvement in reciprocal sharing networks or future prospects in the mating market.

#### *A path model and hypotheses regarding the frequency of spousal violence*

Figure 5.1 displays a path model of variables hypothesized to have direct and indirect effects on the frequency of spousal violence against Tsimane' women. Squares and circles indicate measured and latent variables, respectively.

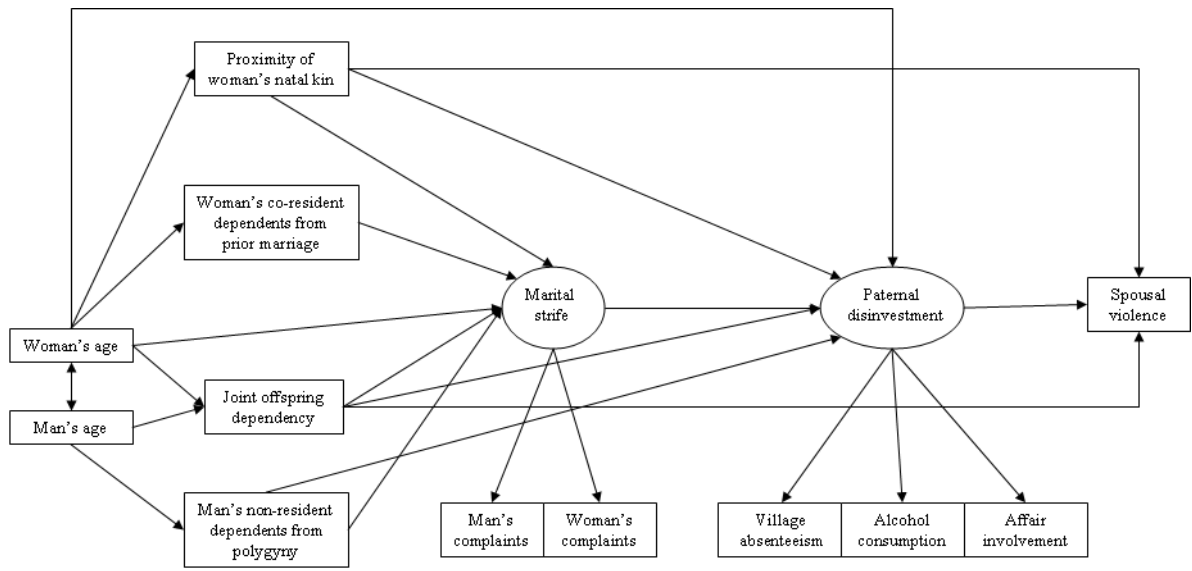


Figure 5.1. A path model of spousal violence

Within a marriage spousal ages covary perfectly. Spousal ages should be positively associated with the degree of joint offspring dependency during the couple’s reproductive years, defined here as the number of surviving children born to the couple under age 10. The man’s age is hypothesized to increase the likelihood of having dependent children from polygynous marriage. Rather than marrying two women simultaneously, polygynous Tsimane’ men generally enter one union and begin developing relations with another woman (usually the wife’s eldest unmarried sister) after several years of marriage. Once the man becomes polygynous, his co-wives usually reside in separate residences with their respective children. The woman’s age is hypothesized to increase the likelihood of having co-resident dependents from prior marriage. In addition, the woman’s age should be negatively related to the likelihood of residing in the same household cluster as consanguineal kin (i.e., biological parents and full siblings). This is due to the nature of Tsimane’ post-marital residence patterns (see Methods).

Matrilocal residence is hypothesized to have a direct negative effect on the frequency of spousal violence due to greater costs to men of abusing wives (Counts et al., 1999; Erchak, 1984; Figueredo et al., 2001). Using similar reasoning, matrilocal

residence is hypothesized to have an indirect negative effect on rates of spousal violence through reductions in marital strife and paternal disinvestment. The provisioning model of marriage suggests fewer spousal conflicts over resource allocation as couples reproduce and invest in joint offspring. We therefore hypothesize that joint offspring dependency will negatively impact violence frequency directly and indirectly through reductions in marital strife and paternal disinvestment.

The existence of a woman's co-resident dependents from prior marriage and a man's non-resident dependents from polygynous marriage are hypothesized to increase levels of marital strife due to greater spousal conflict over resource allocation. The woman's age is also hypothesized to negatively impact levels of marital strife. This is because the frequency of spousal complaints over resource allocation, particularly due to suspected infidelities, is expected to decrease with age.

Marital strife, in turn, is hypothesized to increase levels of paternal disinvestment. Greater marital strife can signal imminent termination of the relationship, leading men to shift investment in reproduction toward mating effort and family formation rather than investing in soon-to-be estranged offspring. The woman's age is also hypothesized to influence paternal disinvestment. If the primary motivation behind men's decision to enter long-term reproductive relationships is to maintain access to women's fertility (the mating effort model of marriage), then we should expect paternal disinvestment to increase as wives lose reproductive value. Husbands of aging women should increasingly bias resource allocation towards enhancing fertility through direct or indirect pursuit of extramarital affairs. Paternal disinvestment is also hypothesized to be greater among polygynously married men simultaneously directing resources away from one household and toward dependent offspring residing in another household. Finally, paternal disinvestment, indicated by men's involvement in extramarital affairs, village absenteeism from wage labor, and store-bought alcohol consumption, is expected to have a direct positive effect on rates of spousal violence.



## *Methods*

### *The ethnographic setting and the study area*

The Tsimane' are a natural fertility population of forager-farmers inhabiting the rainforests and savannas located between the towns of San Borja and San Ignacio de Moxos in the Beni department of lowland Bolivia. Almost all of their food comes from foraging and slash-and-burn horticulture. Census estimates range from 6,351 to 7,130 (INE, 2003; VAIPO, 1998). Villages vary in their degree of access to markets and interaction with other Bolivians, and acculturation mainly occurs through visits to San Borja and men's wage labor with loggers and ranchers.

Tsimane' villages are composed of household clusters, each of which typically contains three or four residences composed of consanguineal and affinal kin. Households cooperate in economic pursuits and the extended family is the foundation of sociality. There are no formal rules of post-marital residence, but newly married couples often reside near the wife's natal kin for at least a few years. During this time the husband works with affinal kin in subsistence tasks, although bride service is not officially recognized. After several years the couple and their joint children often relocate to live near the husband's family.

Marriages are generally facilitated by kin but women do not face divorce restrictions. Upon remarriage, women sometimes send weaned offspring from prior unions to live with maternal grandparents living in the same community. For men, divorce and remarriage usually entails switching communities. Therefore, the probability of conflict occurring with a current spouse over directing resources toward the man's children from previous marriages is fairly low.

There are no restrictions against polygyny but its occurrence is rare (5 – 10% of men). Women consider men seeking only one wife to be more desirable as partners (Gurven et al., In press). Other important characteristics of long-term mates for both sexes include industriousness and a good character. Spouses engage in extensive cooperation on a daily basis and sex roles are well-defined. Women exert considerable domestic control and are responsible for providing childcare, processing food, cleaning the house, washing clothes, preparing *chicha* (homemade beer), delegating household

tasks to children, and weaving bags, floor mats, fans, and baskets. Men acquire game and fish, engage in wage labor, construct houses, and manufacture bows, arrows, and canoes. Both sexes collect forest foods, fetch firewood and water, engage in garden labor, and manufacture roof panels made of woven palm leaves for household use or for sale in the market.

Data were collected in two communities located in the Beni Biosphere Reserve from August to November of 2007. Established in 1982, the Reserve is a nationally protected area encompassing 1,350 km<sup>2</sup> and is home to roughly 1,200 Tsimane' (Miranda, 1995). Use of the Reserve's natural resources is restricted to its inhabitants for subsistence purposes. Since commercial logging is prohibited, wage labor opportunities for men consist of serving as farm hands on ranches located outside of the Reserve. Men usually travel alone, leaving their families in the village to tend gardens. Each of the study villages contained a population of about 200 individuals. The villages are located along the Maniqui River, which serves as the thoroughfare for many communities to the market town of San Borja (population ~19,600).

### *The spousal conflict interview*

Prior to fieldwork, JS obtained institutional IRB, community-wide, and individual approval. Interviews were conducted in our field houses to maintain confidentiality. Part one of the interview focused on complaints with spouses using a mixture of free list and frequency rating methods. First, informants listed their most frequent complaints with a spouse (without prompts), then rated the frequency with which they must demand a partner to perform various sex-specific tasks. Participants also rated the frequency with which a spouse must demand them to perform the relevant tasks.

The second part of the interview focused on violence. Women's reproductive histories were elicited to construct temporal intervals (e.g., pregnancies, interbirth intervals) in which retrospective data were collected. After listing all pregnancies with previous and current partners, women provided responses specific to each interval (see Table 5.1). Questions pertaining to additional intervals were included that spanned the couple's first year of marriage (i.e. prior to the first pregnancy) and the last calendar year

if a woman reached menopause. For each interval, informants stated the number of times an abusive event occurred, defined as any physical contact initiated by the husband with intent to harm the wife. To the extent possible, women also stated the causes surrounding each abusive episode. At the end of the interview, participants were compensated with a kilo of sugar, some soap, and several rifle bullets.

*Table 5.1. Description of variables collected per interval*

<b>Variable</b>	<b>Type</b>	<b>Codes</b>
Woman's age	Continuous	—
Man's age	Continuous	—
Proximity of woman's natal kin	Dichotomous	0 = woman's nuclear family members not resident in cluster 1 = woman's nuclear family member(s) resident in cluster
Woman's co-resident dependents from prior marriage	Dichotomous	0 = woman has no children < age 10 from prior marriage 1 = woman has children < age 10 from prior marriage
Joint offspring dependency	Dichotomous	0 = no joint children < age 10 present 1 = at least 1 joint child < age 10 present
Man's non-resident dependents from polygyny	Dichotomous	0 = man has no children < age 10 with other wife 1 = man has children < age 10 with other wife
Man's complaints over woman's production (woman's report; includes childcare, cooking, sex-specific domestic work, and garden labor)	Continuous <sup>1</sup>	0 = never complains 1 = rarely complains 2 = sometimes complains 3 = frequently complains
Woman's complaints over man's production (man's report; includes hunting, garden labor, sex-specific domestic tasks, and childcare)	Continuous <sup>1</sup>	0 = never complains 1 = rarely complains 2 = sometimes complains 3 = frequently complains

Table 5.1. Description of variables collected per interval (continued)

Variable	Type	Codes
Man's village absenteeism from wage labor	Categorical	0 = never leaves community overnight 1 = rarely leaves community (<2 weeks) 2 = sometimes leaves community (>2 weeks but <1 month) 3 = frequently leaves community (>1 month)
Man's store-bought alcohol consumption	Categorical	0 = rarely uses wage earnings to purchase alcohol 1 = sometimes uses wage earnings to purchase alcohol 2 = frequently uses wage earnings to purchase alcohol
Man's extramarital affair involvement (woman's report)	Dichotomous	0 = husband has no mistress 1 = husband has mistress
<i>Outcome</i>		
Frequency of domestic violence	Continuous	—

<sup>1</sup> Task-specific complaint ratings were summed to create a continuous measure

#### *Age estimation and household composition*

As part of a larger project focusing on Tsimane' health and life history, reproductive histories were collected by JS and another graduate student from 2006 to 2007 among 148 adults in the two sample communities. Birth years and genealogies were assigned based on a combination of methods used elsewhere (Blurton Jones et al., 2002; Hill and Hurtado, 1996; Howell, 1979). These include using known ages from written accounts, relative age lists, dated events, and cross-validation of information from independent interviews of kin (for a thorough description see Gurven et al., 2007).

#### *Data analysis*

The path analysis database consisted of a row per interval, which was assigned a year by indexing the reproductive history dataset. Using EQS software version 6.1,

marital strife and paternal disinvestment latent factors were created using the indicator variables in the path model. Path analysis was then conducted specifying a maximum likelihood estimation method. To further explore the likelihood of violence occurring by cause, multinomial logistic regression was conducted on a reduced dataset using SPSS version 16 (see Discussion). For this analysis the dataset consisted of a row for either an abusive event with an unambiguous cause or an interval in which no violence occurred. The outcome was expressed as a categorical variable with four levels: one level for no abuse occurring during the interval (0=reference category), and three levels representing women's stated cause of the violent event (1=husband's jealousy, 2=wife's jealousy, and 3=husband's complaints over wife's work).

### ***Results***

The path analysis sample consisted of 53 women providing 787 intervals during marriage. Women's age at first marriage ranged from 13 to 24 years with a mean age of 17 years. Nearly half of participants remarried, with 20 women providing responses for first and second marriages (204 intervals for second marriages), and four women providing responses relating to first, second, and third marriages (eight intervals for third marriages).

Two regressions were conducted to assess the reliability of informant responses. There was no effect on the length of time since the first year of marriage on the number of abusive events in the first year ( $t = -0.747, p = 0.458, n = 53$ ), nor was any effect found including all years of marriage ( $t = 0.694, p = 0.488, n = 787$ ).

### ***Marital strife***

Women often complain about the timely completion of men's subsistence tasks, such as providing meat and working in gardens (Table 5.2). Instead of working men usually visit kin or politick with unrelated individuals, especially while drinking chicha. Men's alcohol consumption, in and away from the community, is another frequent complaint among wives since men often squander wage earnings in town on liquor. Anecdotal reports of Tsimane' women hiding money from inebriated husbands wishing to

buy more liquor in the community from traveling river merchants are common (cf. Gallin, 1999).

Accusations of husbands having girlfriends, either in the community, in other villages, or in San Borja, represent another recurrent complaint among wives. Oftentimes the girlfriend in the village (perceived or real) is the wife's eldest unmarried sister, who lives in close proximity to the couple early in the marriage. Another frequent complaint among women concerns men's village absenteeism due to involvement in wage labor. Frustrations stem from a combination of men not fulfilling traditional subsistence roles, women experiencing feelings of loneliness, and women disliking the company of in-laws when few consanguineal kin are present. Perhaps most importantly, unlike men's subsistence labor, women are unable to exert much control over men's earnings. Wives and children often do not accompany men during overnight stints of wage labor, which can range from a few days to several weeks. Indeed, men's self-reports of daily wages and women's estimates of their husbands' wages are weakly correlated ( $r = 0.24$ ,  $p = 0.17$ ,  $n = 36$ ). Men report a higher mean daily wage, but the difference is not statistically significant (paired  $t = 0.191$ ,  $p = 0.85$ ).

*Table 5.2. "What are your most frequent complaints to your spouse?" (free list)*

Women (n=16)		Men (n=16)	
Complaint	% listing complaint	Complaint	% listing complaint
No meat	64	Does not cook	94
Does not work in field	64	Does not wash clothes	56
Drinks too much	32	Does not bring water	31
Has a girlfriend	27	Does not bring firewood	25
Wage labors too often	14	Does not make chicha	25
Poor spending habits	14	Visits family too much	25
Does not get firewood	14	Does not work in field	13
Does not fetch water	9	Does not clean house	13
Gossiping in-laws	9	Does not care for children	13
Does not fix house	5		
Often sick and cannot work	5		

For men, frequent complaints about wives are also over sex-specific daily economic activities. Instead of performing these tasks women are usually engaged in other work or visiting family, which also represents a common complaint among men. Squabbles over visitation of relatives are not confined to co-resident kin either – spouses argue over visiting in-laws in other communities as well for various reasons (e.g., to help clear fields, deliver money for trips to the San Borja hospital). These arguments undoubtedly underscore disputes over residence decisions that occur throughout marriage. Men also express dissatisfaction with the quality of care that wives provide to joint children. Most childcare complaints are over allowing children to get too dirty (by crawling or eating dirt), or physically punishing disobedient children too severely. In the latter case, many Tsimane' men believe that using too much force while reprimanding can lead to illness.

### *Spousal violence*

Selected sample characteristics are displayed in table 5.3. The lifetime prevalence of violence in our sample was 85%, while the prevalence in 2007 was 40%. Figure 5.2 shows how the frequency of spousal violence and number of dependents change with the wife's age. The number of dependent offspring increases until there are as many children reaching age 10 as there are new children being born. This rate stabilizes from the mid 20s to the early 40s, and begins to decline as women cease reproducing. Frequency of violence is greatest at earlier ages, with women under the age of 20 experiencing abuse at a rate of over two times greater (2.18 times/year, n = 158 person years) than their older counterparts (1.01 times/year, n = 629 person years).

Table 5.3. Selected descriptive measures of spousal violence dataset

Wife's age	N women	N intervals	N women abused	% of intervals abused
<20	48	158	30	54
20 – 24	45	182	32	45
25 – 29	38	149	24	42
30 – 34	32	127	17	28
35 – 39	26	102	9	22
40 – 44	19	49	8	35
45+	13	20	2	20

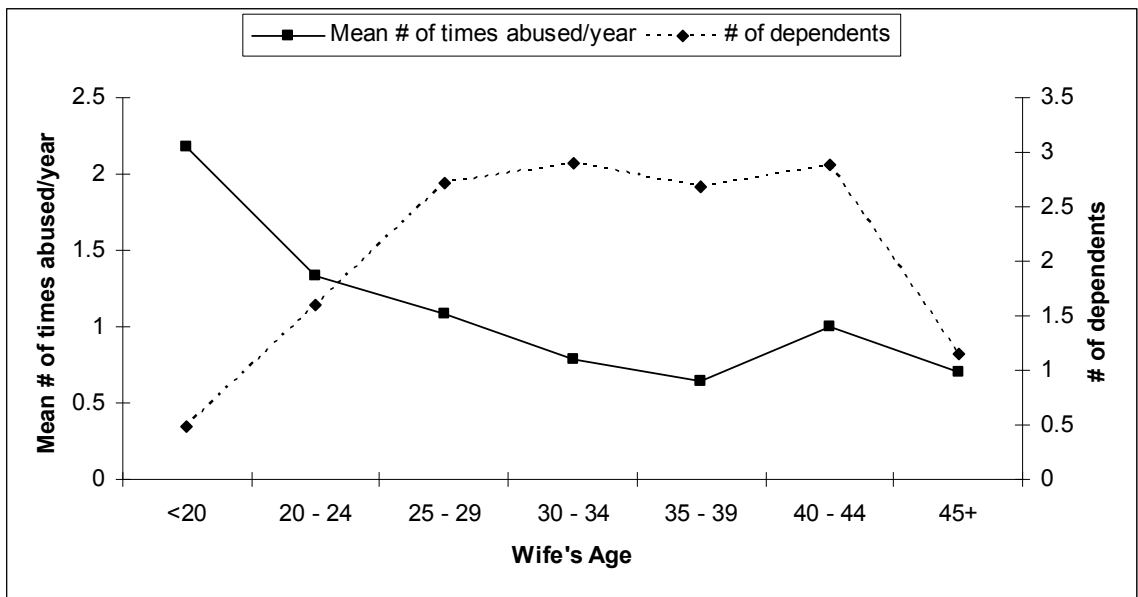


Figure 5.2. Frequency of violence and number of dependents by the wife's age

Table 5.4 displays intercorrelations among indicator variables in the path model. To obtain correlations between frequency of violence and latent variables (not shown), we calculated factor scores by summing the product of standardized values of indicator variables and factor loadings. Frequency of spousal violence is more strongly correlated with the paternal disinvestment factor score ( $r = 0.487, p < 0.001$ ) than it is with the marital strife factor score ( $r = 0.145, p < 0.001$ ).



Table 5.4. Correlation matrix among indicator variables

	Woman's age	Man's age	Prox. of woman's kin	Woman's dependents from prior marriage	Joint dependents	Man is polygynous	Man's complaints	Woman's complaints	Man's village absenteeism	Man's alcohol consumption	Man's affairs	Freq. of violence
Woman's age	—											
Man's age	0.71***	—										
Prox. of woman's kin	-0.11***	-0.2***	—									
Woman's dependents from prior marriage	0.029	-0.1***	-0.046	—								
Joint dependents	0.254***	0.24***	-0.106***	-0.159***	—							
Man is polygynous	-0.02	0.043	0.128***	-0.045	0.026	—						
Man's complaints	-0.04	0.12***	-0.145***	0.024	-0.046	-0.073**	—					
Woman's complaints	-0.076**	-0.042	-0.23***	-0.067*	-0.021	-0.038	0.562***	—				
Man's village absenteeism	-0.13***	0.029	-0.11***	-0.038	-0.01	0.11***	0.21***	0.147***	—			
Man's alcohol consumption	-0.024	0.21***	-0.13***	0.11***	0.047	-0.056	0.078**	0.101***	0.33***	—		
Man's affairs	-0.27***	-0.1***	-0.189***	-0.054	-0.122***	— <sup>a</sup>	0.144***	0.13***	0.37***	0.25***	—	
Freq. of violence	-0.184***	-0.053	-0.253***	0.077**	-0.167***	-0.066*	0.155***	0.107***	0.454***	0.401***	0.39***	—

<sup>a</sup> No polygynously married man reported having sexual relations with women outside of marriage

\*\*\* $p < 0.01$

\*\* $p < 0.05$

\* $p < 0.1$

Figure 5.3 displays results of the path analysis. Standard goodness of fit measures indicate that results should be interpreted with caution ( $\chi^2 = 398.03$ ,  $df = 42$ ,  $p < 0.001$ ,  $RMSEA = 0.104$ ,  $CFI = 0.812$ ). For the RMSEA (root mean square error of approximation) and CFI (comparative fit index), it has been argued that values greater than 0.08 and lower than 0.9, respectively, indicate that the model does not adequately represent the data (Browne and Cudeck, 1992). These goodness of fit measures, however, do not greatly affect our interpretation of the results. The poor fit of the model is due to relatively high covariance among 11% of standardized residuals. High covariance results from lack of independence across years of data on the same woman. To address this issue, we conducted generalized estimating equations (GEE) analyses to obtain valid standard errors and p-values for estimates of each regression effect specified in the path model. GEE modeling permits data analysis of correlated, repeated measures on the same individuals over time (Liang and Zeger, 1986). We found few differences with respect to the uncertainty surrounding regression effect estimates generated from path and GEE analyses (see Notes).

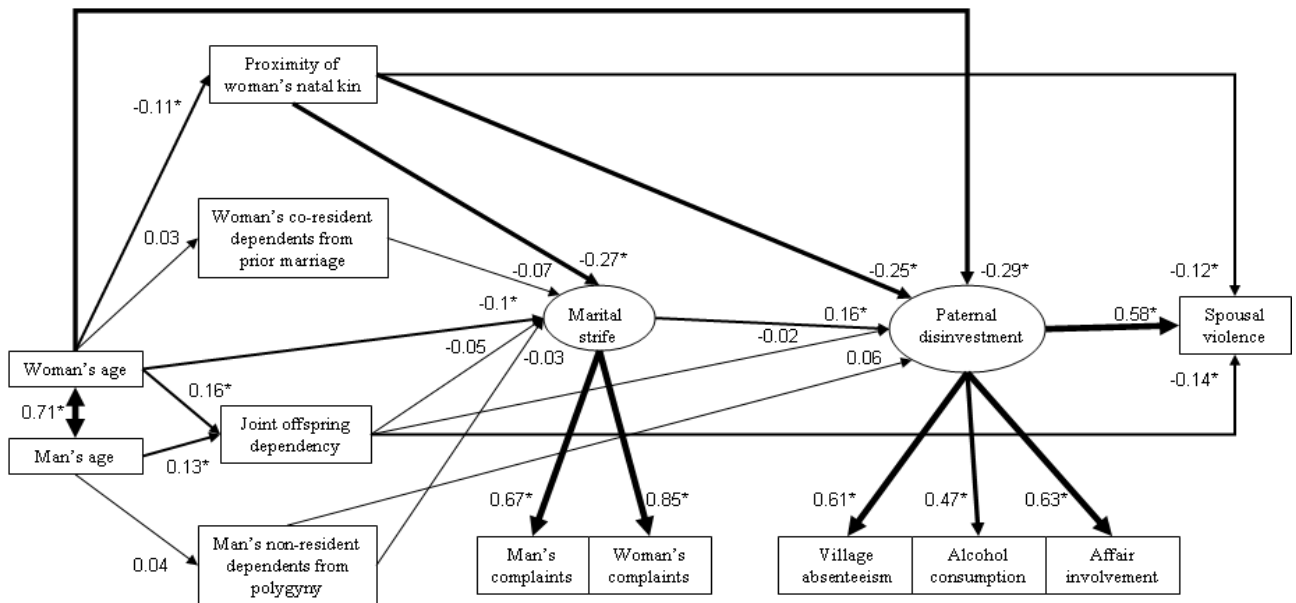


Figure 5.3. Results of path analysis (standardized path coefficients inserted; asterisks indicate significance at the 5% level; line thickness determined by absolute value of path coefficients)

Married women are significantly less likely to live near natal kin with age, indicating a bias toward matrilocality early in the marriage. Both the man's and woman's ages have positive, significant effects on the number of surviving dependents born to the couple. A significant decline in child dependency as offspring age and couples cease reproducing is found after including age and a quadratic age effect for each sex in separate regression models (GEE analyses not shown).

As hypothesized, matrilocality significantly reduces levels of marital strife, although this result should be interpreted with caution (see Notes) and warrants replication. The fact that matrilocality exhibits a stronger negative correlation to women's rather than men's complaints (Table 5.4) suggests that women's natal kin reduce spousal conflict over men's parental investment decisions. This might occur through increased male investment in the family or greater net resource flows to the couple in the presence of the wife's affinal kin. Marital strife also significantly decreases with the woman's age, indicating that concern over paternity is responsible for some conflict. Indeed, the wife's age negatively predicts the man's complaints over the woman's production (GEE  $B = -0.029$ ,  $p = 0.048$ ) controlling for age difference (husband's age – wife's age) as a measure of the man's age. But the man's age (i.e., age difference) has no effect on the woman's complaints over the man's production (GEE  $B = 0.04$ ,  $p = 0.447$ ) controlling for the wife's age. This indicates that the negative effect of the woman's age on marital strife is not being driven by the man's age. However, there is no significant negative effect of the wife's age on the marital strife factor score (GEE  $B = -0.01$ ,  $p = 0.144$ ) controlling for age difference. This suggests that the reduction in marital strife is partially driven by aging women expressing fewer complaints to husbands over the man's production (also see Table 5.4).

As hypothesized, marital strife significantly increases paternal disinvestment. Results should be interpreted with caution (see Notes), but this suggests that spousal conflict over household resource allocation prompts men to bias investment in reproduction toward mating rather than parenting effort given signs of impending termination of the marriage. This also suggests that a recursive model allowing for bidirectional pathways between marital strife and paternal disinvestment is appropriate,

since greater marital strife might initiate a cycle of increased paternal disinvestment followed by greater marital strife, etc. Paternal disinvestment is also significantly reduced when men reside near affines, suggesting that matrilocality raises the cost to men of directing resources outside of the nuclear family. Paternal disinvestment also significantly declines with the woman's age. This finding runs directly counter to the prediction generated by the mating effort model of marriage. Despite the waning reproductive value of the wife, men are less likely to divert resources from families and engage in affairs as both members of the couple age and have children. The reproductive lives of men and women instead appear linked through complementary roles, providing support for the idea that the ultimate goal of men's decisions to enter marriage is to increase offspring quality (cf. Winking et al. 2007).

All three variables hypothesized to have a direct effect on rates of violence are significant and in the predicted direction. Frequency of spousal violence decreases when the couple resides in close proximity to the wife's natal kin. Matrilocality, therefore, reduces the frequency of abuse directly and indirectly through respective reductions in marital strife (although tentative) and paternal disinvestment. Effect decomposition of the proximity of the wife's natal kin and other variables on abuse frequency is shown in table 5.5. As hypothesized, joint offspring dependency also significantly lowers the frequency of spousal violence, providing further support for the provisioning model of marriage. Paternal disinvestment significantly increases the frequency of violence and has the strongest total effect of all variables in the model. We now consider the implications of these findings and limitations of this study.

Table 5.5. Effect decomposition of variables on spousal violence frequency (standardized values)

Variable	Direct effect	Indirect effect	Total effect
Woman's age	—	-0.172	-0.172
Man's age	—	-0.018	-0.018
Proximity of woman's natal kin	-0.122	-0.169	-0.291
Woman's co-resident dependents from prior marriage	—	-0.006	-0.006
Joint offspring dependency	-0.139	-0.015	-0.154
Man's non-resident dependents from polygyny	—	0.033	0.033
Marital strife	—	0.092	0.092
Paternal disinvestment	0.576	—	0.576

### Discussion

A thorough understanding of spousal conflict and the conditions under which violence is more likely to occur will consider the interaction between household demography and resource allocation. Consistent with previous reports, we find that close proximity of the wife's natal kin directly reduces the frequency of violence (Counts et al., 1999; Erchak, 1984; Figueredo et al., 2001). We also reveal a mechanism responsible for the association: matrilineal residence results in less conflict over men's parental investment decisions, highlighting the increasing costs to men of familial maltreatment when affines are present. Our results also add to the growing body of evidence in traditional and modern societies that the presence of joint offspring stabilizes marital relations by directly lowering rates of spousal violence. While this supports the provisioning model of marriage, our hypotheses that joint offspring presence indirectly lowers rates of violence through reductions in marital strife and paternal disinvestment were not strongly supported.

In contrast to previous reports (Daly et al., 1993, 1997), we find no evidence that presence of the wife's children from previous marriage contributes to the risk of female-directed partner violence. We suggest that the expected conflict over resource allocation in step-families often found in modern societies is mitigated in horticultural and other

subsistence-level societies where younger children have several opportunities to contribute to household production.

This study highlights the need for further research into assessing the relative importance of men's versus women's jealousy in precipitating spousal violence. The finding that younger Tsimane' women are at greater risk is consistent with the idea that men's jealousy plays a noteworthy role (e.g., Counts et al. 1999; Daly and Wilson 1988; Goetz 2008). While we do not doubt the significance of men's paternity concerns, we argue that women's concerns over men's withdrawal of parental investment must also be incorporated into models of spousal conflict and violence.

Tsimane' women's reports indicate that the most frequent trigger of abusive events is *women's* accusations of a partner's infidelity (Table 5.6). In contrast, men's allegations of the wife's extramarital sexual behavior account for less than 20% of violent episodes. The likelihood of abuse occurring due to women's concerns of men's resource diversions from the nuclear family is independent of the wife's age when paternal disinvestment is high (Table 5.7 and Figure 5.4). In contrast, the probability of abuse due to men's sexual jealousy when paternal disinvestment is high exhibits a predictable significant decline as the wife's reproductive value decreases. This strongly suggests that women's concerns over paternal disinvestment, rather than men's concerns over paternity, is responsible for the maintenance of violence throughout marriage. In addition, the hypothesis that spousal violence occurs due to concerns over paternity suggests that rates of abuse will increase during pregnancy. Yet the wife's pregnancy status has no effect on the likelihood of being abused due to the man's jealousy (Table 5.7).

*Table 5.6. Stated causes of abusive episodes*

Women's reports (n = 292 episodes)	% of total
1) Wife complains about another woman	36
2) Husband complains about wife's production <sup>a</sup>	29
3) Husband complains about another man	17
4) Wife complains about husband's drinking	5
5) Wife complains about living far from natal kin	4
6) Husband complains about disobedient step-children	2
7) Miscellaneous <sup>b</sup>	7

<sup>a</sup> Includes all instances of the wife's inability to perform domestic tasks (e.g., cooking, childcare, washing clothes) due to her involvement in other work, infirmity, or a desire to visit kin.

<sup>b</sup> Includes men's complaints over reproduction (i.e., wife is infertile, miscarried, gave birth to a girl and husband wanted a boy), wife's attempts to stop a drunken husband from fighting another man, wife's misplacement of a tool, and husband's inability to control his own behavior due to severe inebriation.

Table 5.7. Multinomial logistic regression of abuse by cause (women's reports)

Reason behind abusive episode <sup>a</sup>	Variable	Estimate	Std. Error	p	Odds ratio	95% C.I.	
						Lower	Upper
Husband's jealousy <sup>b</sup> (n=51)	Intercept	-5.047	1.291	<0.01			
	Age of woman	-0.054	0.027	0.049	0.947	0.898	0.999
	Proximity of woman's kin	-2.029	0.462	<0.01	0.131	0.053	0.325
	Woman's dependents from prior marriage	0.152	0.505	0.763	1.164	0.433	3.132
	Joint dependents	-0.612	0.163	<0.01	0.542	0.393	0.747
	Man's complaints	0.245	0.05	<0.01	1.278	1.158	1.41
	Woman's complaints	-0.067	0.072	0.348	0.935	0.812	1.076
	Man's village absenteeism	0.431	0.167	0.01	1.539	1.109	2.137
	Man's store-bought alcohol consumption	1.397	0.346	<0.01	4.042	2.052	7.964
	Man's affairs	1.276	0.403	0.002	3.583	1.626	7.896
	Wife is pregnant during interval (no=ref. category)	-0.108	0.351	0.759	0.898	0.451	1.787
Wife's jealousy <sup>c</sup> (n=117)	Intercept	-4.105	0.987	<0.01			
	Age of woman	0.002	0.024	0.928	1.002	0.956	1.051
	Proximity of woman's kin	-2.847	0.554	<0.01	0.058	0.02	0.172
	Woman's dependents from prior marriage	0.802	0.5	0.109	2.229	0.837	5.936
	Joint dependents	-0.187	0.122	0.125	0.829	0.653	1.053
	Man's complaints	-0.023	0.044	0.591	0.977	0.897	1.064
	Woman's complaints	0.129	0.064	0.044	1.137	1.004	1.289
	Man's village absenteeism	0.316	0.147	0.031	1.372	1.03	1.829
	Man's store-bought alcohol consumption	0.013	0.251	0.959	1.013	0.619	1.657
	Man's affairs	4.277	0.402	<0.01	72.03	32.75	158.4
	Wife is pregnant during interval (no=ref. category)	0.09	0.295	0.76	1.095	0.613	1.953
Wife's work (n=94)	Intercept	-2.387	0.956	0.013			
	Age of woman	-0.131	0.027	<0.01	0.878	0.833	0.925
	Proximity of woman's kin	-2.774	0.472	<0.01	0.062	0.025	0.157
	Woman's dependents from prior marriage	1.078	0.411	0.009	2.94	1.315	6.574
	Joint dependents	0.06	0.126	0.634	1.062	0.83	1.359
	Man's complaints	0.193	0.04	<0.01	1.213	1.121	1.313
	Woman's complaints	-0.023	0.061	0.709	0.977	0.867	1.102
	Man's village absenteeism	0.27	0.139	0.052	1.311	0.998	1.721
	Man's store-bought alcohol consumption	0.899	0.256	<0.01	2.456	1.488	4.055
	Man's affairs	1.72	0.326	<0.01	5.585	2.95	10.57
	Wife is pregnant during interval (no=ref. category)	-0.435	0.29	0.133	0.647	0.367	1.142

<sup>a</sup> The reference category is an interval in which no abuse occurred (n=478).

<sup>b</sup> Includes verbal doubts of paternity and boyfriend accusations.

<sup>c</sup> Includes girlfriend accusations and complaints over men's drinking.



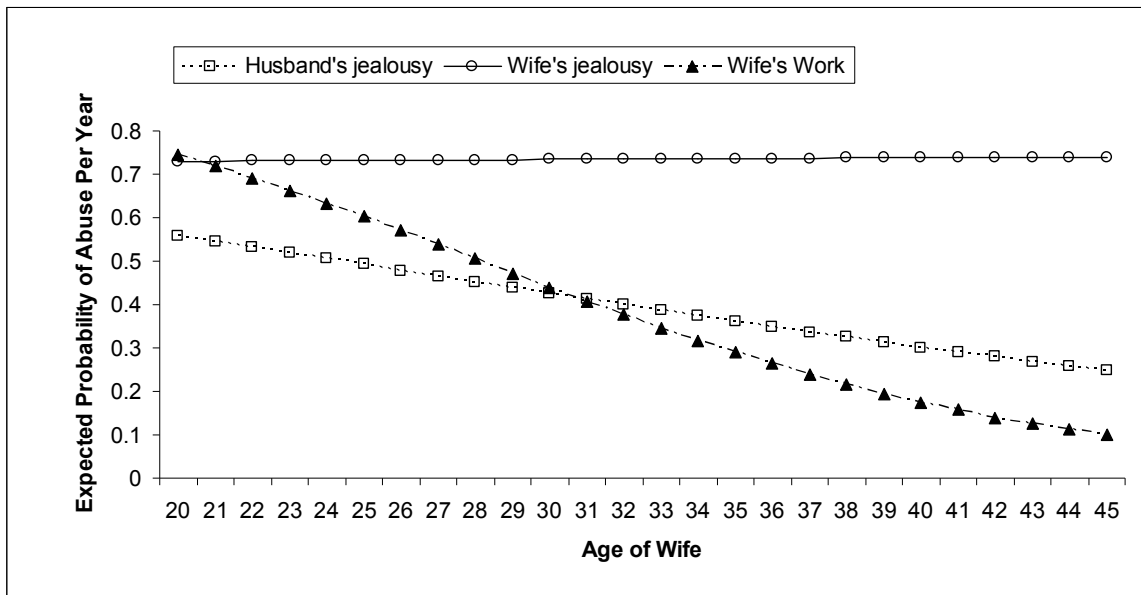


Figure 5.4. Likelihood of abuse by cause when paternal disinvestment is high (i.e., village absenteeism=3, affair involvement=1, and consumption of store-bought alcohol=2; expected probabilities are calculated using estimates obtained from multinomial logistic regression using sample means for controls; each equation is compared to the reference category of no violence occurring per interval)

In our model men’s village absenteeism is an indicator of paternal disinvestment, which is hypothesized to directly increase rates of violence. Yet it is also reasonable to conclude that village absenteeism raises the risk of violence due to the man’s jealousy ( $B = 0.431, p = 0.01$  in Table 5.7). This would result from heightened potential for cuckoldry during the man’s absence and attempts to reduce reproductive costs through coercion. We suspect, however, that village absenteeism has a greater influence on women’s concerns over paternal disinvestment than men’s concerns over paternity. Because Tsimane’ villages are composed of closely spaced houses lacking walls, residential privacy is extremely limited. This helps ensure that many behaviors remain conspicuous, with possibilities for reputational damage ever-present through community gossip. Such scrutiny limits the potential for women’s extramarital sexual exploits, and provides avenues of information to absent men regarding the wife’s behavior. In stark contrast, women have hardly any knowledge of solitary men’s behavior during wage labor, and men’s temptations to direct resources from the family are largely unchecked.

The extent to which men's expenditures are directed toward increasing familial welfare (e.g., buying medicine, clothing) versus enhancing fertility at the expense of the family will better reveal men's motivations for wage labor participation. But the fact that time allocation to wage labor peaks from ages 20 to 24, when many men are married and have few dependents, suggests that familial provisioning is not the ultimate goal of men's market involvement.

Several limitations of our study must be noted. We are unable to disentangle men's overt jealousy (as expressed to wives) from jealousy manifested in more subtle ways. For example, in some cases the man's complaints over the wife's production might represent suspicions of a partner's sexual infidelity. This would underestimate the effect of men's jealousy on rates of violence. In their descriptions of abusive events due to the wife's inability to perform a task, Tsimane' women sometimes quoted angry husbands as saying, "I'm hungry and there is no food! Why weren't you cooking? Were you spending time with a boyfriend?" Indeed, the wife's age negatively predicts the probability of being abused due to her production (Table 5.7). Whether men's concerns over a partner's extramarital sexual exploits are real or even sincere, however, is another question. Of those men who acknowledged having ideas about a wife's affairs in the year prior to interviews, only 13% were actually able to provide a potential lover's name (both of which were ex-husbands of their wives living in distant communities). In contrast, of those women who acknowledged having ideas about a husband's affairs in the year prior to interviews, 63% provided names of potential mistresses. Further research is required to examine the extent to which female partner-directed violence stems from men's sexual jealousy as opposed to a desire to increase household efficiency.

Because causation cannot be directly inferred, we cannot rule out the possibility that paternal disinvestment might be an outcome of violence. Moreover, the strong correlation between men's disinvestment and violence might reflect the fact that philandering men are also more abusive or more likely to select partners tolerating abuse. Finally, even if paternal disinvestment triggers violence, the effect might not be direct and the mechanism remains unclear. Do wives punish disinvesting husbands by reducing work effort, which then results in angry husbands resorting to violence? Do men

preemptively abuse in order to minimize the frequency of women's complaints over future paternal disinvestment?

Overall, factors affecting variation in the degree of spousal conflict are essential to our understanding of the causes of violence in relationships. Across cultures, our results imply that the nature and distribution of resources influence spousal relations vis-à-vis their impact on men's parental investment decisions. Given the extensive focus on the effects of patriarchy and men's sexual jealousy on spousal violence against women, it is unclear how or to what extent women's marital dissatisfaction stemming from men's withdrawal of parental investment motivates men's desires to suppress women's complaints through violence. This study represents a preliminary step in this direction.

*Notes*

1. The following table compares standard errors and p-values of regression effect estimates generated from path and GEE analyses:

*Table 5.8. Comparison between standard errors and p-values of regression effect estimates generated from path and GEE analyses.*

Dependent variable	Independent variable(s)	Standard Error		p-value		Change in significance ?
		Path analysis	GEE	Path analysis <sup>a</sup>	GEE	
Proximity of woman's natal kin	Woman's age	0.002	0.043	<0.05	0.094	Marginal
Woman's dependents from prior marriage	Woman's age	0.001	0.015	>0.05	0.242	No
Joint dependents	Woman's age	0.002	0.027	<0.05	<0.001	No
	Man's age <sup>b</sup>	0.002	0.027	<0.05	0.1	Marginal
Man is polygynous	Man's age	0.001	0.014	>0.05	0.325	No
Marital strife <sup>c</sup>	Woman's age	0.015	0.007	<0.05	0.035	No
	Proximity of woman's natal kin	0.343	0.18	<0.05	0.212	Yes
	Woman's dependents from prior marriage	0.389	0.229	>0.05	0.561	No
	Joint dependents	0.328	0.095	>0.05	0.698	No
	Man is polygynous	0.604	0.15	>0.05	0.969	No
Paternal disinvestment <sup>c</sup>	Woman's age	0.004	0.006	<0.05	<0.001	No
	Proximity of woman's natal kin	0.078	0.183	<0.05	0.015	No
	Joint dependents	0.082	0.078	>0.05	0.84	No
	Man is polygynous	0.143	0.19	>0.05	0.317	No
	Marital strife <sup>c</sup>	0.013	0.107	<0.05	0.326	Yes
Frequency of violence	Proximity of woman's natal kin	0.19	0.247	<0.05	0.003	No
	Joint dependents	0.2	0.306	<0.05	0.001	No
	Paternal disinvestment <sup>c</sup>	0.193	0.137	<0.05	<0.001	No

<sup>a</sup> Output from EQS software indicates whether  $p < 0.05$  but does not specify exact values.

<sup>b</sup> Due to the high correlation between women's and men's ages ( $r = 0.71$ ), age difference (husband's age – wife's age) was used as a measure of the man's age after controlling for the woman's age.

<sup>c</sup> Factor scores were obtained by summing the product of standardized values of indicators and factor loadings.

## CHAPTER 6: CONCLUSION

The goal of this dissertation was to explore the conditions under which intrafamilial allocation of labor and resources results in conflict due to divergent interests of household members. To investigate conflicts of interest between parents and children, we generated predictions from parent-offspring conflict theory regarding individual, familial, and task characteristics affecting variation in the likelihood of delegation and resistance following delegation. To investigate spousal conflicts of interest, we considered individual and relationship characteristics that affect the costs and benefits to men of allocating reproductive resources for mating effort at the expense of parenting effort.

### *Summary of Results*

#### *Parent-offspring conflict and task delegation*

In chapter three we find evidence of conflict and cooperation due to an interaction between the child's age and family labor demand. Controlling for other factors, household need positively influences the likelihood of delegation and, to some degree, resistance toward performing delegated tasks. In addition, high exertion labor and tasks primarily benefiting the family are more likely delegated and resisted than low exertion labor and tasks primarily benefiting the child. This suggests that parental manipulation of the child's time occurs to foster greater levels of kin-directed altruism and is consistent with the hypothesis that parent-offspring conflict is more likely to occur over productive tasks that have fewer positive effects on parental fitness.

We also find evidence of increasingly convergent interests between parent and child as the cost of task performance decreases with age and the benefits of the child's labor increase. An increase in family labor demand with age results in a significantly lower likelihood of delegation and a marginally lower likelihood of resistance. In addition, as paternal absence increases the value of labor substitution we find that children are less likely delegated high exertion tasks and family-directed labor.

*Labor demand, children's time use, and implications for family conflict and cooperation*

In chapter four we find that as the number of younger siblings increases children exhibit a tendency to increase production, but only with respect to kin-directed tasks. While effects of increasing labor demand on time allocation to ego-directed production are less consistent, we find evidence that number of younger siblings negatively predicts time allocation to manufacture, a productive task heavily weighted against generating short-term benefits used to invest in sibling welfare. We also find that number of younger siblings negatively predicts time allocation to non-productive activities including socializing and idling. Since these activities are often children's preferred alternatives to performing delegated work (see chapter three), we consider the possibility that increasing labor demand results in greater parent-offspring conflict over optimal levels of children's kin-directed altruism. Indeed, we find that number of younger siblings significantly lowers the probability of being in close proximity to the mother in/around the house while not working. If parental manipulation of the child's time entails engaging in sub-optimal levels of kin-directed production from the child's perspective, then maternal avoidance might represent an attempt to combat behavioral manipulation by lowering the risk of task delegation and creating opportunities to engage in ego-directed productive or non-productive pursuits.

*Spousal violence and paternal disinvestment*

In chapter five we find that marital strife stems largely from the failure of one partner to meet expectations of the other partner with respect to performance of daily subsistence tasks. Divergent spousal interests over the proper use of familial time and resources are highlighted by women's frequent complaints over men's dissipation of resources through the squandering of scarce wages on goods detracting from familial welfare (particularly alcohol), extramarital affair involvement, and village absenteeism due to wage labor. While we find some evidence that men's sexual jealousy plays a noteworthy role in precipitating violence against women, we argue that consideration of women's concerns over paternal disinvestment must be incorporated into models of spousal violence. Based on interrelationships between the wife's age, joint offspring

dependency, paternal disinvestment, and violence, we find support for the idea that the ultimate goal of men's decisions to enter long-term unions is to increase offspring quality rather than maintain access to women's fertility. Finally, matrilocality is found to decrease rates of spousal violence via direct and indirect routes. Together, this suggests that individual, relationship, and local ecological factors must all be considered in order to understand resource allocation decisions and factors increasing the risk of spousal conflict.

### ***Future Research***

#### ***Parent-offspring conflict***

There is little doubt that task delegation facilitates on-the-job training and is a means by which parents prime children about the timing of participation in household production. Our analyses indicate that delegation also ensures that children perform productive tasks for which they show little initiative for. The general hypothesis that task assignment is the result of parent-offspring conflict therefore merits further attention, particularly due to the fact that children are assigned responsibilities that they are unlikely to encounter with regularity as adults.

Child-focused research is necessary to reveal differences in preference over the allocation of labor between parents and offspring and between siblings. Ironically, much of this dissertation was concerned with the role of the child's initiative in how labor is divided yet little systematic attempt was made to actually ask children! Are there certain productive tasks that children enjoy more than others? Do older children employ capable younger siblings as substitute laborers in order to pursue self-interests, and to what extent does this lead to sibling conflict? How might children actively attempt to minimize opportunity costs of skill acquisition during task performance? Do they insist, for example, that delegated family-oriented labor be conducted among peers? The fact that Tsimane' children often engage in horticultural labor not in isolation but in the presence of siblings or other playmates suggests that parents and children might reach a compromise between efficiency in task performance and the acquisition of social or other abilities generating long-term benefits.

We also know very little about the extent to which children's independent productive decisions are consistent with parental desires. If a task is completed but not delegated, is it because the child is not supposed to be doing it? How might parents discourage involvement in productive activities for which children do not have sufficient strength or skill? Under what conditions might independent task performance result in punishment?

Methodological refinements can also be made with respect to assessing the physical cost associated with task performance. Utilizing heart rate monitors to estimate energy expenditure coupled with structured interviews to assess independent versus delegated task performance would permit comparisons of the extent to which short-term physical costs of altruism are "tolerated" from the parent and child's perspective.

### *Spousal violence*

Sexual jealousy and paternal disinvestment models generate different predictions about the conditions under which spousal violence against women occurs. For example, if violence is primarily motivated by paternity uncertainty then we would expect abuse during pregnancy to be more severe than at other times. We might also expect men to strategically apply force to areas of the pregnant wife's body in such a way that increases the likelihood of harming the fetus. The paternal disinvestment model, in contrast, does not imply that the severity of abuse will vary by the wife's pregnancy status, or that men will direct beatings to specific areas of the wife's body.

To date, we also know very little about the frequency of women's extramarital affairs in traditional societies. The fact that only 13% of Tsimane' men who recently acknowledged entertaining ideas of a wife's affairs could provide a potential lover's name suggests that the prevalence of coercive constraint due to concerns of paternity might be somewhat exaggerated in small-scale, kin-based societies. Also suggestive is the fact that men's time allocation to wage labor outside of the community, and generally away from the wife, peaks in the early 20s. If coercive control over the wife's reproductive behavior is the primary motivation behind spousal conflict and violence, then why are men increasing the likelihood of cuckoldry when women are approaching peak fecundity?



### *Conclusion*

Household production is the result of inputs from a variety of members, each of whom contains overlapping but non-identical interests. In this dissertation we questioned the often overlooked assumptions that kin unconditionally pool resources and that resource use is independent of the individual controlling allocation. In general, our results show that at times self-interest may pervade relations of even the closest of kin. This highlights a need for the development of models of family behavior that incorporate children and parents as effective decision-makers capable of influencing outcomes with respect to converging and diverging goals.

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