Online Supplement 1: Ethnographic information about food production and childcare, and complementary skill categories.

(1) Food production and childrearing

Food Production

Food production requires competence with basic tool use skills and is dependent on food sourced through hunting, fishing, gardening, and animal husbandry. Food material typically requires processing before it is available for consumption. Below we discuss food production skills (twenty nine of which were investigated in the *Skills Survey*) organized into five subcategories: tool use, hunting, fishing, gardening and animal husbandry, and food processing.

Tool Use

Three skills were investigated in the tool use category: use an axe, use a machete, pole a canoe/ raft. These skills are important requisites for basic transportation, foraging, garden work, food production, and craft production.

Hunting

Despite lack of the superior strength, tough hides, sharp teeth, claws, and speed that non-human predators in the Amazon rely upon, Tsimane hunters are extremely successful predators due to their utilization of skills that often rely on stealth, ambush, clever pursuit techniques, culturally and individually learned strategies, and weaponry. Human hunters' skills utilize inter-generationally transmitted and accumulated knowledge with context specific applications concerning information about the local environment, geographic and seasonal distributions and variations, patterns of animal behavior, tools for improving hunting success, and specific knowledge of what to do when specific game is encountered (Liebenberg, 1990; MacDonald, 2007). With experience, Tsimane hunters not only acquire a variety of practical hunting skills and knowledge that they can apply to a wide variety of hunting situations to increase their efficiency and productivity, but they also acquire the confidence that allows them to travel through remote or unknown areas of forest, effectively find their way when disoriented, and to hunt without fear. Less experienced hunters are often inhibited by their lack of skills, poor navigation, poor reactions to problems, and fear of both dangers and the unknown. The greatest source of protein for Tsimane is from hunted game that plays a varyingly important role in the diet depending on the game densities surrounding each community (Chicchón, 1992; Martin et al., 2012). A wide variety of game (birds, mammals, reptiles) are hunted for consumption, making the identifications and knowledge of their distinctions important.[1] Natural resources like fruiting trees, fresh water, and salt licks attract wild fauna while anthropic products (e.g. motorized equipment) and locations (especially San Borja) deter them.

Among the Tsimane, hunting is generally an activity for men and adolescent males, and along with fishing, is practiced year-round and throughout Tsimaneland. Hunting styles vary considerably, based on weaponry, strategy, route, prey choice, time of day, weather, use of calls, dogs, and many more factors. When hunting with dogs, women will sometimes assist, but not often.

The development of hunting skills, such as with bow and arrow, develop gradually from a young age. Before ever being brought along on serious hunting excursions, male children as young as 3 years of age begin playing at

[1] The most sought after and valued types of meat are from collared peccary or "taitetu" (*quitivare*), agouti paca or "jochi pintado" (*naca'*), gray brocket deer or "huaso" (*ñej*) (Gurven & von Rueden, 2006), as well as tapir or "anta" (*shi'*). In terms of biomass harvested from hunting, a multi-season sample of Cuverene and Aperecito hunts (Gurven et al., 2006) determined that the most abundant resources – in order from more to less—are collared peccary, tapir, deer, howler monkey or "mono manechi" (*uru'*), agouti paca, white-faced capuchin monkey or "mono silbador" (*oyoj'*), and ring-tailed coati or "tejon" (*chu'*). Together, these seven species constituted 82% of the biomass, or 70% of all kills in recorded in the sampled presented by Gurven, Kaplan, & Gutierrez (2006). Other common prey animals include capibara (*oto'*), turtle or "peta" (*quijbo*), seven-banded and nine-banded armadillo or "tatú" (*curibu, väsh*), and cracid birds: "mutun" (*opaj*), "pava roncadora" (*emej*), "perdiz" (*fofor*), and "tapacare" *(chajaj*). Less common prey animals are white-lipped peccaries or "chancho de tropa" (*mumujñi*), spider monkeys or "marimono" (*odo'*), squirrel monkey or "chichilo" (*chichi*), owl monkey or "mono nocturno" (*isbara'*), collared anteater or "oso bandera" (*yushi'*), giant anteater or "oso hormiguero" (*o'oyo*), and kinkajou or "mono michi" (*voyo'*).

hunting and related activities within the safety of their homes and villages, using scaled down versions of bows and arrows, worn out and discarded machetes, and by practicing throwing objects and aiming at inanimate targets. As children grow older, they adopt larger toy bows and increasingly take interest in shoot at animate targets including butterflies, frogs, and insects. Their first actual "hunting" activities with bow and arrow may involve shooting at fish poisoned by barbasco that flounder near the surface of water. This might next progress to stalking and shooting fish hiding in the water (a moderately safe skill that requires considerable stealth). Meanwhile, as a result of child involvement with and proximity to game processing, and the simultaneity of hunting stories that are often told and retold by hunters, children become familiar with identification of the various game species and acquainted with knowledge of hunting strategies and corresponding animal behaviors, long before they have had their first opportunities to sample these hunting experiences first hand or view live prey in their natural habitats. When children reach adolescent ages they are nearly able to keep up with adult hunters, but often do so at a cost to the adult's hunting effectiveness. In addition to accompanying adult hunters, adolescents will often go on small hunting and fishing expeditions with only a sibling or a friend close in age. By the time that males are in their upper teens or early twenties they often begin hunting by themselves.

Hunting is most often a solitary activity, but hunting parties are sometimes composed of small groups of related individuals or friends. Most men hunt about twice a week, although some men hunt more and others less (Gurven et al., 2006). Tsimane men often comment that they enjoy and find excitement —and even a sense of peace—in the activity of hunting, and that hunting excursions provide them an opportunity to get away from their home lives, garden work, and other daily activities. Hunting excursions also provide opportunity for fishing (see below) and collecting honey from wild bee colonies. Honey "hunting" and collection requires knowledge of bees and their ecology (some flying hive species are ferocious, potentially deadly, and to be avoided) and typically involves tree climbing or tree felling, honey-comb removal and storage, and may involve the use of smoke (e.g. see Demps et al 2012 discussion of the Jenu Kurubu).

Hunting ability and success make strong contributions to male status and mate value (Gurven and von Rueden, 2006), probably through demonstrating productivity, formidability, knowledge, and valuable experience. When asked, many Tsimane report that hunting success is dependent on strength, knowledge, and experience, but also behaving in accordance with certain superstitious beliefs. In the Tsimane cosmology, animals, fish and plants all have their own guardians and masters or *a'mo'* (Huanca, 2006). Tsimane believe in these spiritual agents with specific relationships to the ecology and dominion over game animals and who have sensitivities to the "right" and "wrong" behaviors of humans, as well as dreams foretelling the future, and magical relationships involving charms and objects. Perhaps one of the most pervasive superstitions regarding hunting success is the belief that possession and use of magic amber (*isatriz*) by hunters and hunting dogs can improve hunting success. Amber is believed to be capable of increasing the frequency of animal encounters for the hunter and is also believed to be capable of increasing stamina, giving strength, improving morale and motivation, and combating apathy and sloth. Some men claim they know where sources of the magic amber can be found (at least a two days journey or further into remote areas of Serrania Eva Eva within the Tsimane territory) and have found their own *isatriz*, while others have received amulets of magic amber and instructions for their use from older kin.

Eleven hunting skills were investigated: six pertaining to both men and women (i.e., identify wild fruits, identify animal tracks and markings, identify wild animals, know the habits of wild animals, train hunting dogs, collect honey), and six exclusive to men (i.e., shoot arrows, fire shotgun or rifle, track animals, travel in the woods without fear, use magic amber).

Fishing

Fish provide an important dietary contribution of fatty acids and protein to Tsimane, who by both hunting and fishing, diversify their diet (Martin et al., 2012). A wide variety of fish are extracted for consumption, making the identifications and knowledge of their distinctions important.[2]The amount of fishing that an individual practices

[2] The most commonly caught fish is *Prochiludus nigricans "*sábalo" (*vonej*), a medium-sized spine-filled fish. Other commonly caught fish include various catfish, *Pimelodus clarias and Pimelodus* spp. or "bagre", sorubim fish *Pseudoplatystoma fasciatum* and *Pseudoplatystoma tigrinum* or "surubí" and "pintado" (*pishva, ítsiquidye, sona're'*), *Hoplias malabaricus* or "ventón" (*sheresherej*), *Schizodon fasiatum* or "pacusillo", and *Surubim lima* or "paleta" (*vatajta'*). Other fish that are caught also include *Brycon* spp. or "mamure", "mamure pintado", *Colossoma macropomum* or "pacú", various species of the Pimelodidae family or "blanquillo", *Salminus maxillosus* "dorado", *Brachyplatystoma filamentosum* "piraiba", and *Astronotus ocellatus* or "palometa real". This list is not exhaustive and many other caught varieties are unmentioned.

varies with access to major rivers and streams, and with age (Gurven et al., 2009). Often hunting and fishing go hand-in-hand, with hunters stopping to fish when they encounter promising fishing holes along their way through the forest. Even small catches—to contribute to the family pot— may be worthwhile from the perspective of an unsuccessful hunter trying to hedge his bets against returning home empty handed. It may be that fishing also provides utility to the hunter by breaking up the hunting activity. Hook and line fishing, for example, gives hunters an opportunity to both rest a while and sit silently by the water, all the while keeping vigilant of sounds from animals visiting the water source or nearby. In general, returns from fishing are less productive than what might be achieved from hunting, but are less risky, especially for women and young adults, guaranteeing a contribution of protein that adds breadth to the diet.

Fishing is usually done with line and hook, bow and arrow, with weirs and, or nets. Shooting fish with an arrow requires good shooting skill and is done by men in clear water or when fish are at the surface of the water, such as when poisoned by "barbasco" (any of a variety of botanical fish poisons). As it is often hard to see fish in murky water, bow and arrow are not always ideal and best suited for use under clean water conditions that occur in the dry season. Many fishing tasks require entering the water without fear, despite venturing out into deep sections of water, or entering areas with known rays, and biting fish (e.g. piranhas) or snakes. Barbasco fishing is often associated with group fishing events, where once or twice a year groups of families, and sometimes entire villages, use plant poisons to stun fish in closed-off sections of rivers, streams, and lagoons. During these events, several men perform most of the initial work (acquiring the plant poisons, selecting, routing, damming the body of water, prepared traps, cutting, processing, and administering the poison), and many more individuals, including women and children, harvest the fish with trap, machete, or knife. Women of all ages work at processing, smoking, and packaging the fish for transport. Smaller events that take place in a similar fashion, but with between one and three families on smaller tributaries and often with less field processing, tend to yield smaller fish but can still be quite productive. Modern technology (e.g. nylon netting, electrocution, dynamite) is not used much and does not have a large impact on Tsimane fishing.

While children are taken out on large barbasco outings even as babies, children will often start fishing at ages as young as 6-8 years, and even contribute their catches to the family meals. It is common for young boys and girls under the age of 15 to spend some of their time bathing and playing at water holes, while occasionally trying hook and line fishing somewhere in or close to the village. Some adolescents are avid fishers and will spend more time fishing daily than adults.

Six fishing skills were investigated: three pertaining to both men and women (know where to find fish, identify different fish, produce and use barbascos), and three exclusive to men (arrow shoot fish, make weir / fish trap, get in water without fear).

Gardening and Animal Husbandry

For the Tsimane, gardens are an extremely important subsistence source where they cultivate more than 80 species of plants (Piland, 1991) including tree crops, medicinal plants, palms for construction, tools, and weapons, cotton for textiles, fish poisons, 30 distinct varieties of manioc, 8 varieties of rice, 6 varieties of corn, and 11 varieties of plantain (Huanca, 1999). While the bulk of protein and fat comes from faunal sources (including domesticated animals such as chicken, ducks, pigs), plant foods provide carbohydrates, dietary fiber, and a compliment of important macro and micronutrients. Almost all Tsimane adults practice polycrop horticulture with families maintaining several fields (each between approximately 0.1 and 1.25 hectares) in various stages of multi-year use, growth, and fallow.

Horticulture relies primarily on human labor input rather than machines, animals, plows, herbicides, pesticides, or irrigation. The choice of garden sites is a tricky business: if the forest growth is too cumbersome the garden clearing will be unreasonably difficult, yet where soils are often the most fertile and vegetation the easiest to clear (such as amongst loamy soiled areas at the edge of rivers), the risk of floods is highest. The responsibility of garden work is managed at the nuclear family leve. Though most Tsimane tend small garden plots, some attempt to develop larger fields for marketable monocrops such as rice. These larger scale productions will typically involve the help of extended family members or even migrant Tsimane workers (as is becoming increasingly commonplace among large mono-crop sites). Garden activities include burning of cut and dried plant materials and the use of steel machetes and axes for tree felling, garden clearing, weeding, planting, tending, and harvesting. The more strength intensive garden tasks (felling large trees and clearing thick underbrush) are male-specific, while much of general work such as planting, weeding, and tending is done by both genders. Tree felling is a high strength task that also requires much skill if it is to be done efficiently. For example, with careful planning and execution, a skilled man can fell a series of trees like dominoes in the time it take to otherwise fell a single tree. There are also two carrying

tasks-- transporting firewood and harvests from the garden to the home--- that require great neck and back strength, and are frequently performed by women. Charred and dried logs that have remained after burning the fields are ideal for firewood. Women returning from work in the fields will typically transport firewood, or harvests – weighing up to 80 pounds per load— to their houses in cotton bags, baskets or makeshift slings suspended from their heads. Children frequently assist with harvesting and make significant contributions to the food processing tasks described below.

This small-scale gardening approach yields a moderate and consistent level of production, which distributes well among extended nuclear family production units but leaves little surplus (except that which goes toward social celebration in the form of *shocdye*, fermented manioc beverage).

Successful gardening, such as seen with the Tsimane involves a great deal of knowledge about cultigen varieties, and requires execution of many careful decisions based on knowledge and risk assessment: garden site choice, timing of garden preparation, burning, and planting, choice of crops to plant, strategy for tending crops and weeding, and how long to leave plots fallow. When asked, many Tsimane report that success with horticulture is dependent on hard work, knowledge of plants, soils, and garden requirements, but also behaving in accordance with certain beliefs. Tsimane believe that every plant has an *amo* (protector), and that aspects of human behavior (either angering or pleasing the spirits) can affect the success one has with planting and harvesting crops. Piland (1991) has identified a Tsimane horticultural knowledge system that, in addition to precautionary rules, behavior taboos, and folklore, includes a detailed taxonomy of soil types and their optimal uses, as well as three conceptually distinct productive systems that the average adult exploits: house gardens, horticultural fields or "chacos" *(quijodye')*, and fallows or "barbechos" (*cum*).

Tsimane also practice a simple form of animal husbandry that allows them to allocate capital to small edible domesticated animals such as chickens, ducks, pigs, and, occasionally, cattle. While necessary for the keeping of animal stocks, Tsimane tend to invest minimally in structures built for the confinement of domesticated animals and in provisioning of feed. Chicken and pigs often wander freely during the day, foraging on available resources and any feed provided by humans. Consequentially, domesticated animals are regularly intruding into homes and gardens, requiring that they be shooed and blocked access to restricted areas. By cultivating a stock of edible domesticated animals (e.g. chickens, ducks, pigs), one develops a buffer against seasonal food shortage (Undurraga et al., 2013) and amasses a stock of goods available for sale or barter. According to a survey of Tsimane households by Undurraga and colleagues (2013), 88% owned chickens, 27% owned pigs, 13% owned ducks, and 8% owned cattle.

In addition to using an axe and a machete (investigated as part of the tool use category described above), five skills used by both men and women in the gardening and husbandry category were investigated: knowing how to find a good place for a garden, knowing how and when to burn field, knowing how to weed a garden, feeding and shooing domesticated animals, and knowing how to sow with a machine.

Food Processing

Food processing (following harvest) of corn, rice, and manioc into edible forms, which is an on-going daily activity, requires a considerable amount of time and energy (Gurven et al. 2009). Women and female children are largely responsible for the processing. While larger game animals are often quartered in the forest for easier transport, and fish are often cleaned and processed on site at the water's edge, smaller game animals often arrive at the house whole, where they are butchered and prepared for cooking. Salting and smoking are the only food preparation options available that can extend the storage life of food items. When large quantities of perishable food become available (e.g. from a successful fishing trip), smoking racks are often constructed and the watchful task of smoking fish follows. These game processing tasks are commonly carried out by older female children, sometimes with assistance of siblings, or else by adult females with the assistance of children. The skinning stretching, and tanning of animal hides is a time consuming task performed exclusively by men. Unless economic value can be likely produced (e.g. from the sale of a prepared ocelot hide to interested tourists), many men do not consider it worthwhile to skin animal hides and choose to forgo the activity when processing game.

In addition to using a machete (investigated as part of the tool use category described above), six skills used by both men and women in the food processing category were investigated: quarter and clean meat, skin animal hides, gut fish, make smoking rack, smoke fish and meats, and process rice.

Childcare and Reproduction

Infants, babies, and children are primarily cared for by their mothers, but also by older siblings, fathers, and grandparents, though childbirth and breastfeeding are clearly obligations of females. Breastfeeding is exclusively performed by biological mothers, maternal age is not a predictor of breastfeeding patterns, and full weaning occurs at 19.2(+/- 7.3) months (Veile et al., 2014). Caretakers of Tsimane children engage in many of the same forms of care seen around the world, including holding, swinging, rocking, playing, comforting, cooing, kissing, hugging, grooming hair and body, dressing, cleaning and changing clothes, bathing, fanning when hot, and keeping out of harm's way. These caretaking behaviors, along with feeding, treating sickness, and treating insect bites are crucial for making children comfortable and stopping them from crying. Additionally, children are both directly and indirectly educated about how to properly treat others, deal with food and body waste, and, when they engage in serious transgressions, are reprimanded and scolded. Samples of time allocations made in villages by Winking (Winking et al. 2009) reveal that men contributed 8.6% of their time in the village to parental care (mostly in the form of play), as opposed to women who contributed 39.4% of their time to parental care (with 17% of this mothering time accounted for by breastfeeding, and much of the remaining time in the form of grooming). Tsimane woman, on average, become mothers by age 18, grandmothers by age 36, and great-grandmothers by age 54 (Gurven and Kaplan 2007). Within marriages, inter-birth intervals average approximately two and a half years. The relatively high fertility of Tsimane (Total Fertility Rate is 9 children, Gurven et al., 2012) gives older individuals greater opportunity to help descendant kin.

Ten skills in the childcare and reproduction category were investigated including seven skills pertaining to both genders (identify medicinal plants, know how a woman can avoid reproducing, care for children to make them stop crying, feed children, clean and change children, treat and heal children when they suffer from insect bites, skin problems, or wounds, and treat sick children), two skills exclusive to women (give birth and breast feed), and one skill exclusive to men (obtain sexual exploits).

(2) Complementary skills important to family organization, cooperation, and socialization

Household Chores and Craft Production

Households can consist of one to four nuclear families. While a Tsimane encountered at home might not be considered to be "working" as he or she would be if in the garden or forest, a number of activities usually keep men, women, and children occupied around home (particularly women and female children, see Gurven et al. 2009). Household activities –which can often be engaged in simultaneously while having conversation or singing to one's self—include food processing and childcare (see above), household chores and craft production (see below). The Tsimane household is also a social unit. High levels of visiting and sharing among members of different households are usually associated with beer consumption. Huge vats of *shocdye,* (manioc beer, often with corn, plantain, or palm fruit adjuncts) attract visitors from other household clusters and even other villages, who gather around to drink and talk about hunting, fishing, other activities, and social gossip. Serving *shocdye* is a form of hospitality, and women often act as servers, providing bowls of the thick beer to guests. Older adults often provide entertainment to their peers and juniors by retelling the hunt, telling traditional stories, interpreting dreams, singing and performing instrumental music (see below).

Household Chores

Household chores include sewing and mending clothes (see craft production below), washing clothes (usually done at a water source near the house), cleaning dishes, cleaning the floor, putting things away, watching the house while others are gone, getting water, sharpening sticks, knives, machetes, and axes, processing forest materials for crafts, feeding and shooing domesticated animals (see animal husbandry above), tending the fire, and collecting firewood. Across adult ages, women spend approximately 6-10% of their time around the house (compared to 4-6% for men) devoted to household chores (Gurven et al. 2009). Children (especially females) help with all manner of household chores and processing work, and are often of service by caring for the youngest children and babies while mothers are busy preparing meals or *shocdye* (manioc beer.

Two skills in the household chores category, performed by both males and females, were investigated: collect fire wood / build and tend a fire, and house-sit.

Craft Production

Material culture among the Tsimane is fairly limited to tools and items used for childcare, the home, hunting, fishing, garden production, food processing, clothing, and music. Collected materials from wild and semi-cultivated trees, lianas, grasses, palms, as well as cultivated cotton, and captured prey are used to produce a wide variety of crafts (particular kinds of skilled hand-made works) and items put to use in daily life. Across adult ages, women spend approximately 6-8% of their time around the house (compared to 2-4% for men) devoted to 'manufacture' and craft production (Gurven et al. 2009). Men's and women's respective areas of craft production overlap considerably little (given the relatively gender-neutral nature of other skills domains). Women produce many woven items such as fans and the floor mats that Tsimane often sit on (in addition to the stools or chairs more used by men): the small mat (*tovo*) and the large double mat (*shipna*). They also prepare cotton thread (spinning it and dying it) from which fabric is woven in simple looms (using a loom rod or *sorota*), and with which clothing, "marico" bags (*saraij*), and baby slings/diapers (*cacdyes*) are made. Cotton thread is dyed with the pigments of any of 13 plants (see Reyes-Garcia, 2001). Increasingly, hand-made cotton thread is being replaced by industrially manufactured cotton thread and synthetic yarn obtained through market exchanges, which is preferred by some for its more vibrant colors and uniformity. Men, on the other hand, work mostly with wood (especially hard woods) producing: bows and arrows for hunting, cots (*waracha*) for sleeping, seats (*toco*) for sitting, wheel barrows and carts (*careto*) for transporting heavy objects, axe handles (*cutudye' jai`ñis),* pounders (*väquitydyes*), musical instruments, combs (*fetsi*), a masher (*cham'chudye'*) for cooked manioc, a spindle and spinner (*buma* and *chudye'*) for cotton, and a loom rod (*sorota*) for weaving, rice pounders (*tacu*) for dehusking rice, troughs (*raveta*), grinding plates (*ta'ta'*), houses (*aca*), and rafts and canoes for river and lagoon transportation. While rafts are often makeshift and assembled in a moment's notice, canoe building, based on careful choice of tree, axe work, and the use of fire, is considered a skill that requires much knowledge and expertise. Men and women both work with palms and bamboo to produce roofing panels, manioc beer strainers (*pasi*), and fans (*fifity*). Baskets (*canasto*) and a large hamper basket (*ubu*) are also made out of palms and sometimes grasses. The grass "jipijapa" is also used to make hats (*shomeroro*). Tsimane might dedicate their time to these handicrafts according to their interests, ambition, and other competing demands on time. Some forms of craft production were practiced in the past but no longer today, as the knowledge is no longer shared (except by very few of the oldest), and alternatives are more easily available. For example, before textile clothing was introduced to Tsimane and before they began growing, processing, and weaving cotton for making clothes, the Tsimane used bark of *Poulsenia armata* (*ashava'*), "corteza de corochó" that was processed from trees, for clothing, hammocks, and bags. Before tin, aluminum, and plastic containers were introduced, ceramic vessels such as the large jar "tinaja" or smaller pitcher "cantaro" (*puñuj po`tso*) were formed out of clay and fired. As ceramic vessels are no longer common and not everyone has obtained aluminum and plastic containers, the bowls that men and women make for serving manioc beer are now typically made out of "tutuma" gourds (*erepa*).

The production of twenty seven items (eight large and hardwood woodwork items, four small woodwork items, six textile items, six coarse woven items, and three old tradition items - see category details in Online Supplement 2) were investigated as part of the "craft production" skill category: seven among both men and women (i.e., weave jatata, make strainer, make fan, repair clothes, get/process bark cloth, make woven hat, make large hamper basket), nine among only women (i.e., make large mats, make small mats, weave purse, make thread, dye thread, make clothes, make loom rod for weaving, make baby diaper / sling, make ceramic vessels), and eleven among only men (i.e., make axe handle, make bow, make arrows, make canoe, make house, make comb, make rice pounder, make wheel barrow, make wood grinding plate, make trough, make raft). The production of four musical instruments by males (discussed below), is investigated but included as part of the "musical and oral tradition" skill category.

Social and Market

In the past, Tsimane lived and primarily socialized in family clusters, but would also travel frequently to visit with affinal kin or kin from a distant and natal group. Now that Tsimane live in more centralized indigenous villages, they still associate primarily among family clusters and extended kin networks, but also visit with fellow villagers, non-kin of neighboring villages, maintain relationships with merchants, ranchers, and loggers, and make visits to market centers like San Borja for market activity and benefit collection (from charity and government).

Social Activity

The sharing and consumption of *shocdye*, or "chicha de yuca" in Spanish– a fermented manioc beer, is an added incentive to many Tsimane for making social calls. Experiences, tales, myths, stories, songs and other cultural codes are shared at these times, both seriously and through humor.

Five skills in the social category were investigated, three pertain to both genders (joking around with others and making people laugh, directing and ordering, beating or punishing the bad) and two are performed by only males (organizing a group of community members and speaking in front of a group). These are only a small subset of social skills, and pertain more specifically to skills that are useful in dealing with community members and outsiders beyond the nuclear family.

Market Activity

Increasingly, Tsimane involvement in wage labor or sales of products is becoming a regular component of the set of essential skills. By working for people and selling goods, Tsimane gain access to market goods and services that are otherwise unavailable. Increased involvement in market activities in San Borja and throughout Tsimaneland enhances spatial knowledge of the terrain travelled and familiarity with the network of individuals found across space that can facilitate journeys to and from the market. Material items that are often acquired through trade with travelling merchants or on visits to San Borja market include: aluminum pots, knives, machetes, fabric, clothes, mosquito nets, utensils, kerosene, school supplies, sugar, salt, cooking oil, flour, pasta, and alcohol. In San Borja, sought after services include medical care, bars and food services (often providing audio, video, or karaoke entertainment), and prostitution. In San Borja, Tsimane can also meet with members of their tribal council and collect their "bono solidario" –a type of social welfare subsidy—from the Bolivian government.

Wage labor for Tsimane in the study region, during the years 2004-2008, was roughly 25 Bolivianos a day (during this time the value of 1$ US fluctuated between 6.5 and 7.8 Bolivianos). Tsimane' men find opportunities to engage in wage labor by finding work providing manual labor for ranchers, loggers, and merchants. Women rarely have opportunities to engage in wage labor and the few cases of Tsimane' women finding money opportunities include working as cooks for logging camps, domestic duties in San Borja, and an isolated case of prostitution in a San Borja brothel. Wage labor opportunities often require men, occasionally accompanied by their wives, to leave their homes and families for a period of time. It is often observed that parental absence affects the quality of life for children (e.g. children left behind receive inferior care from siblings or relatives, instead of parents, and are delegated additional tasks) and husband absences appear to coincide with marital problems, likely due to sexual jealousy and problem arising from spending money away from the home as well as the problems resulting from the consumption of alcohol (Stieglitz, 2009).

Tsimane also become involved in the market economy by selling products such as rice and jatata panels. The trend towards monocropping (occasionally plantain and more frequently rice) for the purpose of selling harvests, and away from polycropping, is increasing among villages closer to the San Borja market and roads that bring commerce (Alvarado, 1996), and has been documented as leading to a loss in agrobiodiversity (Ribera, 2002). Large rice fields are also occasionally planted with a simple non-motorized planting machine. Because of their intimate knowledge and targeting of local soils, use of rice varietals, staggered planting strategy, and careful tending of their crops, Tsimane are very effective rice farmers, with yields per hectare almost twice as productive as world-wide averages, and almost three times as productive as yields from colonist farmers in Yucumo (Piland, 1991). Jatata panels woven from leaves of the jatata palm (*Geonoma deversa)* are the primary product sold and exchanged with trader merchants along the rivers. Jatata panels are very desirable for use as roofing panels due to their durability, insect and water resistant properties, breathability (allowing smoke and ventilation to pass through) and tendency to not become heated by the sun like corrugated metal roof. Traders acquire large quantities of woven roofing panels of jatata often via barter, less frequently via cash purchase. Quite often, jatata is exchanged for alcohol, and in a highly inequitable manner when traded this way (Añez 1992).

Four skills, performed by both men and women that relate to the pursuit of economic "opportunities" are investigated with the *Skills Survey*: getting to San Borja, obtaining work (e.g. with traders, loggers, and ranchers), selling products, and collecting government subsidies.

Music and Stories

Prior to introduction of modern forms of standardized scholastic education, the historic record, and popular media (often transmitted by outsiders), oral traditions of storytelling and singing (and musical traditions that accompanied them) acted as culturally styled systems of socialization (Coe et al., 2006) and cumulative knowledge broadcast by local experts (Scalise Sugiyama, 2011). These experts were regularly encountered among one's family at home, but also through social contact with and extended network of relatives, friends, and neighbors.

Music

The themes of traditional Tsimane songs are forest plants, garden plants, mythical creatures, animals, and people. Songs are sung to others, usually among the confidence of close kin, and sometimes to larger groups of people during festivals where there is much drinking, but also many adults sing in private and would not be comfortable singing in the presence of others. Perhaps due to decreased levels of social anxiety, older adults who are more recognized as musicians (though not necessarily better musicians) tend to perform music more readily at the request of others, or even volunteer to play instruments or sing to groups of people during social gatherings. Instrumental music using flutes or violins that may or may not accompany singing often is based on the recognizable melodies from well-known songs with lyrics and may also be played as traditional party music (played by a band usually composed of a flute along with percussion: *bombo* – the bass drum, and *ricarica* – the snare drum). The hand-making of musical instruments investigated (flute, bass drum, violin, and snare drum) is considered a musician's skill because Tsimane musicians typically fashion their own instruments.

Eleven music related skills were investigated: seven exclusive to men (making a flute, making a bass drum, making a violin, making a snare drum, playing violin, playing flute, playing snare drum) and four pertaining to either gender (singing in front of a group, singing in private, composing music, playing a bass drum).

Stories and Dreams

Storytelling among Tsimane (whether myths, fables, historical or personal stories) shows the same three thematic elements that have been consistently noted for storytelling across cultures: social information, subsistence information, and information about structuring of the world (Huanca, 2006, Scalise Sugiyama, 2001). For example, many Tsimane myths explain the origins and destiny of people, plants and animals, structuring of the world, astral phenomenon, and special events (solar eclipse, wildfires, windstorms). Things and ways of life important to Tsimane, such as salt (specifically local sources), horticulture (e.g., manioc, plantain, maize, tobacco, and cotton), making fire, preparing and preserving meat, acquiring metal tools, marriage, sexual affairs and murder all appear in the traditional stories. Also embedded in many myths and stories is spatial and foraging knowledge specific to the group and local ecology (Scalise-Sugiyama, 2011). For example, according to Huanca (2006, p.7), a specific alignment of the Milky Way with respect to the Maniqui River as described in a myth, serves to indicate to Tsimane "the right time to use poison for fishing". Myths about forest spirits (various gods over trees, wild animals and fish) and their abodes correspond to knowledge about locations of good salt sources and hunting grounds. Other stories, which feature the travels, sexual pursuits, problems, and adventures of various ancestral or mythical characters, transmit various social norms, morals, and respect for emotions that helps socialize children.

It has been suggested that with modern schooling and other new forms of information broadcast (television and movies, the radio, news media, the Internet) being increasingly utilized in forager societies – the perceived value of musical and oral tradition diminishes, and the system of vertical transmission by which it has been maintained over generations breaks down (Zent, 2001). In addition to traditional stories and traditional songs with lyrics, there is a repertoire of more improvisational and personally relevant oral transmission, for example Tsimane will "retell the hunt" (a common practice across foragers: see Blurton Jones and Konner, 1976 ; Bieselle 1993; Scalise Sugiyama 2011) and perform something like "blues singing" (where details of love affairs, sexual exploits, complaints, lamentations, and confessions are sung -- often in a drunken state). Tsimane will also retell their dreams (typically during early hours of the morning in the company of family members) and older specialists will offer interpretations of the dream elements and possible omens.

Two skills relevant to oral transmission were investigated: knowing the traditional stories and myths, and interpreting dreams. To examine the relationship between knowledge of a traditional story and propensity to tell it, a follow-up *Traditional Stories Survey* of 120 stories and myths was conducted among 54 informants knowledgeable of traditional stories and myths.[3]

[3] While a complete report of results from the *Traditional Stories Survey* is unavailable at this time, we report that there was substantial variation among those reporting knowledge of traditional stories indicating the specialized nature of this skill: among the 54 interviewed informants knowing traditional stories and myths, an average of 32.4 stories (27% of 120 stories) were reported "known". 52 of 54 informants (96%) reported also regularly "telling" one or more of the traditional stories they knew. While some of these story tellers reported a repertoire of as many as 110 stories (and others reportedly told only 1 story), the average storyteller reported a repertoire of 22 stories.

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Online Supplement 2: 92 Essential skills investigated with the *Skills Survey,* ranked by difficulty.

Gender Specific	Skill #	Skill Description	Performance Difficulty (SEM) μ = 1.96	Learning Difficulty (SEM) μ = 1.55	Difficulty Composite[4]
♀	1	make ceramic vessels	2.50 (.289)	2.25 (.250)	2.518
♀	2	give birth	2.91 (.026)	2.02 (.033)	2.470
♂	3	make wheel barrow / cart	2.76 (.106)	2.06 (.059)	2.357
♂	4	make canoe	2.78 (.060)	2.03 (.048)	2.300
♂	5	make trough	2.77 (.054)	1.94 (.049)	2.019
♂	6	make bass drum	2.59 (.093)	1.97 (.060)	1.830
♀	7	make loom rod for weaving	2.56 (.166)	1.94 (.127)	1.695
♂	8	make wood grinding plate	2.73 (.056)	1.82 (.043)	1.603
♂	9	make snare drum	2.66 (.081)	1.77 (.072)	1.348
	10	get / process bark cloth	2.73 (.065)	1.73 (.056)	1.338
♂	11	make violin	2.66 (.094)	1.76 (.088)	1.318
	12	make beer strainer	2.52 (.084)	1.83 (.067)	1.309
♂	13	make rice pounder	2.49 (.059)	1.80 (.040)	1.175
	14	treat / heal sick children	2.53 (.040)	1.76 (.028)	1.118
	15	obtain honey	2.60 (.050)	1.72 (.038)	1.108
♂	16	make comb	2.48 (.075)	1.76 (.062)	1.041
♂	17	make house	2.44 (.045)	1.78 (.033)	1.039
♀	18	weave purse	2.44 (.059)	1.77 (.037)	1.009
♂	19	play violin	2.37 (.105)	1.77 (.073)	0.901
	20	get to San Borja	2.42 (.042)	1.74 (.024)	0.890
	21	direct and order	2.32 (.092)	1.76 (.061)	0.795
♂	22	play flute	2.26 (.110)	1.78 (.082)	0.761
♂	23	make axe handle	2.33 (.057)	1.73 (.040)	0.722
♂	24	use magic amber	2.46 (.090)	1.66 (.058)	0.715
	25	make woven hat	2.23 (.145)	1.77 (.089)	0.686
♂	26	organize a group of community members	2.13 (.124)	1.80 (.088)	0.620
	27	use axe	2.30 (.037)	1.71 (.025)	0.617
♀	28	make thread	2.32 (.060)	1.69 (.042)	0.588
	29	train hunting dogs	2.37 (.054)	1.66 (.037)	0.577
	30	compose music	2.27 (.135)	1.70 (.098)	0.541
♂	31	play snare drum	2.26 (.098)	1.70 (.079)	0.525
	32	how to weed garden	2.39 (.036)	1.63 (.026)	0.519
	33	make smoking rack	2.32 (.064)	1.65 (.045)	0.470
♀	34	make small square mat	2.28 (.113)	1.67 (.065)	0.468
♂	35	track animals	2.29 (.057)	1.66 (.035)	0.454
	36	find, produce and use various barbascos	2.23 (.047)	1.68 (.032)	0.420
♂	37	make bow	2.24 (.063)	1.67 (.041)	0.406
	38	know traditional stories / myths	2.22 (.102)	1.68 (.088)	0.405
	39	obtain work with traders, loggers, ranchers	2.27 (.062)	1.65 (.039)	0.393
	40	sing in front of group	1.86 (.155)	1.86 (.108)	0.381
	41	beat or punish the bad	2.27 (.237)	1.64 (.152)	0.364
♀	42	make clothes	2.25 (.078)	1.64 (.050)	0.333
	43	identify medicinal plants	2.26 (.050)	1.62 (.035)	0.289
	44	sing in private	1.93 (.074)	1.78 (.044)	0.253
	45	obtain government subsidies	2.18 (.296)	1.64 (.152)	0.225
♂	46	speak in front of group	2.14 (.143)	1.66 (.091)	0.223

[4] Difficulty composite $= -7.97 + 1.54 \cdot$ Performance Difficulty $+ 2.95 \cdot$ Learning Difficulty.

Online Supplement 2 Table (continued)

Gender Specific	Skill #	Skill Description	Performance Difficulty (SEM) μ = 1.96	Learning Difficulty (SEM) μ = 1.55	Difficulty Composite[5]
	47	care for children to make them stop crying	2.22 (.046)	1.59 (.029)	0.139
♂	48	make weir / fish trap	2.21 (.066)	1.59 (.046)	0.124
	49	weave jatata	2.12 (.045)	1.59 (.028)	-0.015
♂	50	skin animal hides	2.29 (.090)	1.49 (.060)	-0.048
	51	know how women can avoid having children	2.15 (.099)	1.55 (.066)	-0.086
♂	52	make flute	1.88 (.106)	1.68 (.066)	-0.119
	53	sell products	2.00 (.049)	1.61 (.030)	-0.140
	54	know wild animals diet, habits, and where to find	2.05 (.039)	1.58 (.029)	-0.152
♂	55	travel in the woods without fear	2.02 (.059)	1.57 (.039)	-0.228
	56	interpret dreams	2.10 (.065)	1.51 (.043)	-0.281
	57	process rice	2.03 (.041)	1.53 (.027)	-0.330
♂	58	obtain sexual exploits	2.01 (.079)	1.53 (.048)	-0.361
	59	play bass drum	2.00 (.088)	1.51 (.062)	-0.435
	60	treat / heal children suffering from insect bites, wounds	1.91 (.048)	1.55 (.032)	-0.456
	61	how to sow or harvest with a machine	1.79 (.059)	1.61 (.039)	-0.464
♂	62	make arrows	1.81 (.061)	1.59 (.041)	-0.492
♀	63	dye thread	1.90 (.073)	1.51 (.044)	-0.590
♂	64	make raft	1.93 (.063)	1.49 (.040)	-0.602
	65	care for fowl and animal domesticates	1.95 (.050)	1.47 (.029)	-0.631
	66	use machete	1.86 (.039)	1.51 (.026)	-0.651
	67	know how to find a good place for garden	1.93 (.046)	1.47 (.029)	-0.661
	68	collect fire wood / build and tend fire	1.92 (.041)	1.47 (.026)	-0.677
	69	pole canoe / raft	1.78 (.051)	1.52 (.032)	-0.745
	70	make large hamper basket	1.74 (.052)	1.52 (.033)	-0.806
♀	71	make large woven mat	1.81 (.060)	1.48 (.037)	-0.817
	72	quarter, clean meat	1.78 (.043)	1.48 (.027)	-0.863
	73	smoke fish and meats	1.75 (.042)	1.46 (.027)	-0.968
♂	74	get in the water without fear	1.97 (.077)	1.34 (.055)	-0.983
	75	identify wild animals	1.75 (.037)	1.45 (.026)	-0.998
	76	identify animal tracks and markings	1.72 (.040)	1.46 (.026)	-1.014
	77	house-sit	1.74 (.058)	1.44 (.034)	-1.042
♂	78	shoot arrows	1.62 (.057)	1.50 (.039)	-1.050
	79	identify different fish	1.74 (.040)	1.43 (.026)	-1.072
♀	80	breast feed	1.71 (.062)	1.43 (.039)	-1.118
♂	81	fire shotgun or rifle	1.60 (.051)	1.48 (.037)	-1.140
	82	clean and change children	1.65 (.042)	1.42 (.028)	-1.240
	83	repair clothes	1.61 (.043)	1.43 (.029)	-1.272
♀	84	make baby diaper / sling	1.68 (.077)	1.38 (.046)	-1.312
	85	feed children	1.61 (.042)	1.40 (.025)	-1.361
♂	86	arrow shoot fish	1.52 (.054)	1.44 (.038)	-1.381
	87	know how and when to burn field	1.60 (.041)	1.35 (.026)	-1.524
	88	know where to find fish	1.51 (.037)	1.37 (.025)	-1.603
	89	identify wild fruits	1.43 (.035)	1.36 (.024)	-1.756
	90	make fan	1.39 (.039)	1.38 (.029)	-1.758
	91	joke around with people /make others laugh	1.46 (.044)	1.34 (.031)	-1.769
	92	gut fish	1.22 (.026)	1.28 (.023)	-2.315

[5] $\text{Difficulty composite} = -7.97 + 1.54 \cdot \text{Performance Difficulty} + 2.95 \cdot \text{Learning Difficulty}$

Online Supplement 3: Skill Categories

Categories (1) and (2) contain all skills from the *Skills Survey*. Categories (1) and (2) and the subsets within are mutually exclusive.

(1) Food production and childrearing

food production: 15, 24, 27, 29, 32, 33, 35, 36, 48, 50, 54, 55, 57, 61, 66, 67, 69, 72, 74, 75, 76, 78, 79, 81, 86, 87, 88, 89, 92

tool use: 27, 66, 69

hunting: 15, 24, 29, 35, 54, 55, 75, 76, 78, 81, 89

fishing: 36, 48, 74, 79, 86, 88

gardening & husbandry: 32, 61, 65, 67, 87

food processing: 33, 50, 57, 72, 73, 92

childcare and reproduction: 2, 14, 43, 47, 51, 58, 60, 80, 82, 85

(2) Complementary skills important to family organization, cooperation, and socialization

household chores & craft production: 1, 3, 5, 7, 8, 10, 12, 13, 16, 17, 18, 23, 25, 28, 34, 37, 42, 49, 62, 63, 64, 67, 68, 70, 71, 77, 83, 84, 90

household chores: 68, 77

craft production: 1, 3, 5, 7, 8, 10, 12, 13, 16, 17, 18, 23, 25, 28, 34, 37, 42, 49, 62, 63, 64, 67, 70, 71, 83, 84, 90

large or hardwood woodwork: 3, 5, 8, 13, 17, 23, 64, 67

small item woodwork: 7, 16, 37, 62

textiles: 18, 28, 42, 63, 83, 84

coarse woven: 12, 34, 49, 70, 71, 90

old tradition: 1, 10, 25

social and market: 20, 21, 26, 39, 41, 45, 46, 53, 91

social activity: 21, 26, 41, 46, 91

market activity: 20, 39, 45, 53

music and stories: 6, 9, 11, 19, 22, 30, 31, 38, 40, 44, 52, 56, 59

music: 6, 9, 11, 19, 22, 30, 31, 40, 44, 52, 59

stories & dreams: 38, 56

(3) Other categories for comparing skills (alternative to categories (1) and (2) above)

categories capturing secular trends

traditional skills common in the sample and expected to be common in samples of subsequent generations: 14, 27, 32, 60, 65, 66, 69, 75, 87, 88

traditional skills suspected to be "vanishing" (i.e., will not be acquired by younger or next generations): 1, 3, 6, 9, 10, 11, 25, 37, 38, 43, 62

"modern" skills: 26, 39, 61

categories based on high strength-requirement for practicing skill

requiring strength: 2, 15, 17, 27, 32, 35, 36, 39, 41, 57, 61, 66, 67, 69, 74

not-requiring strength: 1, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 16, 18, 19, 20, 21, 22, 23, 24, 25, 26, 28, 29, 30, 31, 33, 34, 37, 38, 40, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 58, 59, 60, 62, 63, 64, 65, 68, 70, 71, 72, 73, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92

categories based on type of production associated with skill

food production: 15, 24, 27, 29, 32, 33, 35, 36, 48, 50, 54, 55, 57, 61, 66, 67, 68, 69, 72, 73, 74, 75, 76, 78, 79, 81, 86, 87, 88, 89, 92

non-food production: 1, 3, 5, 6, 7, 8, 9, 10, 11, 12, 13, 16, 17, 18, 19, 22, 23, 25, 28, 30, 31, 34, 37, 38, 40, 42, 43, 44, 45, 49, 51, 52, 56, 59, 62, 63, 64, 65, 67, 70, 71, 77, 83, 84, 90

Online Supplement 4: Information about 8 villages sampled.

8 Tsimane' villages were sampled in this study. These are semi-permanent villages, distanced from non-indigenous villages, and found between the departments of La Paz and Beni of Bolivia. They lie in a region of the Amazon basin through which the Maniqui and Quiquibey river systems flow. Transportation occurs along rivers and roads, and along lightly trodden paths connecting communities through the forest. Logging roads to forest villages in the interior become impassible during the wet season, cutting off trade routes. The Maniqui is navigable by dugout canoe year round. However, during the dry season the Maniqui is cut off from trade that depends on motorized canoe travel. Seasonal floods causing crop loss, food shortages, and migration occur regularly on a 7-8 year flood cycle caused by 2 principal weather patterns, El Niño and the Southern Oscillation cycle.[6]

Tsimane living in these villages build their residential shelters of natural materials and subsist almost entirely on non-market sources. Tsimane' demonstrate a fair amount of flexibility in location of both residential and garden location, and in reusing areas after long periods of fallow, foraging from areas others have abandoned, and managing natural ecosystems.

Below we indicate which of three eco-regions each sampled village can be grouped with: (Road) along roads closer to San Borja, (Forest) in the interior forest (along seasonally impassible logging roads), or (River) along the Maniqui, up-river from San Borja. The closest market center and town is San Borja (14° 51′ 30″ S, 66° 44′ 51″ W). Travel distance in kilometers from San Borja (TDSB) is given for each village in the table below. TDSB was calculated for each village, tracing most common overland or river routes of transport. Populations reflect census data from time of sample.

Village	Eco-region	TDSB (km)	Population	Occupied residential structures	Residential clusters
1	Road	23.4	325	63	15
2	Road	32.5	313	60	9
3	Road	46.8	95	20	6
4	Forest	59.5	95	13	4
5	Forest	66.9	76	20	6
6	Forest	92.3	113	18	8
7	River	89.7	221	42	9
8	River	100.8	66	14	5

[6] see Aalto, R., Maurice-Bourgoin, L., Dunne, T., Montgomery, D.R., Nittrouer, C.A., & Guyot, J. 2003. Episodic sediment accumulation on Amazonian flood plains influenced by El Niño/Southern Oscillation. *Nature*, 425:493-497.

Online Supplement 5: Statistical Model of Expert Nominations

The statistical analysis of expert nominations N_{ie}^{s} resembles that of the proficiency reports P_{i}^{s} but introduces new conditioning variables and requires attention to some additional statistical issues. We view the probability Π_{ie}^{s} that informant *i* nominates potential expert *e* as an actual expert at skill *s* as $Prob(N_{ie}^{s} = 1|A_e, X_e, A_i, X_i, R_{ie}, Z^s, \bar{H}_e^s)$. The focus of attention here is how the likelihood of expert nomination depends on the age A_e of the potential expert. Six other conditioning factors appear in this probability:

(1) other characteristics of potential expert *e*, captured by a vector of characteristics X_e (potential experts' gender and village);
(2) informant *i*'s current age A_i (knowledge of others' expertise may depend on informant age);
(3) other characteristics of informant *i*, captured by a vector of informant characteristics X_i (informants' gender and interviewer);
(4) relationships between informant *i* and potential expert *e*, captured by a vector of indicator variables R_{ie} (spatial relationships and kin relationships discussed below, identical versus contrasting gender, and whether the potential expert is older or younger than the informant, also discussed below);
(5) other characteristics of skill *s*, captured by a vector of skill characteristics Z^s (skill category, skill difficulty D^s and strength requirement M^s); and
(6) the gender-specific base rate $\bar{H}_e^s$ of having skill *s* in the sample of informants. $\bar{H}_e^s$ is the mean of H_i^s over all informants *i* of the same gender as potential expert *e*.

The single most important determinant of expert nomination is spatial proximity. Nomination of a potential expert in a village other than the informant's own village is exceedingly rare (<1% of all expert nominations), so R_{ie} includes an indicator for *i* and *e* residing in the same village. R_{ie} also includes indicators for *i* and *e* residing in the same residential cluster, and for *i* and *e* residing in the same structure as indicated by GPS locations. Sharing a residential structure turns out to be an insignificant predictor above and beyond sharing a village and residential cluster.

Figure OS5-1 shows how expert nomination rates depend on both consanguineal and affinal relatedness between informants and potential experts. Consanguineal relatedness is expressed with the coefficient of relationship *r*, as defined by Wright (1922).[7] We also use an affinal coefficient of relatedness, based on consanguineal relatedness (*r*) calculated from the spouse's perspective. In the region of the figure where both the consanguineal and affinal coefficients of relatedness are less than one-fourth, the expert nomination rate is a mere 0.0014: outside of that region the expert nomination rate is 0.038, easily an order of magnitude higher. The figure also makes it clear that there are very high rates of nomination of selves (0.22) and spouses (0.085). To control for these effects, R_{ie} includes two sets of six category indicators of consanguineal and affinal coefficients of relatedness as given on the axes of Figure OS5-1.

Respect, reverence, and deference to older adults is nearly universal across cultures (Simmons, 1945; Silverman & Maxwell, 1978).[8] Out of this deference to elders comes the bias to over-attribute expertise and productivity to older adults who might, in fact, be well past their primes (Silverman & Maxwell, 1978; Palmore, 1999; Henrich & Gil-White, 2001).[9] For this reason we evaluate whether informants are more likely to nominate someone older than themselves as an expert. To capture this, R_{ie} includes an indicator for informant *i* being younger than potential expert *e*. Estimates of this effect always show a positive shift in the log odds of nomination when the informant is younger than a potential expert, but this only reaches conventional significance in the case of male potential experts. For example, the magnitude of the log odds shift is +0.26 (standard error of 0.066) in the estimated equation underlying the male panel b of Figure 10. Examination of that figure confirms that the range of estimated variation of the log odds ratios due to absolute expert age (for instance, about 5 for the music and stories category) dwarfs the +0.26 shift due to the potential expert simply being older than the informant.

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[7] Wright, Sewall (1922). Coefficients of inbreeding and relationship. *American Naturalist 56*: 330–338

[8] Simmons, L. W. (1945). *The role of the aged in primitive society.* England: Archon Books.
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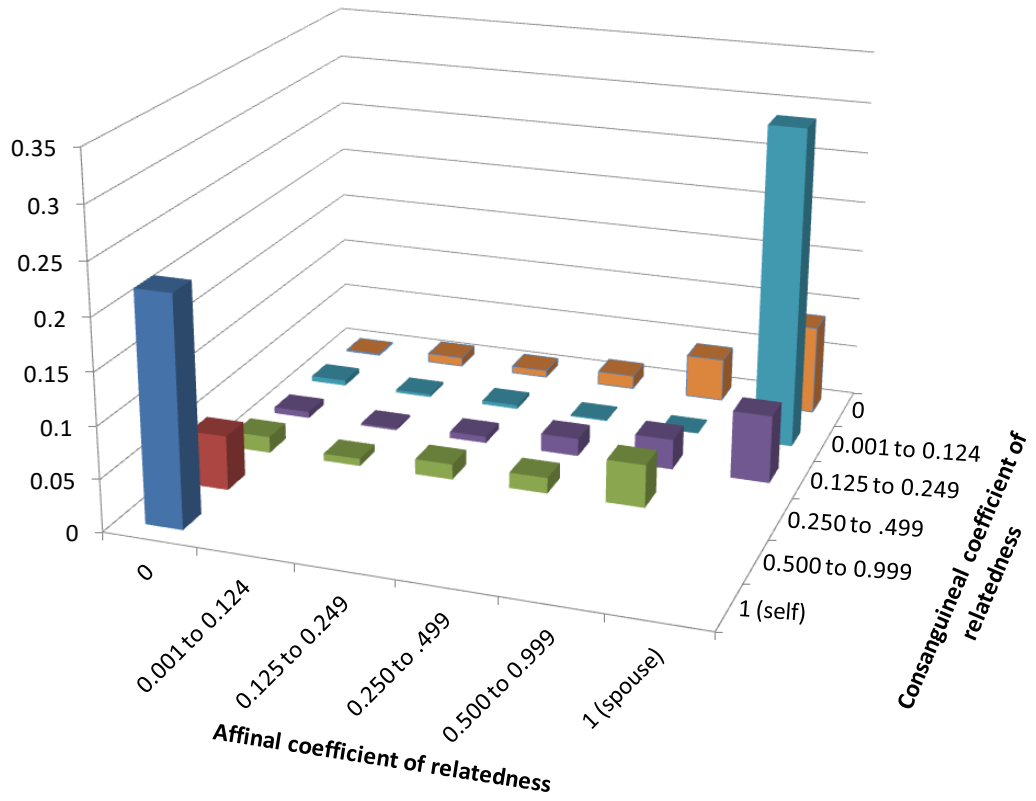
[9] Palmore, E. B. (1999). *Ageism: Negative and positive*. Springer Publishing Company.
(other references available in the publication's References section)

Figure OS5-1. Conditional probabilities of expert nomination, given consanguineal and affinal coefficients of relatedness to the informant



The skill base rates $\bar{H}_e^s$ appear in the model in a specific manner that meets a specific purpose. To illustrate this, consider the following simplified inference situation where the focus of attention, A_e, is the only conditioning variable aside from knowing whether potential expert *e* has skill *s*, which we will denote by $H_e^s = 1$ (zero otherwise). When we analyze expert nominations, we really want to analyze $Prob(N_{ie}^s = 1|A_e, H_e^s = 1)$, that is, the probability of nomination given the age of potential expert *e* and also given that potential expert *e* actually has skill *s*. The analytical problem is that we do not always observe H_e^s (we only observe it when potential expert *e* is among our 421informants; and as discussed in the text, there are an additional 176 potential experts who are not informants—none of these were interviewed and hence we do not know H_e^s for these individuals). By the law of iterated expectations, we have:

$$Prob(N_{ie}^s = 1|A_e) = Prob(N_{ie}^s = 1|A_e, H_e^s = 1)Prob(H_e^s = 1) + Prob(N_{ie}^s = 1|A_e, H_e^s = 0)Prob(H_e^s = 0).$$

Since $N_{ie}^s = 1$ is extraordinarily rare when we know that $H_e^s = 0$ (that is, when *e* is one of our 421 informants and *e* says she does not have skill *s*), we are willing to assume that $Prob(N_{ie}^s = 1|A_e, H_e^s = 0) \approx 0$ everywhere. This is the assumption that informants never nominate an individual who does not have skill *s*—whether or not we can observe H_e^s. Under this assumption, the previous expression becomes:

$$Prob(N_{ie}^s = 1|A_e) \approx Prob(N_{ie}^s = 1|A_e, H_e^s = 1)Prob(H_e^s = 1).$$

The next important assumption is that the 421 informants and the 176 extra potential experts have essentially the same values of $Prob(H_e^s = 1)$. Given that assumption, we may approximate $Prob(H_e^s = 1)$, the base rate for having skill *s*, by the sample proportion of informants who have skill *s*, in which case the expression becomes:

$Prob(N_{ie}^{s} = 1|A_e) \approx Prob(N_{ie}^{s} = 1|A_e, H_e^{s} = 1)\bar{H}_e^{s}$.

This gives us the form of our model of expert nomination probabilities Π_{ie}^{s}. We use the generalized linear model for the term $Prob(N_{ie}^{s} = 1|A_e, H_e^{s} = 1)$, as in the case of proficiency reports; however, we now multiply this by the base rate estimate $\bar{H}_e^{s}$. In this simple case where A_e is the only conditioning variable, this gives the model:

$\Pi_{ie}^{s} = Prob(N_{ie}^{s} = 1|A_e) = [1 + exp(-\eta_{ie}^{s})]^{-1}\bar{H}_e^{s}$, where

$$\eta_{ie}^{s} = a_1(A_e - 35) + a_2(A_e - 35)^2 + a_3(A_e - 35)^3 + a_4(A_e - 35)^4 + f.$$

In the simple case, *f* is just a constant representing the value of the linear predictor for potential experts of age 35 and, as before, the polynomial in A_e represents changes in the linear predictor relative to the age 35 value. Going back to the full model simply involves replacing the constant f by a function $f(X_e, A_i, X_i, R_{ie}, Z^{s}, \theta)$, linearly composed of the conditioning variables, each weighted by estimable parameters in a vector θ. The parameters θ and *a* are estimated by maximum likelihood.

One other important matter needs comment. As mentioned in the text, each informant *i* could nominate up to three potential experts *e* as actual experts in each skill *s*: In the pilot study, no one ever nominated more than three individuals, so we imposed this constraint on total nominations in the full study. This implies that observations for which $N_{ie}^{s} = 0$ add no new error degrees of freedom above and beyond the error degrees of freedom added by observations for which $N_{ie}^{s} = 1$. Put somewhat differently, consider a unisex skill, for which there are 597 potential experts. When informant *i* nominates three specific experts, we may think of her response as a 597-element vector composed of 3 ones (the individuals she nominated) and 594 zeroes. Because the 594 zeroes are fully determined by the locations of the 3 ones, none of these zeroes add anything to error degrees of freedom. The locations of these zeroes *are* useful sample information since the identity and conditioning variable values for un-nominated individuals are just as informative as the identity and conditioning variable values of nominated individuals. But the entire 597-element vector only adds three error degrees of freedom to any finite sample statistic that depends on total error degrees of freedom, such as *t*-tests or *F*-tests—not 597 degrees of freedom. Fortunately, correcting the degrees of freedom of any finite sample test statistics is very simple, and we do so as needed.

Online Supplement 6: Table showing estimated acquisition hazard rates[10] and test for rate change[11] across age cohorts for 92 skills investigated with the *Skills Survey*

Skill Category	skill #	Skill	est % change[a]	Z[b]
food production	92	gut fish	5.02	0.70
	89	identify wild fruits	1.08	0.15
	88	know where to find fish	–0.30	–0.04
	66	use a machete	–2.73	–0.38
	86	arrow shoot fish	–3.24	–0.44
	57	process rice	–4.67	–0.64
	79	identify different fish	–4.92	–0.68
	75	identify wild animals	–5.27	–0.73
	78	shoot arrows	–7.11	–0.97
	76	identify animal tracks and markings	–7.92	–1.09
	73	smoke fish and meats	–9.44	–1.31
	32	weed garden	–10.34	–1.43
	87	know how and when to burn field	–12.35	–1.72
	27	use an axe	–12.53	–1.74
	81	fire shotgun or rifle	–12.90	–1.77
	65	care for fowl and animal domesticates	–12.97	–1.81
	35	track animals	–13.40	–1.84
	54	know what wild animals eat, habits, where to find them	–13.68	–1.91
	72	quarter, clean meat	–13.99	–1.95
	55	travel in the woods without fear	–15.03	–2.07
	69	pole a canoe/raft	–16.05	–2.25
	48	make weir / fish trap	–19.52	–2.71
	67	find a good place for a garden	–19.25	–2.72
	36	find and get various barbascos	–21.16	–3.01
	29	train hunting dogs	–32.02	–4.73
	50	skin animal hides	–34.48	–5.00
	24	use magic amber	–35.02	–5.08
	74	get in the water without fear	–35.32	–5.12
	15	obtain honey	–34.56	–5.16
	61	sow with a machine	–36.58	–5.52
	33	make smoking rack	–36.72	–5.53
childcare and reproduction	85	feed children	32.14	0.88
	82	clean and change children	18.09	0.57
	47	care for children to make them stop crying	17.59	0.51
	2	give birth	11.03	0.28
	80	breast feed	7.58	0.19
	14	treat / heal sick children	5.72	0.14
	60	treat / heal children when they suffer from insect bites	–2.78	–0.10
	58	obtain sexual exploits	–18.41	–0.58
	43	identify medicinal plants	–17.41	–0.80
	51	know how a woman can avoid having children	–64.20	–1.35

[10] The estimated percent change in the skill acquisition hazard rate per year between 1960 and 1993.

[11] z-score against the null hypothesis that the skill acquisition hazard rate is constant between 1960 and 1993.

Online Supplement 6 Table (continued)

Skill Category	skill #	Skill	est % change[a]	Z[b]
household chores and craft production	68	collect fire wood and build a fire	–13.01	–0.85
	83	repair clothes	–14.26	–0.93
	71	make lg. woven mat	–16.13	–1.05
	62	make arrows	–19.17	–1.26
	28	make thread	–24.57	–1.64
	90	make fan	–25.99	–1.77
	18	weave purse	–26.63	–1.80
	49	weave jatata	–28.17	–1.94
	37	make a bow	–29.02	–1.98
	17	make a house	–29.21	–2.00
	63	dye thread	–31.35	–2.16
	23	make an axe handle	–32.09	–2.22
	64	make raft	–32.43	–2.25
	13	make rice pounder	–41.13	–2.99
	42	make clothes	–43.39	–3.18
	70	make lg. hamper basket	–43.98	–3.30
	77	house-sit	–45.50	–3.45
	84	make baby diaper/sling	–47.38	–3.55
	8	make wood grinding plate	–54.34	–4.28
	5	make trough	–56.55	–4.52
	16	make a comb	–60.23	–4.94
	4	make a canoe	–62.72	–5.23
	34	make small square mat	–64.12	–5.38
	12	make chicha strainer	–72.30	–6.81
	10	get/process bark cloth	–72.58	–6.85
	7	make loom rod for weaving	–81.58	–7.50
	3	make wheel barrow	–81.55	–7.69
	1	make ceramic vessels	–88.37	–7.78
	25	make woven hat	–81.08	–8.27
social and market	20	get to San Borja	18.19	1.05
	91	joke around with people / make others laugh	6.25	0.37
	53	sell products	5.12	0.30
	39	obtain work with traders, loggers, ranchers	–11.94	–0.75
	21	direct and order	–24.72	–1.65
	46	speak in front of a group	–25.15	–1.67
	26	organize a group of community members	–26.59	–1.77
	41	beat and punish the bad	–45.24	–3.33
	45	obtain government subsidies	–54.00	–4.02
music and stories	56	interpret dreams	–56.22	–3.22
	44	sing in private	–64.53	–3.99
	31	play snare drum	–66.72	–4.07
	52	make flute	–67.44	–4.14
	22	play flute	–69.93	–4.41
	19	play violin	–70.51	–4.48
	9	make a snare drum	–75.03	–4.98
	11	make a violin	–76.16	–5.12
	59	play bass drum	–74.50	–5.12
	6	make bass drum	–81.35	–5.78
	38	know the old stories/myths	–80.00	–5.91
	30	compose music	–87.48	–7.23
	40	sing in front of group	–88.44	–7.41