ELSEVIER

Evolution and Human Behavior 23 (2002) 407–436

Evolution and Human Behavior

Hunting, healing, and *hxaro* exchange
A long-term perspective on !Kung (Ju/'hoansi) large-game hunting

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Receipt of original submission 4 December 2000; Receipt of final revision 26 February 2002

Abstract

The question of why hunters target large game knowing that most of the meat will end up far beyond their own hearths is an intriguing one. It raises the issue of whether foragers pursue nonnutritional goals in food procurement and which goals they pursue. Here, I will use data from studies that have been carried out over a 34-year period among the Ju/'hoansi (!Kung Bushmen) to evaluate four hypotheses concerning why foragers target large game: reciprocity, costly signaling, nepotism, and long-term political goals aimed at bringing about conditions conducive to cooperative breeding. I will propose on the basis of qualitative and quantitative data that (1) all four hypotheses identify benefits that are gained by Ju/'hoansi through producing and distributing a surplus of meat, (2) different benefits might be important at different stages of a man's life, and (3) the pursuit of broader political goals merits serious consideration in accounting for men's work effort.

Keywords: Hunter–gatherers; !Kung Bushmen (Ju/hoansi); Food sharing; Exchange; Cooperative breeding; Costly signaling; Nepotism; Hunting; Trance

1. Introduction

Recent studies have raised the question of why hunters target large game to produce a surplus of meat, which will be distributed widely as if it were a public good (Hawkes, 1991,

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1090-5138/02/$ – see front matter
PII: S1090-5138(02)00096-X

1993). In doing so, hunters forgo opportunities to procure other resources, such as nutritious plant foods and small animals that would yield greater consumption advantages for their own nuclear families. A related and equally interesting question is why wives encourage men to hunt large game if they are not the ones who benefit. And it is not only anthropologists who pose such questions. Successful hunters among the Ju/'hoansi (!Kung Bushmen) of today sometimes complain that they are the ones who do all the work while younger and stronger men lie in the shade, or parade with ghetto blasters, to draw the glances of young women. The issue is an important one for it raises the question of whether foragers pursue nonnutritional goals in food procurement and which goals they pursue. In response, a number of explanatory frameworks have been proposed. In this paper, I will discuss four hypotheses drawn from evolutionary theory and then evaluate the contribution of each with data from the Ju/'hoansi that span a period of 34 years.

2. Hypotheses to account for large-game hunting

2.1. Reciprocity

Perhaps the most parsimonious explanation for hunting large game and sharing the meat is the hunter's interest in future reciprocation (Winterhalter, 1986). Despite the seeming "logic" of this strategy, a number of studies have convincingly demonstrated that returns that good hunters receive from sharing are not proportionate to amounts given, nor are they directed to the giver in repayment (Bahuchet, 1990; Endicott, 1988; Griffin, 1984a; Harako, 1976; Hawkes, 1993; Hawkes, O'Connell, & Blurton Jones, 2001; Kaplan, 1983; Kaplan, Hill, & Hurtado, 1990; Kent, 1993; von Bremen, 1991; Wiessner, 1996; Woodburn, 1998). Given widespread meat distribution without direct repayment, the optimal strategy should be to contribute enough hunting effort to maintain a reputation as a productive member of society, but not more than necessary. And reputation does matter in foraging societies; able-bodied free-riders are scorned (Endicott, 1988, p. 118; Silberbauer, 1981, p. 95).

A second possibility is that reciprocation occurs in another currency, such as labor, assistance during times of sickness, social support, trade, or exchange (Hill & Kaplan, 1993; Kaplan, 1983; Kaplan & Hill, 1985). Such delayed reciprocal exchange has much higher potential than tit-for-tat exchange to insure against unpredictable losses because reciprocation takes place in the currency of what is needed when it is needed (Cashdan, 1985; Sahlins, 1972; Wiessner, 1982). Systematic research in this important area is lacking because of the formidable task of measurement: (1) reciprocation may occur with considerable delay and, thus, be difficult to evaluate within a 1- to 2-year period of fieldwork, and (2) when reciprocity is geared at reducing risk, the costs and benefits of exchange must be measured in terms of cost to the giver relative to benefit to the receiver, not in absolute values (Hill & Kaplan, 1993; Wiessner, in press). Recent studies have indicated that reciprocation paid out in other currencies or delivered in times of extreme need may bring significant benefits to good hunters (Gurven, Allen-Arave, Hill, & Hurtado, 2000; Sugiyama & Chacon, 2000). This area of research, though complex, is well worth pursuing.

2.2. Showing off and costly signaling

As an alternate explanation to reciprocity, Hawkes (1991, 1993) has proposed that men target large game in order to draw social attention or to "show off. " Proposed gains accrue from favorable attention that affects a man's standing relative to other men and thus makes him a more successful competitor for mates and for support in decisions or disputes. Benefits received are mating opportunities rather than increasing survival of offspring resulting from meat provisioning. Reciprocity in the currency of meat is completely removed from the equation.

Subsequently, Smith (1993) charges Hawkes (1993) with solving one collective action problem (provisioning of the collective good of big-game harvests) by deferring it to a second-order collective action problem of social exchange. As an alternative that excludes all forms of delayed reciprocity, Smith and Bleige Bird (2000) turn to Zahavi's handicap principle (Zahavi & Zahavi, 1997) or "costly signaling." In their arguments, procurement and sharing of large game as a collective good provides an honest signal about the hunter's strength, skill, risk taking, and leadership, which is costly in ways not subject to reciprocation. The value to the recipient is the possibility of evaluating the signaler's abilities, qualities, or motivations by attending to the signal rather than discovering these attributes by more costly means. The value to the signaler resides in the information conveyed to those who receive the signal (Zahavi & Zahavi, 1997, p. 88) with resultant increased likelihood of being chosen as a mate or ally, or, in particular, being deferred to in status competition through which individuals may gain access to mates and resources. They illustrate their case with data from the Meriam of Mer Island (Torres Straits), who incur great costs and forgo other more productive activities when hunting sea turtles to provision public funeral feasts but receive no direct rewards for their accomplishments.

Noting that many human displays involve giving, Hawkes and Bleige Bird (2002) go on to explore the distinction between signaling displays that are merely wasteful and "productive displays" in which the substance transferred might be at least as important to the receiver as the signal. For productive displays, the value to the signaler remains the same, that is, the information conveyed to recipients, but the value to the recipients is expanded to include the material stuff transferred in addition to the information. They propose that under certain conditions, selection might favor more productive displays over more wasteful ones. Hawkes and Bleige Bird then discuss large-game hunting among foragers and subsequent meat sharing as a form of productive display. The benefit to the hunter is favorable attention that affects a man's standing relative to other men, making him more successful in status rivalries. The recipients are attracted to such displays because they gain from both the information received and the meat. Here again reciprocity plays no role. With rich and detailed data, Hawkes, O'Connell, and Blurton Jones (in press) provide evidence that good Hadza hunters have harder working and younger wives (Blurton-Jones, Hawkes, & O'Connell, 1997), an outcome that they suggest might be the result of good hunters outcompeting other males for both first and second wives through productive displays. Compelling though these arguments are, productive displays introduce additional costs that cannot be ignored — they not only incur the direct costs of producing the signal,

but also the indirect costs of provisioning potential competitors with goods or foodstuffs on a regular basis. Payoffs for such productive displays would have to be very high to make them worthwhile.

Costly signaling has introduced important considerations to optimal foraging theory—nonnutritional motivations for food procurement and distribution (Boone, 1998). However, in displays involving the participation of more than one individual, for example, monument building (Neiman, 1998), wealth distributions, or group hunting, cooperation during production and distribution may introduce additional payoffs to both the signaler and receiver: social or political groups may be formed, unified, stratified, or reproduced.

2.3. Inclusive fitness

The facts that foragers share meat primarily within the band or camp and that camps are composed of closely related kin (Bahuchet, 1992; Griffin, 1984a, 1984b; Heinz, 1994, Hill & Hurtado, 1996; Lee, 1979; Rai, 1990) suggest that a good part of meat procured by the hunter will end up in bellies of close kin. Through greater hunting effort, a man thus stands to increase his inclusive fitness. Nonetheless, the few studies that have addressed the question of whether families receive more meat from close relatives have yielded negative results. For example, Kaplan's (1983, p. 77) analysis of Ache meat sharing revealed that "women, children, and adult siblings acquire no more meat from their husbands, fathers, and brothers, respectively, than would be expected by chance." Bleige Bird and Bird (1997, pp. 59–60) found no preferences for sharing within the patriline.

However, if only kilograms of meat received upon the completion of a distribution are tabulated, two significant factors relevant for increasing inclusive fitness will be neglected. The first is that meat given to affines, a primary obligation for hunters in many foraging societies (Altman & Peterson, 1988; Endicott, 1988; Gould, 1980; Heinz, 1994; Marshall, 1976; Myers, 1988), is scored as meat given to non-kin by genetic reckoning. However, maternal grandmothers, aunts, or uncles make significant investments in a man's offspring and may become primary caretakers in the event of the wife's death or the hunter's death or divorce. Through sharing meat with affines, a hunter builds social relationships that induce nepotistic investment in his offspring. Second, once meat is distributed in the first wave of sharing, the recipients have the choice of keeping portions to provision their families or sharing it with their respective kin to help fulfill kinship obligations. If the recipient chooses the former, then nepotistic benefits will be scored, but if he or she chooses the latter, no nepotistic benefits will be registered.

2.4. Long-term political goals: creating optimal conditions for cooperative breeding

Internal political objectives of foragers beyond the politics of jockeying for mates, gender politics, or the politics of equality have received little attention in cultural or evolutionary approaches. Morgan (1877) regarded foragers as humans immersed in "savagery," having few or no concerns for the politics of property and inheritance. With the revival of hunter–gatherer studies after the "Man the Hunter" conference in 1966 (Lee & DeVore, 1968), other

approaches have discouraged analysis of forager politics. For example, Sahlins's (1968) cost–benefit formula for the "original affluent society" — that limited wants are met with limited means — left little rationale for political projects. Woodburn's (1982) classification of foragers as having "immediate return systems" relieved foragers of any need for politics other than those of immediate sharing. Bird-David's (1990) concept of the "giving environment" or "forest as a parent" precluded any concern with control over the means of production. However, everywhere humans pursue long-term political goals and there is little reason to believe that foragers are an exception.

The long-term political goals that I will consider here are those linked to Hrdy's (1999, 2001) cooperative breeding hypothesis — that human offspring are raised in a community with "alloparents" (caretakers other than mother and father) who subsidize long childhoods. Hrdy proposes that human capacities for cooperative breeding allowed our ancestors to rear larger, slower maturing offspring, take advantage of new processes and resources, move into habitats otherwise not available to them, and spread more widely and swiftly than any primate had before. Capacities required for cooperative breeding include (1) group living, (2) delayed dispersal of offspring, (3) availability of young sibling/cousin alloparents owing to delayed maturity and older alloparents owing to longer life spans (Hawkes, 1997; Hawkes, O'Connell, Blurton Jones, Alvarez, & Charnov, 1998; Marlowe, 2000), and (4) ability of infants to send signals that elicit care from others, and the converse, the ability of children and adults to be responsive to infantile signals (see also Eibl-Eibesfeldt, 1972, 1989). It is intriguing to speculate that the roots of human kinship systems might lie in cooperative breeding communities where maternal-like care comes from a number of individuals other than mother, thereby extending concepts of who constitutes family.

The following political strategies in humans create conditions amenable to cooperative breeding. (1) Assembling close genetic kin into a cooperative breeding community should increase investment in the offspring of others because members glean nepotistic benefits from nurturing close relatives (Hrdy, 1999). (2) Preserving continuity of group membership over time should promote cooperation because familiarity at an early age is the most common cue for identifying kin and eliciting sympathy and affection (Hrdy, 1999, p. 271). (3) Limiting group size and, thus, complex configurations of obligations should reduce conflict (Chagnon, 1979; Hurd, 1983; Kosse, 1990; Lee, 1993). (4) Holding land and other resources should establish a familiar and predictable economic base to sustain a group over time. Parental investment is generally measured in terms of provisioning of offspring or direct childcare. However, the cooperative breeding hypothesis extends the list of investment activities to the above mentioned political goals.

In the following pages, I will use qualitative and quantitative data collected over a 34-year period in a Ju/'hoansi community by myself and several other researchers to evaluate what each of the above frameworks contributes to our understanding of why Ju/'hoansi men hunt large game. The data on which this paper is based include (1) the demographic studies of Howell (1979/2000), which provide a starting point from which individuals could be followed through the 1990s; (2) Lee's census data for 1964 and 1968–1969 and his ethnohistorical research on land tenure, which make it possible to obtain a long-term picture

of settlement dynamics at /Kae/kae; and (3)Wilmsen's data on hunting and other forms of income for 1973–1976 from which the productivity of individuals can be measured; and (4) my data on demographic variables, residence, and *hxaro* exchange for 1973–1975, 1977, and 1998. The data on *hxaro* exchange, defined as long-term, semiformal relations of mutual assistance, permit assessment of delayed reciprocity as paid out in a wide range of currencies (Wiessner, 1982, 1986, 1994).

3. Ethnographic background

3.1. The 1960s and 1970s

The Ju/'hoansi are former foragers of NW Botswana and NE Namibia well known from the films of John Marshall and from the work of Biesele (1993), Howell (1979/2000), Lee (1979, 1986, 1993), Lee and DeVore (1976), Marshall (1976, 1999), Shostak (1981), Wilmsen (1989a), Yellen (1977), and others. This paper will center on the Ju/'hoansi of the Dobe-/Kae/kae area of N.E. Botswana. The past tense will be used though many aspects of Ju/'hoan life discussed remain the same today. In the 1970s the Dobe-/Kae/kae area had approximately five hundred residents whose sphere of intermarriage and exchange encompassed a population of some 2000 Ju/'hoansi within a radius of 200 km (Harpending, 1976; Wiessner, 1981), as well as people from other linguistic groups. In the 1960s–1970s, Ju/'hoansi earned their living through hunting and gathering supplemented by various forms of exchange with neighboring pastoralists (Lee, 1979; Wilmsen, 1989a). Groups composed of 15–40 individuals spent 3–8 months of the year in their traditional areas of land rights and converged on permanent waters as seasonal water sources dried. In his input–output analysis at Dobe in 1963, Lee found that men spent an average of 21.6 hours a week hunting and women an average of 12.6 hours a week gathering.

Lee reports that at Dobe in 1964 approximately 30% of the calories in the Ju/'hoan diet came from meat and the remainder from plant foods (Lee, 1979). Both Lee (1979, p. 265) and Wilmsen (1989a, p. 232) found that hunting provided 7–8 kg of meat per person per month. Men's efforts furnished virtually all of the meat, but only about 20% of plant foods. For Ju/'hoan families receiving some support from neighboring pastoralists, milk and grain made up another 2–12% of the diet. Both Lee and Wilmsen found that during the relatively favorable times of year, hunting and gathering provided Ju/'hoansi with an ample 2200–2400 calories per day. Wilmsen's data on hunting collected between 1974 and 1976 at the community of /Kae/kae (some 30 km from Dobe) indicates that approximately 85% of meat acquired (in kilograms) was provided by large animals (weighing 50 kg or more) and 15% from hunting or trapping medium or small game. His data on the breakdown of estimated kilocalories per person contributed by plant foods over a 12-month period yielded: 3% from beans, 5% from "cucumbers" (*Acarthosperma naudinianus*), 72% from nuts, 11% from fruits, 8% from berries, and 1% from roots (tabulated from Wilmsen, 1989a, Table 6.6, p. 235).

Ju/'hoansi seasonal rounds were structured by rules of land tenure. Land tenure was a complex matter among the Ju/'hoansi because variation in available resources between

n!oresi (areas of land rights) is considerable (Ritchie, 1987). Some *n!oresi* have rich nut groves and others have none (Marshall, 1976, pp. 115, 160); not all *n!oresi* have permanent water (Lee, 1976; Marshall, 1976). The complexity of water sharing has been portrayed in Lee's (1976) ethnohistorical study of Ju/'hoan land tenure in the /Kae/kae–G/am areas during the 1920s and 1930s. In the past, groups holding land at permanent waters were focal in internal exchange networks (Lee, 1976) and in external networks that tapped into the broader trade of southern Africa (Wiessner, 1994; Wilmsen, 1989a).

Proprietary entitlement to a *n!ore* was based on inheritance, occupation, and integration into a land holding group. In theory, men and women could inherit rights to a *n!ore* through mother or father or attain rights through their spouses (Lee, 1979; Wiessner, 1977). But holding land involved more than inheritance; residence was an important factor. A person came to inherit a *n!ore* "strongly" if he or she remained in it, but held it "weakly" if he or she lived away from that *n!ore* or shifted residence frequently (Marshall, 1976, pp. 185–187; Wiessner, 1977). *N!ore* tenure also involved becoming successfully integrated into a core of kin who had attained "generationally continuous rights of tenure in their ancestral land" (Wilmsen, 1989a, 1989b). Ju/'hoan manipulated kinship, marriage, and exchange to reproduce land-holding groups (Wilmsen, 1989b).

Ju/'hoan men and women who inherited rights to an area and resided in it permanently became the active *n!ore kxaosi*, "owners of the place." The stronger and more coherent the group they assembled, the less likely it was that they would have to share the land with others who had weak claims. As far as I know there were no cases in the /Kae/kae or Nyae Nyae areas in which two or more bands utilized the same *n!ore* year round (see also Lee, 1976; Marshall, 1976, see also Silberbauer, 1994 for similar observations among the G/wi Bushmen). Bands centered at the same water source held rights to different localities within reach of the water source and foraged there. Despite concern with land tenure and strong emotional ties to the land (Lee, 1976), boundaries between *n!oresi* were not closed (Lee, 1979; Marshall, 1976). Far-reaching networks of *hxaro* exchange allowed Ju/'hoansi to gain access to alternate residences when food, water, or social relations in their areas failed (Wiessner, 1977, 1982, 1986). However, when individuals infringed on the land of others without appropriate ties and permission, the owners made moves to expel the intruders (Lee, 1979; Marshall, 1976, pp. 187–191; Wiessner, 1977).

The Ju/'hoansi maintained a strongly egalitarian society in which men and women enjoyed equal access to resources and status positions (Lee, 1979, 1993; Marshall, 1976). Nonetheless, differences in effort and ability were openly recognized and respected. Ju/hoansi have words that can be glossed as leader (*//aiha*) and poor person (*g//aakhoe*) (Dickens, 1994), as well as words to denote expertise in certain skills created by adding the suffix *kxao*, "owner," to any skill possessed by men or women: *n/omkxao*, owner of the skill of medicine, *!hakxao*, owner of hunting skills, or *!harikxao*, owner of the shade (teenager). Minimally productive men and women who had not mastered any particular skills were sometimes called *tci ma /oa* or *tci khoe /oa*, "nothing thing" or useless. When asked, Ju/'hoansi could position others as strong, average, or weak based on productive abilities, social competence, and rights to land in the areas where they resided. Despite inequalities in achievement, Ju/'hoansi had complex "leveling" institutions to prevent the stronger or more gifted from turning productive

advantage to dominance (see also Boehm, 1999; Cashdan, 1980; Wiessner, 2002): coalitions of camp members mocked, criticized, or ostracized rising "big shots." The daily nitty-gritty of leveling obscured the broader political designs of the more enterprising. It is only in the longer-term perspective that political strategies become evident.

3.2. Changes since the 1970s

In 1976 a borehole was drilled at /Kae/kae to replace a murky open well whose water had been flavored by cow dung. The availability of permanent, clean water qualified /Kae/kae as a community that could host government services. Conditions changed rapidly in subsequent years when a school and clinic were built, mother–child feeding programs instituted, drought relief rations distributed, and programs offering wage employment and agricultural assistance initiated. Ju/'hoansi were discouraged from going to their traditional summer *n!oresi* where they would miss the government dole. Between 1975 and 1995, the population of /Kae/kae increased from some 161 permanent Ju/'hoan residents at /Kae/kae itself and in surrounding *n!oresi* (Wiessner, 1977) and 39 non-Ju/'hoan pastoralists (Wilmsen, 1989a, p. 198) to approximately 277 Ju/'hoansi, 39 non-Ju/'hoan pastoralists, and 27 government workers (Ruigrok, 1995). This rapid increase can be attributed to the availability of health services, sedentism permitting narrower birth spacing, and regular provisioning of the Ju/'hoansi population by government feeding programs. In 1995, 54% of the Ju/'hoansi population was under 20 years old and only 5% over 60 (Ruigrok, 1995).

With sedentism, the size of some, but not all, residential units (camps) declined to clusters of close kin. Trance healing flourished (Katz, Biesele, & St. Denis, 1997). Gathering decreased rapidly with availability of domestic foods, but hunting remained important for the variation it added to the dull diet of maize meal, and for the mood and festivities generated by an abundance of meat. Ju/'hoansi, pastoralists, and government workers alike craved meat, and to deal with the multitude of requests, rules of distribution were altered. On the basis of three distributions that I observed in 1998, the following guidelines emerged: sizable portions were given to all members of the camp, parents-in-law, and a few close relatives in other camps. The remainder was sold (see Tanaka, 1991 for a similar situation among the G/wi Bushmen). Pastoralists and government workers paid market prices, while Ju/'hoan paid prices informally indexed for kinship. Small pieces for immediate consumption were given to Ju/'hoansi, pastoralists, and government workers who visited a camp at the time of meat consumption. Though there were some complaints about the new system, most Ju/'hoansi felt it was a fair solution to the distribution of a scarce resource in a large and ethnically diverse population.

Land tenure remained a prominent issue in the 1980s and 1990s. In 1975, the Botswana Tribal Land Policy gave those who could dig or drill permanent wells on local land a 99-year lease to utilize the resources within a 5-km radius of the well. Though too poor to hire a drilling rig and unsuccessful in completing hand-dug wells, /Kae/kae Ju/'hoansi were deeply concerned that others might use the opportunity to appropriate their land. In one instance a Ju/'hoan *n!ore* owner threatened to shoot members of another group who began to dig for water in his *n!ore* (Wiessner, 1977, p. 55). His reputation as an irascible and dangerous man

deterred the contenders. In 1994, an initiative was launched to establish a community-based natural resource management trust at /Kae/kae, the Tlhabololo Trust (Hitchcock, 2000), which would give local people control over their resources. As plans were formulated to dig wells and develop traditional *n!oresi* for hunting and gathering, tourism, and trophy hunting, interests in assembling kin and holding land were renewed.

3.3. Surplus production: hunting and healing

There were two areas of Ju/'hoansi life in which men invested concerted effort in producing a surplus that was widely distributed: trance healing and large-game hunting. Through trance healing men produced a surplus of positive energy (*n/om*) to share with the community; all people present received its benefits. Trance healing is an art that requires years of investment and apprenticeship before individuals can master the pain and confusion of altered states of consciousness in order to heal (Katz, 1982). In the 1960s and 1970s less than 50% of !Kung men achieved the ability to heal (Katz, 1976; Katz et al., 1997), and of those fewer than half became renowned healers. Trance performances required high-energy expenditures on the part of healers, inflicted pain, and entailed risk of physical injury if the dancer was not carefully supported and tended. Although material rewards were few, trance healers had the power to heal not only individuals but also rifts in the community and, thereby, attain social influence. Trance healing is both moving and impressive, drawing social acclaim, and, according to some healers, the favor of women. Lee (1993, p. 84) reported that 7 of 131 married men he studied were living in polygynous marriages and 5 of those 7 were healers. With the exception of a few blind or handicapped healers, most healers were also good hunters in the prime of life, making it difficult to separate the effects of influence gained through hunting from those gained through healing.

The second means of producing a surplus, in this case a tangible one, was through large-game hunting. (In contrast, harvesting a surplus of rich, communally owned plant resources that are predictable in location, such as nuts or beans, and distributing them widely was not seen as producing a surplus, but as taking more than one's share.) Large game was hunted with poison arrows, from horseback with spears or with dogs and spears. Hunting with bow and arrow was done individually, in pairs, or in small groups (Lee, 1979; Marshall, 1976; Wilmsen, 1989a) and hunting on horseback in groups of two to four hunters. Hunting success rates in killing large game varied greatly by hunter as illustrated in Lee's (1979, p. 244) figures on the number of kudu killed by men: 34% of the hunters in his sample of 127 men accounted for 79% of kudu killed.

Meat was highly valued by the Ju/'hoansi and provided an important part of their diet. In an average month of an average year when mongongo nuts were still plentiful, it is likely that targeting resources other than large game might have provisioned families for less work effort than did hunting large game. However, not all months are average ones. In leaner months caloric intake dropped to 1400–1700 calories per person per day and with it body weight (Wilmsen, 1989a). Considerable yearly variation also occurred. For example, for 7 years in which I obtained information on the mongongo crop yield between 1974 and 1998, in 1 year (1974) the crop totally failed, in another (1996) it was thin, and in 1998 it was extremely

sparse in the /Kae/kae area but not in areas to the north. Small game were not plentiful enough to fill the caloric shortfall left by the absence of nuts in such times, and calories provided by large-game hunting made a substantial contribution to the welfare of the hunter and fellow camp members. For example, figures from 17 months of subsistence studies between 1996 and 1998 in the Nyae Nyae area show that during two "hungry months" when food was scarce, large kills provided more than 80% of the diet (Wiessner & N!aici, 1998). Approximately 20% of this meat was given to relatives outside the camp. The remainder was distributed among the seven households in the camp, cut into strips, dried, and consumed over a period of 2 weeks. Once dry, meat was sometimes concealed in bags, a practice that had also been common in the 1970s.

Meat from large game was initially owned by the owner of the instrument that inflicted the death blow to an animal. By selecting certain arrows for promising shots, a hunter could decide whether he wanted to make the meat distribution. Ju/'hoansi meat sharing (unlike tobacco!) did not conform to the process of demand sharing noted for some hunter–gatherer societies (Peterson, 1993), though demands are on the increase today as traditional frameworks for sharing and exchange break down. Ownership of the implement that inflicted the fatal blow, participation in the hunting party, and kinship structured the patterns of sharing in the first wave of the distribution among the Ju/'hoansi, as in the majority of foraging societies (Wiessner, 1996, pp. 177–178). Reciprocity for pieces of meat given in the recent past was not a major consideration in giving, though failure to share in the recent past was generally met tit-for-tat (see also Myers, 1988). More often than not shares were received with little comment, though complaints regarding stinginess might be lodged on the basis of kinship obligations or, less frequently, obligations incurred in previous exchanges. After the first wave of sharing, recipients launched a second and third wave of sharing, following their respective social obligations, until the meat reached all members of the camp, the primary unit of sharing (Lee, 1979; Marshall, 1976; Wiessner, 1996).

Establishing a reputation for generosity via food sharing was a two-edged sword: to give to too few was frowned upon, but to give too widely created a seemingly infinite pool of potential receivers and incited jealousy on the part of every person who did not receive. In response, most sharing was conducted along the lines of socially recognized obligations: with members of the hunting party, spouse and children, spouse's parents or other close affines, and hunter's parents or siblings (see the initial distribution of meat made by Gao Beard, in Marshall, 1976, p. 301, for an excellent example). Subsequent gifts from individual shares often took on obligations of reciprocity (Marshall, 1976, p. 299). Ju/'hoansi accepted that meat was distributed according to certain obligations, and that meat was not simply up for grabs. Thus, the question of who did not come to collect a share was as interesting as that of who received a share. In 1974, I asked 17 Ju/'hoansi why they did not go and request meat when a large kill had been scored by hunters in neighboring camps (ca. a half to one kilometer away). All 17 replied that they did not have the right to ask because the owners of the meat were not their immediate kin, camp members, or exchange partners. After distributions, substantial quantities of meat were cut into strips, dried (Lee, 1979, p. 247; Wilmsen 1989a, 1989b, p. 232; Yellen, 1977), and consumed or given away over the next 2 weeks or longer. Throughout the period of meat distribution and consumption, strict sanctions

against showing off prevented the hunter from making himself the focus of attention (Lee, 1979; Marshall, 1976). Only hunting stories told days or months later recalled adventures of the hunt and all who had been involved (Blurton-Jones & Konner, 1976; Lee, 1979; Marshall, 1976; Wiessner, 1981).

The breadth of Ju/'hoansi meat distribution outside the camp was context dependent. In the rainy season when Ju/'hoansi were widely dispersed in groups of two to three families, most meat was consumed within the camp and the hunter's family got some 40–60%. For example, in 141 foraging days away from Dobe in which returns from hunting were extremely high, Yellen (1977) noted only two incidents in which meat was given to people in other camps. At winter camps around more permanent waters, sharing takes place largely within the camp with some 10–20% of the meat reaching neighboring camps. In Lee's 28-day subsistence study from 1964, only 7% of the meat consumed at Dobe was obtained from elsewhere even though at least two kudu were killed in nearby villages (Lee, 1979, pp. 266–267). For four distributions that I observed at /Kae /kae in 1974–1975 when six camps were present within a 3-km radius of the well, meat was not given to anybody outside the camp in one case, and in three cases, approximately 20% of the meat was given to immediate kin, affines, or Bantu pastoralists outside the camp in the first wave of distribution. Finally, there were occasions when meat was distributed very widely between camps, usually when several bands were settled around the same permanent water source in the dry season. Lorna Marshall describes one such incident when seven bands had converged at Gautscha. More than 100 people received a share of meat from a large kill. I observed a similarly widespread distribution at /Kae/kae in 1977 after a giraffe kill, which generated intense social interaction and trance dancing, but such occasions were exceptional. I have only witnessed three such distributions during my fieldwork of 1973–1975 and 1996–1998, and in one of these the hunters were eager to dispose of illegally hunted giraffe meat.

4. Why do Ju/'hoansi hunt large game? Testing the four hypotheses

4.1. The costly signaling hypothesis

4.1.1. Qualitative evidence from the ethnographic record

Signaling hidden qualities appears to have played an important role early in a man's hunting career. In the past, the motivation of young men to undergo the arduous process of learning to hunt large game was driven by socially stipulated conditions for marriage. Today men may demonstrate ability to feed a family in other ways such as wage labor or agriculture, though hunting remains important. The killing of a large animal indicated that a young man had mastered the art of hunting and was able to support a family (Marshall, 1976). He subsequently underwent solemn rites of scarification (Lee, 1993; Marshall, 1976). After a man's first kill, parents made plans to procure a spouse for their son, often a child bride promised long ago. Prepubescent marriages of women to be consummated after puberty were desirable to make sure that advantageous ties were formed and to avoid competition over

young women that might lead to violence (Lee, 1993, p. 87). This fear was not unfounded: 23% of murders documented by Lee (1979) were over sexual jealousies.

Had a wife not yet been promised to the young man, parents searched widely for a bride, drawing on networks of kinship and *hxaro* exchange. Parents of prospective brides sought a man who was a good hunter, had an agreeable character, was generous in exchange, could speak competently to defend the interests of the bride and her parents, and would provide advantageous social ties (Howell, 1979/2000; Lee, 1979; Marshall, 1976; Shostak, 1981). Young women who moved from home to the hut of an unfamiliar groom had other preferences: attributes of physical attractiveness, compatibility, and men who were close to their own age (Shostak, 1981). Because hunting ability was a prerequisite for marriage, young men who were good hunters stood a chance of entering the marriage market earlier than others. But whether they were able to marry more productive and socially competent spouses is hard to ascertain. Since girls were married at an early age, even in the second or third marriages, it was difficult to judge their productive or reproductive potential. As Marshall (1976, p. 268) puts it: "I suppose the parents of the boys can only watch the girls grow and hope for the best." Having followed individuals over a period of 24 years, I have observed that some of the most difficult, recalcitrant, and "spoiled" young women became highly productive and influential women in their 40s.

After marriage, young men began bride service, which continued until the second or third child was born, engaging in the hard work of hunting to provide meat for the brides' parents and establishing bonds between the families (Howell, 1979; Lee, 1979; Marshall, 1976; Shostak, 1981). Thus, social conventions redirected their energies from advertising their suitability for marriage to delivering their services. Ju/'hoansi marriages were unstable in the early years owing to young, recalcitrant brides who refused their husbands for months or years while they grew up (Shostak, 1981; Marshall & Meismar, 1980). Divorce rates in early marriages are high: 56% of divorces occur in the first year of marriage and 68% within the first 5 years (Howell, 1979, p. 237). If a young man provided meat for the camp during these trying years, kin encouraged the bride to accept her husband. If he did not, they might be just as happy to see him go. The societal pressure for a young man to hunt for his in-laws is underscored in Ju/'hoan tales (Biesele 1993, p. 171). Obligations to share meat with parents-in-law remained throughout life.

Once a Ju/'hoan couple had given birth to two or three children, the mature couple decided if they wished to reside with the husband's or wife's family, or to assemble a camp of their own. Motivation to hunt was no longer driven by culturally stipulated demands to demonstrate hunting ability prior to marriage nor the demands of bride service. Nonetheless, men between 30 and 50 were often those who put the most effort into hunting, and owing to experience, had high success rates (Lee, 1979; see also Marlowe, 2000 for the Hadza). I occasionally asked men of this age group why they made so much effort while others were idle. One response given by Tomazho, a prominent hunter and healer at /Kae/kae, was: "So that we (people in a camp) can eat and stay together with our kin in our *n!ore*s." Other hunters, Kha//an of Xamsa, /Aece of Dobe, and =oma of /Kae/kae expressed similar motivations. Some mature men also cited the demands for meat by their wives as a reason for hunting, but not the desire to attract women for polygamous marriages, serial monogamy, or extramarital affairs.

4.1.2. Quantitative evidence

Though not expressed overtly, could it be the case that hunting success deters competitors in mating competition and furthers a mature man's chances for polygamous unions or serial monogamy, or might men who are not skilled in hunting large game have qualities that make them equally or even more successful in marriage and reproduction? If so, one would expect that (1) good hunters would be more likely to start a second family through either serial monogamy or polygamy, (2) age differences between husband and wife would be greater for good hunters if they married younger wives in serial monogamy, and (3) good hunters would therefore have higher reproductive success.

Table 1 presents comparisons of marriage and reproduction measures for good and poor hunters for the /Kae/kae and *hxaro* samples (for Methods, see Appendix A). Putative genetic fathers other than husbands were named as such, and the congruence of marriage and paternity was high because Ju/'hoansi were apparently effective in adjusting marriage to match the fait accompli of pregnancy (Howell, 1979/2000, p. 232). Accordingly, genetic studies have found a low rate of paternity exclusions (Harpending, 1971). Deaths of infants born to ex-wives who were not available for interview may be unreported. Completed fertility in 1998 (Table 1) indicates that good hunters did father almost twice as many children as poor hunters. Good hunters also had more surviving children than poor hunters (Table 1).

If these differences are not due to chance, what gave good hunters their reproductive advantage? Was it more mating opportunities or other factors such as social assistance in child rearing or provisioning? None of the hunters in the /Kae/kae sample had polygamous marriages. Polygamy was a form of marriage practiced by only 5% of men because women generally rejected co-wives. In the *hxaro* sample, two good hunters had polygamous marriages. For one, the first wife was deceased by the time of my *hxaro* study and the hunter only fathered one child with his second wife. For the other, the older wife was childless and mentally disturbed; only the sphere of *hxaro* and possessions of the younger wife were included in the analysis in Table 1. For many polygamous marriages (Howell, 1979/2000), one wife was infertile or had completed her childbearing years with another husband.

In 1974 most men in both the /Kae/kae and *hxaro* samples had well-established marriages; after 1974 there was only one divorce of a good hunter and one of a poor hunter and one remarriage of a poor hunter whose wife had died. By 1998 good hunters and poor hunters in the /Kae/kae and *hxaro* samples had had a similar number of marriages (Table 1). Interestingly, completed fertility was not positively but negatively related to number of marriages for men as well as women. The nine men in the /Kae/kae sample with only one marriage had an average of 3.7 (S.E. = 1.18) children and the nine with two or more marriages a mean of 2.8 (S.E. = 0.97) (*t* test, two-tailed, P=.56,). This nonsignificant, counterintuitive relationship may be the product of random chance or influenced by a number of factors including increased exposure to venereal disease with each marriage (Howell, 1979/2000, pp. 185–187; Pennington, 1992) and the fact that some men and women with difficult personalities divorce frequently and take some time to remarry. Infertility per se is generally not a reason for the dissolution of marriages among the Ju/'hoansi though disappointment created by infertility may contribute to divorce. The two women in the sample who had not

Table 1
Demographic variables for good and poor hunters and their wives (*t* test, two-tailed)

		Good hunters		Poor hunters		
/Kae/kae sample		$n=9$		$n=9$		
hxaro sample		$n=9$		$n=9$		
Samples combined[a]		$n=14$		$n=12$		
		N	*Mean ± S.E.*	*N*	*Mean ± S.E.*	*P*
Age in 1974	/Kae/kae		41.0 ± 3.42		46.1 ± 2.09	.22
	hxaro		44.7 ± 3.87		39.9 ± 2.06	.20
	combined		44.4 ± 3.0		43.1 ± 2.31	.75
Years older than spouse	/Kae/kae		2.3 ± 3.72		3.2 ± 3.73	.87
	hxaro		0.4 ± 3.38		3.9 ± 3.48	.49
	combined[b]		3.3 ± 2.70		5.8 ± 3.17	.56
1998						
Number of marriages	/Kae/kae	15	1.7 ± 0.29	16	1.8 ± 0.32	.80
	hxaro	16	1.8 ± 0.27	14	1.6 ± 0.32	.72
	combined	22	1.6 ± 0.20	24	2.0 ± 0.30	.23
Completed fertility	/Kae/kae	36	4.0 ± 1.25	23	2.6 ± 0.93	.37
	hxaro	49	5.4 ± 1.17	22	2.4 ± 0.88	.06
	combined	66	4.7 ± 0.85	36	3.0 ± 0.85	.18
Children surviving to age 15	/Kae/kae	30	3.3 ± 1.05	14	1.6 ± 0.65	.17
	hxaro	38	4.2 ± 0.91	16	1.8 ± 0.70	.05
	combined	53	3.8 ± 0.70	24	2.0 ± 0.62	.08
		Good hunters' wives		Poor hunters' wives		
		$n=9$		$n=9$		
		$n=9$		$n=9$		
		$n=14$		$n=12$		
Age in 1974	/Kae/kae		38.3 ± 3.72		42.2 ± 3.20	.44
	hxaro		42.8 ± 2.59		36.3 ± 3.45	.20
	combined		40.1 ± 2.84		37.0 ± 3.58	.50
Number of marriages by 1998[c]	/Kae/kae	21	2.3 ± 0.47	17	1.9 ± 0.31	.44
	hxaro	17	1.9 ± 0.51	14	1.5 ± 0.27	.52
	combined	27	1.9 ± 0.35	22	1.8 ± 0.26	.93

[a] The combined sample consists of all hunters in the /Kae/kae sample plus those in the *hxaro* sample who are not also in the /Kae/kae sample (i.e., five good hunters and three poor ones were added to the /Kae/kae sample). See Appendix A.

[b] Three poor hunters were added to the /Kae/kae sample from the *hxaro* sample to create the combined sample. Of these three men, two were more than 15 years older than their wives. Therefore the figure 5.8 for the combined sample is surprisingly high.

[c] Most existing marriages in 1998 were stable; only three marriages occurred after 1974.

delivered a live birth had lifelong monogamous marriages. One was the wife of a poor hunter and the other the wife of the best hunter at /Kae/kae who, despite his wife's infertility, did not marry a second wife.

The higher fertility of good hunters did not appear to be associated with having younger wives than themselves. Though good hunters in the /Kae/kae sample were, on average, 5 years younger than poor ones (Table 1), the average man was 3.7 years older than his spouse for good and poor hunters alike (see Howell, 1979/2000, p. 243 for comparable figures). Note that none of the poor hunters in the sample were men who had a reputation of being good hunters in the past. One important factor affecting the lower reproductive success of poor hunters was the late age of some poor hunters at the time of their first enduring marriages, either because they married late or early marriages were very short-lived. In the /Kae/kae sample at least three poor hunters entered enduring marriages at an advanced age. Howell (1979/2000, p. 266) has made similar observations about late marriage for some of the less gifted men. In summary, while signaling hidden abilities through large-game hunting appears to be an important factor for age at first marriage, once bride service has been completed, there is little indication that signaling via hunting success played a role in men outcompeting other men for mates, even though men hunt actively into their 50s and 60s.

4.2. The reciprocity hypothesis

Once Ju/hoansi have established families, might reciprocity in currency other than meat play a role in the motivation to hunt large game? Though delayed reciprocity is extremely difficult to measure by direct observation, among the Ju/'hoansi *hxaro* relationships may serve as a proxy for long-term mutual support. *Hxaro* involved a roughly balanced, delayed exchange of nonfood gifts — beads, arrows, tools, clothing — that gave information about the status of an underlying relationship. Partners were said to "hold each other in their hearts" and be willing to offer various kinds of assistance when one had and the other was in need (Wiessner, 1982, 1986, 1994). *Hxaro* partners of adult men and women were selected from the wide range of consanguineous kin. A detailed study of 955 *hxaro* partnerships of 59 adults and 14 children (Wiessner, 1977, 1982) found that the average Ju/'hoansi adult had 16 partners though the range was 2–42. Sets of partners were comprised of individuals of both sexes and all ages, with a variety of skills. Partnerships were well distributed in space — approximately 18% of partners resided in ego's camp, 24% in neighboring camps 1–15 km away, 25% in camps 16–50 km away, and 33% in camps between 51 and 200 km away (Wiessner, 1982). Exchange of *hxaro* gifts was carried out discreetly so as not to attract attention. As a result, few Ju/'hoansi knew the entire sphere of *hxaro* maintained by others.

Hxaro with close consanguines began during childhood. Upon marriage, husbands and wives took gifts received from their kin and gave them to their spouses with the intent that they be passed on to spouse's kin, linking the two networks of *hxaro*. Only under certain circumstances was *hxaro* done directly with affines. Young couples with small children maintained a moderate sphere of *hxaro* with a mean of 13 partners each ($n = 27$; S.D. = 7). As they matured, they added new *hxaro* partnerships, some initiated by themselves and others inherited from their parents. Adults with mature children had much broader networks of partners (mean = 24, S.D. = 8, $n = 14$) whom they called on when seeking spouses for their children or helping their children during their early years of marriage, among other reasons. With old age and decreased mobility, spheres of *hxaro* narrowed as parents passed on

partnerships to their children (mean = 12, S.D. = 8, $n = 8$). Upon death, partnerships were dropped or inherited by descendants (Wiessner, 1986). Choice of *hxaro* partners conformed closely with predictions from inclusive fitness theory. Adults in my 1974 *hxaro* study ($n = 59$ individuals) did *hxaro* with 93% of individuals related to them by a coefficient of $r = 1/2$; 52% of those related by $r = 1/4$; 34% of those related by $r = 1/8$; 15% of those related by $r = 1/16$ (Wiessner, in press).

Hxaro supplied families with material possessions from arrows to clothing to beadwork. For example, in 1974, 69% of the possessions of Ju/'hoansi at /Kae/kae were obtained through *hxaro* (Wiessner, 1986). Moreover, the underlying relationship furnished people with alternate residences in times of food shortage or conflict. A survey of the visits made by 20 !Kung adults during 1968 and 1974 lasting 1 week or longer revealed that the average !Kung made 1.5 extended visits a year with a mean duration of 2.2 months per visit. Eighty of the 86 extended visits recorded (93%) were made to camps in which ego or his/her spouse had *hxaro* partners (Wiessner, 1981, 1986). *Hxaro* also structured meat sharing outside the camp. For three large kills that I observed at /Kae/kae in which meat was shared outside the camp, those who came for a share were *hxaro* partners of the owner of the meat or of a relative of the hunter who received large portions in the first wave of distribution. Finally, broader *hxaro* networks afforded people greater access to information of many kinds and assistance for locating spouses and arranging marriages.

Through hunting large game, do good hunters attract more *hxaro* partners for the family, or do men who do not engage as intensively in hunting use other resources to increase their spheres of exchange? Because families received assistance from husbands' and wives' partners, I combined data on *hxaro* partnerships for spouses to form a family sphere of *hxaro*. The results of comparing *hxaro* spheres of good and poor hunters and their wives are shown in Table 2. The number of *hxaro* partners of good hunters and their wives were significantly greater than those of poor hunters and their wives (Table 2). When men's and women's spheres of *hxaro* are handled separately, the analyses give similar results: good

Table 2
Spheres of *hxaro* of good and poor hunters and their wives compared (*t* test, two-tailed)[a]

	Good hunters and wives $n = 9$		Poor hunters and wives $n = 9$		
	N	Mean ± S.E.	*N*	Mean ± S.E.	*P*
Number of *hxaro* partners	386	42.9 ± 4.83	213	23.7 ± 3.63	.006
Number of *hxaro* partners who are close kin: $r = 1/2$, 1/4, 1/8	138	15.3 ± 1.45	110	12.2 ± 1.88	.21
Number of adult close kin available for *hxaro*: $r = 1/2$, 1/4, 1/8[b]	259	28.8 ± 3.64	230	25.6 ± 2.97	.50
Number of distant kin who are *hxaro* partners ($r < 1/8$)	248	27.6 ± 4.10	103	11.4 ± 2.40	.004
Number of household possessions	544	60.4 ± 4.79	366	40.7 ± 5.97	.02
Income from crafts (South African Rand)		12.00 ± 5.4		12.63 ± 4.6	.93

[a] See Appendix A for sample selection criteria.
[b] Calculated from genealogies.

hunters have significantly more hxaro partners than poor hunters and good hunters' wives significantly more partners than poor hunters' wives. I think that this congruence between spouses' *hxaro* efforts can be partially attributed to an interactive effect between husbands' and wives' economic efforts. Wives of good hunters appeared encouraged and worked hard to raise the family's reputation and expand their spheres of *hxaro*. In contrast, some but certainly not all wives of men who were poor hunters and unproductive in other areas of life appeared discouraged.

When *hxaro* figures are broken down by coefficient of relatedness, good hunters and their wives did not have significantly more *hxaro* partners who were related to them by a coefficient of $r = 1/2$, 1/4, or 1/8 (see Table 2) than did poor hunters and their wives. However, good hunters and their wives had a mean of 16.2 more partners who were related to them by $r = 1/16$ or less than did poor hunters and their wives. These results suggest that (1) most Ju/'hoan families have sufficient ties among close kin to secure themselves in times of need; (2) good hunters' families were not favored over those of poor hunters in *hxaro* partnerships with close kin; and (3) in *hxaro* exchange with distant kin where nepotistic benefits are lower, people were more willing to engage in partnerships with good hunters and their wives than with poor hunters and their wives, presumably because they anticipated greater material or social payoffs.

Not all *hxaro* relationships are equally intense, so more partners do not necessarily imply more support. Do families of good hunters have indicators of greater social support than those of poor hunters as evidenced by material possessions? Comparison of number of material possessions held by the families of good and poor hunters such as beadwork, blankets, clothing, equipment, etc. (Table 2) reveals that good hunters had significantly more possessions than poor hunters. For both, approximately 69% of possessions were received in *hxaro* and the rest recently made or purchased and destined for *hxaro* networks (Wiessner, 1982). Four out of nine good hunters and five out of nine poor hunters possessed goats, cattle, donkeys, or horses. Good hunters who owned livestock had an average of 4.0 head and poor hunters 3.6 head. Finally, I checked to see if spheres of *hxaro* and numbers of possessions might be related to other sources of income by comparing Ed Wilmsen's data on income from sale of crafts in 1975–1976 by families of good and poor hunters. Income from crafts sold via anthropologists offered considerable economic opportunity; however, there were no statistically significant differences between good and poor hunters or their spouses in amount of income obtained from sale of crafts (Table 2). In summary, these data suggest that delayed reciprocation paid out in a variety of currencies is an important benefit of being a good hunter.

4.3. The cooperative breeding hypothesis — long-term political goals

Ju/'hoansi children were and still are brought up in an environment that is rich in "alloparents." Just a few days after birth, infants were assigned their first alloparents when they were named after closely related elders who invested in their namesakes throughout their lifetimes (Lee, 1979; Marshall, 1976). During the first year of life infants remained close to mother, but nonetheless were passed from lap to lap in a milieu of affectionate and caring kin of all ages (Konner, 1972, 1975, 1976). As soon as a child could walk, he or she entered a

mixed-age playgroup of siblings and other kin for entertainment and learning, taking some of the burden of childcare off the mother. By the age of approximately three, children were secure enough to be left in mixed-age playgroups under the vigilance of other adults who served as alloparents while mothers went gathering (Draper, 1976). Adult parents and alloparents fed, washed, or comforted children, but did not entertain children (except infants), did not teach them, suggest or organize games, nor did they interfere with play unless they perceived danger. Younger children learned from older ones, engaging in a variety of noncompetitive games (Konner, 1972; Marshall, 1976; Sbrezny, 1976) and fantasy play in which almost every aspect of adult life was imitated (Draper, 1976; Marshall, 1976). Although children of foraging Ju/'hoansi did little work that contributed substantially to subsistence on a regular basis (Blurton-Jones, Hawkes, & O'Connell, 1996; Draper & Cashdan, 1988), boys hunted birds and reptiles and children of both sexes gathered plant foods close to camp, cooked, and shared them during play. For example in subsistence studies carried out by myself and /Aice N!aici in 1997 at the community of Xamsa, there were days on which girls in a playgroup picked a kilogram of berries in addition to those they consumed in the bush close to camp. On other days the boys shot up to 16 small birds, which were cooked and shared, tiny though they were. On still other days children gathered tubers, bulbs, and melons in small quantities and shared them within their playgroups. However, when different activities caught the interest of playgroups, children did not hunt or gather at all. From my extensive informal observation of the dynamics of these playgroups, it appeared that gifted children had already started building reputations among the other children in camp by the age of 10–12 years (for parallels among the Hadza, see Blurton Jones et al., 1997). Hold (1980) has documented the existence of social hierarchy in G/wi San playgroups as measured by the amount of time children are the focus of other children's attention. Thus, the seeds for future cooperative communities may be sown during childhood.

For reasons discussed earlier, camps composed of close biological kin with continuity of membership and holding strong claims to a *n!ore* are more likely to foster favorable conditions for cooperative breeding. Are good hunters more likely to bring about such conditions through their ability to manipulate surplus meat than other men? If so, how?

Ability to assemble close kin was assessed by counting number of close kin who were residents in a hunter's camp in 1974. Comparison of camp composition of good and poor hunters for 1974 indicates that good hunters did have significantly more adult married siblings with spouses and children in their camps than did poor hunters (Table 3). However, this difference is only marginal when analyzed by the proportion of one's living siblings who were in camp. Good hunters also had significantly more adult, married siblings, parents, and children with their families in camp (Table 3) and more parents' siblings, half siblings, parents' siblings' children, and their families (Table 3). I did not have sufficient data to count number of available living relatives related by a coefficient of $r = 1/8$ for some people in the /Kae/kae sample who were not part of the *hxaro* study.

Continuity of residence for good hunters and their wives in a core group of close kin inhabiting a given *n!ore* was 32 years in contrast to 17.4 years for poor hunters and their wives (Table 3). Wilmsen (1989a) has traced continuity in some of these camps back several generations. There was no indication that good hunters sought to attract larger residential

Table 3
Number of adult married kin in camp[a] and duration of residence in a camp for good and poor hunters (*t* test, two-tailed)

	Good hunters $n=9$		Poor hunters $n=9$		
	N	Mean ± S.E.	*N*	Mean ± S.E.	*p*
1974					
Siblings in camp	13	1.44 ± 0.41	4	0.44 ± 0.24	.05
Living siblings	22	2.44 ± 0.60	13	1.44 ± 0.38	.18
Parents, children, siblings in camp	24	2.67 ± 0.44	8	0.89 ± 0.48	.02
Parents' siblings, half-siblings, and parents' siblings' children in camp	25	2.78 ± 0.28	14	1.56 ± 0.58	.08
1964–1998					
Duration of camp residence (in years)		32.0 ± 1.41		17.4 ± 2.46	.0001

[a] Applies only to relatives who were married by 1974 or had been married previously. There were no individuals in the /Kae/kae population in 1974 who were over ca. 30 and had never been married.

groups. Since there were good hunters in all camps, it is not possible to correlate hunting success with camp size in a meaningful way. However, of the top three hunters in Wilmsen's data in 1974, one lived in a camp of 10 people, another in a camp of 17, and a third, who was childless, lived in a camp of 35 members that included three of his siblings and their families. Interestingly, there were few cases at /Kae/kae in 1974 of a camp having more than one top hunter unless the others were his siblings, father/son, or son-in-law. Apparently, men who can produce a surplus of meat and who are distantly related preferred to assemble their own camps. In contrast to good hunters, poor hunters changed camps frequently and thereby received less sustained support from a steady core of kin. Nonetheless, there were examples of less gifted men who stuck with more productive siblings, almost as their protégés, thereby profiting from continuity of residence. Interesting in this context are the findings of Draper and Hames (1999) that (1) being born late in the birth order in Ju/'hoan society has a positive outcome on fertility, and (2) number of older siblings and sibling set size are even stronger predictors of fertility, particularly for males. Being born late and having many siblings may increase the chances of moving into a favorable residential situation.

Ju/'hoan women encouraged their spouses to hunt and praised their successes; some even cooperated intensively through exchange of information about animals' tracks in the area (Biesele & Barclay, 2001). Thus, one might expect that the wives of good hunters, like the hunters themselves, would have more close kin in their camps. Surprisingly, this was not the case; the wives of poor hunters had, on average, more kin in camp than wives of good hunters though the differences are not statistically significant (Table 4). In view of these results, were there any advantages for women married to good hunters? As indicated in Table 4, good hunters' wives did indeed receive their payoffs later in life. The survivorship of children to adulthood was 83% for good hunters' wives and 67% for poor hunters' wives (Table 4). This difference in child survival, if not due to chance, may be attributed to a number of factors: genetic inheritance, provisioning, or growing up in a community with dedicated alloparents. Moreover, good hunters' wives had a significantly greater likelihood of residing with their

Table 4
For good and poor hunters' wives, the number of adult married kin in camp[a] in 1974, completed fertility, number of children surviving to age 15 by 1998, and number of children co-resident in 1998 for the /Kae/kae sample (*t* test, two-tailed)

	Wives of good hunters $n=9$		Wives of poor hunters $n=9$		
	N	Mean ± S.E.	*N*	Mean ± S.E.	*P*
Siblings in camp	3	0.3 ± 0.17	7	0.8 ± 0.36	.28
Parents, children, siblings in camp	12	1.3 ± 0.53	15	1.7 ± 0.50	.65
Parents' siblings, half-siblings, and parents' siblings' children in camp	11	1.2 ± 0.68	12	1.3 ± 0.50	.90
Completed fertility	36	4.0 ± 1.21	27	3.0 ± 0.82	.50
Children surviving to age 15	30	3.3 ± 1.00	18	2.0 ± 0.53	.25
% of children ever born who survived to age 15		83%		67%	
Number of adult married co-resident children	26	2.9 ± 0.83	7	0.8 ± 0.36	.03
% of adult married children who were co-resident in 1998		84%		31%	

[a] Applies only to relatives who were married by 1974 or had been married previously. There were no individuals in the /Kae/kae population in 1974 who were over ca. 30 and had never been married.

married children later in life than did poor hunters' wives (Table 4). A full 84% of the surviving children of good hunters' wives were co-resident as adults compared to 31% of the children of poor hunters' wives. Having a father who is a good hunter thus appears to attract married children to the camp, allowing both husbands and wives to enjoy much greater opportunities to invest in their grandchildren and to be assisted by their children later in old age. Old age is a time when many Ju/'hoansi experience some years of partial or total dependency (Rosenberg, 1990).

How could a hunter manipulate the meat to achieve the above conditions? First, he could adjust hunting effort to the current social situation. If a camp was large, unwieldy, and full of freeloaders, he might reduce hunting effort (Lee, 1979; Wiessner, 1982) or merely hunt small game for the pot to speed up camp fissioning. If his camp was of desirable size and composition but beset with hunger and tension, he might put all his efforts into obtaining meat to fill stomachs and generate the festivities that heal rifts. Upon the arrival of large quantities of meat in the past and present, "hearts soared" and women broke into bouts of song, which culminated in dance and trance healing. Grudges generated during meatless weeks dissolved and camp cohesion was strengthened once the tension of meat distribution had diffused. Shared identity of a community of *juasi kxaea khoe*, "people who help each other," was revived (see also Myers, 1988, p. 58). For example, between 1996 and 1998, I recorded topics of conversation at Xamsa village in the Nyae Nyae area before and after three large kills, which were made during periods of hunger. Before the kills, there was much discord, quarreling, and backstabbing, together with discussion of a village split. Separate camps were mapped out for construction. After the kills, the sharing of meat, and subsequent nights of song, dancing, and hilarious conversation, plans for the fission evaporated. Silberbauer (1981, p. 234) noted a similar situation for the G/wi San, "... the festival

atmosphere of the (meat) feast is deliberately manipulated to help rebuild the bond threatened by the late quarrel.''

Secondly, the hunter's arrow choice left room for social strategy. If the hunter chose to kill with his own arrows, he made the first wave of distribution with knowledge of approximately where the meat would go in the second wave. If he chose to kill with the arrow of another, he directed the meat towards that person's kin and won their favor. In the Nyae Nyae area, men even made and gave arrows to their wives to bestow on them the honor of the distribution, particularly couples who worked cooperatively in assembling information on the location of animals. Even though everybody ended up with a share, nobody forgot who was favored in the first wave of the distribution.

Thirdly, since meat was always shared within the camp, the hunter indirectly decided with whom he wanted to share meat when he chose residence. Moreover, he could influence the composition of his camp through preferential giving, among other things (see also Sugawara, 1988). Ju/'hoansi generally disliked living in large camps for any extended period of time, as tensions inevitably developed. An example of preferential giving is evident in Marshall's (1976, p. 301) fascinating description of Gao Beard's eland distribution in the 1950s. Gao Beard gave the lion's share to his first wife, nothing to his second wife who received meat from his first wife, and nothing to his sibling /Qui who later ate from the pot with Gao. As a result, his second wife and /Qui ate well with Gao Beard but had nothing to pass on to their own kin. I cannot guess what the politics of this distribution were as it took place long ago, but certainly, Gao Beard did not express equal favor to all who were present in camp. Being stingy with meat might be a subtle indication that certain parties in camp were not welcome co-residents—the meat could be the message (see also Shostak, 1981, p. 76). When a subtle message was not heard in the past or present, strong individuals who were landholders, good hunters, and perhaps healers, or sometimes their wives, had the authority to make the point more bluntly. I have witnessed six incidents when unwanted segments of a camp were expelled by subtle, or in two cases less subtle, messages from men who were prominent for their hunting and healing and held strong rights to a *n!ore*. In two of these, I was told by camp leaders not to give any food or material goods to the unwanted members so as not to encourage them to stay. The influence of good hunters persisted for years after they ceased hunting. Their social knowledge and competence developed in the context of years of successful hunting and manipulating the sharing of meat allowed them to continue to exert strong influence.

Thus, the use of surplus meat by mature hunters goes far beyond signaling and reciprocity. It is used (1) to produce long-term residential arrangements favorable to giving support to close kin and receiving support from them, and (2) to assemble a core group of close kin, which occupies a given *n!ore* over time, thereby holding its resources for their descendants. Ju/'hoansi do talk a lot about long-term plans, but no longer term planning or motivation need be attributed to good hunters to achieve these goals beyond the pleasure of living with close kin on one's own land and eating well year in and year out. This is apparent as the successful hunter sits back smugly and enjoys the activities that follow the meat distribution while others may steal the show. He appears satisfied that his relatives are well fed and that social cohesion within the camp has been restored. Most foraging societies exert strong sanctions against

hunters who show off (Lee, 1993; Wiessner, 1996; Woodburn, 1998). Perhaps one driving force behind institutions aimed at social leveling is the need for equality in order to foster stable, cooperative communities.

4.4. The inclusive fitness hypothesis

As Howell (1979/2000, p. 329) has observed: "There is a sense in which having kinship ties of all kinds, even ties to dependent kin, is a source of social strength for people like the !Kung ... influencing their life chances and social position, just as characteristics such as personality and skill do." Because kin provide such strength, do men hunt to provision their own wives and children and secure their own social ties, as well as to help kin related by a coefficient of $r = 1/2$, 1/4 or 1/8 do the same? Earlier I argued that among the Ju/'hoansi, as among most hunter–gatherers, the lion's share of the meat given out in the first wave of the distribution was given to camp members. However, without knowing the relatedness of people within a camp, it is not possible to ascertain how many close and distant kin good hunters are supporting when they share meat. Table 5 summarizes the degree of relatedness of the best hunter and his spouse in each camp to other families in the camp for six camps at /Kae/kae in 1974. The results show that 58% of co-resident families were the hunter's own family or families of men or women who were related closely enough to the hunter to provide nepotistic benefits ($r = 1/2$, 1/4, 1/8). Another 17% were close relatives of his wife who, as maternal kin, would invest heavily in his children. Finally some 25% of families in the camp were distantly or unrelated to the hunter; for example, wife's brother's spouse's parents or siblings. From these families, good hunters and their wives would derive few nepotistic benefits. Thus, provisioning close kin was one benefit of large-game hunting. And hunters and their wives saw it as such, even though a substantial number of distant kin also benefited.

Table 5
Relatedness of the best hunter in each camp and his wife to the co-resident nuclear families for six dry season camps at /Kae/kae in 1974

	Number of nuclear families	%	Mean nuclear family size
Hunter's own nuclear family	6	13	3.2
Related to hunter by $r = 1/2$	16	34	2.9
Related to hunter 's wife by $r = 1/2$	7	15	2.7
Related to hunter by $r = 1/4$ or 1/8	5	11	3.6
Related to hunter 's wife by $r = 1/4$ or 1/8	1	2	2.0
Distant or non-kin	12	25	2.4
Total	47	100	2.8

Relatedness is calculated on the basis of the closest tie between the families.
To qualify as having a nuclear family, a person had to have his or her own hut and to be or have been married. Nuclear family size varied from one person for widows or widowers to eight persons for nuclear families with many children. In no case did a nuclear family include individuals other than parents and children. People making extended visits to the camp are not included.
Adult married children in camp were listed as $r = 1/2$ relatives of hunter, not his wife, to avoid counting them twice; if they were his wife's children from a former marriage they were listed as related to wife by $r = 1/2$.

5. Concluding remarks

Sample sizes in the above analyses are too small to be more than suggestive of worthwhile areas for further research. Work that is currently in progress combining my data with that of the Marshall family should yield results for a much larger population on the long-term outcomes of being successful hunters or healers. In closing, I would like to make two points. The first is that foraging societies vary greatly (Kelly, 1995). From the Ju/'hoansi point of view, Ache practices of having 10 marriages before the age of 30, partible paternity, and vicious club fights (Hill & Hurtado, 1996) would inspire days of discussion. In evaluating Hadza life, Ju/'hoansi might be envious of the ample supply of large game and the idea that children can forage to feed themselves, whereas lack of attachment to land and unstructured meat sharing might seem odd. Local ecology, society, marriage systems, beliefs, and history of relations with neighbors do much to structure strategies in all areas of life. Until now, some studies of why men hunt large game have sought one explanation to the exclusion of others in order to demonstrate the power of a particular approach. However, long-term data from the Ju/'hoansi suggest that, in addition to provisioning, signaling, reciprocity, nepotism, and long-term political objectives were all outcomes achieved by producing and distributing a surplus of meat. Moreover, the data indicate that different motivations might be important at various stages of a man's life (see also Gurven et al., 2000; Sosis, 2000).

Secondly, I would like to emphasize that the pursuit of broader political goals is an all-too-often neglected factor that merits serious consideration in accounting for men's work. To give a few examples, ethnographies of other Kalahari foragers (Barnard, 1986, 1992; Cashdan, 1983; Heinz, 1994; Silberbauer, 1981) indicate that the G/wi and !Xo Bushmen have interests similar to those of the Ju/'hoansi in gathering kin and holding land. Amongst forest-living foragers such as the Efe pygmies of central Africa, the external politics of exchange with neighboring horticulturists impacts hunting effort (Bailey, 1991). Sosis (2000) has suggested that torch fishing by older men on Ifaluk atoll may signal the work effort of the matriline, not the individual. The Hadza separate valued joints of meat, God's meat, from the bulk of the meat, people's meat. The former is consumed in strict secrecy, bonding initiated men as equals (Woodburn, 1998). In parts of the Western Desert of Australia, young men hunt to provide meat for elders who reciprocate by passing down sacred knowledge that links people to land and to each other over the generations (Myers, 1988; Tonkinson, 1988). Understanding subtle forager political strategies and their outcomes often requires a long-term perspective. But more than 30 years have passed since the "Man the Hunter" conference that marked the beginning of extensive, systematic research on foraging societies (Lee & DeVore, 1968). Enough data may have accumulated to make research on long-term political strategies possible.

Acknowledgments

I am grateful to Richard Lee, Nancy Howell, Pat Draper, and Ed Wilmsen for generously giving me some of the data used in this paper and to Megan Biesele for helpful discussions of orthography and glosses. Many Ju/'hoansi have helped me over the years. Particular thanks

go to Tsao = Oma who has stuck by me for 25 years and advised me when I was asking the wrong questions, and to his stepson, /Aice N!aici, who jointly participated in my 1996–1999 research. Nancy Howell, Eric Smith, Elizabeth Cashdan, and the journal's reviewers have given me valuable comments on earlier drafts of this paper.

Appendix A. Methods

The qualitative data used to evaluate the above approaches come from my own interviews, observations, and records of Ju/'hoansi conversations collected in 1974–1975, 1977, and 1996–1998, as well as from the rich literature on the Ju/'hoansi. For quantitative testing of specific hypotheses, a sample of good and poor Ju/'hoansi hunters at the community of /Kae/kae was selected on the basis of the following criteria.

A.1. The /Kae/kae sample

1. The men had to be residents when Richard Lee visited /Kae/kae in 1964 and to be married at that time or within the next few years. This meant that all men in the sample had completed their period of bride service and had well-established families by 1974. I also had to be able to find these men or their wives in 1998 to record their completed reproductive histories and residence history, a task greatly facilitated by the fact that I could work in both Botswana and Namibia.

2. Good hunters were men who had killed between 3 and 10 large animals during Wilmsen's study period of 19 months between 1973 and 1976 and had been evaluated as *!xakxaosi* ("owners of hunting") in my interviews with camp members. Included under good hunters was one man whose eyesight was too poor to hunt large game but who tirelessly hunted medium and small game and distributed it to provision his camp on a regular basis. I have no information on rate of success per hour of hunting effort. However, from informal observations, all good hunters worked hard at it. Poor hunters were men named as such and who had killed one or no large animals during Wilmsen's study period. Some poor hunters worked hard but only had success with small game, while others spent little time hunting. None of the poor hunters in the sample had past reputations as good hunters; men who were evaluated as good hunters in former times but were past their prime owing to disability or age in 1974 were excluded from the sample.

The sample selected on the basis of these criteria yielded 18 men — nine good hunters and nine poor ones drawn from the six bands in Lee's (1976) study of land tenure who had descendants at /Kae/kae. Men in the sample represented both Ju/'hoansi who led foraging lifestyles and those with partial dependence on domestic foods. Most good hunters were strong individuals competent in other areas of life as well, while some of the poor hunters were strong and capable men in other areas of life. Five of the nine good hunters were healers but only two of the nine poor hunters were healers. Though this sample is small, it does represent more than 80% of the good and poor hunters of a "generation" in a community of some 150 residents in 1974 who had land rights extending over an area of some 2000 km^2.

Detailed information was available for all individuals in the sample and the following data were recorded for all hunters and their spouses: age in 1974 (based on Nancy Howell's demographic research), area of land rights, and whether the individual was a trance healer. On the basis of my 1974 genealogies and census data I tallied, for each of the hunters and wives, the number of adult, married co-residents in camp who were parents, children, half siblings, parents' siblings, grandparents, and parents' siblings' children. From Ed Wilmsen's records it was possible to obtain number of large animals killed, amount of money earned from sale of crafts, and income from domestic foods. From data that I collected in 1998, the following variables were added: completed fertility, survival of children, percent of surviving married children who were co-resident in camp in 1998, and continuity of camp membership as measured by number of years that an individual had been a resident of a certain camp and exploited the resources of that camp's *n!ore*. Completed fertility includes children fathered in marital and extramarital unions. Children born to wives not interviewed by Nancy Howell or myself who died in early infancy might not be recorded. Such cases would be few.

The starting points for measurement of continuity of residence was 1964 based on data given to me by Richard Lee (summarized in Wiessner, 1977), the midpoints in 1974 and 1977 were based on my fieldwork, and the end points were based on demographic and residential data collected during my visit to /Kae/kae in 1998. If an individual was (1) at /Kae/kae in the same basic "core" of kin (parents, siblings, and/or married children) in both 1964 and 1998 and interviews did not reveal an extended absence during this period and (2) if the camp occupied the same *n!ore*, he was considered to belong to the same camp. His duration of residence in that camp was scored as 34 years. (If he had no living parents or siblings and resided with his wife's relatives, the core was considered to be composed of his wife's parents, siblings, and the couple's adult children.) Of course, during this time his parents or some of his siblings would have died and their households been "replaced" by married children of the hunter. In four cases, the hunter had died in the early 1990s; if his spouse and adult married children continued to reside in the same camp with the same core of kin, then duration was scored as 34 years. If the individual left /Kae/kae to live in other *n!ores* or continually shifted from camp to camp within the 34-year period, duration began in 1964 and ended when the first major move took place that removed the family from what had been their core residential unit of 1974. During this period of time changes in camp composition did occur that did not disrupt core groups of kin: (1) Ju/'hoansi made extended visits to kin in other locations and remained for some months before they returned (Wiessner, 1977). (2) Core groups of kin joined others to form larger settlements and then split again. Such temporary aggregations did not usually disrupt the continuity of units of closely related kin who remained together after the split.

A.2. The hxaro sample

For measurement of participation in *hxaro* exchange (see p. 25), a different sample was used because I only had *hxaro* data for four good hunters and six poor ones in the /Kae/kae data set. The *hxaro* sample comprised all individuals in the /Kae/kae sample for whom I had data on *hxaro* ties plus all individuals from my study of *hxaro* exchange (Wiessner, 1977)

who had well-established families by 1974, who were of comparable ages to individuals in the /Kae/kae sample, and on whom I had information about hunting ability. Individuals added to the /Kae/kae sample to form the *hxaro* sample include five good hunters and three poor ones from other communities in Botswana and Namibia. The remaining people in my *hxaro* study were unmarried, too young, or too old to be included in the sample. For men in the sample and their spouses I had the following information: demographic data, data on *hxaro* partnerships and household possessions, and information on abilities and hunting skills from interviews, observations in 1974–1975, 1977, and 1996–1998 (when some of the 1974 hunters were still scoring large kills), and Yellen's (1977) study at Dobe. I do not have data on camp composition for individuals who lived in Namibia in 1974, so I cannot calculate either percent of close kin in camp nor duration of residence for this sample. The *hxaro* sample includes nine good hunters and nine poor ones.

A.3. Combined samples

To increase sample size for demographic variables (Table 1), the /Kae/kae and *hxaro* samples were combined. Since there was overlap between the two samples the combined sample consists of all hunters in the /Kae/kae sample plus those in the *hxaro* sample who are not also in the /Kae/kae sample (five good hunters and three poor ones).

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