

Dynamics of Postmarital Residence among the Hadza A Kin Investment Model

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Abstract When we have asked Hadza whether married couples should live with the family of the wife (uxorilocally) or the family of the husband (virilocally), we are often told that young couples should spend the first years of a marriage living with the wife's family, and then later, after a few children have been born, the couple has more freedom—they can continue to reside with the wife's kin, or else they could join the husband's kin, or perhaps live in a camp where there are no close kin. In this paper, we address why shifts in kin coresidence patterns may arise in the later years of a marriage, after the birth of children. To do so, we model the inclusive fitness costs that wives might experience from leaving their own kin and joining their husband's kin as a function of the number of children in their nuclear family. Our model suggests that such shifts should become less costly to wives as their families grow. This simple model may help explain some of the dynamics of postmarital residence among the Hadza and offer insight into the dynamics of multilocal residence, the most prevalent form of postmarital residence among foragers.

Keywords Kinship · Hadza · Hunter-gatherers · Postmarital residence · Inclusive fitness

Cross-culturally, patterns of kin coresidence among hunter-gatherers are different from those of non-foragers in at least two important ways: married adults live with the kin of wives more often (uxorilocality), and forager couples engage in more transfers between kin groups during the course of their marriage, with a shift from early uxori-local residence to later bilocal or virilocal residence (living with the husband's kin) quite common (Marlowe 2004). These patterns illustrate an important

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change that occurred in human social organization during the past 6 to 7 million years, since our last common ancestor with *Pan* (Chapais 2008; Hill et al. 2011). Among chimpanzees and bonobos, males stay in their natal community their entire lives whereas females tend to disperse into a neighboring community when they reach reproductive maturity, where they will typically stay the rest of their lives (Boesch and Boesch-Achermann 2000; Furuichi and Ihobe 1994; Goodall 1986). Human societies, especially foragers, exhibit more variable residential patterns, and the network of kin with whom individuals interact in residential groups changes numerous times in a lifetime. Higher paternity certainty (at least putative paternity) allows humans to recognize both maternal and paternal kin and thus identify more kin than would a promiscuously mating species, such as chimpanzees (Chapais 2008). In addition to paternity certainty, language is a key adaptation that permits humans to stay connected with a larger and more dispersed network of kin than other primates (Rodseth et al. 1991).

Flexibility in kin coresidence is a key feature of social organization among foragers, and it appears particularly useful for how hunter-gatherers find food and raise children (Lee and DeVore 1968). A large network of available kin can be especially useful in the realm of cooperative childcare, in which individuals associate with other kin who can provide the most help, or who could themselves use the most help raising their children (Blurton Jones et al. 2005; Scelza and Bliege Bird 2008). Various types of allomaternal helpers may have had a large impact on the evolution of human life history (Hawkes et al. 1998; Kaplan et al. 2000; Kramer and Ellison 2010).

When couples marry, they must make a joint decision about where they are to reside, and with whose kin. In 49% of forager societies in the Standard Cross Cultural Sample, just-married couples typically reside uxori-locally. After the first few years of marriage, uxori-local residence becomes less frequent. Twenty-five percent of the forager societies in the SCCS practice residence similar to the Hadza ideal: uxori-local in the early stages of a marriage, followed by the couple moving to live with the husband's family, or else to neolocal or bilocal arrangements (Marlowe 2004).

Anthropologists have investigated how variation in ecology, systems of descent, demography, warfare, and the sexual division of labor influence patterns of kin coresidence (Divale 1974; Ember and Ember 1971; Korotayev 2003; Marlowe 2004; Otterbein 1968). Although these studies differ in their assumptions, they agree that kinship and residential group organization are critical components of social structure. Theories of kin coresidence have been tested using cross-cultural data (Naroll 1970), but surprisingly few studies have addressed the causes and consequences of variation in kin coresidence patterns within one society.

Patterns of Hadza Kin Coresidence

Among the Hadza, the choice of where to live is made under a suite of social and ecological constraints. When we have spoken with Hadza about possible residential moves, such discussions tend to focus on who is already living where, what types of food are available at different locations, and the quality of different sources of water.

Woodburn (1968) argued that residential decisions among the Hadza are driven more strongly by social concerns than by subsistence, and we would agree that social affiliations and tensions often lead to camps growing in size or splitting apart. In our experience, in keeping with the ideal described to us by Hadza, couples in the early stage of their marriage tend to closely associate with their parents (usually the wife's parents). After family size increases, the couples take a more active role in deciding where to live, while their parents may choose to associate with other children or other kin who currently need help, as described by Blurton Jones et al. (2005).

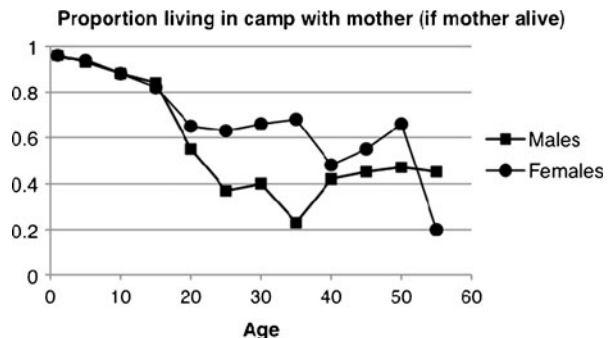
Notwithstanding a significant degree of residential flexibility, some general patterns emerge in Hadza kin coresidence. In his sample of 21 married couples in which both the husband and the wife had living mothers, Woodburn (1968) found that 48% of the couples lived with only the wife's mother, 24% lived with both the mothers, 10% with only the husband's mother, and 19% with neither mother.

Blurton Jones et al. (2005) reported on patterns in Hadza kin coresidence and explored, among other results, the influence of age and sex on residence. Their work shows an apparent sex difference in coresidence with mothers, with men between the ages of 20 and 40 less likely than women to coreside with their mothers.

Our observations of the Hadza support their explanation for this sex difference in kin coresidence: "Hadza men say they have to leave home to find a wife because women like to stay in their home range" (Blurton Jones et al. 2005:225). There are several reasons why women might prefer to begin their reproductive careers living in close proximity with their mothers: we, like Hawkes et al. (1989), have observed that Hadza women's mothers are especially helpful during their early reproductive years, when vital child-rearing skills are acquired and provisioning from the wife's family may be crucial. Hadza men are obliged to perform bride-service for their wife's parents, especially in the case of women's first marriage. Young husbands are expected to share meat generously with their mothers-in-law and provide other types of gifts to their fathers-in-law, such as a bow or a set of arrows. Early uxorilocal residence is a part of this bride-service, as it is in other foraging cultures (Collier 1993).

As shown in Fig. 1, women are more likely than men to reside with their mothers during their twenties and thirties, but after age 40, Hadza men appear to be nearly equally likely as women to reside with their mothers. Married couples may disperse from the wives' kin for a variety of reasons. Older mothers will have gained critical experience, and perhaps the couple's children are old enough now to be able to feed

Fig. 1 The proportion of Hadza with living mothers who were observed to reside with their mothers, redrawn from Blurton Jones et al. (2005)



themselves and help care for younger siblings. An additional factor that may influence shifts in postmarital residence, which we take up here, is that as nuclear families grow, men should become more focused on providing parental care to the couple's children relative to helping their other kin. If this is the case, then the cost to a wife of transferring away from uxori-local residence may decrease as their family grows. We model the net fitness benefits that wives receive from their husbands' investments in their nuclear families and other kin as a function of nuclear family size. The results of this model will be used to test the following prediction:

Prediction: All else being equal, as the number of children in a nuclear family increases, the inclusive fitness cost to wives of switching from uxori-local to viri-local residence lessens.

The Model

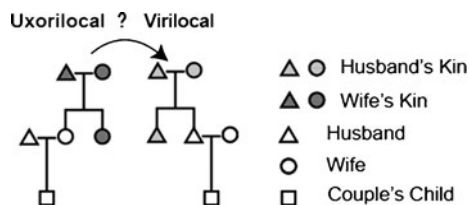
Our model addresses how individuals would allocate help among members of their residential group if their goal were to maximize their inclusive fitness in one-shot interactions. It does not address the question of how much individuals should invest in themselves prior to helping others; instead it explicitly deals with how to distribute one unit of assistance to others. This model does not address how reciprocity, mutualism, trade, or other processes might influence whether and to what extent individuals cooperate with kin and others. We simply employ Hamilton's (1964) theory of kin selection, which proposes that all else being equal, egos should assist others when the cost to themselves, c , is less than the benefit to the other, b , multiplied by the coefficient of relatedness, r , between ego and other:

$$c < r * b$$

In our model we hold c constant and then describe how husbands and wives would distribute one unit of assistance to others if they were attempting to maximize $r * b$. We characterize b , the benefit to others, in two ways. In model A, parents allocate help to others strictly based on their relatedness. This model is usefully conservative, but because husbands and wives are the primary caretakers of their children, a couple's own children would typically benefit more from their parents' help than would other individuals with the same coefficient of relatedness, such as the couple's parents or full siblings. In model B, therefore, we assume that parents would bias assistance giving to favor their own children over other individuals of equal relatedness.

We represent viri-local and uxori-local residential groups as shown in Fig. 2. These simplified models of residential groups are not meant to capture the real variety of

Fig. 2 Models of uxori-local and viri-local residence, showing the kin who would be present in each



kin relations existing in residential groups; rather they are used to explore basic consequences of uxori-local and viri-local residential arrangements and assistance-giving strategies. In the conditions of model A, in which husbands and wives give help to others based on their degree of relatedness, different patterns of assistance-giving emerge in the context of uxori-local versus viri-local residence. A couple with one child would, under the assumptions of model A, distribute a single unit of assistance as indicated in Table 1.

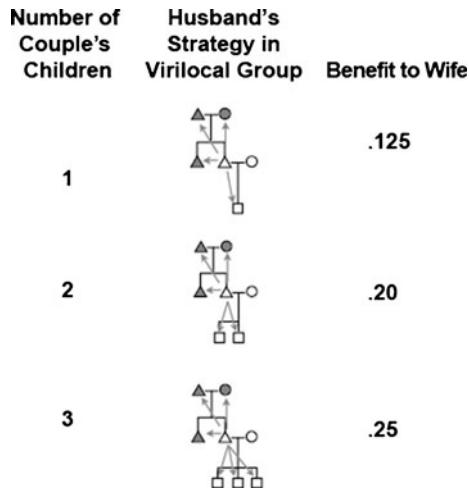
The growth of a nuclear family should affect the strategies that husbands and wives follow when living among kin and deciding how to allocate help to others. Specifically, as a family grows, a greater fraction of the total helping behavior that mothers and fathers exhibit should be directed toward their own children and less toward other kin. As a result, the helping strategies of husbands and wives are expected to increasingly converge as their commitment to their children increases. This increased commitment to parental effort by the couple may reduce the costs of moving from an uxori-local group to a viri-local group. Figure 3 illustrates the strategies of assistance-giving that husbands are predicted to follow if the couple resides with the husband's kin, as a function of the number of children in the nuclear family.

As shown in Fig. 3, if a couple with one child were to reside virilocally, husbands would be compelled to help their parents and siblings as well as their one child. In this viri-local context, a wife only gains fitness benefits from that portion of her husband's help that is directed to their child. In this model, a single child would receive only a modest amount of help from his or her father in such a context. If, on the other hand, the couple with one child were to reside uxori-locally, then fathers would not be in a position to divert such a large portion of their help to natal kin other than their child. The mother, as a consequence, would receive more fitness benefits from her husband's allocation of kin-directed help in an uxori-local setting. In this model, as a family grows, husbands would be expected to allocate a greater fraction of their total helping behavior toward the

Table 1 Distribution of help by a husband and wife with one child in the context of viri-local and uxori-local residential groups in model A. The model assumes that husbands and wives will distribute fractions of their total helping behavior among the kin with whom they are residing based on their relatedness. Thus, in a viri-local context, a man who resides with his father, mother, brother, and child gives equal fractions of his investment (i.e., .25) to each

	Husband's allocation		Wife's allocation	
	Viri-local	Uxori-local	Viri-local	Uxori-local
Child	.25	1	1	.25
Husband's father	.25	0	0	0
Husband's mother	.25	0	0	0
Husband's brother	.25	0	0	0
Wife's mother	0	0	0	.25
Wife's father	0	0	0	.25
Wife's sister	0	0	0	.25

Fig. 3 The benefits that a wife receives from her husband's distribution of kin-directed help (represented with arrows) in a virilocal group, under the assumptions of model A, as a function of nuclear family size. Each arrow represents an equal fraction of help that a husband distributes. The benefit to the wife is that fraction of her husband's help that goes to their children, multiplied by 0.5, the coefficient of relatedness between the wife and her children



couple's children. In model A, in which a husband allocates assistance to his children and to three coresident natal kin of equal relatedness, the effect of his help on his wife's fitness is described by:

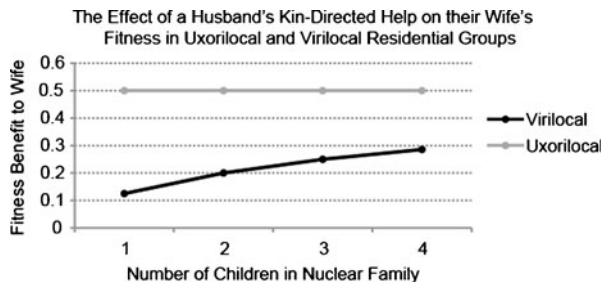
$$\text{Wife's fitness benefit} = 0.5 * [n_{\text{kids}} / (n_{\text{kids}} + 3)]$$

Following these assumptions, Fig. 4 plots the fitness benefits that wives would be expected to receive from their husbands' kin-directed help as a function of family size and residential context.

Figure 4 shows that the fitness benefits that wives are expected to receive from their husband's kin-directed help would always be higher in uxoriocal groups than in virilocal groups. Though this is true, the cost to wives of moving from an uxoriocal into a virilocal residential group decreases when couples have more children, supporting our earlier prediction.

If we change the assumptions of the model and specify that a father would bias assistance-giving to his own children over other kin of equal relatedness, then the cost to wives of transitioning from uxoriocal to virilocal residence decreases further. In model B, we modify the husband's allocation strategy with the constraint that he will always give twice as much help to his children as he does to his three other coresident kin of equal relatedness. Under these

Fig. 4 Benefits that a wife receives from her husband's kin-directed help as a function of family size and residence, in model A



assumptions, the benefit to a wife from her husband’s kin-directed helping is described by:

$$\text{Wife's fitness benefit} = 0.5 * [2 * n_{\text{kids}} / (2 * n_{\text{kids}} + 3)]$$

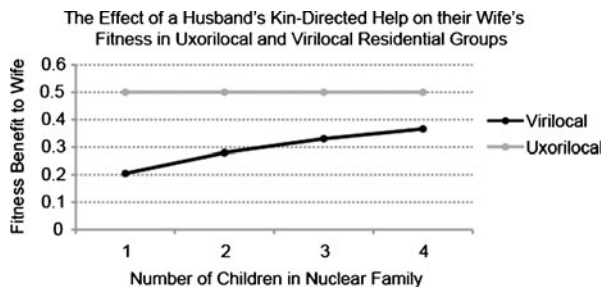
This produces the relationship displayed in Fig. 5, which shows the same general relationship as Fig. 4, with the difference that the predicted costs to the wife of moving into a virilocal camp is reduced at all family sizes compared with model A. Therefore, if fathers favor their own children over giving help to their own siblings and parents (a reasonable assumption, given children’s typically greater dependence and need for such help), then transitioning from an uxori-local into a virilocal setting would be less costly to their wives. The general form of our model includes a factor that describes how much husbands bias their assistance to their children over kin of equal relatedness:

$$W = 0.5 * [(b * n) / (b * n + s / 0.5)]$$

where *W* is the wife’s fitness benefit from her husband’s allocation of kin-directed help in a residential group; *b* is the factor by which a father biases assistance to the couple’s children; *n* is the number of children a husband and wife share; *s* is the sum of the coefficients of relatedness between the father and all those in the residential group; and 0.5 is the coefficient of relatedness between parents and their offspring.

In our model, husbands who live uxori-locally are predicted to direct all their assistance toward their own children, but as we have already mentioned, Hadza men living uxori-locally are expected to share food and give assistance to the parents of their wife. If we were to include such assistance-giving in our model, it would not change the computed values of wife’s fitness benefits in uxori-local residential groups because such help would be received by kin who, like the couple’s children, are related to the wife by *r*=0.5. Therefore, adding such details to our model would not change our findings that (1) in general, uxori-local residence should be more beneficial to wives than virilocal residence but that (2) the cost to wives of moving from uxori-local to virilocal residence should lessen as a function of nuclear family size. If we had included in our model husbands giving assistance to their kin of *r*=0.25 in virilocal residential groups, this would make the transition from uxori-local residence more costly to wives (because a greater fraction of their husbands’ help would not be directed to their children), but this cost would likewise decrease as a function of nuclear family size.

Fig. 5 Benefits that a wife receives from her husband’s kin-directed help as a function of family size and residence model B, in which husbands allocate twice as much help to their children as they do to other individuals of *r*=0.5



Discussion

Uxorilocal residence in the early stages of a marriage followed by a transition to virilocal or bilocal residence is a common pattern of postmarital residence among foragers. This custom is present among well-studied populations of foragers in Africa, including the Ju/'hoansi of Namibia and Botswana (Hames and Draper 2004; Lee 1979), the Aka of the Central African Republic (Bahuchet 1991), their neighbors the Bofi (Fouts et al. 2001), and the Hadza.

Ethnographers describe the function of early uxori-local residence in these populations as bride-service, and the means by which a son-in-law provides food, labor, and other gifts to his wife's parents. A residential arrangement of this type helps ensure that the foods that a husband produces will materially benefit his wife and her parents. These arrangements also place the wife and her kin in a good position to evaluate whether a young man is a suitable husband. If a wife decides she wants to break off the marriage in its early stages, she might be in a better position to do so when she is surrounded by her kin.

Ethnographic descriptions of uxori-local bride-service attest to the constraints it places on husbands. Fouts et al. (2001), describing Bofi foragers of Central Africa, mention how young husbands might try to evade such responsibilities: "newlywed fathers usually participate in matrilocal bride-service, which requires that they provide services for their brides' families. In an effort to minimize this 'service,' they tend to hunt or gather together, take long trips, and are simply not around the camp very often" (Fouts et al. 2001:41). If bride-service is what compels early uxori-local residence, then the consequential problem that arises is determining how long the period of bride-service should last, and when prescribed uxori-local residence should end. For the sake of discussion, we can define two general ways that this problem might be solved. If uxori-local bride-service is equivalent to a form of "payment" to the kin of the wife, then the length of its tenure should be a function of time, or how much service a husband has provided. If, on the other hand, the length of bride-service is structured by the dynamics of reproduction and kin-investment, as our model proposes, then the length of bride-service should be a function of the couple's reproduction. A few ethnographic descriptions provide some insight into this problem.

Hames and Draper's description of the Ju/'hoansi suggests that the length of bride-service and early uxori-local residence was influenced by the couple's reproduction.

the custom of bride service practiced by the foraging Ju/'hoansi meant that girls and their husbands remained in the camps of the bride's parents (Marshall 1959). The period of bride service lasted several years, not only until the young bride matured and began to bear her own children but in many cases until two or three children were born (Hames and Draper 2004:333).

Bahuchet, writing about the Aka pygmies, notes that the birth of a couple's first child is what usually determines the end of uxori-local bride-service, but that other kin-investment dynamics also play a role: "there are many cases in which a son-in-law stays in his wife's camp. If the husband's community is large, and the wife's smaller, or if the young man feels comfortable with his parents-in-law, he will stay there" Bahuchet (1991:219).

Bahuchet's description seems relevant to our model. We would suggest that if a father has a large community of kin in which he could potentially reside, this might further dilute the amount of his kin-investment that would otherwise go to his child. If the couple were to leave the wife's kin in a small camp with few helpers, this would increase the cost that wives would experience by leaving their kin and would lead to her greater resistance to residing virilocally.

Unfortunately, a quantitative test of whether a "payment" of bride-service to the wife's parents or patterns in the couple's reproduction more strongly influence the length of uxori-local residence is not currently possible with our Hadza data. We have not yet attempted to calculate the length of the marriages of the people we observed living in different Hadza camps, nor do we have measures of the amount of time that couples have lived with the wife's family prior to our periods of observation, and therefore we have no measures of how much bride-service has been provided. But as we mentioned at the start of this paper, we do know ethnographically that when men and women describe to us their reasons for leaving an uxori-local residential group, they often state that the move is predicated upon the birth of a few children.

Our model predicts that as a nuclear family grows, fathers should become more invested in providing care to their children, leading to a greater convergence in the reproductive strategies of husbands and wives. Human behavioral ecologists studying life history traits in general (Hill and Kaplan 1999), and the likelihood of marriage infidelities in particular (Winking et al. 2007), have made similar arguments, while our model highlights how residence decisions may be influenced by such trade-offs.

Conclusion

In an evolutionary perspective, the advent of multilocal residence represents an important change in the types of kinship relationships that existed in human residential groups. We have used a simple model to explore some of the costs and benefits of uxori-local and viri-local residence, assuming that husbands will direct help to the kin with whom they reside. This model explored the consequences of such kin-directed help on the fitness of wives. It predicts that a shift from uxori-local residence to viri-local residence should become less costly to wives as a function of the couple's reproduction. Specifically, a greater fraction of the total helping behavior that husbands provide should be directed toward their own children and less toward other kin as their nuclear family grows. This increased commitment to parental effort by the couple may reduce the cost of moving between different types of kin groups. This finding may contribute to a better understanding of a common pattern in multilocal residence among the Hadza and other foragers in which couples begin their marriages residing uxori-locally and later are more likely to transition to viri-local, bilocal, or neolocal residential groups.

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