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Reviewed work(s):

Source: *Current Anthropology*, Vol. 54, No. 1 (February 2013), pp. 96-103

Published by: [The University of Chicago Press](http://www.uchicago.edu) on behalf of [Wenner-Gren Foundation for Anthropological Research](http://www.wenner-gren.org)

Stable URL: <http://www.jstor.org/stable/10.1086/668867>

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## Living with Kin in Lowland Horticultural Societies

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### CA+ Online-Only Material: Supplement A

Postmarital residence patterns in traditional human societies figure prominently in models of hominid social evolution with arguments for patrilocal human bands similar in structure to female-dispersal systems in other African apes. However, considerable flexibility in hunter-gatherer cultures has led to their characterization as primarily multilocal. Horticulturalists are associated with larger, more sedentary social groups with more political inequality and intergroup conflict and may therefore provide additional insights into evolved human social structures. We analyze coresidence patterns of primary kin for 34 New World horticultural societies (6,833 adults living in 243 residential groupings) to show more uxorilocality (women live with more kin) than found for hunter-gatherers. Our findings further point to the uniqueness of human social structures and to considerable variation that is not fully described by traditional postmarital residence typologies. Sex biases in coresident kin can vary according to the scale of analysis (household vs. house cluster vs. village) and change across the life span, with

women often living with more kin later in life. Headmen in large villages live with more close kin, primarily siblings, than do nonheadmen. Importantly, human marriage exchange and residence patterns create meta-group social structures, with alliances extending across multiple villages often united in competition against other large alliances at scales unparalleled by other species.

Patterns of postmarital residence in traditional human societies have figured prominently in models of hominid social evolution. Some have argued for mostly patrilocal human bands (Ember 1978; Murdock 1949; Radcliffe-Brown 1931; Service 1962; Steward 1938) similar in social structure to female-dispersal systems typical of other African apes (Harcourt 1978; Kuroda 1979; Pusey 1979; Wrangham 1986). The patrilocal human model from a primate perspective suggests that male philopatry may stem back to a last common ancestor between chimpanzees and humans, if not earlier (Wrangham 1986). Indirect evidence of stable isotopes in Australopithecines (Copeland et al. 2011) and mtDNA in Neanderthals (Lalueza-Fox et al. 2010; but see Vigilant and Langergraber 2011) may also tentatively support a deep evolutionary history of male philopatry. In contrast, some have argued for more female philopatry and the importance of maternal grandmother provisioning as ancestral human conditions (Hawkes et al. 1998). However, considerable variation in residence patterns both within and among human foraging societies has led to the characterization of hunter-gatherers as primarily “multilocal” in nature, with both males and females commonly dispersing or residing with natal families (Alvarez 2004; Hill et al. 2011; Kramer and Greaves 2011; Marlowe 2004). In a global sample of 32 hunter-gatherer societies, adult brothers and sisters often coreside and there is no overall tendency for either men or women to live with more parents or offspring (Hill et al. 2011). Long-term cooperation among adult brothers, sisters, and bilateral kin may have emerged from a novel and flexible human residence system facilitated by pair bonding and father recognition (Chapais 2008). Chapais’s (2008) model, a synthesis of contemporary primate evolutionary/ecological studies and human kinship and alliance theory as expounded by Lévi-Strauss (1949), explains how the affiliation of several men to the same woman, related to each other as consanguineal and affinal kin, ameliorates hostile between-group relations and allows visiting and opportunistic coresidence in human meta-group social structures (multiple residential bands exchanging spouses, goods, and information). Other primates lack this meta-group structure because either males or females generally emigrate at maturity without a system of exchange, a pattern that mostly isolates kin lineages to single communities.

The extent to which modern human societies represent ancestral human patterns may be partially addressed by concurrent

examination of patterns in both hunter-gatherer and horticultural societies. One point of contention against using contemporary hunter-gatherers as models of human evolution is that they reside in marginal habitats after being displaced by more powerful horticultural and agricultural groups (Alexander 1979; Lee and DeVore 1968; but see Porter and Marlowe 2007). This displacement likely led to smaller residential groups and more flexible residence strategies (Ember and Ember 1971; Service 1962). Horticulturalists are associated with higher-quality environments, larger social groups, more sedentary villages, more political inequality, and more intergroup conflict, and they may therefore provide additional insights into evolved human social structures. In terms of material wealth and wealth inequality, horticulturalists are more similar to hunter-gatherers than to pastoral or agricultural societies (Borgerhoff Mulder et al. 2009). Furthermore, lowland horticulturalists supplement their small-scale agricultural production with considerable hunting, fishing, and gathering (Hames 1989; Hames and Vickers 1983) and have mortality and fertility profiles similar to hunter-gatherers (Bentley, Goldberg, and Jasienska 1993; Gurven and Kaplan 2007).

Here we focus on lowland South America, a region of the world generally associated with swidden manioc horticulture and considerable tribal warfare (Chagnon 1967; Steward 1959; Steward and Faron 1959). Serious depopulation caused by introduced European diseases may have led to more ambi- or multilocality in Amazonia, but to alleviate this problem partially we try to focus as much as possible on earlier studies with more intact populations. Patrilocality and patrilineality were originally listed as defining traits of tropical forest culture in lowland South America (Oberg 1955; Steward and Faron 1959). More recently, however, this view has been challenged by ethnographic descriptions that emphasize lateral over lineal principles in social structure and relationships (Århem 1981; Crocker 1967; Hornborg 1988; Kaplan 1975; Mason 1997). We test the patrilocal tropical forest culture hypothesis, which predicts coresidence biases of men with their parents, against the sibling coresidence hypothesis, which predicts frequent coresidence of brothers and sisters.

We compare our lowland data set with a global sample of hunter-gatherers (Hill et al. 2011) further to investigate complexities of human coresidence patterns in traditional human societies. An important aspect of more sedentary horticultural societies is that residential units are often hierarchically nested (e.g., houses within clusters within villages), and analyzing kin coresidence patterns at multiple scales of analysis provides insight into emergent patterns in social structure often glossed over by traditional residence typologies. We also investigate age trends to examine differential strategies of coresidence between males and females across the life span (e.g., bride service demands, mothers helping daughters). Finally, high-status males such as headmen are likely to owe their positions of political power, at least in part, to the number and strength of kinship ties (Chagnon 1982; Hughes 1988; Mair 1962; Thomas 1982; von Rueden, Gurven, and Kaplan 2008). Headmen have higher fitness (Chagnon 1979; von Rueden, Gurven, and Kaplan 2011; Werner 1981) and are

also likely to attract more kin to their village, and more kin in turn may lead to even higher status. This positive feedback is likely to be especially important in places like Amazonia where social capital is paramount and heritable resources are mostly lacking (Gurven et al. 2010). We compare kin coresidence patterns of headmen to nonheadmen and examine how this relationship varies with residential group size.

## Methods

We analyze census and genealogical data on group composition collected from published literature and unpublished field notes for a sample of 34 small-scale horticultural societies in lowland Central and South America (see CA+ online supplement A). This sample includes 6,833 adults living in 243 residential groupings (extended households, longhouses, and villages). We calculate the average number of adult primary kin (i.e., mother, father, sisters, brothers, daughters, and sons) coresiding in each ethnographic study group, replicating previous methods (Hill et al. 2011). The 95% confidence intervals for the estimated mean number of coresident kin of each type were constructed by resampling with replacement 10,000 times from the available sample of adults in each society using a Java program. Age estimates are available for 10 societies, and adults are defined as individuals 15 years of age or older. Kin counts are parsed into age intervals if there are sufficient individuals in the oldest age interval ( $n > 10$ ). In the absence of age information, adults are defined as individuals listed as married, divorced, widowed, or reproductive. Paternity is taken at face value as reported by informants. Fictive kin relationships are ignored. Half and full siblings are combined.

The relative number of coresiding primary kin living with men versus women is well described by a measure developed by Helm (1965). Helm's measure ( $H$ ) is calculated as the sum of all adult primary kin living with an average man ( $k_m$ ) divided by the sum of all primary kin living with both an average man ( $k_m$ ) and an average woman ( $k_f$ ) such that:

$$H = \frac{(k_{\text{siblings},m} + k_{\text{offspring},m} + k_{\text{parents},m})}{(k_{\text{siblings},m} + k_{\text{offspring},m} + k_{\text{parents},m}) + (k_{\text{siblings},f} + k_{\text{offspring},f} + k_{\text{parents},f})}$$

Measure  $H$  can theoretically vary from zero, where women live with close kin but men do not, to unity, where men live with close kin but women do not. The valid measurement of residence patterns is an inherently complex problem (Fischer 1958; Goodenough 1956; Kronenfeld 1992). We prefer to focus on the simple elegance of  $H$ , which easily incorporates some of Fischer's (1958) critiques, such as defining marital residence in terms of individuals and not couples and reporting residence of both married and nonmarried individuals. However,  $H$  does not define residence in terms of the composition at the time of entry into that household and does not specify the degree of social integration into residential groupings, both of which are difficult to address given the available data.

A convenient aspect of  $H$  is that it does not vary system-

atically with the size of residential units because, while total kin counts increase with residential group size, this increase is similar for both men and women. Across our sample, the overall number of primary kin does not vary systemically with age because at population equilibrium parents die at approximately the same rate as offspring are born, although demographic stochasticity will affect age-related differences of coresiding kin within societies. There might be a concern that higher numbers of certain kin coresiding with a particular sex is simply driven by biased sex ratios, but none of the primary kin counts in our sample show this to be the case.

For a total of 78 residential groupings from 20 different societies in our sample, headmen were identified by ethnographers according to political leadership of longhouses or villages. More acculturated systems of leadership, such as elected “presidents,” were excluded (see CA+ supplement A). We compare the number of primary kin living with headmen versus the average for all other men in the headmen’s village as a function of residential group size. Group size was log transformed (base 10) better to approximate linear relationships of kin counts as a function of log group size, headman status, and the interaction effect between headman status and log group size. We ran models with society as random effect (varying intercept) because headmen analyses were at the level of a residential grouping and societies have variable numbers of entries (1–16).

## Results

Tabulations of the mean number of primary adult kin (parents, siblings, and offspring) coresiding in the same house, village, or longhouse (table 1) clearly support bisexual philopatry and dispersal for lowland horticulturalists not unlike that found for a global sample of hunter-gatherers where brothers and sisters commonly coreside (Hill et al. 2011). However, the lowland horticultural sample presented here is more uxorilocal (women live with more primary kin) on average ( $t = 3.86$ ,  $P = .0003$ ,  $n = 34$  horticulturalists vs. 33 hunter-gatherers) using Helm’s measure (fig. 1). Hunter-gatherers illustrate a greater tendency for brother-brother coresidence, and the total number of coresiding primary kin for men is typically higher (Hill et al. 2011). In contrast, 11 lowland horticultural societies show significant biases for women to live with more total primary kin, but only four societies show significant biases for men. There are 14 uxorilocal examples of women living with significantly more parents than men, but only three significant virilocal examples of men living with more parents. Overall, both men and women live with similar numbers of brothers ( $\sim 0.7$ ) and sisters ( $\sim 0.8$ ). Given these results and that lowland horticulturalists are actually more uxorilocal on average ( $H = 0.46$ ), especially for censuses at the extended household level ( $H = 0.38$ ,  $n = 5$ ), we reject the hypothesis of patrilocality as a defining trait of Amazonian tropical forest culture.

Statistical patterns of coresidence, including both individual kin counts and Helm’s measure, match to some degree with

ethnographically reported postmarital residence typologies. Makuna longhouses exchange sisters across residential groups (Århem 1981), and they are the most virilocal society in our sample ( $H = 0.63$ ), with men coresiding with approximately twice the number of parents and siblings as women do. Another virilocal example is the Yanomamo (Chagnon 1974; Lizot 1984), where men coreside with 1.8 brothers on average, one of the highest kin counts in the sample. On the female-biased side, there is a cluster of five uxorilocal groups ( $H \sim 0.35$ ), including the Je-speaking Krikati (Lave 1967), Bororo (Crocker 1967), and Suya (Seeger 1981), renowned for males transferring to live with in-laws of opposing moieties.

### Multiple Scales of Analysis

Arawete (Viveiros de Castro 1992) and Xavante (Maybury-Lewis 1967) show opposing examples of how residence biases can vary at different scales. Arawete men live with more kin at the level of clusters within their village ( $H = 0.55$ ), but women live with more kin at the village level ( $H = 0.44$ ), perhaps because they are a recent conglomeration of previously more dispersed groups. In contrast, Xavante women live with more kin at the level of extended households ( $H = 0.37$ ), but men live with more kin at the village level ( $H = 0.55$ ). In another case, the Krahô (Melatti 1970) are more uxorilocal at the extended household level ( $H = 0.33$ ) than they are at the village level ( $H = 0.45$ ). We also examined multiple scales of analysis for the Barí (hearth group vs. longhouse), Tsimane (house vs. cluster vs. village), Yanomamo (lineage vs. village section vs. village), and Marubo (longhouse vs. longhouse cluster) but found similar results in terms of Helm’s measure at different scales, and we therefore only report village level values in table 1.

### Coresidence over the Life Course

Helm’s measure generally decreases slightly with age toward more uxorilocality (fig. 2). The decreasing Helm’s trend with age reflects the fact that women marry and reproduce earlier and live longer than men (Gurven and Kaplan 2007) and may also reflect beneficial coresidence strategies of parents and daughters for cooperative reproduction later in life (Hawkes et al. 1998). Young men are often still in their natal house in the 15–21-year age interval, but then temporary bride service and often more permanent uxorilocal residence drag down Helm’s measure throughout later adulthood. One major exception is the Yanomamo, where older men (45+ years) are living with a number of sons (1.6) and brothers (2.2) on average. Also of note is the Makuna sister-exchange system, where emigrated women in their twenties live with almost no primary kin ( $H = 0.89$ ), while at later ages (30+ years) women begin to live with more adult offspring, primarily sons ( $H \sim 0.5$ ).

### Do Headmen Live with More Kin?

Our analysis shows that, in large groups, headmen live with more total number of adult primary kin than do other men

Table 1. Mean number of coresiding adult primary kin for men and women sorted from most to least biased toward women living with more primary kin

Society	Residential units	Total adults	Women's parents	Men's parents	Women's sisters	Men's sisters	Women's brothers	Men's brothers	Women's primary kin	Men's primary kin	Helm's measure	Source
Machiguenga	20 ext. houses	68	.26 <sup>†</sup>	.08	.14	.04	.02	.00	.63 <sup>†</sup>	.28	.31	1
Krikati	22 ext. houses	120	.38 <sup>†</sup>	.24	.34 <sup>†</sup>	.20	.17 <sup>†</sup>	.04	1.29 <sup>†</sup>	.72	.36	2
Tenetechara	1 village	60	.59 <sup>†</sup>	.21	.81	.21	.19	.21	1.96 <sup>†</sup>	1.11	.36	3
Bororo	19 ext. houses	101	.24 <sup>†</sup>	.13	.07	.11	.09	.04	.67 <sup>†</sup>	.38	.36	4
Suya	1 village	44	.36	.26	1.60	.95	.72	.63	3.24 <sup>†</sup>	1.84	.36	5
Xavante	65 ext. houses	356	.29 <sup>†</sup>	.10	.83 <sup>†</sup>	.17	.11	.24 <sup>*</sup>	1.39 <sup>†</sup>	.81	.37	6
Wakuenaí	2 villages	29	1.13 <sup>†</sup>	.46	.80 <sup>†</sup>	.38	.33 <sup>†</sup>	.15	2.99 <sup>†</sup>	1.91	.39	7
Waiwai	4 villages	34	.22	.13	.33	.25	.22	.25	1.06	.69	.39	8
Trio	8 villages	102	.33	.18	.17	.13	.10	.22	.93	.69	.43	9
Ka'apor	2 villages	55	.40	.24	.27	.24	.20	.16	1.23	.92	.43	10
Wari <sup>†</sup>	5 villages	48	.15	.27	.77 <sup>†</sup>	.18	.15	.27	1.28	.96	.43	11
Apinayé	1 village	59	.81 <sup>†</sup>	.50	.45	.50	.45	.29	2.41	1.89	.44	12
Mayangna	2 villages	143	.99 <sup>†</sup>	.72	1.61	1.35	1.33	1.13	4.93 <sup>†</sup>	3.90	.44	13
Arawete	1 village	77	.65 <sup>†</sup>	.30	.81	.95	1.03	.85	3.09 <sup>†</sup>	2.45	.44	14
Krahó	4 villages	296	.58 <sup>†</sup>	.37	.63	.63	.54 <sup>†</sup>	.31	2.23 <sup>†</sup>	1.80	.45	15
Chacobo	20 villages	388	.87 <sup>†</sup>	.60	1.04 <sup>†</sup>	.84	.81	.68	3.48 <sup>†</sup>	2.81	.45	16
Kagwahiv	2 villages	39	1.05 <sup>†</sup>	.50	.63	.60	.63	.50	2.99	2.45	.45	17
Yuqui	1 village	39	.32	.59 <sup>*</sup>	1.91	1.29	1.00	1.06	3.82	3.18	.45	18
Karitiana	1 village	90	.81	.92	2.91	2.38	1.66	1.41	6.25	5.53	.47	19
Tsimane	28 villages	2397	.98	.94	1.23	1.15	1.27 <sup>†</sup>	1.14	4.54 <sup>†</sup>	4.09	.47	20
Waimiri	3 villages	70	.34	.34	.75	.71	.84	.79	2.35	2.13	.48	21
Panare	2 villages	36	.81	.67	.76	1.00	.71 <sup>†</sup>	.40	3.05	2.81	.48	22
Piaroa	10 ext. houses	72	.41	.46	.43	.46	.38	.37	1.73	1.60	.48	23
Barí	10 longhouses	228	.33 <sup>†</sup>	.21	.53	.61	.58	.50	1.72	1.60	.48	24
Warao	3 villages	81	1.12 <sup>†</sup>	.84	1.40	1.58	1.40	1.11	4.88	4.55	.48	25
Katukina	2 villages	58	.90	.68	.47	.96 <sup>*</sup>	.90	.79	3.11	3.18	.51	26
River Pumé	2 villages	125	.76	.83	.65	1.13 <sup>*</sup>	1.15	1.08	3.51	3.68	.51	27
Ayoreo	2 villages	76	.44	.41	.21	.19	.18	.38 <sup>*</sup>	1.28	1.35	.51	28
Pemon	3 villages	47	.78	.85	1.33	2.00 <sup>*</sup>	1.48	1.00	4.37	4.70	.52	29
Yekwana	6 villages	98	.83	.88	.83	1.13 <sup>*</sup>	.78	.60	3.25	3.57	.52	30
Shuar	25 villages	928	.66	.84 <sup>*</sup>	.99	1.23 <sup>*</sup>	1.13	1.39 <sup>*</sup>	3.58	4.13 <sup>*</sup>	.54	31
Yanomamo	5 villages	313	.52	.62	1.15	1.25	1.24	1.77 <sup>*</sup>	3.46	4.20 <sup>*</sup>	.54	32
Marubo	4 longhouses	57	.47	.39	.94	.87	.59	1.30 <sup>*</sup>	2.47	2.95	.54	33
Arawete	6 clusters	77	.30	.28	.22	.44 <sup>*</sup>	.46	.72	1.36	1.66	.55	14
Xavante	3 villages	356	.37 <sup>†</sup>	.28	1.23	1.38	.93	1.31 <sup>*</sup>	2.77	3.44 <sup>*</sup>	.55	6
Makuna	17 longhouses	99	.28	.63 <sup>*</sup>	.13	.37 <sup>*</sup>	.40	.77 <sup>*</sup>	1.32	2.21 <sup>*</sup>	.63	34
Mean			.59	.49	.83	.80	.69	.67	2.70	2.46	.46	

Sources. 1 = Johnson (2003), 2 = Lave (1967), 3 = Wagley and Galvão (1949), 4 = Crocker (1967), 5 = Seeger (1981), 6 = Maybury-Lewis (1967), 7 = Hill and Moran (1983), 8 = Meggers and Evans (1964), 9 = Rivière (1969), 10 = Balée (1984), 11 = Conklin (1989), 12 = Da Matta (1971), 13 = Koster (ND), 14 = Viveiros de Castro (1992), 15 = Melatti (1970), 16 = Córdoba and Villar (ND), 17 = Kracke (1978), 18 = Stearman (2001), 19 = Lucio (1996), 20 = Gurven and von Rueden (ND), 21 = Silva (2009), 22 = Dumont (1978), 23 = Kaplan (1975), 24 = Beckerman (ND), 25 = Suárez (1968), 26 = Deturche (2009), 27 = Kramer and Greaves (ND), 28 = Bugos (1985), 29 = Thomas (1982), 30 = Arvelo-Jimenez (1971), 31 = Sugiyama and Hagen (ND), 32 = Chagnon (1974) and Lizot (1984), and Hagen (ND), 33 = Melatti (1977), and 34 = Århem (1981). (ND) = data not published elsewhere.

Note. Arawete and Xavante enter twice at different scales but only the village level enters into the overall averages. "Ext. houses" refers to extended family households. Significant differences were determined by resampling.

\* Indicates significantly more kin coresiding with men.

† Indicates significantly more kin coresiding with women.

(fig. 3). Further statistical tests of individual types of kin show that the interaction effect between group size and headman status is driven primarily by siblings and secondarily by offspring (table 2). The interaction effect for offspring is only borderline significant and diminishes when age is introduced into the model because headmen are 40 years old on average,

about 6 years older than average nonheadmen. The finding that headmen live with more siblings in large villages, both brothers and sisters in approximately equal amounts, may suggest both that coresident siblings are fundamental for headmen to attain leadership in competitive settings and that siblings prefer to reside in villages where their brother is headman.

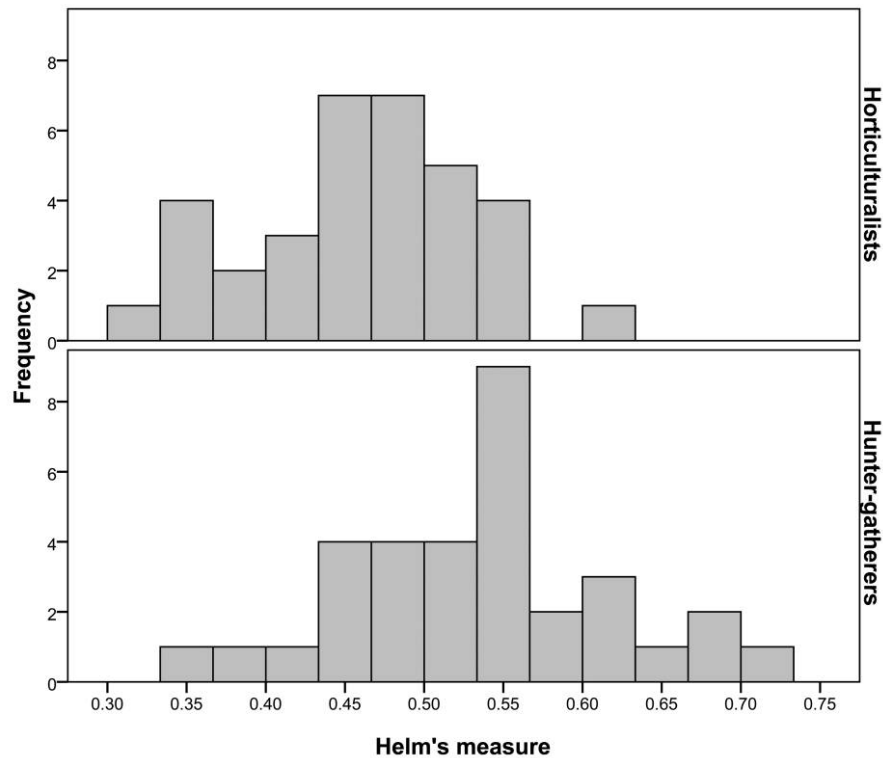


Figure 1. Frequency distribution of Helm's measure for 34 lowland horticulturalists (top, mean = 0.46, SD = 0.07) compared to 33 hunter-gatherer societies (bottom, mean = 0.53, SD = 0.08).

Discussion

Several of our findings point to a human social structure not fully described by traditional postmarital residence typologies or by biological categorizations of philopatry. First, adult brothers and sisters frequently coreside in nearly all societies in our sample, and more sibling coresidence is associated with

political leadership in large villages. Second, Arawete and Xavante show how residence biases can vary at different scales of analysis, and there is no known anthropological term for this type of variation. Third, sex biases in coresident kin vary considerably across the life span, with age trajectories generally showing an increasing importance of women living with

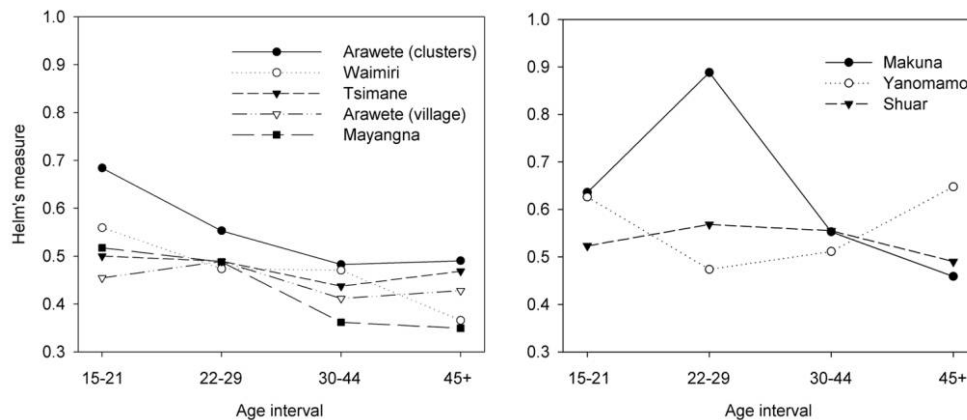


Figure 2. Helm's measure as a function of age (where available) for societies with an age trend toward more uxorilocality (left) and for the more virilocal societies in the sample where age trends are more variable (right).

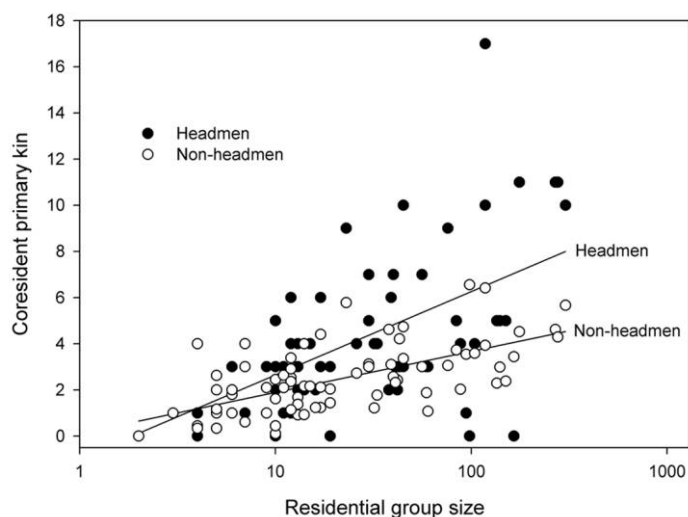


Figure 3. Total number of coresident primary kin as a function of residential group size (log scale) for 78 headmen versus all other nonheadmen averaged. The slope of this relationship for headmen is twice as high (slope = 3.6, 95% confidence interval = 2.6–4.7,  $R^2 = 0.38$ ) as the slope for nonheadmen (1.8, 95% confidence interval = 1.3–2.3,  $R^2 = 0.42$ ).

primary kin, at least in more uxorilocal contexts. Finally, while statistical patterns of coresidence do match to some degree with ethnographically reported postmarital residence, there is again no appropriate anthropological term for some cases. For example, at both the village and household levels, Xavante men live with statistically more brothers than do women, and women live with significantly more parents.

Classical social organization studies examine postmarital residence decisions by asking whether or not couples generally reside with or near particular relatives after marriage (Murdock 1949). Historically, the standard method was to note the ideal arrangement or the most common type of residence pattern and to ignore variation. However, it can be difficult clearly to distinguish actual decisions made by individuals and the on-the-ground availability of kin of different categories from preferences for particular residence situations that may not be realized due to demographic constraints. Our method using actual coresidence information may offer some advantages over standard anthropological typologies by reporting and comparing counts of coresident kin (Helm 1965; Hill et

al. 2011; Kramer and Greaves 2011). Stated cultural “rules” may still be informative, however, since our method can only clearly distinguish moves between segments within villages from coresidence in the natal house when censuses are specific to multiple scales of analysis. For example, the “matrilineal puzzle” (Schneider 1961) is potentially solved by men marrying locally to retain decision-making power over matrilineal groups. In such a case, a society may be strictly matrilocal at the household level but coresidence analysis at the community level will show brothers and sisters coresiding. The Xavante are another example where women live with more kin at the level of extended households, perhaps to facilitate child care, but men live with more kin at the village level, perhaps to facilitate male alliances. Because of these complexities, more complete accounts of ethnographic variation should ideally include both traditional residence typologies and actual patterns of coresidence from censuses taken at multiple scales of community structure.

Explaining variation in residence patterns remains a formidable task. Some potentially important variables include

Table 2. Parameter estimates from regressions of kin count as a function of log residential group size, headman status, and the interaction between the two

Dependent variable	Intercept	Log group size	Headman	Log group size × headman
Total close kin	-.04	1.90*	-1.07	1.83*
Parents	.24	.22	-.35	.12
Siblings	-.14	1.20*	-1.08	.95*
Offspring	.04	.43	.36	.76

Note. Society was entered as random effect (varying intercept). Estimates not marked with an asterisk have  $P > .05$ .

\*  $P < .01$ .

the scale of horticulture, relative importance of fishing versus hunting (Beckerman 1993), value of bride service, internal versus external warfare (Ember and Ember 1971), brother-brother competition over mates, male or female cooperative labor, length of male absence, rate of wife capture, costs of obliging kin, and demographic stochasticity. While these variables are likely to affect residence strategies, most are difficult to quantify in our sample given the anecdotal nature of the ethnographic record. We do note that lowland Amazonians are traditionally more warlike than the hunter-gatherer sample, and yet lowlanders are more uxorilocal and show less of a brother-brother bias than that seen in hunter-gatherers. Tentatively, it seems that those Amazonians traditionally under strong pressure of internal conflict within ethnolinguistic boundaries (e.g., Makuna, Marubo, Shuar, Xavante, and Yanomamo) do emphasize brother-brother coresidence, whereas those under mostly external conflict, which potentially requires more male absence, are more uxorilocal (e.g., Suya, Bororo, Trio, and Arawete), as has been supported in a global sample of human cultures (Ember and Ember 1971). If warfare is intense between multivillage blocks, and brothers are not too far away, they can still form important alliances in external warfare without competing directly for available mates in the local village.

While hunter-gatherers show more brother-brother coresidence biases (Hill et al. 2011) and lowland horticulturalists show more parent-daughter biases, a uniquely human pattern of flexible philopatry, dispersal, and visiting across multiple levels of social structure creates frequent adult brother-sister coresidence across both subsistence types (see also Irons 1979). This is further support for the importance of long-term sibling and bilateral kin cooperation as predicted from Chapais's (2008) model, where amicable between-group relations are facilitated by visiting and opportunistic coresidence in human meta-groups. As seen across Amazonia, meta-group social structure also serves to ramp up the scale of warfare by uniting multiple lineages, villages, and even chiefdoms against other confederations (Chagnon 1967, 1974; Oberg 1955; Redmond 1994; Steward 1959). Between-group alliances stemming from marriage exchange and trading systems likely increased the scale of cooperative networks to levels unparalleled by other species and essential for successful competition against other large alliances.

### Acknowledgments

Financial support was provided by Research Board and Arts and Science Alumni Organization Faculty Incentive Grants (University of Missouri) to Robert S. Walker. We thank the Amazon course (Fall 2011) for help with finding ethnographic sources and Summer Sanford for much help in data coding.

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