Original Article

Hypothetical rankings of prospective husbands for female kin in lowland Nicaragua: consensus analysis indicates high agreement and associations with wealth and hunting skill ☆

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Abstract

In preindustrial societies, kin may exert influence on the mating choices of women, but there have been few systematic studies of the preferred characteristics of husbands for female kin. In an indigenous Mayangna and Miskito community, photographs of 29 male household heads were presented to informants, who ranked the men on three characteristics: desirability as a spouse, hunting ability and wealth. For the desirability rankings, informants were asked to consider the advice that they would give to young female relatives and rank the men based on the qualities that such women should seek in a husband. Consensus analysis indicates that there is high agreement among informants on all three sets of rankings. There is no evidence that the age and sex of informants are associated with variation in evaluations of the desirability of men, which suggests that the evaluations by reproductively active women do not significantly differ from rankings by other informants. Multivariate analysis indicates that perceptions of both a man's wealth and his hunting ability are positively associated with his desirability as a prospective husband for female kin. By contrast, a strong kin-based social network, as measured by the presence of consanguineal kin in the community, seems unimportant to a man's desirability as a husband. Although it remains unclear to what extent hunting ability is a signal of phenotypic quality, these results support predictions that individuals will encourage female kin to marry men who are good resource providers. Finally, compared to a conventional reliability analysis, consensus analysis is demonstrated as a superior method for assessing both unidimensionality and subgroup variation in informant rankings.

Keywords: Consensus model; Mate preferences; Parental choice; In-law preferences

1. Introduction

Much of the pioneering evolutionary research on mating preferences is based on studies conducted in industrialized nations (Buss, 1989). As predicted by parental investment theory (Trivers, 1972; see also Kokko & Jennions, 2008), these studies indicate that females place greater emphasis than males on the ability of their spouses to acquire resources (Shackelford, Schmitt, & Buss, 2005). To investigate the

cross-cultural reliability of this apparent difference, a few ethnographers have conducted studies of mating preferences in small-scale, preindustrial societies. There is evidence that Hadza women desire skilled hunters as husbands, for example (Marlowe, 2004). In Amazonian Ecuador, attractiveness rankings of Quichua and Achuar men show positive correlations with hunting ability and social status after controlling for the effects of age (Escasa, Gray, & Patton, 2010). Among the Shuar, peer evaluations indicate that both men and women value a good personality and physical attractiveness in their potential mates, but only women consider the merits of prospective partners as providers (Pillsworth, 2008).

The design of these studies provides insight into the unconstrained mating preferences of females. In many small-scale societies, however, parents and other family members exert considerable influence on the mate choices of women (Apostolou, 2007; see also Faulkner & Schaller, 2007). There

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is probably considerable agreement between women and their kin about the desired characteristics of prospective husbands. Although women may exhibit relatively stronger preferences for heritable physical traits (Buunk, Park, & Dubbs, 2008), both women and their kin should prefer men with the traits needed to support the woman and her offspring. From the perspective of the woman's kin, paternal investment by the husband may relieve their need to support the woman and her offspring. There can also be direct benefits when kin receive resources from the woman's husband.

The importance of a prospective husband's wealth, industriousness, character and family background is a recurring theme in the ethnographic literature on parental influence on female mate choice in small-scale societies (Apostolou, 2010). Yet, few ethnographers have specifically investigated the preferences of a woman's kin. As a result, there is little quantitative evidence that kin prioritize resource-related traits over other characteristics of possible suitors, and cross-cultural reviews such as Apostolou's (2010) must therefore rely on anecdotal ethnographic reports, which typically offer little indication that the reported preferences are representative of the entire population. This study addresses that gap in the literature by using peer rankings of male household heads to investigate preferences for prospective affinal kin among indigenous horticulturalists in lowland Nicaragua. This research uses consensus analysis to assess patterns of agreement among informants, specifically testing for differences related to the age and sex of the informants. Additional tests examine the relationships between the aggregated desirability rankings and other measures of resource provisioning and kin-based cooperation.

2. Study site

The lowland tropical forest of Honduras and Nicaragua is known as the Mosquitia. Located in the center of the Mosquitia in northern Nicaragua, the Bosawas Reserve is inhabited by two indigenous groups, the Mayangna and the Miskito (Stocks, 2003). Although the language and ethnicity of the Mayangna and Miskito remain distinct, there is considerable acculturation and intermarriage between the two groups, especially along the tributaries of the Rio Coco. The indigenous societies have also adopted some Western norms via exposure to European missionaries and the mestizo populations surrounding the reserve (Stocks, 1996).

The Mayangna and Miskito are swidden horticulturalists whose major crops include bananas, plantains, manioc, yams, corn, rice and beans. Although women contribute to horticultural production by planting and harvesting grain crops, they allocate relatively little time to horticulture compared to women in other indigenous Neotropical societies (Hames, 1989). Hunting and fishing, which provide much of the protein in the diet, are also primarily male-oriented activities (Koster, 2008b). Hunters use dogs and .22

caliber rifles, and common prey types include agoutis, pacas, nine-banded armadillos, collared peccaries, white-lipped peccaries and tapirs (Koster, 2008a). Fishing returns peak in the dry season (January–May), when the clear water allows men to use the bow and arrow, lures and SCUBA masks and crossbows (Koster, 2007). During the rainy season, both males and females typically use fishhooks. The Mayangna and Miskito also keep livestock, including cattle, pigs and fowl. Beef is rarely consumed, however, because households keep cattle primarily for sale during times of economic need. Although barter and trade are common, the indigenous communities frequently use Nicaraguan currency. A few adults hold jobs as schoolteachers, including a female preschool teacher, but occasional wage labor and panning for gold represent the leading sources of income for most households. Compared to men, women devote less time to moneymaking activities, including gold panning, and therefore they are largely reliant on their husbands' earnings for cash-related purchases (Koster, 2007).

The indigenous societies of the Mosquitia have been described as tolerant of casual sex among young adults (McSweeney, 2002). Yet, although females in their early teenage years are considered marriageable, there is a clear expectation that sexual activity by a young woman should be restricted to long-term relationships in which her partner is co-residing and contributing to household chores and subsistence labor (e.g., agricultural work). The Mayangna and Miskito are vigilant about the budding relationships of their female kin, who typically begin their first long-term relationship in their late teenage years. The initial stages of courtship occur in a public setting, as male suitors seek opportunities to converse with women, usually on the porches of their homes. A teenage female's relatives, especially parents, aunts and uncles, can often be overheard discussing these courtships, and possible interventions are openly discussed when they disapprove. If a man surreptitiously continues a courtship following an intervention, then verbal disputes and violent threats that embroil the respective extended families may ensue upon the discovery of his actions.

Adolescent females who have never been married usually reside with their mothers and, by extension, either their fathers or stepfathers. When a prospective husband expresses an interest in a relationship with the young woman, she may invite him to move into her household if her parents consent. Prior to initiating a conjugal relationship with the woman, the man may spend multiple weeks in the household while often assisting other male household members with subsistence tasks. Broad public recognition of the relationship generally occurs once the woman is pregnant. It is common for young couples to form an independent household only when the woman is pregnant with a second child. Descent is traced bilaterally, and there are no clearly established postmarital residence rules (von Houwald, 2003), but couples typically build their houses near either partner's parents.

This study was based in Arang Dak, a community of 30 households on the Lakus River, a tributary of the Coco River. Arang Dak is nominally a Mayangna community, but 17% of the household heads self-identify as Miskito; all of these people were born in other communities. The absence of consistent postmarital residence rules is evidenced by the fact that, of the 24 household heads who are lifelong residents of Arang Dak, 54% are female and 46% are male.

Polygyny is no longer practiced in the Mosquitia (cf., Conzemius, 1932:149), but divorces at younger ages are relatively common. Of the 35 women in Arang Dak who are at least 22 years old, 40% have had children with more than one man. Adultery rates can be difficult to estimate (Winking, Kaplan, Gurven, & Rucas, 2007), but multiple widely acknowledged affairs prior to the study period suggest that adultery is not uncommon, even though it is not condoned.

3. Methods

3.1. Data collection

This research took place in July 2008. The participants in this study were adult community members. From each household in Arang Dak, either the male or female head of household was randomly selected and invited to participate. To expand the sample, additional informants were randomly selected from the pool of individuals who had not been invited in the first stage of the recruitment. The first nine interviews were used to refine the questions posed to informants and not included in the final sample. In total, the sample of 41 informants used in subsequent analysis includes 18 men and 23 women, ranging in age from 17 to 65.

Before the interviews, 29 male household heads posed for photographs. During the interviews, these photographs were randomly placed on a table and presented to the informants, who were asked to conduct a series of rankings. To reduce the influence of demand characteristics on the dependent variable (Orne, 1962), informants were first asked to rank the men in order of their desirability as husbands. For these rankings, the informants were specifically told to consider the advice that they would give to a young female relative who was thinking about getting married for the first time. Given that consideration, which of the men would be the kind of husband whom she should aspire to marry? In this context, informants ranked the men from the most desirable to the least desirable.

Following the first set of rankings, the informants ranked the men in order of hunting skill, and finally, they ordered the photos in order of the men's wealth, from the wealthiest to the least wealthy.

Additional data on the male household heads and informants came from censuses and genealogical interviews, which were conducted in 2004–2005 and updated in 2008.

3.2. Analysis

The rankings data were analyzed with the informal cultural consensus model of Romney, Batchelder, and Weller (1987), as implemented in UCINET 6.275 (Borgatti, Everett, & Freeman, 2002). Developed as a way to assess patterns of agreement among informants, the consensus model is essentially a factor analysis of participants' responses. In general, consensus is inferred when there is a single factor solution or a single response pattern (i.e., the first factor accounts for at least three times as much variance as the second factor). Usually called the informants' "competence," the first factor loadings provide information about the level of agreement in the sample because the square of the average competence is approximately equal to the average Pearson correlation coefficient between all pairs of informants (Weller, 1987). The second factor loadings can be used to examine residual subgroup variation in agreement after accounting for the consensus agreement (Weller, 2007).

The first set of factor scores, sometimes called the "answer key," provides an average of the rankings for each man, weighted by the informants' competence scores. The factor scores are hereafter described as the aggregated rankings for each of the three traits (i.e., wealth, hunting skill and desirability). The rankings were scaled such that higher numbers represent wealthier men, better hunters and more desirable husbands.

Standard inferential statistics were used to test relationships between the aggregated desirability rankings and other predictor variables. Following Apostolou (2010), I predicted that the wealth rankings and the hunting rankings will be positively correlated with desirability. That is, wealthier men and better hunters will be perceived as more desirable spouses. Given the importance of kin-based social networks in preindustrial societies (see Alvard, 2009 for a recent review), I also predicted that men with more kin in the community will be considered more desirable as prospective husbands. Also, Helms (1971) notes that village endogamy was preferred in a nearby Miskito community because the character and personality of long-time residents are already known. Because long-time residents usually have more consanguineal relatives in the community, the presence of extensive kin-based networks in the community may be a proxy for the confidence that informants feel about the trustworthiness and character of the men being ranked.

To examine the importance of kin-based networks, I used DESCENT Version 0.2.0.2 (Hagen, 2005) to generate Wright's (1922) coefficient of relatedness between all residents of Arang Dak. Then I calculated the average degree of relatedness between each male household head and other community members.

Given the hypothetical nature of the desirability rankings, there were no specific predictions about the age of the men. Age is included primarily as a control variable, both as a linear and a quadratic term. In the multivariate analysis, the term for age is centered at the mean of 40 years old.

4. Results

4.1. Consensus analysis: wealth

The wealth rankings exhibited a strong consensus. The ratio of the first eigenvalue to the second eigenvalue was 27.88:2.34, which exceeds the recommended 3:1 ratio. The average competence was high (.82±.08), with a range of .61 to .93. These results indicate that there is considerable shared agreement about the wealth of the male household heads in Arang Dak.

In a regression model with the wealth rankings as the outcome variable and the men's ages as the predictor variable, there was a significant quadratic relationship (R^2=.22; p=.04), with predicted values peaking for men in their late forties (Fig. 1).

Again setting the wealth rankings as the outcome variable in a multiple regression model that exhibits a good fit to the data (R^2=.66; p<.001), predictor variables for the number of cows owned by the men (Beta=.39; p=.01), rifle ownership (Beta=.32; p=.03) and the ownership of a house with a separate kitchen (Beta=.35; p=.01) exhibited significant positive effects on the rankings. This result suggests that the informants' wealth rankings are associated with conspicuous indicators of wealth in this community.

4.2. Consensus analysis: hunting ability

Like the wealth rankings, the rankings of hunting ability exhibited a strong consensus. The ratio of the first to the second eigenvalue was 27.83:1.25. The average competence was high, (.82±.07) with a range of .61 to .93.

As reported by Koster (2010), the hunting rankings are also characterized by a convex age pattern (R^2=.33;

Fig. 1. The best-fitting quadratic curve (R^2=.22; p=.04) of age regressed on the aggregated wealth rankings.

p=.005). The highest predicted rankings are for men in their late forties.

Much like the associations with the ownership of material possessions provide support for the external validity of the aggregated wealth rankings, Koster (2010) reported a significant relationships between the aggregated hunting rankings and observed hunting skill, as measured in a quantitative ethnographic study of hunting returns.

4.3. Consensus analysis: desirability as husband

There was a consensus in the desirability rankings (eigenvalue ratio 18.66:2.62). The average competence was relatively high (.64±.22). The range of competence scores was −.15 to .88, and most (78%) were greater than .50.

For both male and female informants, the average competence was .64. If female informants were to exhibit high agreement on the rankings while men ordered their rankings at random, then the average female competence would be relatively higher. The lack of a sex-related difference in competence is an indication that both male and female informants view the desirability of the male household heads in broadly similar terms.

The second factor loadings provide additional information about the possibility of residual agreement beyond the overall shared agreement, based on characteristics of the informants. In a multiple regression model with the informants' second factor loadings as the outcome variable (R^2=0.06; p=.55), the standardized coefficients for sex (Beta=.61; p=.18), age (Beta=.25; p=.28) and the interaction of those two terms (Beta=−.53; p=.27) accounted for little variation. In other words, after accounting for the agreement associated with the consensus model, there was little residual agreement shared by any age–sex class. The apparent absence of residual agreement is consistent with the high overall agreement among the entire sample of informants. That is, virtually all informants perceived the men's desirability similarly, including reproductively aged women who might view the men as prospective husbands or extra-pair mating partners.

As with the previous rankings, there was a significant convex relationship between the men's ages and the aggregated desirability rankings (R^2=.30; p=.01), with predicted values again peaking for men in their late forties (Fig. 2).

4.4. Bivariate analysis

There was a strong correlation between the aggregated desirability rankings and the aggregated wealth rankings (Pearson's r=.93; p<.001). That is, wealthier men were considered more desirable as spouses for female kin (Fig. 3).

There was also a significant correlation between the aggregated desirability rankings and the aggregated hunting rankings (Pearson's r=.70; p<.001). In other words, informants considered skilled hunters to be preferred spouses for female kin (Fig. 4).
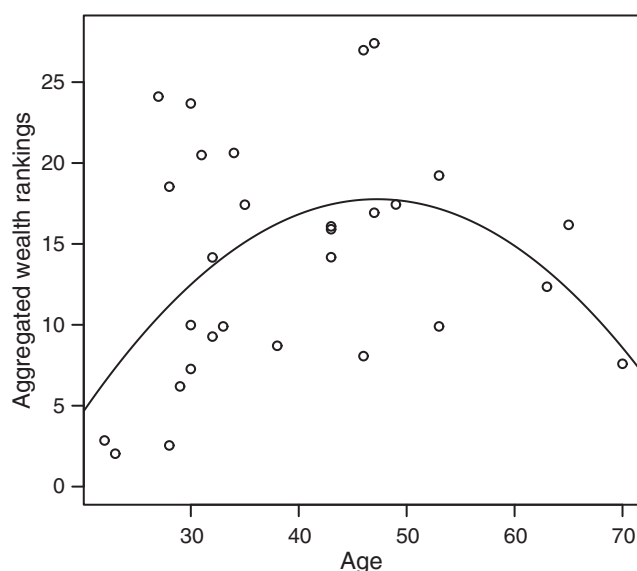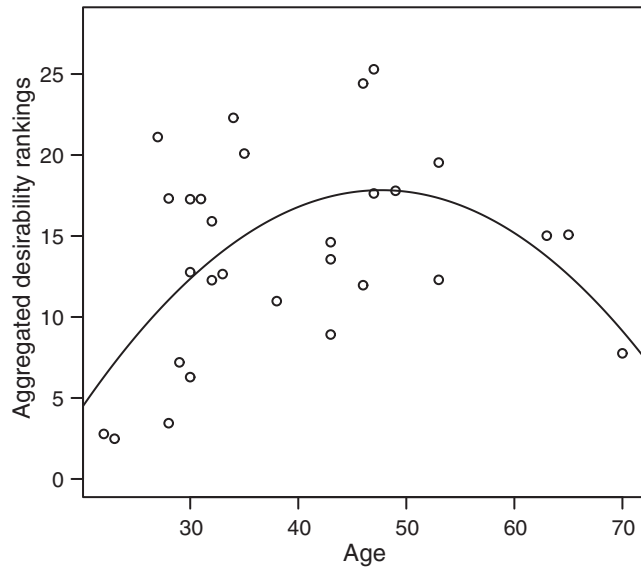
Fig. 2. The best-fitting quadratic curve (R^2=.30; p=.01) of age regressed on the aggregated desirability rankings.

In terms of kin-based networks, there appears to be little relationship between the aggregated desirability rankings and the average relatedness of men to other community members (Pearson's r=.09; p=.64). That is, men with more consanguineal kin in Arang Dak were not consistently rated higher as prospective spouses.

4.5. Multivariate analysis

Along with the terms for age, the significant predictors from the bivariate analysis, wealth and hunting ability, were included in a multiple regression model with the aggregated desirability rankings as the outcome variable. This model
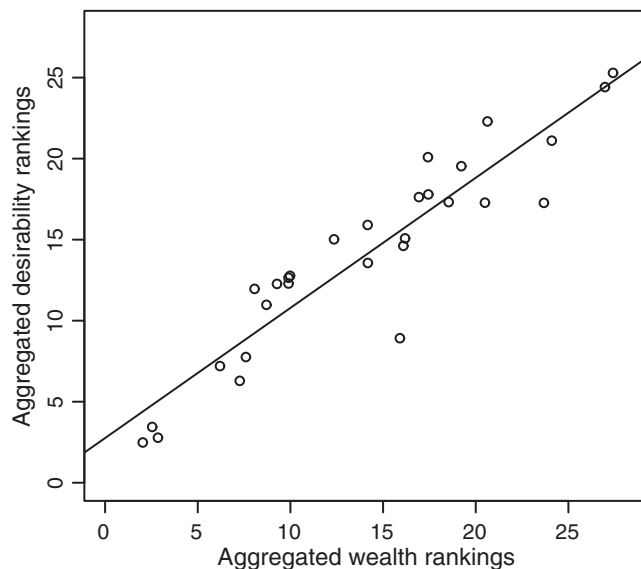

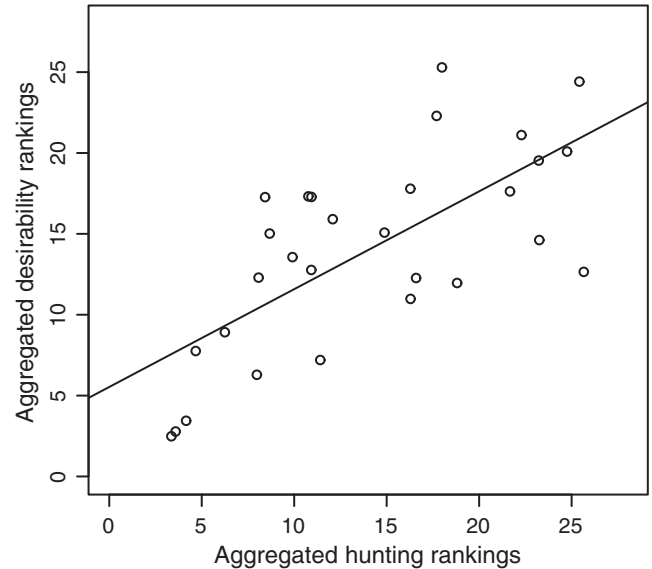Fig. 3. Aggregated desirability rankings by aggregated wealth rankings.

Fig. 4. Aggregated desirability rankings by aggregated hunting rankings.

accounted for much of the variation in the aggregated desirability rankings (R^2=.92), and both the wealth rankings (Beta=.77) and the hunting rankings (Beta=.27) were significant predictors (Table 1). After controlling for the effects of wealth and hunting ability, however, there was little relationship between age and desirability.

5. Discussion

5.1. Mate preferences

For a small-scale, generally egalitarian society, the high agreement among informants on the wealth rankings is noteworthy. The consensus on the wealth rankings is likely attributable to the high visibility of relatively expensive material possessions. For example, in a community in which cattle are allowed to roam freely, informants are keenly aware of differences in livestock ownership. This study incorporated ownership of livestock, rifles and building materials to assess the external validity of the wealth

Table 1
Multiple regression model, with the aggregated desirability rankings as the outcome variable

	Parameter estimate	Standard error	Standardized coefficient	p
Intercept	1.50	1.32		.27
Aggregated wealth rankings	.66	.06	.77	<.001
Aggregated hunting rankings	.23	.07	.27	.002
Age (centered)	.03	.04	.07	.38
Age-squared	.001	.003	−.01	.92

Model F value=68.5; p<.001; R^2=.92.

rankings, but other indicators of wealth in the reserve are also highly visible, such as radios, clothing, wristwatches, chain saws and outboard motors. In a similar way, the evidence of successful hunting is highly visible. That is, given an average interhousehold distance of approximately 120 m, residents have ample opportunities to see hunters returning with large game. Coupled with the high variance in hunters' harvests (Koster, 2010), high agreement on the hunting rankings is relatively unsurprising.

To the extent that the aggregated desirability rankings reflect the best interests of young, unmarried female relatives, this study provides additional support for a female emphasis on the resource-related traits of their prospective husbands. The strength of the correlation ($r=.93$) between a man's wealth and his perceived desirability as a spouse suggests that wealth is the primary consideration when evaluating prospective husbands. This result is consistent with informants' responses when they are informally asked about the qualities of a "good husband." As in the data of Buss et al. (1990), many respondents mention personality traits such as kindness, but most also indicate that good husbands should provide their wives with the things they need around the house. The ability to buy needed medicines for sick family members was mentioned by several informants. Interestingly, some female respondents reported that their own husbands were poor, so they hoped their daughters would marry wealthier men and have more comfortable lives. Given this emphasis on wealth, it is interesting to note that several informants, including two of the young unmarried women in the sample, also said that young women should not allow their attraction to a handsome man to influence their mating choices. Overall, these opinions contrast with qualitative data from male informants about the traits associated with the desirability of females, which reportedly include a woman's skill at domestic chores, "common sense," attractiveness and virginity (cf., Gurven, Winking, Kaplan, von Rueden, and McAllister, 2009). These informants seldom mentioned wealth, which is consistent with the limited economic opportunities for women in this society.

From the perspective of a woman's kin, there may be benefits if she marries a wealthy man. For example, wealthy men are a comparatively promising source of medicines, loans of money and other loaned items, such as SCUBA masks and plastic tarps. Furthermore, several of the wealthier men have small business ventures, such as the selling of commercial goods, processed lumber or cash crops. Such ventures frequently require hired help, and these men seem inclined to hire their kin whenever possible. Given these possibilities, it appears to be advantageous for individuals to encourage their young female relatives to marry a man with good financial prospects.

Although it exhibits a relatively weaker effect after controlling for the wealth rankings, the aggregated hunting rankings are also a significant predictor of desirability. This result could be interpreted as additional support for the importance of resource-related traits. Early ethnographic reports indicate that hunting and fishing have traditionally been important husbandly duties among the indigenous societies in the Mosquitia: "Before giving their daughter away in marriage, the parents will satisfy themselves that the suitor is able to provide for his future wife and that he understands the manufacture of hunting and fishing implements" (Conzemius, 1932:145). Changes in the economic landscape of the Mosquitia have made it possible to obtain an adequate diet in other ways, but hunting and fishing remain the primary sources of dietary protein in Arang Dak (Koster, 2007). Also, much as individuals can benefit from wealthy affinal kin, a recent study of interhousehold meat sharing in Arang Dak suggests that hunted game is frequently given by skilled hunters to closely related households (Koster, in press). This custom provides additional motivation for individuals to encourage their female kin to marry talented hunters.

A separate but compatible interpretation is that hunting success serves as an honest signal of phenotypic quality. In other words, because successful hunting requires both good physical condition and sophisticated cognitive abilities (Gurven, Kaplan, & Gutierrez, 2006), skilled hunters could be signaling their superior health or intelligence (Smith & Bliege Bird, 2000). Evidence of these traits could then be used to distinguish the desirability of the men as prospective husbands or allies. Yet, as in other settings (e.g., Smith, Bliege Bird, & Bird, 2003), it is not clear to what extent the residents of Arang Dak use knowledge of hunting ability to make inferences about other traits. Nevertheless, the apparent importance of hunting ability among prospective affinal kin merits attention in anthropological reconsiderations of the motives for hunting by men (Gurven & Hill, 2009).

Finally, given the evidence that "good family background" is often a preferred characteristic for prospective in-laws in preindustrial societies (Apostolou, 2010), the weak effect of the relatedness variable in this analysis is somewhat surprising. It is likely that the framing of the question prompted informants to consider only the men's attributes and personality, not their embeddedness in broader social networks. Almost all of the men being ranked had lived in the community for at least several years, so the rankings exercise was not necessarily analogous to the questions that arise when an unfamiliar, marriageable man has recently arrived in the community. Alternative measures of family background may therefore be needed to assess the importance of this variable for actual mate choice decisions.

5.2. Consensus analysis

As a methodological approach, consensus analysis has many benefits for the study of human mating preferences. Unlike a reliability analysis (Schmitt, 1996), consensus analysis provides a measure of the unidimensionality of rankings, and consensus analysis also provides opportunities

to study patterns of agreement among informants. The first factor loadings (i.e., competence scores) indicate how well each informant's responses correspond to the aggregated group responses, and the second factor loadings can reveal residual subgroup agreement. In this study, there were no sex-related differences in competence scores or second factor loadings. Among other implications, this result suggests that the reports of preferences in cross-cultural ethnographic samples such as Apostolou's (2010) may accurately represent the preferences of all community members, not just key informants, when applied to peer rankings. It would be worthwhile to test for subgroup variation in other settings, however.

Consensus analysis could be especially valuable to research on peer evaluations of desirability (e.g., Pillsworth, 2008). It would also be interesting to compare peer evaluations to rankings by parental evaluations of the same prospective mates, but small sample sizes may preclude a consensus analysis, which requires that all informants evaluate the same items or questions. That is, there may be relatively few settings, especially in preindustrial societies, in which multiple sets of parents are all sufficiently familiar with 20 or more prospective mates for their offspring to offer more than superficial assessments of their desirability as in-laws. Extensions of this research might nevertheless be compelling. For example, using standardized photographs or video of unfamiliar men or women, rankings of desirability by parents and offspring could reveal systematic differences in the importance of objective measures of attractiveness, as suggested by Beckerman (2000). These and other problems could be profitably investigated with consensus analysis in preindustrial societies.

6. Conclusion

The quantitative evidence in this study is consistent with the ethnological evidence that people in preindustrial societies consistently prefer wealthy and industrious husbands for their female kin. Although it is unclear to what extent preferences for traits such as hunting ability reflect the importance of either phenotypic quality or expected paternal investment, this study nevertheless suggests that there is considerable concordance in the preferences of women and their kin for resource-related traits. Despite this concordance, the ethnographic literature abounds with descriptions of conflicts between women and their families, not only about the characteristics of their husbands but also about the timing of their marriages. The ways in which these conflicts are negotiated and resolved remain a largely unaddressed topic for evolutionary anthropologists.

Acknowledgments

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