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Indigenous Siberian Food Sharing Networks: Social Innovation in a Transforming Economy

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Abstract

The sustainability of indigenous communities in the Arctic, and the vulnerable households within, is in large part dependent on their continuing food security. A social food-sharing network within the Ust'-Avam community on the Taimyr Peninsula in northern Siberia is analyzed for underlying patterns of resilience and key evolutionarily stable strategies supporting cooperative behavior. Factors influencing the network include interhousehold relatedness, reciprocal sharing, and interaction effects. Social association also influences sharing. Evidence for multiple determinants of food sharing in this sample is discussed in reference to major evolutionary hypotheses and comparable studies. In sum, the findings illustrate the robustness of self-organizing distribution networks in an economic context of uncertainty.

1 Introduction

Anthropologists have documented traditions encouraging generous transfers of essential foodstuffs among a wide variety of indigenous groups as diverse as the Hadza of Tanzania (Wood and Marlow 1982), Ache of Paraguay (Kaplan and Hill 1985) and Apache of southwestern United States (Basso 1996). These traditions of sharing are conventions that prioritize social relationships, and such customs still are observed by many households in Siberia. The present article identifies the mechanisms by which sharing networks developed to provide food security during the economic crisis that ensued following the collapse of the Soviet Union. Here, we present results from a social network analysis of food sharing events documented among 10 women in the community of Ust'-Avam in 2001, and discuss these results in light of comparable network analysis studies.

Ust'-Avam is situated near the confluence of the Avam and Dudypta Rivers on the Taimyr Peninsula in north central Siberia. Two indigenous small-numbering peoples are represented in the community—the Dolgan and the Nganasan—along with a small minority of ethnic Russians and other former Soviet nationalities. The community is approximately 250 km by air from the regional center, Dudinka, and 400 km by water from the large industrial city of Noril'sk (Ziker 2002). Transportation to and from the cities is expensive and time-constrained, and the community depends primarily on the production from hunting, fishing, and trapping activities for nutrient dense foods. Approximately 60% of caloric intake (and almost all the protein) is derived from local hunting and fishing (Ziker 2014).

Ichikawa (2004) describes three common phases of food sharing for hunter-gatherers: 1) obligatory sharing after the kill; 2) voluntary sharing of raw meat (large, first-butchering portions) to those not participating in the kill; and 3) sharing portions prepared for consumption. Individual decisions and structural constraints vary across the distribution cycles of large-game kills. Making these distinctions is important because each phase of distribution is the potential outcome of varying socio-ecological pressures, and may be dependent on the resources being procured and residence patterns.

In the Ust'-Avam context, obligatory sharing amongst individuals taking part in the hunt immediately follows the kill. A second wave of sharing is done after hunters return to their homes. Normally, the wife or mother of the hunter will manage the distributions at this phase. Women often share portions with their friends, and they, in turn, share to their friends. Interhousehold sharing in the third phase of distribution is also a common occurrence in Ust'-Avam (Ziker and Schnegg 2005). In the present article, we focus on the second wave of sharing in Ust'-Avam, particularly the women's sharing network, whereby food portions are redistributed to households without a resident hunter. We consider the cross-cultural work on food sharing and evolutionary hypotheses for cooperation to examine the sharing network. The research questions can be summarized thus: 1) What is the relative importance of kinship, reciprocity, indirect reciprocity, demand sharing, and costly signaling in women's sharing networks? and 2) How does the evidence for food sharing in Ust'-Avam compare with other kinds of social networks?

2 Explanatory Hypotheses and Comparative Studies

Studies of food sharing among other hunter-gatherer groups have demonstrated a variety of correlations relevant to explanatory hypotheses for helping behavior: kin selection, reciprocal altruism, indirect reciprocity, signaling, and demand sharing (Gurven 2004). Indicators of kinship also are linked to food sharing behaviors in numerous studies. For example, among the Indonesian Lamalera whale hunters, Nolin (2011) found that biological kinship is a better predictor of food-sharing relationships than social kinship (i.e., patrilineage membership). Consanguineal (blood) relatedness predicts food sharing on Ifaluk Atoll (Betzig and Turke 1986), Ache farmer-foragers in Paraguay (Gurven Allen-Arave Hill and Hurtado 2001), Hadza hunter-gatherers in Tanzania (Wood and Marlowe 2013), and Mayangna and Miskito horticulturalists in Nicaragua (Koster and Leckie 2014). Favoring relatives in food sharing follows the psychology of nepotism and the predictions of inclusive fitness theory for the evolution of altruistic behaviors via improved outcomes for descendants and collateral relatives (Hamilton 1964).

According to theory of reciprocal altruism (Trivers 1971), rewards accrue directly to cooperative individuals, benefits can be delayed and favoring kin is not necessary. In their work with the reservation Ache, Gurven et al (2000) found significant positive correlations between the amounts of food transferred among pairs of families—demonstrating the contingency component required of reciprocal altruism models. Reciprocal food sharing has been postulated to be a mechanism that reduces the variance in daily food intake among regularly cooperating members of a community through delayed returns (Cashdan 1985; Kaplan and Hill 1985). Nolin (2010) also finds that reciprocity was the strongest predictor of Lamalera food sharing patterns.

In indirect reciprocity based on image scoring (reputation), individuals invest only in partners that have sufficiently helped others in the past and who are, therefore, interested in how others view them (Alexander 1987). Among Ache, Gurven et al (2000) find that consistently high food producers give more than they receive. However, these hunters gain the least on a daily basis because on any given day they are more likely to have their own supplies. The explanation Gurven et al provide for this apparent generosity is that high producers receive additional food during hard times. Generosity signaling is hypothesized to provide long-term risk-buffering benefits to the signaler by maintaining social norms of sharing and may represent indirect reciprocity via image scoring. A recent study of men and women Martu hunters in the western desert of Australia (Bliege Bird and Power 2015) also finds support for prosocial signaling. "Those who consistently pay higher costs to share, [were]...not necessarily…better hunters," but they were "preferred…for cooperative hunting" activities (Bliege Bird and Power 2015, 389). Another form of hypothesized indirect reciprocity is generalized reciprocity (Bshary and Bergmüller 2008). Rather than purposefully investing to receive benefits in the future via a good image score, individuals who receive help simply are willing to invest into third parties. This is synonymous with the concept of *pay it forward*, so wonderfully represented in the film by the same name (Abrams et al 2000).

The costly signaling model proposes that big-game hunting evolved as part of competitive displays, rather than as part of provisioning relatives, risk buffering, signaling, or avoidance of defense costs (Zahavi 1975). Marcel Mauss (1954 [1925]) discusses the obligatory, public, and sometimes antagonistic nature of gifts, particularly amongst hunter gatherers on the northwest coast of North America, and notes that this type of gifting is likely a form of costly signaling. Hawkes and Bliege Bird (2002), using data from Torres Strait Meriam and Tanzanian Hadza, argue that the distribution of meat can best be seen in light of the evolution of men's subsistence work, where "honesty is at a premium" and political alliances contribute to status acquisition. Similarly, Smith, Bliege Bird, and Bird (2003) find that Meriam turtle hunters gain social and reproductive benefits via meat distribution, which is consistent with the idea that hunting is a form of costly signaling. Nolin's (2012) most recent analysis of sharing by Lamalera men with leadership positions finds excessive giving by leaders is consistent with the sharing-as-signaling hypothesis. Among Lamalerans, however, status did not explain much of the variation in sharing patterns because the exchanges observed in high-status households were best explained by the same factors that defined the activities of other households. This pattern suggests that while multiple mechanisms may operate simultaneously to promote sharing in Lamalera status acquisition is not driving that system.

When the consumption of food stores exhibits declining marginal value to the producer, then marginal portions are worth more to other individuals who have no food. As a result, there may be a cost associated with defending these food reserves and a producer should relinquish marginal portions to other individuals if the price of defense is greater than the additional value gained by others. Blurton Jones (1984) refers to this as tolerated scrounging. An additional prediction of this model is that the disparity in amounts should be low, since portions are given out until the marginal consumption value or utility is equal for all potential recipients (Winterhalder 1996). For example, Bliege Bird, Bird, Smith, and Kushnick (2002) find that the marginal valuation of the food to the acquirer conditioned Meriam sharing, but was only weakly affected by harvest variance—leading the authors to conclude that sharing on Mer does not function to reduce foraging risk. Similarly, Peterson's (1993) concept of demand sharing emphasizes the social and symbolic significance of requests for food and other resources. While acknowledging its correspondence to the tolerated-scrounging model, Peterson views demand sharing as part of a wider *testing behavior* that is used to establish relationships by incurring *debt*. Both tolerated scrounging and costly signaling models are more egocentric in their hypothesized benefits than are the kinship, reciprocal altruism, indirect reciprocity, and generosity signaling models. However, economic need can intersect with kinship to drive sharing without the presence of tolerated theft or demand sharing, as Koster (2011) demonstrated for the Mayangna and Miskito horticulturalists in Nicaragua.

Most empirical research on indigenous food sharing networks indicates a multiplicity of mechanisms at play (Nolin 2012). The particular combination of sharing strategies in any given society is likely to make the most sense when viewed in light of the local socio-ecology of food production and embeddedness in surrounding economies and societies. A case in point is Elspeth Ready's (2016) consideration of the multiplicity of mechanisms in food sharing as demonstrated in the northern Canadian community of Kangiqsujuaq. Ready found that food sharing did not serve a single function, such as reciprocity. Instead, she argues that food sharing "emerge[d] as a complex of social, political and economic phenomen[a] that accomplishe[d] different [objectives] for actors based on their social position[s]" (Ready 2016, 155). The network approach adopted in Ready's research highlights the conjugate role of individual decisions and structural constraints on the economic strategies available to households. Her detailed analysis demonstrates that the benefits of food sharing are concentrated among high income/high harvest households—those who are able to give the most. Likewise, a basic premise of the Ust'-Avam research is that a multiplicity of factors informs decisions to share food beyond the household. What these factors are and how they change during each phase of sharing, is of interest to the comparative studies of network organization.

3 Methods

John Ziker's (JPZ) research in the Ust'-Avam community comprised a sum of 36 months from 1994 through 2007. During field trips in 2001 and 2003, Ziker investigated the primary distributions of hunters and their respective households (Ziker et al 2015), as well as women's sharing patterns discussed here. Women residing in a household without a hunter (n = 10) were asked to complete a *diary* (a survey developed specifically for this investigation) by making entries for seven days, every three weeks. Diary responses and the results of interviews and observations JPZ conducted over a 12-week period (August - October 2001) were combined with community census and genealogical data for our analyses. These data included 162 distributions among 69 household dyads. One report from August 2002 and the remainder of the 2003 data were not included in this analysis.

To analyze the independent variables influencing the Ust'-Avam sharing patterns we used matrix regression, specifically the MRQAP (double-Dekker semi-partialling) process in UCINET (Borgatti Everett and Freeman 2002). The independent variables used in the matrix regressions included: maximum genealogical relatedness between households (*kinship*, or r_{max}), the transpose of the dependent variable matrix representing reciprocal food transfers (*reciprocity*), ego-to-sharer returned gifts in non-food goods and services (*returned gifts*), sharer-to-ego visitation frequency (*social association*), the differences in the number of active individual sharers in sharing households (*active sharers differences*), and the differences in the number of total household occupants (*occupant differences*). These variables were used to represent the predictions derived from explanatory hypotheses (Gurven 2004; Ziker and Schnegg 2005). Interhousehold relatedness and reciprocal food sharing were relevant to kin selection (Hamilton 1964) and reciprocal altruism (Trivers 1971). The returned gifts variable was relevant to the costly signaling hypothesis (Zahavi 1975).

We also included the differences in the number of active sharers in each household as a control variable. Obviously if more than one individual in each household was sharing, the frequency of food shared could be greater than in households with only one sharer. The differences in the total number of household members for each household represented in the sample were used to provide indices of relative need (Blurton Jones 1984). The sharer-to-ego visitation frequency provided an independent measure of social association (following Koster and Leckie 2014). Finally, we checked an additional attribute matrix: the sum of active individual sharers in sharing households. This variable was relevant to the hypothesized risk-buffering function of reciprocal altruism, but it was an insignificant predictor of the food sharing in this sample.

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4 Results

The following independent variable matrices were found to individually predict the overall food sharing pattern (see Table 1): maximum genealogical relatedness between households (r_{max}), reciprocal food transfers (*reciprocity*), ego-to-sharer returned gifts in non-food goods and services (*returned gifts*), sharer-to-ego visitation frequency (*social association*), and the differences in the number of active individual sharers in sharing households (*active sharers differences*). The variables in Table 1 were arranged by the strength of each individual model's R^2, and provided an indication of the relative magnitude of the variance explained in the frequency of sharing.

Table 1. Variance explained for interhousehold food transfers (main effects)

Independent Variables	Model R^2
Kinship (rmax)	.072***
Reciprocity	.052***
Returned gifts	.014**
Social Association	.013**
Active sharers differences	.012**
Occupant differences	. 001[a]

** $p < 0.01$, *** $p < 0.001$, [a] not significant $p > .05$

Taken alone, each of the main independent variable's effects tells a limited story. To explore underlying patterns in more detail, we introduced interaction terms using the product of each pair of independent variable matrices. The new set of matrix regressions included the paired main effects along with their interaction to reveal more about the structural features underlying the pattern. Finally, a series of combined models were generated to arrive at a model that explained the most variation in the derivative sharing network with the least number of variables. Our best, combined model (see Table 2) included the following main effects and one interaction: interhousehold genealogical relatedness (r_{max}), reciprocal food transfers (*reciprocity*), the dissimilarity in number of active household members (*active sharers differences*), an interaction term (r_{max} * *reciprocity*), and sharer-to-ego visitation frequency (*social association*). The model $R^2 = .117$ ($p < .001$) indicated that this set of independent variables explained 12% of the variance in the total food sharing pattern.

Two things were noted about this combined model when it was compared to the main effects presented in Table 1. First, the variable representing the frequency of returned gifts, which appeared to be strong in the individual results, dropped out of significance (also found in Ziker et al 2015). When we included the frequency of returned gifts in the model, the overall model coefficient was unchanged and the standardized variable coefficient (p = .135) was not statistically significant. The fact that this variable dropped out of significance in the multiple regression model indicated that the variation in food sharing explained by returned gifts was better understood by other variables. This had obvious implications for the hypotheses under consideration. Second, the interaction between kinship and reciprocity was statistically significant and it remained in the combined model along with the main effects of kinship and reciprocity. Ziker and Schnegg (2005) and Ziker et al (2015) found a similar interaction in food shared at meals and in the primary distributions in Ust'-Avam. In both studies, this effect represented something more than generous giving to kin—likely childcare and meat pooling among extended households, respectively. Correspondingly, Axelrod and Hamilton (1981) theorized that kinship could help initiate systems of reciprocity in small groups.

Table 2. Best combined model for frequency of interhousehold food transfers

Independent Variables	Unstandardized Coefficient	Standardized Coefficient
Kinship (r_{max})	.720	.210***
Active sharers differences	.024	.122**
Reciprocal food transfers	.126	.126**
r_{max} * Reciprocity	.161	.053*
Social Association	.085	.053*

* $p < .05$ ** $p < .01$ *** $p < .001$

The combined model in Table 2 shows that interhousehold relatedness (as measured by the strongest genealogical link between households) was statistically the most significant variables to explain the food sharing pattern. The number of active sharers in each household pair, a control variable, was also significant. In addition, reciprocal food sharing, the interaction of kinship and reciprocity, and the social association indicator were relevant variables in this network. Uncooked portions of meat and fish provided to egos by other households were shared to additional households by the pathways of kinship and social association (friendship). Unlike many ethnographically documented food-sharing networks, status striving (as measured by returned gifts) did not appear to be a factor in conditioning resource flows in this network. While reciprocal exchange could have indeed have functioned to serve risk buffering in the network, it appeared that kinship and friendship ties manifest as the predominant criteria by which partner choice operated for resource redistribution in this data set.

5 Discussion

A few words from the sharing diaries of the women in Ust'-Avam would help to contextualize these findings. Regarding the question, "Why did you share? What do you get out of sharing?" answers include: "Pleasure, joy;" "Nina also shared;" "I simply gave it when I was outside;" "You need meat, just take it;" and "She's a neighbor, I simply gifted it." Regarding the question "What did you or do you do for the person who shared?" answers include: "I thanked them;" "I give to her too—if she has it she gives it to me and if I have it I give it to her;" and "Together we drank tea, ate breakfast, and went to gather berries." As can be seen here, there are a combination of factors that lead to sharing, but the desire to attain status or leverage over other households is not among them. This finding is consistent with traditional knowledge about sharing patterns in the community (Ziker et al 2015).

Comparing the results of three food sharing studies in Ust'-Avam, we find that the women's food sharing network is influenced by some of the same variables that condition the network of primary distributions as reported by hunters (Ziker et al 2015) and the consumption events observed by JPZ in 1994 through 1997 (Ziker 2002; Ziker and Schnegg 2005). There are important distinctions that illustrate the relevance of sharing phase. One difference relates to the inclusion of the r_{max} * *reciprocity interaction*. Ziker et al (2015) report that when the r_{max} * *reciprocity interaction* is added into a combined model for primary distributions with the main effects, the coefficient on the main effect of reciprocity changes signs from positive to negative, indicating that the frequency of food sharing by hunters increases as reciprocal sharing by recipient households decreases. This result provides evidence for three hypothesized kinds of sharing: 1) nepotistic food sharing; 2) food sharing increasing with reciprocal relationships between related households; and 3) food sharing as indirect reciprocity, as either generosity signaling (Gurven et al 2000; Bliege Bird and Power 2015) or indirect reciprocity (i.e., paying it forward) (Bshary and Bergmüller 2008).

We find the analogous effects for the first two types of sharing in this women's sharing network, but the opposite effect for the third type. There is a positive correlation between interhousehold relatedness and food sharing, as well as a positive correlation between food sharing and the interaction of interhousehold relatedness and reciprocal sharing. However, when controlling for kinship and the interaction effect in our final model, the sign on reciprocal sharing remains positive. This indicates that reciprocal sharing (i.e., giving back) with relatedness held constant is the predominant pathway, rather than indirect reciprocity. Furthermore, since we are controlling for differences in the number of household members participating in the network sample, social association, and gifts returned, it is likely that such reciprocal sharing is related to a risk-buffering function, rather than from incurring *debt* for prestige (Hawkes and Bliege Bird 2002; Nolin 2012; Smith Bliege Bird and Bird 2003).

Overall, household economic need appears to be prompting the later phases of food sharing (i.e., meal sharing), rather than the earlier phases. Although providing goods or services back to givers is individually predictive in the primary distribution and women's sharing networks, it drops out of significance in the combined models, thereby suggesting that this effect is part of the reciprocal relationships households have as kin or friends, rather than payback for food transfers or status-seeking activities as predicted by the costly signaling hypothesis. All in all, in Ust'-Avam sharing is more prosocial and less influenced by egocentric pathways.

One limitation of this study is that it is based on a partial snowball sample of the community. Although our analysis finds several independent variables that are highly significant predictors of flows, the use of social network variables (as in Ready 2016) is not justified without a complete network of the community. This may be why the amount of total variation explained is low. Future studies should integrate network statistics from a complete network sample to test the relative importance of network position of households versus other kinds of independent variables (such as the interhousehold relatedness) as analyzed here.

A second limitation of our study is in comparing the novel sharing patterns developed in this economically challenged community with that of other remote groups. While our study relies heavily on the foundational research of traditional hunter-gatherer groups, comparisons with more industrialized populations need further exploration. For example, there are similarities in some of the patterns of sharing behaviors identified in online communities and those found in our study. Virtual networks enable people to overcome distance constraints and garner access to a broader range of resources, making them a conduit for social innovation. While status striving is often an attribute of members in online groups (Hanson and Jiang 2016; Utz and Jankowski 2016), it is not the only reason for group participation. Porter et al (2011) report that status striving is but one of the common needs fulfilled—others being information seeking, desire to help others, relationship building, belonging, enjoyment, and social identity. In short, participation in virtual networks permits individuals to fulfill psychological needs, whether utilitarian or hedonic (Hanson and Jiang 2016; Porter et al 2011; Utz and Jankowski 2016). Using this terminology, when looking at the women's sharing network in Ust'-Avam, partner selection through kinship and social association likely fulfills hedonic needs, while reciprocity fulfills more utilitarian functions.

Regardless of an individual's motivation, successful virtual networks, like those of face-to-face systems, require membership participation and contribution. Porter et al (2011) note that successful virtual networks demonstrate reciprocity through member contributions—allowing individual fulfillment of needs—and when member needs are supported, group trust increases. Once trust is established an environment exists to foster cooperation and continued sharing within the group. Further work should look at the relationship between online sharing and the sharing of material resources. When considering multiplex networks, communication and material flows are likely candidates for theoretically relevant interactions.

6 Conclusion

Following Ichikawa's (2004) typology, we have found that the second phase of food distribution operating through women's networks is a social innovation facilitating household resilience in the face of change. In the Ust'-Avam women's network, social association, kinship, and friendship are the pathways by which food is shared beyond the household. These food sharing events appear to be driven by social relationships and cooperation, rather than status striving in the Ust'-Avam community.

Importantly, this research illustrates the resilience of traditional sharing strategies. Since the demise of its planned economy following the 1991 collapse of the USSR, cooperation among community members has been essential for survival in this remote Siberian Arctic location. We found that successive waves of food sharing serve a slightly different array of economic and social functions. Food sharing helps to establish and maintain these important social ties, providing a buffer against the unpredictable economic conditions. This social innovation of food sharing provides a safety net for vulnerable households and is founded in multiple evolutionarily stable strategies promoting cooperation.

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References

1. Alexander RD (1987) The Biology of Moral Systems. Aldine de Gruyter, New York
2. Axelrod R, Hamilton WD (1981) The evolution of cooperation. Science 211(4489):1390-1396
3. Basso K (1996) Wisdom Sits in Places. University of New Mexico Press, Albuquerque, NM
4. Betzig LL, Turke PW (1986) Food sharing on Ifaluk. Current Anthropology 27(4):397-400
5. Bshary R, Bergmüller R (2008) Distinguishing four fundamental approaches to the evolution of helping. J Evol Bio 21:405-442
6. Bliege Bird R, Bird DW, Smith EA, Kushnick GC (2002) Risk and reciprocity in Meriam food sharing. Evolution and Human Behavior 23(4):297-321
7. Bliege Bird R, Power EA (2015) Prosocial signaling and cooperation among Martu hunters. Evol Hum Behav 36(5):389-397
8. Blurton Jones NG (1984) A selfish origin of human food sharing: Tolerated theft. Ethol Sociobiol 5(1):1-3
9. Borgatti SP, Everett MG, Freeman LC (2002) Ucinet 6 for Windows: software for social network analysis. Analytic Technologies
10. Cashdan E (1985) Coping with risk: reciprocity among the Basarwa of northern Botswana. Man (n.s.) 20(3):454-474
11. Gurven M (2004) To give or not to give: the behavioral ecology of human food transfers. Behav Brain Sci 2(4):543-583
12. Gurven M, Allen-Arave W, Hill K, Hurtado AM (2000) It's a wonderful life: signaling generosity among the Ache of Paraguay. Evol Hum Behav 21(4):263-282

13. Gurven M, Allen-Arave W, Hill K, Hurtado AM (2001) Reservation food sharing among the Ache of Paraguay. Human Nature 12(4):273-297
14. Hagen E (2007) Descent 02.02. Retrieved from: https://code.google.com/archive/p/descent/ Accessed 6 September 2016
15. Hamilton WD (1964) The genetical evolution of social behavior. I. J Theor Biol 7(1):1-16
16. Hames R, McCabe C (2007) Meal sharing among the Ye'kwana. Hum Nature-Int Bios 18(1):1-21
17. Hanson S, Jiang, L (2016) The low status advantage: the effect of status structure on participation in an online community. Electronic Markets 26(3):233-244
18. Hawkes K, Bliege Bird R (2002) Showing off, handicap signaling, and the evolution of men's work. Evol Anthropol 11(2):58-67
19. Ichikawa M (2004) Food sharing and ownership among Central African hunter-gatherers: an evolutionary perspective. In: Widlok T, Tadesse W (eds) Property and Equality, vol. 1. Berghahn Books, New York, pp 151-164
20. Kaplan H, Hill K (1985) Food sharing among Ache foragers: tests of explanatory hypotheses. Curr Anthropol 26(2):223-246
21. Koster JM, Leckie G (2014) Food sharing networks in lowland Nicaragua: an application of the social relations model to count data. Soc Networks 38:100-110
22. Koster JM (2011) Inter-household meat sharing among Mayangna and Miskito horticulturalists in Nicaragua. Human Nature 22(4):394-415
23. Mauss M (1954[1925]) The gift: the forms and functions of exchange in archaic societies. Cohen & West, Ltd, London
24. Nolin DA (2010) Food-sharing networks in Lamalera, Indonesia. Human Nature 21(3):243-268
25. Nolin DA (2011) Kin preference and partner choice. Human Nature 22(1-2):156-176
26. Nolin DA (2012) Food-sharing networks in Lamalera, Indonesia: status, sharing, and signaling. Evol Human Behavior 33(4):334-345
27. Peterson N (1993) Demand sharing: reciprocity and the pressure for generosity among foragers. Am Anthropol 95(4):860-874
29. Porter CE, Donthu N, MacElroy WH, Wydra D (2011) How to foster and sustain engagement in virtual communities. California Management Review 53(4):80-110
30. Ready E (2016) Food, sharing, and social structure in an arctic mixed economy. Dissertation, Stanford University
31. Smith EA, Bliege Bird R, Bird DW (2003) The benefits of costly signaling: Meriam turtle hunters. Behav Ecol 14(1): 116-126
32. Trivers RL (1971) The evolution of reciprocal altruism. Q Rev Biol 46(1):35-57
33. Utz S, Jankowski J (2016) Making “Friends” in a virtual world: the role of preferential attachment, homophily, and status. Social Science Computer Review 34(5):546-566
34. Winterhalder, B (1996) Social foraging and the behavioral ecology of intra-group resource transfers. Evolutionary Anthropology 5(2):46-57
35. Wood BM, Marlowe FW (2013) Household and kin provisioning by Hadza men. Hum Nature-Int Bios 24(3):280-317
36. Zahavi A (1975) Mate selection: selection for a handicap. J Theor Biol 53(1):205-214
37. Ziker JP (2002) Peoples of the tundra: northern Siberians in the post-communist transition. Waveland Press, Prospect Heights, IL
38. Ziker JP (2014) Subsistence and sharing in Northern Siberia: Experimental economics with the Dolgan and the Nganasan. In: Ensminger J, Henrich JP (eds) Experimenting with social norms: Fairness and punishment in cross-cultural perspective. Russell Sage Foundation, New York, pp 337-356
39. Ziker JP, Nolin DA, Rasmussen J (2015) Indigenous Siberians solve collective action problems through sharing and traditional knowledge. Sustain Sci 11(1):45-55
40. Ziker J, Schnegg M (2005) Food sharing at meals: kinship, reciprocity, and clustering in the Taimyr Autonomous Okrug, northern Russia. Hum Nature-Int Bios 16(2):178-210