Parent-Offspring Conflict in Rural North Sumatra: Behavioral Ecology of Reproductive Effort amongst Karo Mothers

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Introduction

This paper reports a 12-month quantitative-ethnographic study in 2 Karo villages in North Sumatra, Indonesia. The aim of the study was to assess the value of parent-offspring conflict (POC) theory for explaining variation in human reproduction and parenting. Predictions from POC were tested with data from interviews and systematic observations of parent-offspring interactions. The project has widespread implications for meshing the diverse theoretical and methodological foundations of demography, anthropology, and biology. Specifically, it addresses the need for a strong theoretical foundation for explaining variation in parenting and fertility across time and space.

Theory and Predictions

Behavioral ecology theory, including a subset life history theory, has proven a valuable framework for understanding demographic phenomena (e.g., Borgerhoff Mulder 1998; Clark & Low 2001; Kaplan & Lancaster 2003; Low et al 1992; Sear et al. 2002). Under this framework, humans are predicted to behave in ways that maximize inclusive fitness given prevailing social and physical environmental constraints (Winterhalder & Smith 2000). That is, humans on average should behave as if striving to maximize the number of surviving/reproducing relatives—the value of each weighted by their relatedness to the actor. It is important to note that decisions about inclusive-fitness maximization need not be conscious ones—the human behavioral ecology framework assumes that natural selection has shaped our behavioral decision-making capabilities to adjust to environmental cues and these adjustments can, but need not be based on rational choice.

The inclusive-fitness maximization approach to parental behavior, including childcare and fertility, is complicated by the fact that the inclusive fitness interests of parents and offspring diverge (Trivers 1974). The reason for this is straightforward and referred to as parent-offspring conflict (POC) theory: In diploid, sexually reproducing species, a parent is equally related to all her offspring, and thus, *all else being equal*, favors an equitable allocation of resources amongst them. A given offspring, on the other hand, is more closely related to himself than to his siblings and thus, *all else being equal*, favors a larger share of resources than the parent would like to provide. All else is rarely equal, however. The degree and magnitude (also referred to as the "battleground") of the conflict is mediated by the ability of offspring to convert parental investment into increased survivability and fecundability, and the cost of investment to the parent in terms of her ability to invest in additional offspring. The outcome (also referred to as the "resolution") of the conflict—whether the parent, offspring, or neither get their way— depends heavily on the ability of the offspring to manipulate the parent, whether by physical, physiological, or psychological means, and the reliance of parents on information provided by the offspring about his need for parental resources.

The specific hypotheses addressed by my research are derived from a set of graphical and mathematical models of POC (Kushnick 2000). These incorporate the inclusive-fitness payoffs of various behaviors and timings of life-history events given important details about the mother (e.g., age and household economics) and her current offspring (e.g., sex and birth order), and the prevailing socioecological context. The qualitative versions of these hypotheses can be outlined as follows:

1. parents should be responsive to offspring signals of need when doling out parental investment;

2. in contexts where the conflict is dampened, parental investment, birth-spacing, and fertility should conform closely to predictions based on parental inclusive-fitness maximization; and,

3. in contexts where the conflict is amplified, parental investment, birth-spacing, and fertility should fall somewhere within the range defined by the parental maxima at the lower end and the offspring maxima at the upper end (note that only an offspring-wins or compromise resolution support a POC interpretation of the data).

Study Group

The Karo are a group of mixed subsistence and cash-cropping agriculturalists from the peri-equatorial highlands of North Sumatra, Indonesia. Living in scattered villages between 700 to 1400 m (2,297 to 4,593 ft) above sea level, the typical Karo household farms either wet (*sawah*) or dry (*ladang*) rice, and other endemic and introduced vegetables, fruits, and spices, as well as engaging in small-shop ownership or other work. The Karo are 1 of 6 Batak groups from North Sumatra. The majority of Karo people are Protestant or Catholic, though an increasing number are Muslim. Karo language (*Bahasa Karo*) is Austronesian. All Karo people belong to 1 of 5 exogamous patrilineal clans. Cross-cousin marriages are the stated ideal, but this arrangement is loosely enforced. Polygynous marriages and divorce are allowed, but also rare. Karo people sometimes albeit infrequently marry with non-Karo people. Karo have relatively high fertility (TFR 4.5 and 3.3 in focal villages—compared to 2.7 on a national level [DHS 1998]), though contraceptives are available and used to some degree (see Sibeth 1991).

Methods

Two Karo villages were the foci of the research: *Doulu* and *Laubuluh*. They were chosen because they provide interesting inter and intra-village variation in socioeconomic factors important for the testing of hypotheses derived from POC. *Doulu* comprises 1003 people in 235 households. It is relatively close to a small town (Berastagi, pop.17,000), well connected with the trade road leading to a metropolitan lowland city (Medan, pop. 3,000,000), less affected by malaria and diarrhea, and exhibits a lower child mortality rate (39 per 1,000). *Laubuluh* comprises 791 people in 228 households. It is relatively more remote, less well connected to trade routes and other facilities, more affected by malaria and diarrhea, and exhibits a higher child mortality rate (61 per 1,000).

I collected complete data on reproductive histories, household economics, offspring health and facility-use histories, and offspring mortality histories on 236 ever-married women between the ages of 16 and 50 in *Doulu* and *Laubuluh*, as well as behavioral observations of parent-offspring interactions with a small subset of these women. For interviews, the sample of women were chosen from stratifications based on village and age, so that each category contained an equal number of subjects. For observations, the sample of women were chosen from stratifications based on village, age, and whether offspring was currently nursing, so that each category contained an equal number of subjects. Female research assistants who were fluent in *Bahasa Karo* helped with the data collection, including the 1-on-1 interviews with women. I intensively trained each in administering interviews. I double-checked the data for accuracy after the interviews; inconsistencies were fixed on the spot or the next day. I managed the multiple, linked

datasets using MS Access 2003, while predictive models and statistical analyses were done in MS Excel 2003 and SPSS 13. I am using a variety of statistical methods to test hypotheses, including bivariate correlation, chi-square contingency tables, t-test comparison of means, and multiple linear and Cox regression. Significance of statistical tests is set at $\alpha=0.05$ level, though significance between that level and $\alpha=0.10$ are identified as weakly significant and, for the most part, receive discussion in the results sections of my reports.

Results

Some of the initial results include the following tests with intervillage data. Additional analyses are underway that explore and test hypotheses on the intra-village level. These, I feel, provide the strongest testing groung for POC as an explanatory framework for human reproduction and parenting. These additional results will be included in my presentation at the *Population Association 2006 Annual Meeting* in Los Angeles.

The simple model of POC predicts that the length of the parental investment interval should be relatively longer in *Laubuluh*. When only intervals were included where the woman was married to the same husband at the opening and closing of the interval (or at the time of interview for open intervals), median second birth intervals in *Laubuluh* (2.92, $n=104$) were higher than in *Doulu* (2.49, $n=90$). When the child whose birth opened the interval died, the interval was excluded from the analysis. Three cox regression models were built to test the hypothesis that intervals "survived" significantly longer in *Laubuluh* village. In Model 1, the binary predictor, `village`, was regressed upon length of the interval, and found to be statistically significantly associated with an increase in interval length ($p=0.044$). In Model 2, I tested the same hypothesis while controlling for mother's age at the beginning of the interval. The predictor, `village`, remained a significant predictor ($p=0.046$). In Model 3, I tested the same hypothesis while controlling for both mother's age and sex of offspring. The predictor, `village`, remained a significant predictor ($p=0.057$).

Breastfeeding mothers in both villages were responsive to offspring (age 2 or less) solicitation, providing access to the breast in response to crying. The relationship during the number of crying bouts and the number of breastfeeding bouts were highly correlated in *Doulu* ($r=0.743$, $p=0.003$) and *Laubuluh* ($r=0.0557$, $p=0.030$). The total number of crying bouts were not statistically significant between the two villages, using a t-test ($t=-1.493$, $p=0.15$) and a Mann-Whitney comparison ($U=46.5$, $p=0.134$).

Acknowledgements

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