Supporting Information

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SI Materials and Methods

Method S1: Calculation of *DSI*. We calculated *DSI* for all coresident dyads annually by applying the formula $DSI_{xy} = (\sum_{i=1}^{n} f_{ixy}/\overline{f_i})/n$, where f_{ixy} is the rate of behavior i for dyad xy (30). Only focal observations while x and y were both adult and members of the same group were considered (i.e., rates were corrected for coresidence time). The variable $\overline{f_i}$ is the mean rate of behavior i across all dyads, and n is the number of behaviors that contribute to the index. Three different behaviors ($n = 3$) were considered in the analyses: (*i*) grooming, (*ii*) approaching within short distance, and (*iii*) approaching within long distance. In 2005 and 2006, approaching within physical contact was considered as a close approach and approaching within 2 m was considered as a long-distance approach. In the following years, close approaches were defined as approaching within one body length (~0.5 m), whereas long-distance approaches were defined as approaching within five body lengths (~2.5 m). This difference should not result in any bias because the *DSI* is a relative index that was calculated annually, and for each given year, both long and close approaches only had one single definition.

Method S2: Calculation of Average *DSI* Values for Each Partner Rank. For each year and each female, we ranked all potential partners according to bond strength (*DSI*). For each female and each *DSI* rank (first rank, second rank, etc.), we calculated the average bond strength over all years during which the female was present. For example, with her top partner (which could be a different female each year), the female Baloo had a *DSI* of 4.510 in 2009, 1.244 in 2010, and 2.602 in 2011, resulting in an average *DSI* value for her top partner of 2.740. We did the same for the second-ranked partner, third-ranked partner, etc.

Method S3: Calculation of the *PSI* and Simulated *PSI* Values. The original *PSI* (45) is defined as $PSI = (M - U)/(M - S)$, where M is the maximum number of top partners, S is the number of rank slots being evaluated (i.e., number of top partners), and U is the observed number of unique partners (within the S rank slots). In the original paper by Silk et al. (45), M was calculated as $n * S$, where n = number of years for which the rank orders were evaluated for a specific female. However, the maximum number of top partners might be smaller than $n * S$ if a female is observed for a long time or the group only contains a few females. For example, if a female was observed for 7 y and eight different females were coresident during that time, the maximum number of different top partners would be eight and not $n * S = 7 * 3 = 21$. Thus, M was corrected for this issue in the current study.

We calculated the simulated random *PSI* values by picking three top partners randomly from the pool of potential partners for each female for each year the female was present, and then calculated the *PSI* using these top partners. We iterated this procedure 10,000 times and created a frequency table of different *PSI* values for each female that showed how often they would occur by chance (table 3 of ref. 45 as an example). We then used the frequency table to calculate an average simulated *PSI* for each female.

Method S4: Model Procedures. Before running the models, we scaled all numerical predictor variables to a mean of 0 and SD of 1. We included female and dyad identity in the LMMs testing for predictors of bond strength (*DSI*) and only female identity in the LMMs testing for predictors for *ASI* and in the GLMMs testing for infant survival. Furthermore, we included all necessary random slopes. All models were visually inspected for normal distribution and homogeneity of residuals and tested for model stability and multicollinearity of predictor variables. Binomial models were checked for overdispersion.

To establish the significance of full models, we compared them with null models (not containing the test variables but containing all other variables) using likelihood ratio tests (function "anova" with the argument "test='Chisq'"). Likelihood ratio tests were also used to obtain P values for single predictor variables using the function "drop1" (again with the argument "test='Chisq'"). To achieve more reliable P values, we fitted LMMs using maximum likelihood (rather than restricted maximum likelihood; ref. 50).

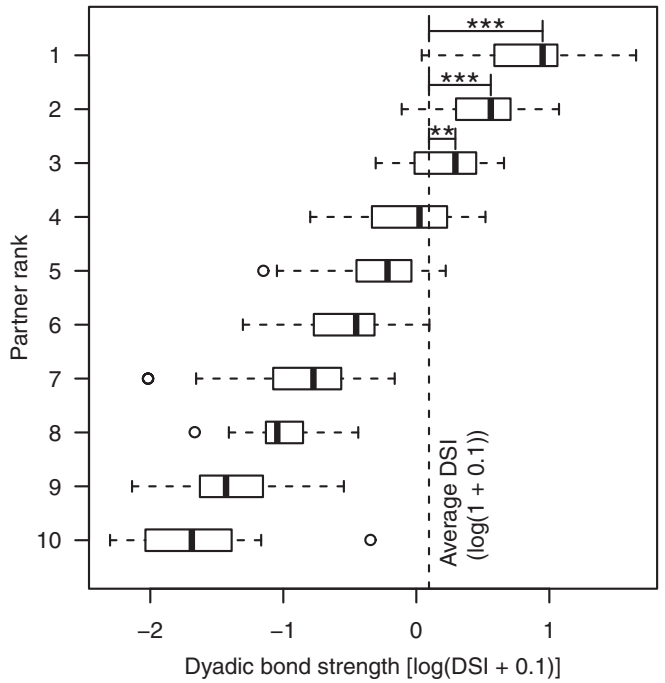

Fig. S1. Averaged bond strengths for different partner ranks (i.e., first top partner, secondary top partner, etc.). Box plots depict log-transformed *DSI* (+0.1) values ($n = 285$), for which all dyads were included during each year both females were coresident. The vertical dashed line indicates the average bond strength [which is, per definition, *DSI* = 1 (*SI Materials and Methods*, *Method S1: Calculation of DSI*), and therefore log (1.1) in this plot]. Asterisks above boxplots indicate significant differences between bond strength for each partner rank and average bond strength: $^{**}P < 0.01$ and $^{***}P < 0.001$ (results from *t* tests using log-transformed *DSI* + 0.1 values).

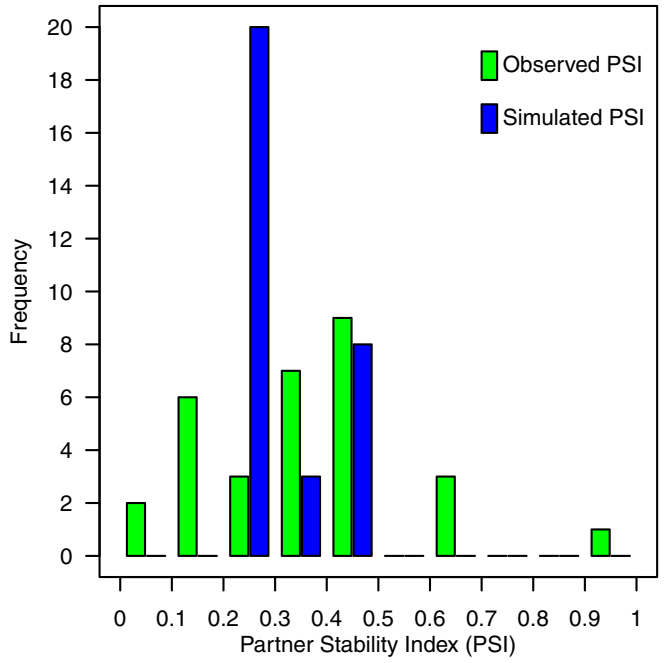

Fig. S2. Stability of bonds with top three partners. The plot shows the histograms for observed and simulated *PSI* values.

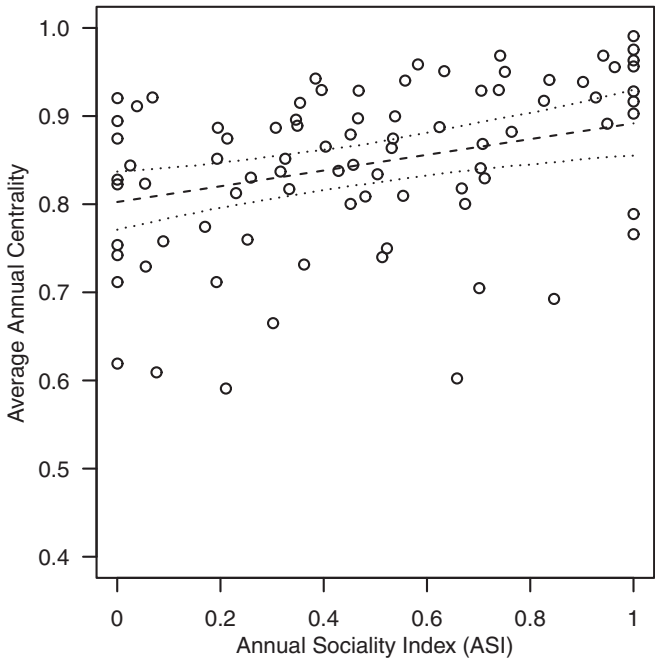

Fig. S3. Relationship between annual centrality values and sociality (*ASI*) of females. The dashed line depicts the prediction of the LMM, and dotted lines depict the bootstrapped 95% confidence intervals (n = 84 data points from 31 different females and 3 different years).

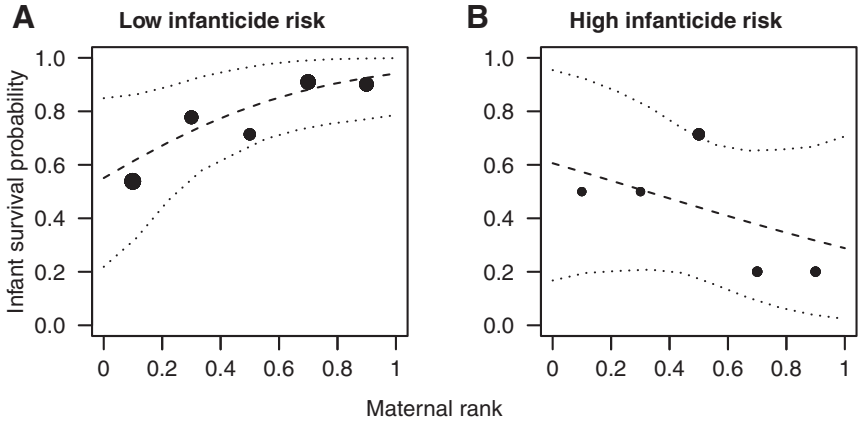

Fig. S4. Effect of female rank on infant survival for infants at low risk of infanticide (*A*; n = 50 infants), and infants at high risk of infanticide (*B*; n = 25 infants). The circles (●) show the observed survival probability, summarized for five equally large intervals of rank, and the area of the circles is proportional to the (square rooted) number of infants included in each of these intervals. The dashed line shows the survival probability predicted by the GLMM, and the dotted lines depict the bootstrapped 95% confidence intervals (number of bootstraps = 1,000).

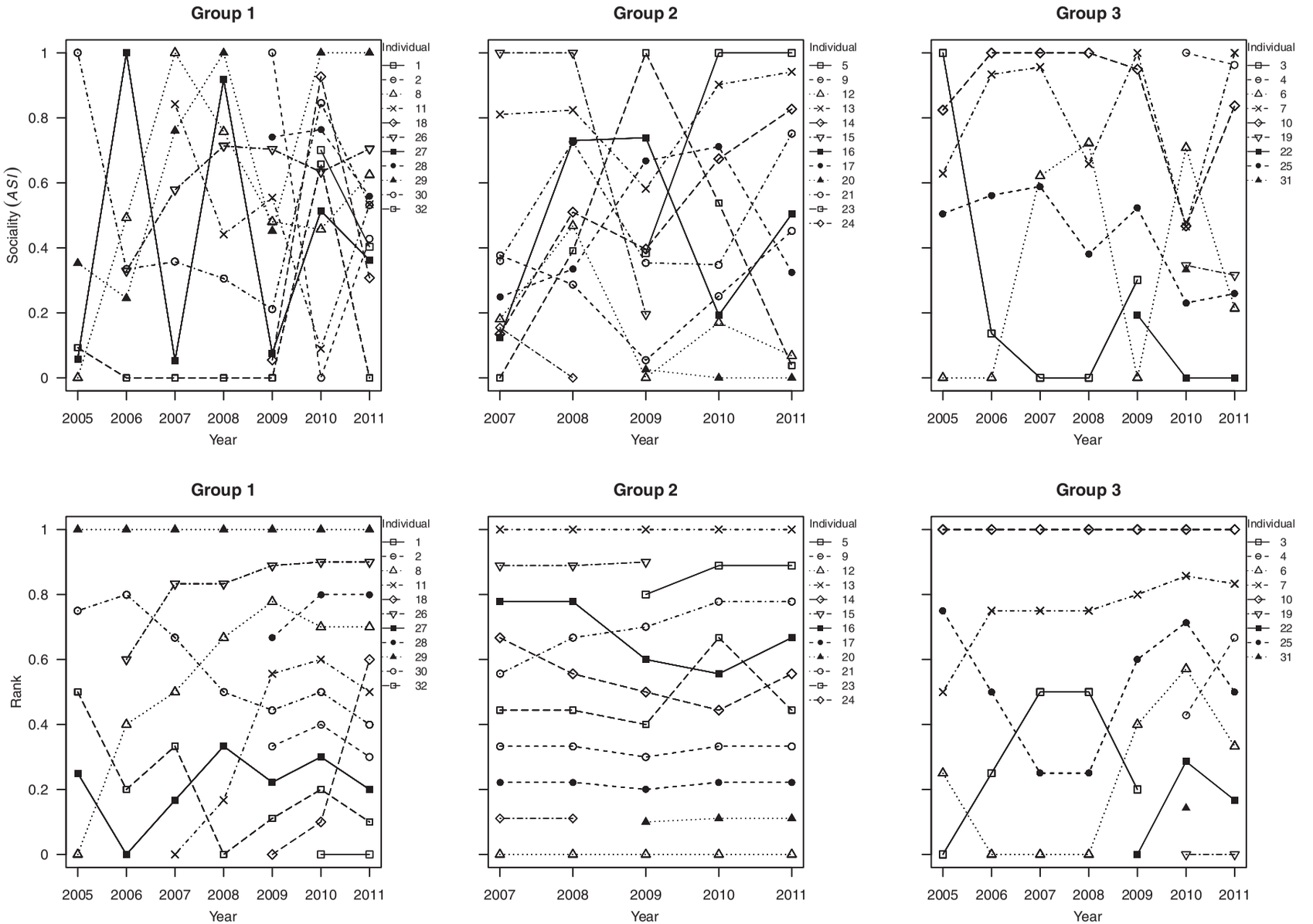

Fig. S5. Changes in *ASI* and dominance ranks over time. (*Top*) Three plots show changes over time in *ASI* values for each group and female separately. (*Bottom*) Three plots show the same for dominance ranks.

Table S1. Predictors of dyadic bond strength using kinship categories instead of *R*-values

Term	Estimate (SE)	df	χ^2	*P*
(Intercept)	0.304 (0.144)	—	—	—
Kin-full sib	**−0.095 (0.236)**	**4**	**33.255**	**<0.001**
Kin-maternal sib	**−0.730 (0.204)**	**4**	**33.255**	**<0.001**
Kin-paternal sib	**−0.587 (0.182)**	**4**	**33.255**	**<0.001**
Kin-nonkin	**−0.815 (0.141)**	**4**	**33.255**	**<0.001**
Age difference	−0.056 (0.051)	1	1.202	0.273
Rank difference	**−0.179 (0.042)**	**1**	**16.561**	**<0.001**
Male infant present	0.052 (0.068)	1	0.554	0.457
Female infant present	**0.266 (0.065)**	**1**	**15.510**	**<0.001**

Results from an LMM with the log-transformed DSI (+0.1) values as the response variable. The full model was significantly better than the null model ($\chi^2 = 73.771$, df = 8, $P < 0.001$). Age difference and rank difference were scaled to a mean of 0 and an SD of 1 before running the model. The original mean ± SD were values were as follows: age difference = 6.179 ± 4.672 and rank difference = 0.430 ± 0.250 ($n = 499$ data points from 134 different dyads and 32 different females). Significant results are shown in boldface.

Table S2. Infanticide risk and survival rates for infants born during the study periods

Infanticide risk	Group	Period start	Period end	Infants <1 y at beginning of or born within this period (survived/not survived first year of life)	
Low	CP	2005-01-01	2007-08-15	4 (3/1)	50 (38/12)
	CP	2008-01-29	—*	17 (15/2)	
	GN	2007-01-01	2010-04-14	15 (9/6)	
	GN	2011-12-07	—*		
	LV	2005-01-01	2006-04-29	2 (1/1)	
	LV	2007-04-16	2012-02-18	12 (10/2)	
High	CP	2007-08-16	2008-01-28	4 (3/1)	25 (11/14)
	GN	2010-04-15	2010-10-27	5 (3/2)	
	GN	2011-05-12	2011-12-07	8 (3/5)	
	LV	2006-04-30	2007-04-15	6 (2/4)	
	LV	2012-02-19†	2012-10-01†	2 (0/2)†	
Total					75 (49/26)

*These periods ended outside the study period, and the end date is irrelevant for this study.
†This period falls outside the study period but affected two infants born during the study period.

Table S3. Results of different GLMMs testing for predictors of infant survival (first year of life) as the response variable

Model (full null model comparison)	Predictor variables in model	Estimate (SE)	χ^2	*P*
a) *ASI*:infanticide risk (χ^2 = 19.445, df = 3, *P* < 0.001)	(Intercept)	−0.205 (0.469)	—	—
	Infanticide risk (low)	1.768 (0.711)		—*
	ASI	−1.013 (0.509)		—*
	ASI:infanticide risk (low)	**2.067 (0.718)**	**11.369**	**<0.001**
b) *ASI only* (χ^2 = 8. 0759, df = 2, *P* < 0.05)	(Intercept)	−0.293 (0.459)	—	—
	Infanticide risk (low)	**1.601 (0.643)**	**8.008**	**<0.01**
	ASI	0.150 (0.288)	0.277	0.598
c) *PSI* (χ^2 = 10.065, df = 2, *P* < 0.01)	(Intercept)	−0.232 (0.482)	—	—
	Infanticide risk (low)	**1.569 (0.662)**	**7.121**	**<0.01**
	PSI	−0.478 (0.356)	2.266	0.132
d) Rank:infanticide risk (χ^2 = 13.407, df = 3, *P* < 0.01)	(Intercept)	−0.247 (0.473)	—	—
	Infanticide risk (low)	1.757 (0.682)		—*
	Rank	−0.438 (0.509)		—*
	Rank:infanticide risk (low)	**1.285 (0.677)**	**4.287**	**<0.05**
e) Rank only (χ^2 = 9.120, df = 2, *P* < 0.05)	(Intercept)	−0.308 (0.454)	—	—
	Infanticide risk (low)	**1.610 (0.634)**	**8.201**	**<0.01**
	Rank	0.338 (0.300)	1.321	0.250
f) *ASI*:infanticide risk + rank:infanticide risk (χ^2 = 20.996, df = 5, *P* < 0.001)	(Intercept)	−0.204 (0.493)	—	—
	Infanticide risk (low)	1.805 (0.727)		—*
	ASI	−1.207 (0.639)		—*
	Rank	0.363(0.668)		—*
	ASI:infanticide risk (low)	**2.030 (0.815)**	**7.530**	**<0.01**
	Rank:infanticide risk (low)	0.147 (0.820)	0.033	0.857

Infanticide risk is a binary variable with two categories: high risk and low risk. Maternal *ASI* and rank were scaled to a mean of 0 and an SD of 1. The original mean ± SD values were as follows: *ASI* = 0.535 ± 0.360 and rank = 0.508 ± 0.329 (n = 75 infants). Significant results are shown in boldface. Model a is the same as shown in Table 3.

*Because the interaction including this term is significant, the *P* value for the main effect is not interpretable.