

## Descent Systems, Paternity Uncertainty and Cousin-directed Altruism

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**ABSTRACT:** Jeon and Buss (2007) found that human altruistic tendencies towards different categories of cousins are adaptively regulated as a consequence of paternity uncertainty. Since the study sample was drawn from a large US city where the effects of patrilineality may be weak, the question of whether descent systems also independently affect cousin-directed altruism remained unanswered. We replicated the cousin-directed altruism study in a population of urban Korean college students, who have lived in a highly patrilineal society. As predicted, mother's sister's children were favored the most, followed by both mother's brother's and father's sister's children. Contrary to our predictions, however, father's brother's children was more, not less, favored than either mother's brother's or father's sister's children. We discuss why this cross-cultural difference may be observed with regard to the highly patrilineal culture in Korea.

**Key words:** Altruism, Cousin, Paternity uncertainty, Patrilineality

### INTRODUCTION

Inclusive fitness theory accounts for the evolutionary biology of kin interactions (Hamilton 1964). Hamilton's rule states that an altruistic trait will be favored by selection if  $rB > C$ , where  $B$  is the fitness benefit to the recipient,  $C$  is the fitness cost to the actor, and  $r$  is the coefficient of relatedness between the two parties. Hamilton's rule thus represents a unified theory for understanding the adaptive basis of family relationships (Mock and Parker 1997). For instance, Hamilton's rule can be used to generate predictions as to whether the probability of parentage should affect the level of parental care. In species with biparental care, such as socially monogamous birds and humans, a female's brood might be sired by multiple males due to extra-pair copulation. Trivers (1972) argued that when the risk of extra-pair paternity is substantial, and each male has lower expected relatedness to the brood, males should provide less care to the brood than females. Indeed, ample evidence shows that human fathers do invest less in parental care as their paternity is lowered (Anderson et al. 1999, Marlowe 1999).

Paternity uncertainty has also been found to affect investment by extended kin such as grandparents, aunts/uncles, etc. (Euler and Weitzel 1996, Gaulin et al. 1997). In animals with internal fertilization, vertical links through males are less certain predictors of offspring parentage than links through females; hence, the number of uncertain links between distant kin should influence the nature of social relationships among them. A paternal grandfather has had two opportunities for his genetic links to his social grandchildren

to be severed; a maternal grandfather or a paternal grandmother has had one; a maternal grandmother has had none. Empirical tests have shown that maternal grandmothers indeed invest the most in their grandchildren, followed by both maternal grandfathers and paternal grandfathers, with paternal grandfathers investing the least (Smith 1988, Euler and Weitzel 1996, Pashos 2000, Michalski and Shackelford 2005).

Recently, Jeon and Buss (2007) found that the logic of differential altruism as a function of paternity uncertainty also applies to altruistic behavior among cousins. From the viewpoint of a focal individual, there are two uncertain links to the father's brother's (FaBro) children; one uncertain link to the father's sister's (FaSis) or mother's brother's (MoBro) children; and no uncertain links to the mother's sister's (MoSis) children. Based on these varying levels of paternity uncertainty, Jeon and Buss (2007) predicted that MoSis children should be favored the most, followed by MoBro children and FaSis children, and FaBro children the least. The empirical results documenting participants' willingness-to-help in a hypothetical life-or-death situation clearly confirmed the prediction.

Although the matrilineal bias resulting from paternity uncertainty seems substantial in social interactions among distant kin, there remains the question of whether the culturally specified descent system (i.e., patrilineality or matrilinearity) of a population also affects a person's altruistic tendencies towards different categories of cousins. Patrilineal descent refers to a system in which one belongs to a descent group because one has links through the male line back to the male founding ancestor. A man remains a member of his natal family even after he marries. In a matrilineal society, descent

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is traced through the female line. In general, human descent groups organize religious observances and rituals together, share and manage properties together, and influence their members' long-term mate choice (Cronk and Gerkey 2007). Hence, in order to perform collective actions for the sake of their descent groups, individuals in a highly patrilineal society may be more likely to interact with their patrilineal cousins (especially FaBro children, since patrilineal aunts, the mothers of FaSis children, would disperse into other descent groups and thus individuals in these societies will less likely to meet FaSis children). The frequent social interactions with FaBro children might drive individuals to act more altruistically towards FaBro children. Although Jeon and Buss (2007) did control for the possibility that residential distance might explain the observed differences in altruistic tendencies towards cousins, the collective actions of descent groups often mandate obligatory participation in events such as common rituals of ancestor worship, irrespective of residential distance.

To investigate the possible influence of descent systems on differential altruism towards cousins, we replicated Jeon and Buss' (2007) study with college students in Korea, a highly patrilineal society, and investigated whether Jeon and Buss' (2007) prediction of differential altruism towards cousins (MoSis children > MoBro children = FaSis children > FaBro children) is consistent with the actual patterns of cousin-directed altruism in Korea. We report a manifest cross-cultural difference between urban US and urban Korean populations in patterns of cousin-directed altruism.

## METHODS

### Participants

Two hundred and thirty undergraduate students (86 women and 144 men) of a large university in Seoul, Korea participated in this study. We recruited only students with one or more "blood-related" cousins, and gave them ₩ 5,000 gift certificates as compensation for their participation. The mean ( $\pm$  S.D.) age of participants was  $20.8 \pm 2.3$  years (range = 18–28).

### Instrument

We first asked participants to provide basic demographic information (age, sex, and socioeconomic status (SES)). We then asked participants to consider only their "blood-related" cousins; hence, any genetically unrelated cousins through stepparents or foster parents were ignored in this study. For each cousin category, participants were instructed to think of the cousin whose age was closest to their own to prevent bias that might occur if participants were allowed to freely choose any cousin from each cousin category. The remaining sections of the instrument were repeated for each cate-

gory of cousins; thus, participants who had all four categories of cousins answered four times for each question.

We measured how willing a participant was to act altruistically toward cousins in a hypothetical dilemma involving life-or-death situations. Participants were asked to imagine that their cousin was in a burning building and asked to rate their willingness-to-help on a seven-point scale from 1 (extremely unlikely) to 7 (extremely likely). We also asked the residential distances between participants and each category of cousin to examine whether residential distance acts as a confounding variable affecting the willingness-to-help scores. The rating scale was based on the logarithmic ten-point scale developed by Euler and Weitzel (1996).

We also measured proximate variables that may mediate the association between genetic relatedness and kin-directed altruism: emotional closeness, empathic concern, and the frequency of contact. Using a seven-point rating scale from 1 (not at all) to 7 (very much), participants evaluated how emotionally close they felt to each cousin. They also evaluated how much they cared for the well-being of each cousin, and were asked to rate how often they communicated with each cousin by email, phone, letter, or in person on a ten-point rating scale from 1 (never) to 10 (every day).

Finally, we asked forced-choice questions about emotional closeness, empathic concern, and the willingness to help cousins. Participants were asked, for example, which kind of cousins were they emotionally closest to. Participants having only one category of cousin were instructed not to answer. For more information about the methods, see Jeon and Buss (2007).

### Statistical Analysis

One hundred and twenty-eight participants had all four categories of cousins. The number of cousin categories participants had did not affect the average rating of willingness-to-help (one-way ANOVA,  $F_{3,229} = 1.70$ , n.s.). Although the dependent variables such as willingness-to-help scores were slightly negatively skewed, we used parametric statistics throughout this study because the  $F$  statistic is quite robust to moderate violations of the normality assumption (Cohen 1969). We confirmed that both non-parametric tests and tests using data transformation to handle non-normality produced nearly identical results.

## RESULTS

We detected no significant main effects or interactions for sex of participant in responses on instrument items. Nor were there any significant main effects or interactions for the sex of participants' cousins. Hence, we collapsed the data across the two variables (sex of participants, sex of participants' cousins).

**Forced-choice Data**

For the 128 Participants who had all four categories of cousins, the observed distribution of choices was 43 : 32 : 15 : 38 for MoSis, MoBro, FaSis, and FaBro children, respectively. Hence, the prediction of our hypothesis that FaBro children would be helped the least based on the number of links of paternity uncertainty (MoSis > MoBro = FaSis > FaBro children), was not supported. To examine if the remaining predictions of our hypothesis were supported, we conducted a series of chi-square tests. First, we tested the overall null hypothesis that each category of cousins would be equally chosen by chance. The observed distribution was significantly different from the expected distribution of 1 : 1 : 1 : 1 ( $\chi^2 = 13.94$ ;  $df = 3$ ;  $p < 0.001$ ). Second, the null hypothesis that MoSis : MoBro + FaSis = 1 : 2 was tested; a significant difference was also detected ( $\chi^2 = 8.45$ ;  $df = 1$ ;  $p < 0.001$ ). Therefore, whereas one prediction of our hypothesis was supported by the data (MoSis > MoBro = FaSis), the prediction that FaBro children would be helped the least was not supported (Table 1).

Similar results were obtained for the forced-choice items about emotional closeness and empathic concern. For both items, our hypothesis was mostly supported (MoSis > MoBro = FaSis); yet FaBro children were never the cousin who would be helped the least (Table 1).

**Rating Scale Data of Willingness to Act Altruistically**

As described in Jeon and Buss (2007), we controlled for the effects of the residential distance between participants and each of their cousins and the age difference between the two. Cousins living closer to each other will generally have more chances to develop close social relationships than those living far away, so residential distance may act as a confounding variable. Another potential confounding variable is the age difference between participants and their cousins, which may also influence the level of cousin-directed altruism.

We conducted repeated measures analysis of covariance (ANCOVA) with the two covariates for the total sample. There was a highly significant main effect of different cousin categories on the willingness-to-help scores ( $F_{3,510} = 2.910$ ,  $p < 0.05$ ). The adjusted mean ratings were arranged in the following order: MoSis children, FaBro children, MoBro children, and FaSis children (Table 2). To further examine our prediction that MoSis > MoBro = FaSis > FaBro, we did planned repeated comparisons where adjacent group means were compared. The greater willingness of participants to help their MoSis children than their MoBro children approached significance ( $p = 0.083$ ). Also consistent with our prediction was the absence of a significant difference between the willingness-to-help scores for MoBro children and FaSis children ( $p = 0.289$ ). Contrary to our prediction, however, participants were slightly but significantly more, not less, willing to help their FaBro children than their FaSis children ( $p = 0.050$ ). Consequently, our hypothesis was only partially supported because the willingness-to-help score for FaBro children was higher, not lower, than the scores of either MoBro children or FaSis children (Fig. 1). A similar analysis for the subset of participants having all four categories of cousins found the same pattern. Since both samples show qualitatively the same picture, we hereafter focus on the total sample.

Table 2. Raw and (adjusted) mean ratings of willingness-to-help scores for the total sample ( $N = 230$ ), adjusted for age differences and residential distance

Category of cousins	Total sample ( $N = 230$ )		
	Mean	S.D.	N
MoSis children	4.79 (4.95)	1.63	180
MoBro children	4.77 (4.75)	1.72	190
FaSis children	4.66 (4.62)	1.84	183
FaBro children	4.87 (4.85)	1.76	190

Table 1. Forced-choice data of willingness-to-help scores and other psychological variables for the subsample having all four cousin categories ( $N = 128$ )

	Willingness-to-help	Emotional closeness	Empathic concern
Observed distribution (MoSis : MoBro : FaSis : FaBro)	43 : 32 : 15 : 38	38 : 26 : 15 : 49	39 : 25 : 15 : 49
$\chi^2$ of overall null hypothesis (MoSis : MoBro : FaSis : FaBro = 1 : 1 : 1 : 1)	13.94*	20.31*	21.13*
$\chi^2$ of null hypothesis #1 (MoSis : MoBro + FaSis = 1 : 2)	8.45*	14.67*	9.14*

An asterisk (\*) indicates significant differences ( $p < 0.001$ ).

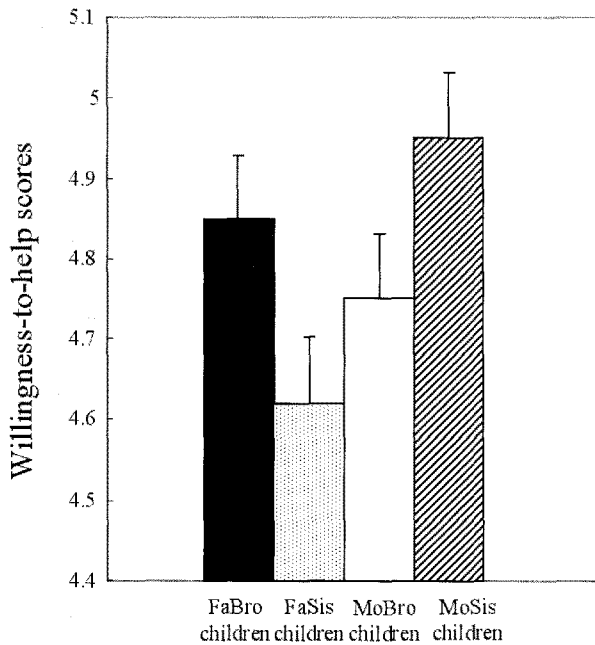


Fig. 1. The adjusted mean ratings (and standard error) of willingness-to-help scores among four different cousin categories, controlling for age differences and residential distance.

#### Rating Scale Data of Emotional Closeness, Empathic Concern, and Contact Frequency

Repeated measures ANCOVA including residential distance and age differences as covariates were conducted on each of three proximate variables. Emotional closeness ratings were significantly different across distinct cousin categories ( $F_{3,510} = 8.333$ ,  $p < 0.001$ ). The adjusted mean ratings were arranged in the descending order of (1) MoSis children, (2) FaBro children, (3) MoBro children and FaSis children (Table 3). Planned repeated comparisons based on our prediction (MoSis > MoBro = FaSis > FaBro) verified that participants felt significantly closer to MoSis children than either MoBro children or FaSis children ( $p < 0.001$ ), yet there was no significant difference in the closeness ratings of MoBro children and FaSis children ( $p = 0.927$ ). Again, contrary to our prediction, participants

felt significantly closer to their FaBro children than their FaSis children ( $p < 0.01$ ).

Analyses conducted on empathic concern ratings revealed a significant main effect of different cousin categories on empathic concern (repeated measures ANCOVA,  $F_{3,510} = 5.931$ ,  $p < 0.001$ ). The ratings of contact frequency were also significantly different among different cousin categories (repeated measures ANCOVA,  $F_{3,510} = 5.704$ ,  $p < 0.001$ ). The adjusted mean ratings for these variables showed the same pattern as emotional closeness. In planned repeated comparisons, the mean rating for MoSis children was significantly higher than that for either MoBro or FaSis children ( $p < 0.05$  for empathic concern,  $p = 0.063$  for contact frequency). There was either no significant difference between the ratings of MoBro and FaSis children ( $p = 0.418$  for empathic concern) or only marginally significant difference between them ( $p = 0.029$  for contact frequency). However, the mean rating of FaBro children was significantly higher, not lower, than the mean ratings of MoBro or FaSis children ( $p < 0.001$  for empathic concern,  $p < 0.01$  for contact frequency).

#### DISCUSSION

We found a clear cross-cultural difference between urban US and urban Korean populations. The previous results from a large US city population were consistent with our theoretical prediction that MoSis children would be the most favored, followed by both MoBro and FaSis children, with FaBro children favored the least (Jeon and Buss 2007). However, the present results from a Korean city population were only partially consistent with the prediction. Participants reported the greatest willingness to act altruistically towards their MoSis children, with a lower willingness to behave altruistically toward their MoSis children and FaSis children; yet their willingness to act altruistically towards their FaBro children was significantly higher, not lower, than that for either MoSis children or FaSis children. In brief, contrary to the prediction that MoSis children > MoBro children = FaSis children > FaBro children, the ur-

Table 3. Raw and (adjusted) mean ratings of emotional closeness, empathic concern, and contact frequency across distinct cousin categories for the total samples of participants, adjusted for age differences and residential distance

Category of cousins	N	Emotional closeness		Empathic concern		Contact frequency	
		Mean	S.D.	Mean	S.D.	Mean	S.D.
MoSis children	180	4.82 (4.84)	1.43	4.41 (4.43)	1.57	3.64 (3.63)	2.44
MoBro children	190	4.35 (4.26)	1.63	4.16 (4.06)	1.69	3.21 (3.23)	2.20
FaSis children	183	4.22 (4.28)	1.70	3.90 (3.94)	1.68	2.72 (2.76)	2.31
FaBro children	190	4.77 (4.74)	1.65	4.46 (4.41)	1.70	3.38 (3.34)	2.26

ban Korean participants expressed their altruistic tendency towards cousins as the order of MoSis children > FaBro children > MoBro children = FaSis children.

Where did the cross-cultural difference come from? We suggest that the stronger effect of patrilineal culture in the Seoul population caused participants to be more willing to help FaBro children than was expected based on Jeon and Buss' (2007) hypothesis, which predicts matrilineal bias resulting from paternity uncertainty. Jeon and Buss' (2007) study sample was drawn from Austin, a large US city in which the effect of patrilineal culture is assumed to be very weak. By contrast, despite being a metropolitan city, Seoul is still under the influence of a highly patrilineal culture. The frequent, often obligatory, collective actions performed by patrilineal descent groups may have led Seoul participants to be more altruistic towards FaBro children, a confounding effect that was not fully removed by the statistical control of residential distance. In other words, if we had controlled for the frequency of past social interactions, rather than residential distance, we might have found the same pattern of cousin-directed altruism as Jeon and Buss (2007). We are currently conducting a novel, cross-cultural study of cousin-directed altruism that will explicitly examine the effects of past social interactions with distinct types of cousins.

We emphasize that this interpretation is not a post-hoc explanation of the current findings, but an updated hypothesis about cousin-directed altruism. Jeon and Buss (2007) suggested the quality of adult sibling relationships in the parental generation as an important environmental input that is processed by the evolved psychological mechanism for cousin-directed altruism. Based on the present results, we suggest that the frequency of past interactions with distinct cousins may be another environmental input for the psychological mechanism. Even if one cannot be completely 'certain' that putative FaBro children are genetically related to oneself with a coefficient of relatedness of one-eighth, the fact that one meets a putative cousin frequently may be interpreted as a reliable cue indicating a non-zero degree of relatedness. Indeed, in a replication of Jeon and Buss' (2007) study in a rural US population (Decorah, Iowa), Bishop et al. (2008) found qualitatively the same result as the current study (MoSis children > FaBro children > MoBro children = FaSis children), confirming the validity of the explanation offered here.

In summary, we found an unexpected pattern of cousin-directed altruism in an urban Korean population, a highly patrilineal society

in which individuals are forced to frequently meet FaBro children irrespective of residential distance. Future research should clarify how two environmental inputs, past social interactions and the quality of parental sibling relationships, may interact when being processed by the evolved psychological adaptation for cousin-directed altruism.

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