GRANDPARENTAL INVESTMENT AS A FUNCTION OF RELATIONAL UNCERTAINTY AND EMOTIONAL CLOSENESS WITH PARENTS

Richard L. Michalski
Hollins University

Todd K. Shackelford
Florida Atlantic University

Several theoretical perspectives have generated research on grandparental invest-ment, notably socialization and evolutionary psychological perspectives. Using data collected from more than 200 older adults (mean age 67 years), we test three hy-potheses derived from socialization and evolutionary perspectives about grandpar-ents' relationships with and investment in grandchildren. Results indicate that (1) emotional closeness with both children and children-in-law is positively related to reports of emotional closeness with grandchildren; (2) maternal grandmothers in-vest more in grandchildren than do other grandparents; and (3) grandparents invest more in daughters' children than in sons' children. Discussion addresses limitations of self-report methodology in this context and situates the current findings within the body of research indicating the existence of psychological mechanisms designed to guide differential nepotism.

KEY WORDS: Emotional closeness; Grandparental investment; Relational uncertainty

S everal theoretical perspectives have generated predictions about differences be-tween grandparents in the investments they make in their grandchildren. Promi-nently included among these are socialization theories and evolutionary theories

(Spitze and Ward 1998). As noted by Szinovacz (1998), these theories often do not generate contradictory hypotheses about grandparental investment. Most research on grandparental investment in grandchildren has been inspired by socialization perspectives that invoke sex differences in socialization and lineage differences based on the sex of the parental generation (see, for example, Somary and Stricker 1998). Socialization theorists argue that women, but not men, are socialized to act as "kin-keepers." Women are expected to maintain familial relationships, and these relationships are predicted to be stronger among women as a result of this differential socialization. Socialization theories predict that, across generations, maternal grandmothers will invest the most in their grandchildren and that paternal grandfathers will invest the least.

Evolutionary theories explicitly invoke the operation of evolved, domain-specific psychological mechanisms that process information differently when situated in male and female psychology, and that generate sex-specific behavior (see, e.g., Tooby and Cosmides 1992). Evolutionary theorists argue that, throughout human evolutionary history, humans could have increased the likelihood that their second-degree relatives (e.g., grandchildren) survived to reproductive age by investing in them directly or by investing in first-degree relatives (e.g., children) who, in turn, could distribute resources to second-degree relatives (see, e.g., DeKay 1995; Gaulin et al. 1997; Hawkes et al. 1998; Hill and Hurtado 1996; McBurney et al. 2002). Grandparental investment can be substantial and includes aiding in the psychological, social, and physical development of grandchildren and the reduction of the investment costs incurred by the grandchild's parents. As a result of the importance of grandparents as investors in grandchildren, differential investment in grandchildren could have substantial impact on grandchildren and on the grandchild's parents.

Many researchers have used grandparental contact with grandchildren and their parents as variables of interest (King and Elder 1995; Rossi and Rossi 1990; Uhlenberg and Hammill 1998; Whitbeck et al. 1993). Frequency of contact with family members, although the most commonly used of these variables, may not sufficiently reflect the motivation to pursue such contact (Bengtson and Mangen 1988). Relying solely on frequency of contact is a limitation because we do not know who initiated the contact and how the grandparent feels about the contact. In short, a single-item measure of frequency of contact may not accurately reflect grandparental sentiment towards grandchildren. King and Elder (1995) found that more frequent contact is reported between paternal grandparents and grandchildren than between maternal grandparents and grandchildren in a rural sample. Pashos (2000) found similar results in samples of rural Greeks. Frequency of contact, in these cases, may reflect the desires of the parental generation and not the desires of grandparents, however. In rural samples, for example, land acquisition through inheritance of farmland may benefit males more than females. The results reported by King and Elder (1995), for example, may reflect attempts by males to acquire parental resources. To address this concern about the use of a single, and sometimes ambiguous, frequency-of-contact investment item, we use three investment items

reported on up to five grandchildren in the current study. These variables are collapsed into a composite measure to test all hypotheses and, in addition, are analyzed and discussed individually to explore aspects of grandparental investment that may underscore differences between cognitive, subjective processes and overt behaviors.

Grandparental sentiment towards grandchildren varies with the relationship that grandparents have with the parents of their grandchildren, particularly after their child's divorce (Johnson 1988, 1998). Grandparents who characterize their relationships with the parents of grandchildren as close report greater contact with their grandchildren. The following hypothesis is offered as a replication of previous work on grandparental sentiment towards grandchildren:

Hypothesis 1: Investment in grandchildren will correlate positively with reported emotional closeness with the parental generation.

Inclusive fitness theory (Hamilton 1964) states that natural selection favored not only those traits that promoted individual survival or reproductive success, but also those traits that increased the chances that other related family members, who share copies of genes, would reach reproductive age and produce children. Not all ancestral humans, however, shared the same assurance of relatedness to other family members. Ancestral women could place their long-term partner at risk of investing resources in a rival's offspring by cuckolding their long-term partner. Ancestral women never faced the problem of unknowingly diverting resources to unrelated offspring because they could be certain that the offspring they produced were genetically their own (Buss 1994; Daly et al. 1982; Symons 1979). Maternity certainty and paternity uncertainty across generations resulted in differing degrees of relational uncertainty between grandparents and grandchildren in ancestral environments (DeKay 1995; Hartung 1985). Evolutionary psychologists argue that the selection pressure of relational uncertainty may have crafted psychological mechanisms in grandparents that result in differing attention to socialization practices and that, as a consequence, generate differences in overt investment behavior by grandparents (DeKay 1995).

Relational uncertainty is the number of times in the line of descent between two family members that the genetic relationship between them could be severed by cuckoldry. Maternal grandmothers (MoMos) had no relational uncertainty over human evolutionary history. MoMos could have been certain of a genetic relationship to their daughter and to their daughter's offspring. Paternal grandfathers (FaFas) had the greatest relational uncertainty because the genetic links between them and their son and between their son and their son's children could have been severed by cuckoldry. Previous research has identified patterns of grandparental investment that correspond to the likelihood that grandparents were related genetically to their grandchildren in ancestral environments (DeKay 1995; DeKay and Shackelford 2000; Euler and Weitzel 1996; Euler et al. 2000; Pashos 2000). Grandchildren re-

port that maternal grandmothers invest the most in them, whereas paternal grandfathers invest the least. Few studies, however, have tested this hypothesis using self-reports of grandparents (cf. Smith 1991). We attempt to replicate the finding that maternal grandmothers invest more in their grandchildren than do paternal grandfathers in the following hypothesis:

Hypothesis 2: Maternal grandmothers will report investing more in their grandchildren than will paternal grandfathers.

We ask participants to report their investment in multiple grandchildren and to indicate whether each grandchild is related through a son (agnatic) or a daughter (uterine). This allows us to assess whether the same grandparent invests differently depending on relational uncertainty. We can assess whether grandparents invest more in uterine grandchildren than in agnatic grandchildren. Grandparents who have grandchildren through both sons and daughters invest more in their daughter's children than in their son's children. Smith (1991) found that grandparents spend more time with their daughter's children than with their son's children, controlling for the number of grandchildren through sons and daughters and for the age of the grandchildren. We attempt to replicate this finding using additional measures of investment:

Hypothesis 3: Among grandparents who report investment in grandchildren related through both sons and daughters, investment will be greater in uterine grandchildren than in agnatic grandchildren.

Grandparental investment may depend on factors other than relational uncertainty. To isolate such mediating variables from effects attributable to relational uncertainty, we secured reports on four such variables: residential distance from grandchild, participant age, participant SES, and grandchild age.

METHODS

Participants

We recruited 207 older adults (69 men, 138 women) from retirement communities in southeastern Florida, with ages ranging from 47 to 86 years. The average age of the total sample was 67.1 years (s.d. = 8.7). The grandchildren of the grandparents ranged in age from one year to 38 years with an average age of 15.5 years (s.d. = 9.4). The mean residential distance of grandparents from their first reported grandchild was 841 miles (s.d. = 922.8). The mean number of children reported by participants was 2.5 (s.d. = 1.8), and the mean number of grandchildren reported by participants was 2.9 (s.d. = 3.0). The racial composition of the sample was as fol-

lows: 76.0% white, 7.0% Hispanic, 8.0% African American, 6.0% Native American, 0.5% Asian American, and 2.5% other.

Materials

Participants were assured confidentiality of their responses and were provided with a security envelope in which to place the completed survey. Participants were instructed that the survey would take one hour to complete. The first section of the survey requested demographic information, including the age, sex, and socioeconomic status (SES) of the participant. Participants placed a circle around their current SES (1 = Upper, 2 = Upper-Middle, 3 = Middle, 4 = Lower-Middle, 5 = Lower).

The remaining sections of the survey requested information on any of up to five of the participant's biological grandchildren. To ensure that participants could complete the survey within an hour, the number of grandchildren for which participants could respond was limited to five. This limitation results in the possibility that grandparents list only their five "favorite" grandchildren. The impact of this limitation on the data is minimal, however, because only a minority of participants (13.0%) reported having more than five grandchildren. Participants reported the age and sex of each grandchild. Participants were asked, for each grandchild, "Are you related to this biological (natural) grandchild through your daughter or your son?" Participants placed a check on one of two lines provided for "Related through my *daughter*" or "Related through my *son*." Following this, we asked participants, "Approximately how far away from this grandchild do you currently live?" Participants responded in miles. Participants also indicated on a scale from 0 (Not at all close) to 8 (Extremely close) how emotionally close they are to each grandchild's biological mother and biological father.

For investment assessments, we asked participants three questions. We asked participants, "On average, approximately how much money do you spend in a *month* on this grandchild? (including gifts, meals, cash, etc.)," "On average, approximately how much time do you spend in a *week* with this grandchild?" and "How *emotionally close* do you feel to this grandchild?" For this last question, participants responded on a scale from 0 (Not at all close) to 8 (Extremely close). We used these questions to create a composite investment variable (see Results).

RESULTS

Variable Construction and Initial Analyses

We recoded and constructed several variables prior to conducting analyses. The three investment items were transformed due to skew (Tabachnick and Fidell 2001). The variables "time spent per week" and "money spent per month" were positively skewed on reports for all grandchildren. A value of 1 was added to each of these variables for each grandchild to remove zero as a value. We then took the inverse

for each recoded variable, following correction procedures outlined by Tabachnick and Fidell (2001). Emotional closeness was negatively skewed for all grandchildren. Like the previous two variables, a value of 1 was added to all values to remove values of zero. We then took the inverse of these recoded values to yield a transformed emotional closeness variable that paralleled the previous two investment variables. For efficiency in reporting and reduction in Type I error, the three investment items were collapsed into a composite investment variable for each grandchild (α values were fair, averaging .60). Because the computed investment variables are composed of three inverse transformed variables, smaller values indicate more investment.

Grandparents reported the distance they lived from each grandchild. These distance variables were positively skewed. A value of 1 was added to each of these values to remove zero as a value. We then took the log of these variables to correct for skew, following Tabachnick and Fidell (2001). Participant's sex (0 = male, 1 = female) and participant's responses to whether the grandchild is related through a son or through a daughter (1 = related through daughter, 2 = related through son) were multiplied to yield one of four values for each grandchild. These four values represent the relationship of the grandparent to the grandchild (MoMo, FaMo, MoFa, and FaFa).

Hypotheses and Predictions

Hypothesis 1 stated that investment in grandchildren will correlate positively with reported emotional closeness with the grandchildren's parents. A larger percentage of participants reported information on the first grandchild than any other of the five possible grandchildren. To retain reasonable statistical power, we limited analyses to reports for the first grandchild. Partial correlation coefficients were computed between reported emotional closeness with sons, with daughters-in-law, with daughters, and with sons-in-law and the collapsed measure of the three investment items and with the three investment items separately (see Table 1). These partial correlations were computed, controlling for participant age, participant SES, grandchild's age, and residential distance from grandchild. None of the correlations for the collapsed investment measure was statistically significant (all p values > .05). Among correlation coefficients computed separately for each investment measure, emotional closeness with grandchild's parents and emotional closeness with grandchild revealed a pattern consistent with the hypothesis. Time spent per week and money spent per month did not correlate significantly with emotional closeness with sons, daughters, sons-in-law, or daughters-in-law. Follow-up analyses were conducted to examine whether the partial correlation coefficients differed between sons and daughters and between daughters-in-law and sons-in-law. Fisher's r-to-z transformations were conducted, and no significant differences emerged (both z values < 1.96, p values > .05). Tests of the differences between the dependent partial correlation coefficients for sons and daughters-in-law and for daughters and

Table 1. Correlations between Emotional Closeness with Children and Children-in-law and Grandparental Investment in Grandchildren (Hypothesis 1)

Emotional Closeness to Parental Generation	Grandparental Investment							
	Collapsed Measure		Emotional Closeness		Time/Week		Money/Month	
Sons	−.14	(−.37*)	−.49***	(−.61***)	−.05	(−.30*)	−.06	(−.14)
Daughters-in-law	−.14	(−.13)	−.34**	(.40**)	.02	(−.07)	−.03	(.00)
Daughters	−.10	(−.06)	−.40***	(−.37**)	−.04	(−.07)	.07	(.11)
Sons-in-law	−.07	(−.05)	−.26*	(−.26*)	.24*	(−.03)	.07	(.05)

Partial correlation coefficients controlling for participant age, grandchild age, participant SES, and distance from grandchild are in parentheses. Because of value transformations, negative correlations indicate increased investment.
* $p < .05$; ** $p < .01$; *** $p < .001$

sons-in-law were conducted (Meng et al. 1992). Results from these follow-up tests did not reveal a significant difference between either of these sets of correlations (both *z* values < 1.96, *p* values > .05). Hypothesis 1 was not supported using the collapsed measure of investment in grandchildren, but it was supported with emotional closeness to grandchildren.

Hypothesis 2 stated that maternal grandmothers will report investing more in grandchildren than will paternal grandfathers. Mean investments made in grandchildren are shown in Table 2. Following Smith (1991), we first tested differences between grandparent groups on each of the covariates to determine whether there were significant differences between the groups. If there was no significant difference between groups on a covariate, that covariate was dropped from subsequent analyses. Results revealed no significant difference between paternal grandfathers and maternal grandmothers on any of the covariates. An independent samples *t*-test revealed a significant difference between the mean investment of paternal grandfathers and the mean investment of maternal grandmothers, $t_{73} = 2.30$, $p < .05$. The mean difference was in the predicted direction, with maternal grandmothers reporting more investment than paternal grandfathers.

Initial tests of Hypothesis 2 relied on a sample size of paternal grandfathers (*n* = 17) that may not have been sufficient to test this hypothesis adequately. To address the small sample size, paternal grandfathers, paternal grandmothers, and maternal grandfathers were combined into one group. This modified grouping of grandparents allowed for tests between reports of grandparents with at least one link of potential cuckoldry between themselves and their grandchildren and another group with no such link. Tests of the covariates revealed that maternal grandfathers, paternal grandmothers, and paternal grandfathers did not differ significantly from maternal grandmothers in age or SES [all $F_{1, 134} < 2.00$, *p* values > .05]. Grandparents did differ significantly in the distance they reported living from the first grandchild,

Table 2.   Mean Investment Reported by Maternal Grandmothers and Paternal Grandfathers and Maternal Grandmothers and Collapsed Group of Grandparent Types (Hypothesis 2)

Investment Measure	Maternal Grandmothers (n = 58)		Paternal Grandfathers (n = 17)		Maternal Grandfathers, Paternal Grandmothers, and Paternal Grandfathers (n = 77)	
Collapsed Measure	0.27	(.22) [a, b]	0.41	(.24) [a]	.38	(.26) [b]
Emotional Closeness	6.58	(1.73)	6.06	(2.08)	5.99	(2.20)
Time/Week	13.10	(36.70) [a]	11.67	(43.27) [a]	5.31	(21.69)
Money/Month	32.27	(35.40)	45.47	(73.36)	65.34	(106.43)

Analyses on individual investment items were conducted on transformed values, not raw values. Raw values are presented in the table, except for the collapsed measure of investment. Standard deviations are in parentheses.
[a]   *t* significant at $p < .05$
[b]   *F* significant at $p < .05$

$F_{1, 134} = 8.28$, $p < .05$. Maternal grandmothers reported living significantly closer to their grandchildren than other grandparents (For MoMos, $M = 638.4$ miles, s.d. = 863.2 miles; For MoFas, FaMos, and FaFas, $M = 964.7$ miles, s.d. = 951.4 miles). Additionally, maternal grandfathers, paternal grandmothers, and paternal grandfathers reported investing in significantly younger grandchildren than maternal grandmothers [for MoMos, $M = 17.9$ years, s.d. = 8.9 years; for MoFas, FaMos, and FaFas, $M = 14.1$ years, s.d. = 9.4 years; $F_{1,98} = 4.23$, $p < .05$]. We therefore included residential distance from grandchild and grandchild age as covariates in the test of the hypothesis. Results from the analysis of covariance with distance and grandchild age included revealed a significant difference between grandparental groups in investment reported in grandchildren, $F_{1, 131} = 3.97$, $p < .05$. The means were in the predicted direction, with maternal grandmothers reporting more investment in grandchildren than the combined grouping of the other three grandparent types. Analyses conducted on the investment items separately revealed a significant difference only between maternal grandmothers and paternal grandfathers in the time they spend per week with the grandchildren, $t_{56} = 2.42$, $p < .05$. Hypothesis 2 was supported using the collapsed measure for tests of differences between maternal grandmothers and paternal grandfathers and tests of differences between maternal grandmothers and a collapsed grouping of other grandparent types.

Hypothesis 3 stated that, among grandparents who report investment in grandchildren related through both sons and daughters, investment will be greater in uterine grandchildren than in agnatic grandchildren. Additional variables were constructed prior to testing this hypothesis. Cases were first screened to identify participants who reported investing in daughter's children and in son's children. For these 38 participants (8 men, 30 women) we computed average investment scores

separately for investment in son's children and in daughter's children. We then replicated this procedure to determine the average age of son's children and daughter's children and the average residential distance from son's children and daughter's children. Each of these participants therefore had scores for grandchildren through sons and through daughters for the following variables: mean investment, mean distance, and mean age. We computed dependent samples t-tests on the means of these variables. The results revealed significant differences for average investment in grandchildren and average residential distance from grandchildren. Supporting the hypothesis, significantly greater investment was reported for grandchildren through daughters than through sons, $t_{37} = 2.55$, $p < .05$. In addition, participants lived closer to grandchildren through daughters than to grandchildren through sons, $t_{37} = 3.18$, $p < .05$.

We next assessed whether the significant difference in investment could be accounted for by residential distance. We dropped grandchild age and the number of grandchildren through sons and daughters as covariates because no significant effects emerged for these variables. We then conducted a repeated-measures analysis of covariance with varying covariates to isolate the effects of distance on investment. The results revealed a marginally significant difference between investment in agnatic and uterine grandchildren once we controlled for average residential distance from grandchildren, $F_{1,36} = 3.71$, $p = .06$. Thus, although Hypothesis 3 was not supported statistically, the means were in the predicted direction.

DISCUSSION

The current research tested three hypotheses about grandparental investment. The results from tests of the first hypothesis indicate that, although the collapsed measure of investment does not correlate positively with emotional closeness to grandchildren's parents, emotional closeness with grandchildren is related positively to emotional closeness to grandchildren's parents. Results from tests of the second hypothesis corroborate previous research indicating that maternal grandmothers invest more in grandchildren than do other grandparents, even after controlling for residential distance from grandchildren and grandchildren's age. The third hypothesis was supported initially, and follow-up analyses revealed that the greater investment in uterine grandchildren than in agnatic grandchildren is accounted for by closer residential proximity to uterine grandchildren.

Research using grandparental self-reports and ratings by grandchildren indicates that maternal grandmothers invest more in their grandchildren than do other grandparents (DeKay 1995; Euler and Weitzel 1996; Euler et al. 2000; Leek and Smith 1991; Smith 1991). A key difference between previous self-report examinations of grandparental investment and the sample used in the current study is that participants in the current study were drawn from retirement communities. Retirement samples—particularly those in Florida, such as the current sample—may not be representative of the grandparental population. A substantial number of retirees in

Florida are from other states (see Longino 2001). This is reflected in the large mean distance that participants in the current study reported living away from their grandchildren. Grandparents interested in and financially capable of relocating in retirement may have different family relationships than grandparents not willing or able to relocate once they retire. Despite this limitation, the results do largely replicate previous research. Modern retirement may be an evolutionarily novel circumstance, however, and this study offers a unique addition to the literature on grandparental investment through an initial examination of how evolved psychological mechanisms may operate in such circumstances.

A potential covariate not assessed in the current study is the quality of the marital relationship of the parental generation. Marital conflict and divorce in parental generations has less of an effect on contact with grandchildren for maternal grandparents than for paternal grandparents (Ahrons and Bowman 1982; Johnson 1988). This is largely attributable to the tendency to award custody to mothers following divorce. This potential mediator of grandparental investment may have attenuated effects obtained in the current study. The data used to test Hypothesis 1 very likely include reports on divorced children. If we had been able to separate cases by parental divorce, we might have found differences in emotional closeness with children and children-in-law that produced for paternal grandparents a stronger positive relationship between emotional closeness with daughters-in-law and emotional closeness with grandchildren.

It may be fruitful to examine the hypothesized relationships using a within-family design. Self-reports of grandparental investment may be subject to response biases designed to present the image of an impartially investing grandparent. Harwood (2001) found that grandparents report greater closeness to their grandchildren than the same grandchildren report with their grandparents. This finding may reflect the desire of grandparents to present themselves as close to their grandchildren. Indication of self-report bias in the current study also may be manifest in the substantially skewed distributions of the investment variables. Grandparental reports of investment in grandchildren are likely to be biased, and consequently, using a within-family design to secure assessments of investment may be a more appropriate methodology for identifying differential grandparental investment. In addition, results of the current study indicate that future research would benefit from the development of an inventory of grandparental investment that can capture multiple aspects of grandparent-grandchild investment. The current study also highlights that frequency of contact might not reflect the underlying psychology of grandparents. A small correlation between emotional closeness with grandchildren and time spent with grandchildren suggests that frequency of contact may be tapping an aspect of grandparental psychology that is independent of sentiment towards grandchildren and perhaps more likely to be attributable to contact sought by the parent generation than by the grandparent generation.

Residential distance from grandchildren has been identified as a source of variation to be controlled in tests of grandparental investment (e.g., Euler and Weitzel

1996). Residential distance from grandchildren also can be viewed as a form of investment. Perhaps in part owing to greater relational certainty, grandparents may be more interested in relocating in retirement closer to uterine grandchildren than to agnatic grandchildren. Results from the current study corroborate this speculation. Grandparents reported a significantly smaller average residential distance from uterine grandchildren than from agnatic grandchildren.

The current study makes several contributions to the understanding of grandparental investment and provides direction regarding the methodology that future research should employ to test these hypotheses more precisely. This study is unique in that multiple indexes of investment were obtained on multiple grandchildren, allowing us to compare investment in grandchildren through daughters with investment in grandchildren through sons. Although not supported with the collapsed measure of investment, the pattern of responses corroborated Hypothesis 1, that closeness with the parental generation is correlated positively with emotional closeness to grandchildren. Tests of Hypothesis 2 suggest that maternal grandmothers invest more in grandchildren than paternal grandfathers and a collapsed grouping of grandparents with at least one link of potential cuckoldry between themselves and their grandchildren. Hypothesis 3 was supported, indicating that among grandparents with grandchildren through both sons and daughters, grandparents invest more in grandchildren through daughters. Follow-up analyses reveal that this effect is attributable to the closer proximity to daughter's children than to son's children.

In addition to implementing within-sample designs, future research should test these hypotheses with a reliably developed inventory of grandparental investment and with potential covariates that may have affected the current results. Each of these possibilities highlights the potential benefit of incorporating results generated from both socialization and evolutionary perspectives to develop a more powerful theoretical engine capable of more accurately predicting grandparental investment in grandchildren.

Richard L. Michalski received his Ph.D. in Psychology from Florida Atlantic University in 2005. He is currently an assistant professor of psychology at Hollins University. His research interests include family relationships, especially investments made in family members.

Todd K. Shackelford received his Ph.D. in Psychology from the University of Texas at Austin in 1997. He is currently an associate professor of psychology at Florida Atlantic University and chair of the Evolutionary Psychology Area. His research interests include conflict between the sexes, especially sexual conflict.

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