
Darwinian Grandparenting: Preferential Investment in More Certain Kin

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Studies on grandparental investment have revealed that mothers' fathers are emotionally closer to their grandchildren than are fathers' mothers. In the current study, it was hypothesized that this difference is caused by the fact that fathers' mothers often have the potential to invest in genetically more certain kin (children through their daughters). To test this hypothesis, 787 participants rated their emotional closeness and exposure to their grandparents and indicated whether they had cousins through paternal and maternal aunts and uncles. Results indicated that participants felt closer to mothers' fathers than fathers' mothers only when alternate investment outlets for fathers' mothers were available. Closeness ratings to fathers' fathers also were reduced when they had grandchildren through their daughters. Exposure to grandparents revealed a similar pattern of findings but did not show the same sensitivity to the presence of more certain kin and did not appear to account for the closeness ratings.

Keywords: *grandparenting; close relationships; paternal uncertainty; evolutionary psychology*

The arrival of grandchildren is usually seen as a joyous occasion. Although most find grandparenting a pleasant experience (Fischer, 1983), not all grandparents invest the same amount of time and resources in their grandchildren. Typically, mothers' mothers invest the most, followed by mothers' fathers, then fathers' mothers, with fathers' fathers investing the least (Eisenberg, 1988; Hoffman, 1978-1979; Kahana & Kahana, 1970; Rossi & Rossi, 1990; Smith, 1988). Recently, this trend in grandparental investment has been explained by evolutionary theories of paternal uncertainty (Buss, 1999; DeKay, 1995; Euler & Weitzel, 1996).

Because differing levels of genetic relatedness between individuals have been recurrent selective forces over human evolutionary history, psychological adapta-

tions are hypothesized to have evolved to regulate investment in accordance with reliable cues to genetic relatedness. Grandparental investment mechanisms represent a special case of such adaptations because grandparental genetic relatedness can vary from completely certain (a grandchild of a woman through her daughter) to doubly uncertain (a grandchild of a man through his son), with the two other cases being of intermediate uncertainty. These differences in grandparental certainty can explain why mothers' mothers invest the most in their grandchildren and why fathers' fathers invest the least. This explanation does not provide a complete account of the investment pattern, however. Specifically, it remains unclear why mothers' fathers consistently invest more in their grandchildren than fathers' mothers, as both carry the same presumptive level of uncertain genetic relatedness. The present study addresses this issue.

Paternal Uncertainty and Grandparental Investment

Throughout evolutionary history, men have faced the adaptive problem of paternal uncertainty—they cannot be sure that their children are theirs. A man can be cuckolded and potentially tricked into thinking another's offspring are his own but a woman cannot. In almost all circumstances, a woman is 100% certain that her offspring

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are hers—fertilization occurs within her, she carries a child for 9 months and then gives birth, and she knows it. This certainty is present for a woman regardless of whether she knows the identity of the father. A number of diverse psychological and behavioral responses, ranging from male sexual jealousy to female assurance that newborn babies resemble their fathers, have been identified as probable consequences of these gender differences in parental uncertainty (for a review, see Buss, 2003).

If we extend this reasoning about gender differences in parental certainty back a generation to grandparents, we see two opportunities for genetic kinship to be severed. Grandfathers cannot be certain that their children are really their own, and both paternal grandparents cannot be certain that their sons' children are really their grandchildren. These differences in genetic certainty predict differences in grandparental investment. DeKay (1995), for example, asked American undergraduates to rate grandparental investment in terms of time invested, knowledge acquired, gifts received, and emotional closeness (an obvious consequence of investment). Results supported the predicted pattern. Mothers' mothers invested the most in their grandchildren, followed by mothers' fathers, then fathers' mothers, and last, fathers' fathers. Emotional closeness ratings exhibited the same pattern.

Euler and Weitzel (1996) replicated this pattern in a sample of German participants. These researchers asked participants to report how much each grandparent had cared for them until the age of seven. Again, participants reported differential closeness that matched previous results. This pattern of grandparental investment also has been found in Greece (Pashos, 2000). These studies suggest that patterns of grandparental investment are a robust phenomenon not easily explained by alternatives such as grandparental gender (Euler & Weitzel, 1996), residential distance (Eisenberg, 1988; Euler & Weitzel, 1996; Thomas, 1989), grandparental age (Euler & Weitzel, 1996), or number of living grandparents (Euler & Weitzel, 1996).

Although the current evolutionary account provides a clear explanation for the two ends of the continuum—relatively high-investing mothers' mothers and relatively low-investing fathers' fathers—a satisfactory explanation for the reliably greater closeness of mothers' fathers compared to fathers' mothers has yet to be provided. Theoretically, both of these grandparents have one uncertain link, so they might be expected to show similar levels of investment. One explanation that has been proposed for the greater investment of mothers' fathers than fathers' mothers is that of different generational cuckoldry rates (DeKay, 1995). DeKay suggests that infidelity may be more prevalent in the younger than the

older generation, which would imply that genetic relatedness would be more uncertain for fathers' mothers, as their uncertain genetic link falls in the younger generation. This explanation lacks supportive evidence, however, as there are no clear data showing that cuckoldry rates are higher in younger than older generations across different cultures. Although people may *talk* more about cuckoldry now than in previous generations, there is no clear evidence that they in fact *do* it more. Indeed, surveys of representative samples have yet to document higher infidelity rates than were originally reported by Kinsey, Pomeroy, and Martin (1948), whose participants would now be grandparents or great-grandparents (see Buss, 2003).

The Present Research

We propose a refinement of the current evolutionary account to explain the differential investment of mothers' fathers and fathers' mothers. The basis of this refinement is a hypothesis we term *Preferential Investment in More Certain Kin*, or more simply, the *Preferential Investment Hypothesis*. This hypothesis states that the greater observed investment of mothers' fathers is caused by the fact that fathers' mothers typically have genetically more certain alternate investment outlets available. According to this hypothesis, the presence or absence of cousins through one's father's sisters should moderate the differential investment between mothers' fathers and fathers' mothers. The logic underlying this hypothesis is simple. Consider your father's mother. She has one uncertain genetic link—that between your father and you. If, however, your father's mother also has a daughter who has children, she can be 100% certain of her relatedness to those grandchildren. According to the preferential investment hypothesis, if your father's mother has grandchildren through her daughters, she will invest in them at your expense. Your mother's father, on the other hand, cannot be more certain of a genetic relationship to any of your cousins than he is to you. For this reason, mothers' fathers are likely, on average, to be closer to their grandchildren than fathers' mothers, but this effect should disappear when fathers' mothers do not have grandchildren through their daughters.

It should be noted that although the current research focuses on the difference in investment between fathers' mothers and mothers' fathers, the preferential investment hypothesis also makes predictions regarding closeness to fathers' fathers. As is the case with fathers' mothers, investment by fathers' fathers should depend on the presence of more certain outlets. When fathers' fathers are also mothers' fathers, they have more certain outlets in which they may invest at the expense of investment in their sons' children. Consequently, the preferential investment hypothesis predicts investment by fathers'

fathers to be less when they have grandchildren through their daughters.

Although the preferential investment hypothesis focuses only on the availability of more certain investment outlets, there is also likely to be an independent effect of the total number of grandchildren. A grandparent has only so much time and resources to give, and thus, when there are large numbers of grandchildren there is likely to be *diffusion* of grandparental resources, such that any one grandchild receives commensurately less as a function of the number of cousins he or she has. This diffusion effect, however, should be strongest in the case of equally certain offspring, as grandparents should focus their efforts first on their most certain kin, as suggested by the preferential investment hypothesis, and only then diffuse their remaining time and resources for their less certain kin. As a consequence, grandchildren through daughters should only suffer diffusion effects from the presence of other grandchildren through daughters, whereas grandchildren through sons should suffer preferential investment effects from the presence of other grandchildren through daughters and diffusion effects from the presence of other grandchildren through sons.

These effects of preferential investment and diffusion are expected to emerge in the feelings of closeness that grandchildren have for their grandparents. These ratings served as the primary measure of grandparental investment in the current research for three reasons. First, directly asking grandparents about their investment in or emotional closeness to grandchildren may not yield the predicted pattern of results, as social desirability pressures would cause many grandparents to claim that they invest equally in all of their grandchildren. Second, asking grandchildren how close they are to their grandparents can be considered a proxy measure of how close grandparents are to their grandchildren. Relationship research suggests that people tend to like others to the degree that others like them (Aronson & Linder, 1965; Backman & Secord, 1959; Condon & Crano, 1988; Kenny & Nasby, 1980). So, if a grandchild feels particularly close to a certain grandparent, it is likely that the reverse is also true. Third, emotional closeness patterns closely resemble patterns of other, more direct investment measures (Eisenberg, 1988; Euler, Hoier, & Rohde, 2001; Euler & Weitzel, 1996; Fischer, 1983; Hoffman, 1978-1979; Rossi & Rossi, 1990).

Alternative and Mediating Mechanisms

An alternative explanation for the difference between fathers' mothers and mothers' fathers is based on exposure—how often grandparents see their grandchildren. There are three ways that exposure might account for investment differences between mothers' fathers and

fathers' mothers. First, *incidental exposure* may explain the observed difference. Given that mothers' mothers reliably invest most in their grandchildren, and that investment often involves visiting those grandchildren, it may be that the increased investment of mothers' fathers is a function of incidental exposure. Mothers' mothers see their grandchildren the most, and when they visit, they may often bring their husbands with them. This incidental exposure to grandchildren may lead to greater perceived or actual investment by mothers' fathers. Conversely, fathers' fathers, who are genetically less certain of their grandchildren, may resist seeing their grandchildren and so their wives may be discouraged from investing as much as they otherwise would. It is thus possible that the difference in closeness between mothers' fathers and fathers' mothers may be caused by such differences in incidental exposure.

Second, exposure may be a proximal mechanism through which the preferential investment effect is manifested. Investment is likely to involve spending time with grandchildren, and spending time with grandchildren should typically lead to increased closeness. Thus, we would expect grandparental certainty to be correlated with exposure. Consistent with such a possibility, research shows that time spent with grandchildren (Smith, 1988) and interaction frequencies (Eisenberg, 1988; Hartshorne & Manaster, 1982; Salmon, 1999) correspond with the general investment pattern.

Third, exposure could itself be considered an indicator of grandparental investment. In the current research, however, exposure is not considered to be as clear of a measure of grandparental investment as emotional closeness because frequency provides little evidence about quality. A grandparent could visit frequently, perhaps due to geographic proximity, but be cold and distant on most visits. Conversely, a grandparent could visit only infrequently, perhaps due to geographic distance or poor health, but be highly engaged and giving whenever visits take place.

Because all three exposure hypotheses predict at least a moderate relationship between exposure and closeness, the key to interpretation of the exposure data is not to test the correlation between exposure and closeness but to test whether differences in exposure are larger between mothers' fathers and fathers' mothers than within maternal and paternal grandparent couples. According to the incidental exposure hypothesis, mothers' fathers should see their grandchildren more than fathers' mothers, but there should not be large differences in exposure within grandparent pairs. In contrast, if exposure is a proximal mechanism for preferential investment, or if exposure *is* preferential investment, then we would expect reliable differences in exposure both between and within grandparent pairs.

The aims of the present study are thus threefold. First, the current study seeks to replicate the differential grandparental investment effect in an Australian sample. It is expected that grandchildren will feel closest to mothers' mothers, followed by mothers' fathers, then fathers' mothers, and finally fathers' fathers. Second, the current study tests the preferential investment hypothesis, which predicts that grandchildren feel closer to mothers' fathers because fathers' mothers typically have more genetically certain kin available (grandchildren through their daughters). Third, this study compares the "incidental exposure" versus "exposure as proximal mechanism" or "exposure as investment" accounts for the difference in closeness between mothers' fathers and fathers' mothers.

METHOD

Participants. 787 psychology students from the University of New South Wales (564 women, 214 men) age 17 to 59 ($M = 20$, $SD = 4.08$) participated in partial fulfillment of 1st-year and 2nd-year psychology course requirements.

Procedure and materials. Participants first rated their emotional closeness to each of their biological grandparents from 0 (*cold or negative feelings*) to 100 (*warm or positive feelings*) on a feeling thermometer. Participants were instructed to report "not applicable" for grandparents who had died before they were born or when they were too young to remember. Participants then reported how often they saw each of their grandparents from the earliest point in childhood they could remember until they began university on a 5-point scale (0 = *never*; 4 = *very often*). Participants then reported how many biological aunts and uncles they have on their father's and mother's side of the family and how many biological children each of these relatives have. Finally, age, gender, and ethnicity were collected.

RESULTS

Replicating differential grandparental investment. The pattern of closeness ratings replicates findings from previous research (see Figure 1). Pairwise comparisons from the total sample revealed that participants felt closer to mothers' mothers than mothers' fathers, $F(1, 464) = 35.88$, $p < .001$, closer to mothers' fathers than fathers' mothers, $F(1, 424) = 3.96$, $p < .05$, and closer to fathers' mothers than fathers' fathers, $F(1, 417) = 4.88$, $p < .03$.¹ A similar analysis including only participants who rated all four grandparents revealed the same pattern of means, although not all pairwise comparisons were reliable (see Figure 1). In this subsample, participants reported feeling closer to mothers' mothers than

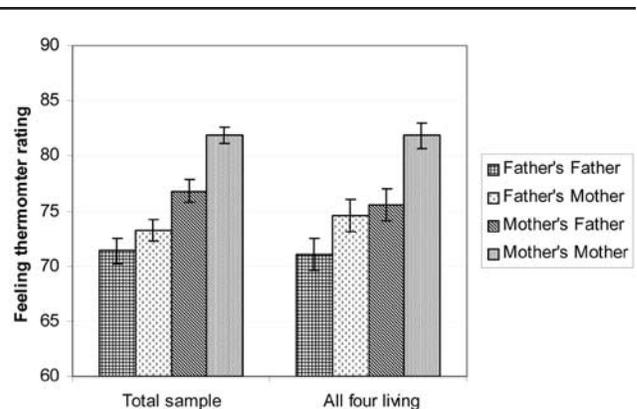


Figure 1 Mean feeling thermometer ratings (out of 100) of grandparents for total sample (father's father, $n = 463$; father's mother, $n = 617$; mother's father, $n = 514$; mother's mother, $n = 664$) and from participants with all four grandparents alive at childhood ($n = 287$).

mothers' fathers, $F(1, 286) = 22.75$, $p < .001$, not significantly closer to mothers' fathers than fathers' mothers, $F < 1$, *ns*, and closer to fathers' mothers than fathers' fathers, $F(1, 286) = 7.02$, $p < .01$. A linear contrast revealed the expected linear trend across these four grandparents in the order indicated in Figure 1, $F(1, 286) = 28.90$, $p < .001$.

Of particular interest to the present study is the difference between mothers' fathers and fathers' mothers. This difference reached significance in the total sample but not in the sample restricted to those participants who provided closeness ratings for all four grandparents. Because previous research indicates that the pattern of grandparental investment does not differ among participants with all four grandparents living compared to participants for whom some grandparents are deceased (Euler & Weitzel, 1996), and because our own results showed the same linear pattern in both samples, subsequent analyses focused on the difference between mothers' fathers and fathers' mothers in the total sample, which had substantially greater power.

The preferential investment hypothesis: Primary predictions. According to the preferential investment hypothesis, the preference for mothers' fathers over fathers' mothers should be significant only when participants have cousins through their fathers' sisters. This logic suggests an interaction between type of grandparent (mother's father vs. father's mother) and presence of cousins through fathers' sisters (no cousins vs. one or more cousins). This predicted two-way interaction was marginally significant, $F(1, 412) = 2.85$, $p < .10$ (see Figure 2). Although the predicted interaction only obtained marginal significance, simple effects analyses explored

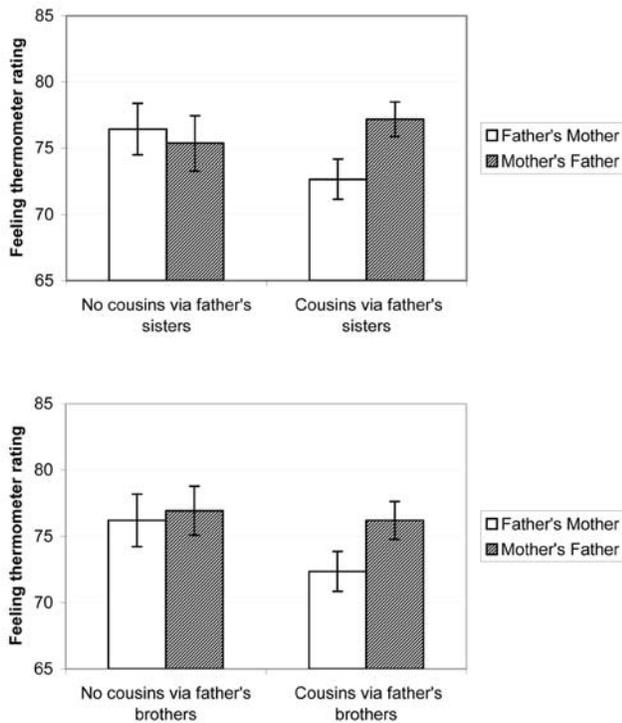


Figure 2 Mean feeling thermometer ratings for fathers' mothers and mothers' fathers as a function of (a) the presence of cousins through fathers' sisters and (b) the presence of cousins through fathers' brothers.

whether the shape of this interaction conformed to the preferential investment hypothesis. These analyses revealed that, consistent with predictions, the preference for mothers' fathers over fathers' mothers was reliable for fathers' mothers who have grandchildren via their daughters, $F(1, 276) = 5.92, p < .02$, but not for fathers' mothers who do not have grandchildren via daughters, $F < 1, ns$.

The preferential investment hypothesis predicts that the presence of cousins through fathers' sisters are the key to explaining the closeness of fathers' mothers, but an alternative possibility is that cousins through fathers' brothers would have the same effect (a finding that would be consistent with diffusion effects). To test this possibility, a similar two-way analysis was conducted as a function of whether fathers' mothers have grandchildren via other sons. Because diffusion effects are expected to be weaker than preferential investment effects, the interaction between type of grandparent and presence of cousins through paternal uncles should be weaker than the effect with paternal aunts. Consistent with this logic, the two-way interaction was not significant, $F < 1, ns$. Nevertheless, comparable simple effects analyses revealed that the preference for mothers'

fathers was significant when participants had cousins through fathers' brothers, $F(1, 271) = 4.02, p < .05$, but not when participants did not have such cousins, $F < 1, ns$ (see Figure 2).

Two types of follow-up analyses were conducted to further explore these effects. First, a three-way analysis was conducted comparing type of grandparent, presence of cousins through fathers' sisters, and presence of cousins through fathers' brothers. This interaction did not approach significance, $F < 1, ns$.

Second, to further explore preferential investment and diffusion effects, the difference in closeness between mothers' fathers and fathers' mothers was examined as a function of whether participants have cousins on their mother's side but not their father's side, and vice versa. Preferential investment effects should be most evident when fathers' mothers have grandchildren through other daughters and mothers' fathers do not. In this case, a clear preference should emerge for mothers' fathers over fathers' mothers. In contrast, when mothers' fathers have grandchildren through other daughters, and fathers' mothers do not, diffusion effects should reduce the closeness of mothers' fathers to their grandchildren, whereas fathers' mothers should be closer to their grandchildren as they do not have more certain kin available. In this case, the typical preference for mother's fathers over fathers' mothers should disappear, and perhaps even reverse. Due to diffusion effects, this same interaction pattern may emerge with alternative grandchildren through other sons, but the effects should be weaker in this case, as grandchildren through sons can only reduce closeness through diffusion and not through preferential investment. That is, although grandchildren through other sons provide additional outlets that may redirect some investment, they are not more genetically certain outlets.

To examine these proposed interactions, a variable was created to differentiate participants who had cousins via their mothers' sisters but not their fathers' sisters from participants who had cousins via their fathers' sisters but not their mothers' sisters. An ANOVA was then conducted to compare these participants' preferences for their mothers' fathers versus fathers' mothers as a function of the selective presence of cousins through mothers' versus fathers' sisters. As can be seen in Figure 3, the interaction between presence/absence of cousins through mothers' versus fathers' sisters was as predicted, $F(1, 162) = 7.11, p < .01$. Simple effects analyses revealed a significant preference for mothers' fathers when they did not have grandchildren through other daughters and fathers' mothers did, $F(1, 79) = 5.14, p < .03$. In contrast, the reversal of this preference, whereby participants preferred their father's mother when she did not have grandchildren through other daughters and their

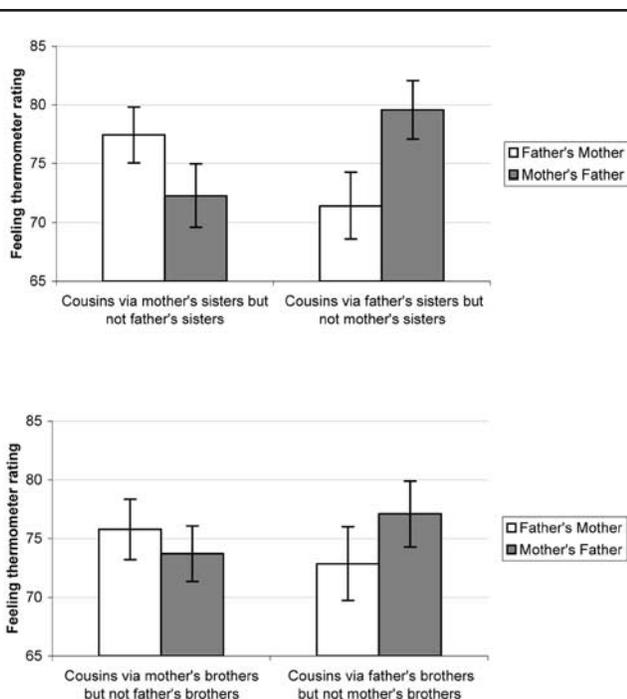


Figure 3 Mean feeling thermometer ratings for fathers' mothers and mothers' fathers as a function of (a) the selective presence of cousins through mothers' and fathers' sisters and (b) the selective presence of cousins through mothers' and fathers' brothers.

mother's father did, was not significant, $F(1, 83) = 2.30, p > .10$. A similar analysis was then conducted examining the impact of the selective presence of cousins through fathers' and mothers' brothers, and the interaction was found to be nonsignificant, $F(1, 154) = 1.48, p > .20$, although the pattern was similar to that found with parents' sisters (see Figure 3).

The preferential investment hypothesis: Secondary prediction. The preferential investment hypothesis also predicts that the presence of more certain investment outlets should affect closeness to fathers' fathers. Specifically, people should feel less close to their fathers' fathers if they have cousins through fathers' sisters because these cousins are more certain investment outlets. To test this prediction, separate ANCOVAs were conducted on closeness ratings for fathers' fathers and mothers' mothers, using average closeness ratings for the remaining living grandparents as a covariate to control for individual differences in overall closeness to grandparents.² Results of these analyses were consistent with the preferential investment hypothesis. Participants felt closer to their fathers' fathers when they did not have cousins through fathers' sisters ($M = 74.7$) than when they did ($M = 69.6$), $F(1, 447) = 5.28, p < .03$. In addition,

the presence of cousins through fathers' brothers did not influence closeness ratings to fathers' fathers, $F < 1, ns$. The presence of alternate investment outlets did not influence closeness ratings for mothers' mothers. Neither cousins through mothers' sisters nor cousins through mothers' brothers had a reliable impact on closeness ratings for mothers' mothers, $F_s < 1, ns$.

Exposure. Pairwise comparisons of the exposure data provided little support for the incidental exposure hypothesis (see Figure 4). Participants reported seeing mothers' mothers more than mothers' fathers, $F(1, 464) = 34.70, p < .001$, they indicated no significant difference in exposure to mothers' fathers and fathers' mothers, $F(1, 424) = 2.42, p > .10$, and reported seeing fathers' mothers more than fathers' fathers, $F(1, 417) = 35.61, p < .001$. Thus, the exposure data suggest a gender effect within each grandparental couple, with greater exposure to grandmothers than grandfathers, but the critical difference between mothers' fathers and fathers' mothers was not apparent.

These results are inconsistent with the incidental exposure hypothesis, as the difference within couples was larger than the difference between couples, but exposure could still be a proximal mechanism through which adaptive investment preferences are manifested. Correlations between exposure and closeness ratings support this possibility, as closeness was positively correlated with exposure for all four grandparents, (mothers' mothers, $r = .32, p < .01$; mothers' fathers, $r = .39, p < .01$; fathers' mothers, $r = .32, p < .01$; fathers' fathers, $r = .42, p < .01$). Nevertheless, the fact that such a small percentage of the variance is shared between exposure and emotional closeness suggests that exposure does not guarantee emotional closeness and that quantity of exposure may not be a strong predictor of quality.

If exposure is a proximal mechanism or an independent indicator of investment, we would expect the presence of more certain investment outlets to influence exposure ratings in a manner similar to closeness ratings. To test this possibility, a series of ANCOVAs was conducted to examine exposure to each of the four grandparents as a function of the presence of cousins via mothers' and fathers' sisters and brothers, with average exposure to all other available grandparents used as a covariate. The results of this analysis did not provide clear support for either account, however. Inconsistent with the analyses of the closeness data, the presence of cousins through fathers' sisters influenced exposure to fathers' fathers, $F(1, 447) = 4.76, p < .04$, but not fathers' mothers, $F < 1, ns$, and the presence of cousins through mothers' sisters influenced exposure to mothers' fathers, $F(1, 496) = 4.05, p < .05$, and mothers' mothers, $F(1, 618) = 4.20, p < .05$ (see Figure 5). Cousins through

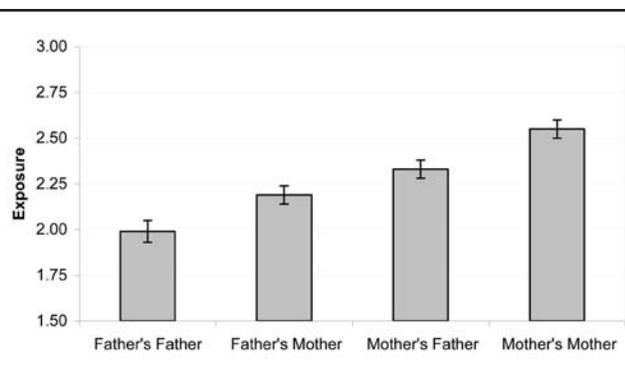


Figure 4 Mean exposure ratings for grandparents.

uncles had no effect on exposure to any of the grandparents, $F_s \leq 1.12$, $p_s > .25$. As such, the exposure data do not clearly support either the incidental exposure hypothesis or the proximal mechanism account, and exposure does not seem to be serving as an independent indicator of grandparental investment in a manner consistent with the preferential investment hypothesis. Rather, the exposure data seem to be providing evidence that is generally consistent with a diffusion account, as the presence of cousins through parents' sisters seems to be having an effect that is insensitive to the distinction between equally and more certain kin.

Further analyses of the exposure data involved the same coding procedures used to differentiate people who had cousins through fathers' sisters (or brothers) but not mothers' sisters (or brothers), and vice versa. These analyses failed to reveal an interaction between grandparent (mother's father vs. father's mother) and the presence of cousins via mothers' but not fathers' sisters versus cousins via fathers' but not mothers' sisters, $F(1, 162) = 1.78$, $p < .15$ (see Figure 6). In contrast, analysis of the selective presence of cousins through uncles rather than aunts revealed a reliable interaction, $F(1, 154) = 4.30$, $p < .05$ (see Figure 6). Simple effects analyses revealed marginally greater exposure to mothers' fathers when participants had cousins through fathers' but not mothers' brothers, $F(1, 69) = 3.08$, $p < .09$, and no significant difference when they had cousins through mothers' but not fathers' brothers, $F(1, 85) = 1.39$, $p > .20$. These data fail to provide a coherent picture across both types of cousins but are weakly suggestive of a role for diffusion effects in exposure to mothers' fathers and fathers' mothers.

Finally, it should be noted that participant gender did not moderate any of the effects reported in this study, $F_s < 1$, and there were not any main effects of participant gender on closeness or exposure to any of the grandparents, $F_s \leq 2.58$, $p_s > .10$.

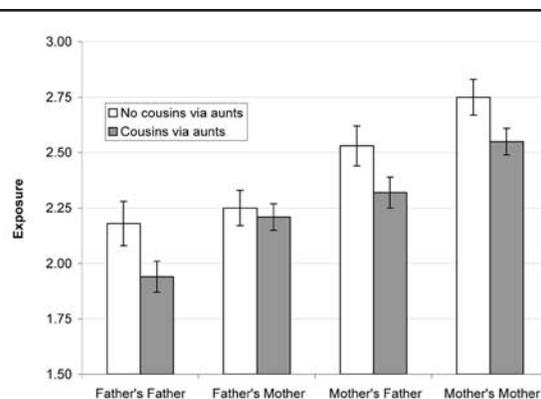


Figure 5 Exposure to fathers' parents as a function of cousins via fathers' sisters and exposure to mothers' parents as a function of cousins via mothers' sisters.

DISCUSSION

Consistent with previous work on grandparental investment, participants in the current research reported feeling emotionally closest to their mothers' mothers, followed by mothers' fathers, then fathers' mothers, and finally fathers' fathers. Most important for the purposes of the current study, the results also provide support for the preferential investment hypothesis. Consistent with the preferential investment hypothesis, the preference for mothers' fathers over fathers' mothers was reliable when more certain investment outlets were present for fathers' mothers but not when these outlets were absent. The presence of more certain outlets also reduced closeness for fathers' fathers as predicted by the preferential investment hypothesis.

In addition to these effects of preferences for more certain kin, the current results also provide evidence for diffusion of grandparental resources. When participants had cousins through their mothers' sisters but not their fathers' sisters, they showed no preference for mothers' fathers over fathers' mothers, and indeed showed a non-significant reversal of the typical effect. This finding represents a combination of diffusion of the resources of mothers' fathers and lack of a preferred investment outlet for fathers' mothers. This finding suggests that preferential investment in more certain kin and diffusion of resources combine to produce differences in closeness to mothers' fathers and fathers' mothers. These results also highlight an additional reason why paternal grandparents are more likely than maternal grandparents to feel distant from their grandchildren: Paternal grandchildren are more likely than maternal grandchildren to suffer from diffusion effects because their cousins through paternal uncles are equally viable investment alternatives, whereas maternal grandchildren are

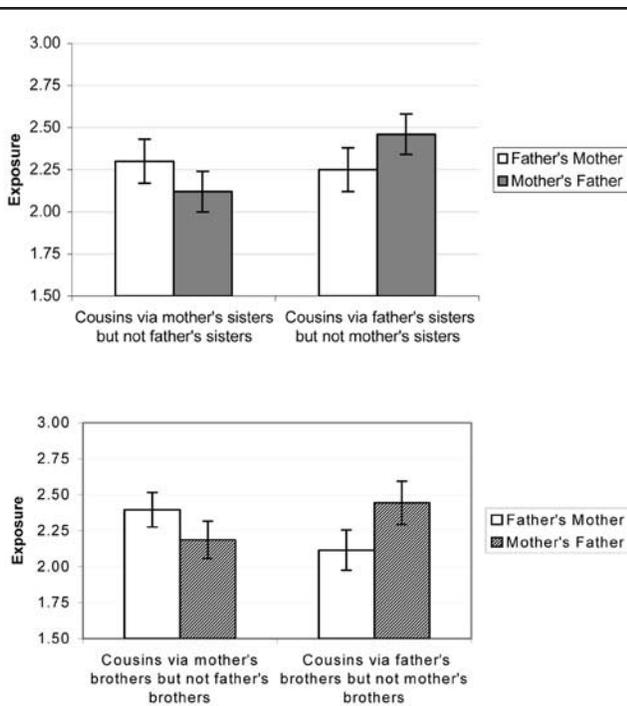


Figure 6 Exposure to fathers' mothers and mothers' fathers as a function of (a) the selective presence of cousins through mothers' and fathers' sisters and (b) the selective presence of cousins through mothers' and fathers' brothers.

themselves more viable investment options than their uncles' children.

Although the preferential investment hypothesis adequately accounts for the preference of mothers' fathers over fathers' mothers, claims about the evolutionary origins of relationship effects need to be considered alongside alternate explanations. With this in mind, the current study considered incidental exposure as a possible explanation for differences in closeness between mothers' fathers and fathers' mothers. Results indicated that incidental exposure does not adequately account for the reliable preference for mothers' fathers over fathers' mothers. If incidental exposure accounted for this preference, exposure ratings within grandparental pairs should have been more similar than exposure ratings between grandparental pairs, which was not the case.

This is not to say that exposure is unrelated to grandparental investment; to the contrary, in the current study, as well as in previous work (Eisenberg, 1988; Hartshorne & Manaster, 1982; Salmon, 1999; Smith, 1988), exposure conforms to the general pattern of grandparental investment. Maternal grandmothers see their grandchildren the most, followed by mothers' fathers, fathers' mothers, and then fathers' fathers. In addition, modest correlations emerged between closeness and exposure for all four grandparents, whereby increased exposure was associated with increased close-

ness. Nevertheless, these data suggest a differentiation between quantity and quality of exposure that seems worthy of investigation in future research on grandparental investment.

It is also worth noting that these results do not rule out the possibility of other kinds of dependencies within grandparental couples, aside from exposure. Thus, it may be the case that fathers' fathers discuss their grandchildren with their spouses in a manner that disparages investment by fathers' mothers, or that mothers' mothers encourage investment by their spouses. Research on grandparents, rather than grandchildren, will be necessary to test these alternative possibilities.

The Evolutionary Approach

The current study highlights the value of evolutionary theorizing in close relationship research in particular and in social psychological research in general. Given that many adaptive problems faced by humans were social and focused on relationships, evolutionary principles should play a major role in these areas (Buss, 1999). The preferential investment hypothesis, for example, is clearly derivable from evolutionary theory but could not easily be derived from traditional approaches to relationship research. The reliable finding of differential grandparental investment is itself based on an evolutionary hypothesis that is not clearly derivable from social role prescriptions. The stereotype of the doting woman, for example, does not apply to all grandmothers. Although it may be an apt description of mothers' mothers, fathers' mothers tend to be *less* involved with their grandchildren than mothers' fathers, a finding that highlights the advantages of using evolutionary theorizing to complement sociocultural approaches. Similarly, the current findings cannot be explained by proposing that parents prefer daughters, and hence prefer their daughters' children, as such a hypothesis would suggest that gender effects should have emerged among grandchildren as well. The absence of any gender effects in our results provides further support for the evolutionary account of the current findings.

Limitations and Future Directions

Although the current findings are consistent with hypotheses regarding preferential investment in more certain kin and diffusion of grandparental resources, one of the critical predicted interactions was only marginally significant. Replication with additional samples, ideally from non-Western cultures, and with different measures of exposure (perhaps emphasizing quality rather than quantity) would help support the preferential investment hypothesis.

Although a basic call for replication is important, replication using different measures of investment also

would be desirable. Future work might consider the use of more direct measures of investment to extend the current findings. DeKay (1995), for example, used gifts received by grandchildren as a measure of grandparental investment. According to the preferential investment hypothesis, one would expect a different pattern of gift giving as a function of the presence of more certain investment outlets. Other examples of more direct measures of investment are grandparental mourning after a grandchild's death (Littlefield & Rushton, 1986), the adoption of grandchildren (Daly & Wilson, 1980), and assets left to grandchildren in wills (Judge, 1995; Smith, Kish, & Crawford, 1987). Naturally, the difficulty in obtaining some of these indicators will limit their use in most research.

Future work should also address the relationship between the preferential investment hypothesis and other factors involved in grandparental investment. Extant work on grandparental investment has not explicitly considered the role of alternate investment outlets. The current findings add a layer of complexity to our understanding of grandparental relations and future work should integrate the effects of alternate investment outlets with other evolutionary and sociocultural mechanisms.

Finally, it is worth addressing the issue of effect size in this research. As is undoubtedly apparent, the preferences that emerged for different types of grandparents were small. Smaller still were the effects predicted by the preferential investment hypothesis, which moderated effects that were themselves small in nature. Rather than being unimpressed by the small size of these effects, however, one might instead be impressed that such an effect emerges at all. Of all the reasons to feel close or distant to a grandparent (such as geographic location, relationships between parents and grandparents, personality consistencies and inconsistencies, language and cultural differences between generations, mental and physical health of grandparents, and whether grandparents are working or retired, to name just a few), the fact that genetic uncertainty and preferred investment outlets led to predicted differences in closeness testifies to the potency of evolutionary principles. In so doing, the current findings also highlight the important role played by different types of kinship in the development and maintenance of close relationships, an area whose relative neglect has been aptly described by Daly, Salmon, and Wilson (1997) as a "conceptual hole" in social psychology.

NOTES

1. Degrees of freedom fluctuate across these comparisons because most participants indicated that at least one grandparent had died before they were born or able to remember. Thus, these analyses rely

on different sample sizes as a function of which grandparents are compared.

2. These ANCOVAs are conceptually similar to the mixed model analyses comparing mothers' fathers and fathers' mothers, as in these prior analyses the presence of more than one grandparent served as a partial control for fluctuations in overall closeness to one's grandparents. Analysis of the secondary prediction concerning fathers' fathers does not involve a mixed model because the presence or absence of the effect does not logically depend on the existence of a comparative grandparent. Thus, to control for individual differences in overall grandparental closeness, average ratings of all other living grandparents were used as a covariate in testing this secondary prediction.

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