



Darwinian Grandparenting Redux: a Pre-registered Replication and Extension

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Abstract

Mothers' fathers consistently invest more in their grandchildren than fathers' mothers. This pattern was explained by Laham et al. in *Personality and Social Psychology Bulletin*, 31(1), 63–72. (2005) via the *preferential investment hypothesis*—the idea that fathers' mothers invest less in grandchildren than mothers' fathers because the former typically have more certain alternate investment outlets available. In two studies of prolific workers (combined $N=4086$), we first failed to replicate the findings of Laham et al. and then successfully replicated them. In the combined sample, mothers' fathers received more positive ratings than fathers' mothers when participants had cousins through fathers' sisters, but this difference between grandparents disappeared when participants did not have cousins through fathers' sisters. We also found that people spent more time with their maternal and paternal grandparents to the degree that they were not maternal grandparents to someone else, which mediated the closer feelings.

Keywords Parental investment · Preferential investment · Replication · R-index

Grandparents do not invest equally in all their grandchildren. Typically, mothers' mothers invest the most, followed by mothers' fathers, then fathers' mothers, with fathers' fathers investing the least (Eisenberg, 1988; Hoffman, 1980; Kahana & Kahana, 1970; Rossi & Rossi, 1990; Smith, 1988). This pattern of grandparental investment has been explained by evolutionary theories of paternal uncertainty (Bishop et al., 2009; Euler & Weitzel, 1996; Pashos, 2000; Pollet et al., 2009; Salmon, 1999). Because conception is internal, men can never know with complete certainty whether their children are their own, or the product of cuckoldry. In response to this threat, psychological adaptations have evolved to regulate investment in accordance with reliable cues to genetic relatedness. Grandparental investment mechanisms may 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 intermediate uncertainty (a grandchild of a woman through her son or a man through his daughter), to doubly uncertain (a grandchild of a man through his son).

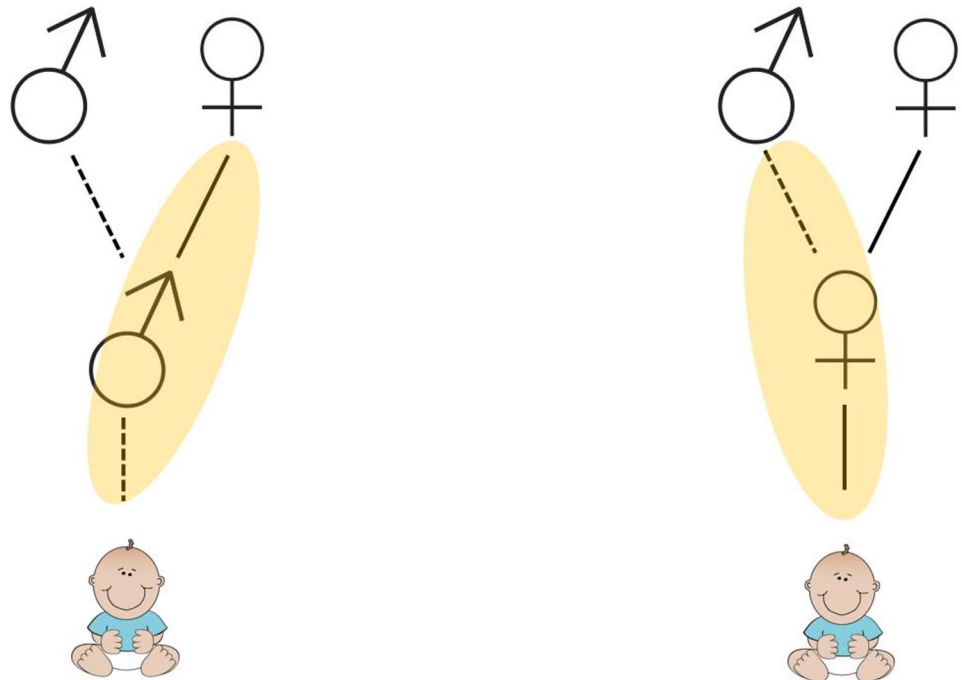
Differences in grandparental genetic relatedness (referred henceforth as grandparental certainty) explain why fathers' fathers invest the least and why mothers' mothers invest the most and why. However, it is not immediately obvious how grandparental certainty might also account for why mothers' fathers consistently invest more in their grandchildren than fathers' mothers, as both grandparents have one uncertain link connecting them to their grandchild (Fig. 1).

Seeking to answer this question, Laham et al. (2005) proposed the *preferential investment hypothesis*, arguing that fathers' mothers may invest less in these grandchildren than mothers' fathers, because the former typically have more certain alternate investment outlets available. For example, consider your father's mother. She has one uncertain genetic link—that between your father and you. If 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

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Fig. 1 Cases of uncertainty in grandparental genetic relatedness



disappear when fathers' mothers do not have grandchildren through daughters.

Alternative explanations have been proposed for the difference in investment between fathers' mothers and mothers' fathers, such as DeKay and Shackelford (2000) who proposed that this difference might be a function of greater female

sexual infidelity in the parental generation compared to the grandparental generation. While such an account is plausible, the preferential investment hypothesis has the advantage of parsimony, as it relies on the same mechanism of grandparental certainty to explain an effect that would otherwise seem to require an additional mechanism or assumptions.

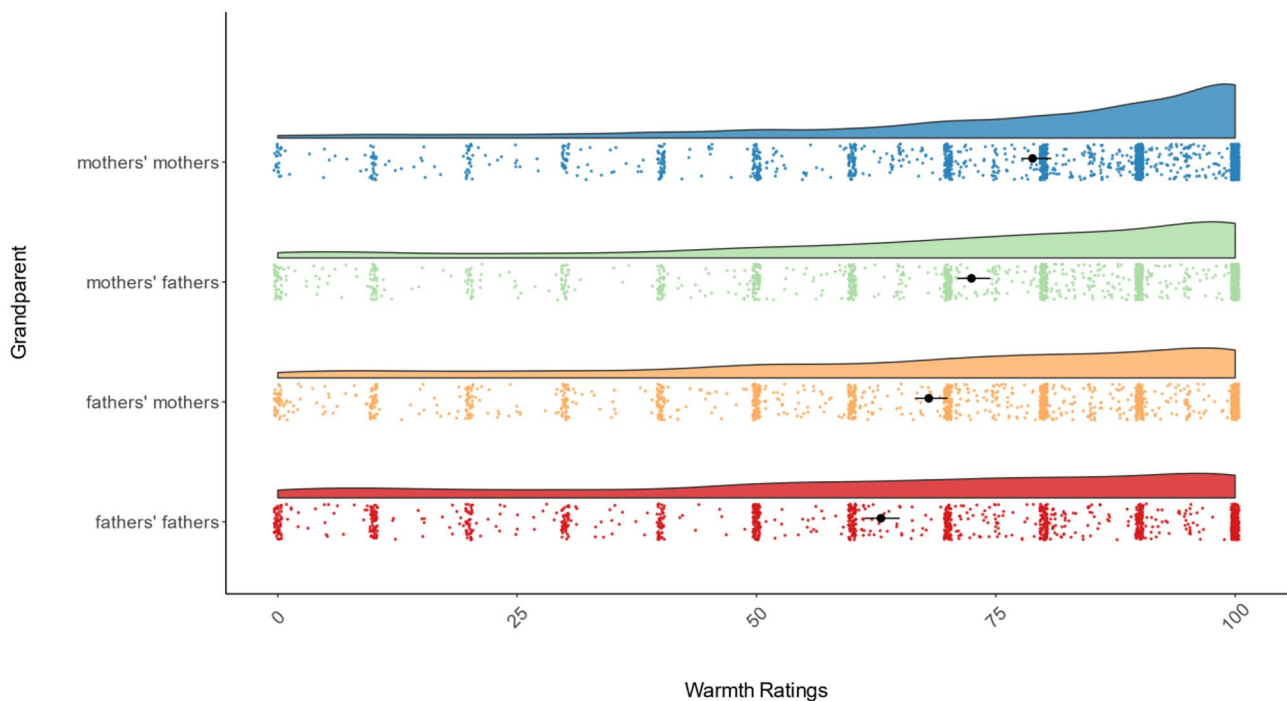


Fig. 2 Study 1 grandparental warmth ratings

To test the preferential investment hypothesis, Laham et al. (2005) asked university students to rate 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 then reported how often they saw each of their grandparents from the earliest point in childhood they could remember until they began university. Participants also 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. The authors found evidence for the predicted 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), but it was only marginally significant, $F(1, 412) = 2.85, p < .10$. Nonetheless, consistent with preferential investment hypothesis, the preference for mothers' fathers over fathers' mothers was reliable when fathers' mothers had grandchildren via their daughters, $F(1, 276) = 5.92, p < .02$, but not when fathers' mothers did not have grandchildren via daughters ($F < 1, ns$).

The replicability of this interaction reported in Laham et al. (2005) was recently criticized by). In a blog post on the replicability indices of social psychologists, Schimmack noted that many of von Hippel's articles had low R indices. Furthermore, the R-index formula indicated that the Laham et al. (2005) paper was von Hippel's least replicable publication, due to the low estimated probability that the marginal interaction would replicate. That criticism led to a collaborative pre-registered replication of Laham et al. (2005) between von Hippel and Schimmack, discussions of which are reported in two blog posts (<https://replicationindex.com/2021/05/07/bill-von-hippel-and-ulrich-schimmack-discuss-bills-replicability-index/> and <https://replicationindex.com/2021/06/20/bill-von-hippel-r-index-part2/>).

The current paper reports the results of that pre-registered replication of Laham et al. (2005) as well as a follow-up replication. The initial pre-registered replication failed to replicate the key interaction from Laham et al. (2005), but exploratory analyses revealed three new findings that were consistent with the evolutionary logic of the preferential investment hypothesis. To test the reliability of these findings, we pre-registered

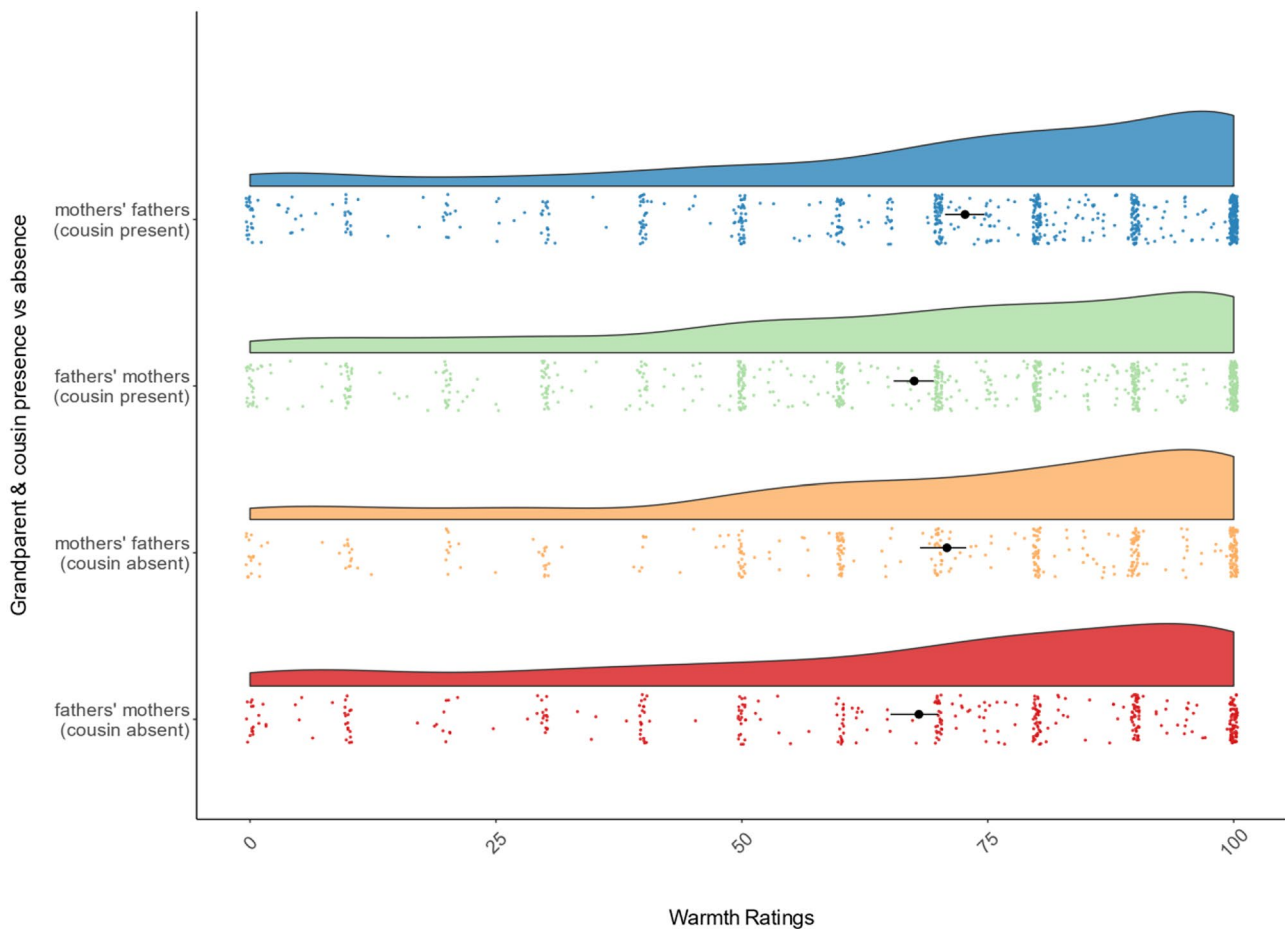


Fig. 3 Study 1 warmth ratings of fathers' mothers vs mothers' fathers in presence and absence of cousins through fathers' sisters

these exploratory analyses in a second replication study that was methodologically identical to the first replication study. This paper reports these two replication studies.

Method

Study 1

Participants and Design

Two thousand thirty-one prolific workers completed all measures. The data and pre-registration are available at https://osf.io/cu68f/?view_only=829f094252fd4ec19794b82c94c16a91.

Measures

All measures were identical to those used in Laham et al. (2005).

Emotional Closeness 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.” Ratings of paternal vs maternal grandparents were counterbalanced, such that half the participants rated their maternal grandparents first, and half rated their paternal grandparents first. Participants were instructed to report “not applicable” for grandparents who had died before they were born or when they were too young to remember.

Table 1 Study 1 exploratory analyses

DV	Closeness to paternal grandparents		Closeness to maternal grandparents		Time spent with paternal grandparents		Time spent with maternal grandparents		
	β	<i>p</i>	β	<i>p</i>	β	<i>p</i>	β	<i>p</i>	
Model 1:	<i>N</i> =1694		<i>N</i> =1853		Model 2:	<i>N</i> =1877		<i>N</i> =1877	
#children/mother's sisters	0.065	0.013	−0.099	0.00	0.057	0.026	−0.133	0.000	
	[0.013, 0.116]		[−0.148, −0.051]		[0.007, 0.108]		[−0.181, −0.085]		
#children/mother's brothers	0.020	0.450	0.034	0.168	−0.031	0.232	−0.086	0.000	
	[−0.032, 0.071]		[−0.015, 0.083]		[−0.079, 0.022]		[−0.134, −0.038]		
#children/father's sisters	−0.079	0.003	0.040	0.109	−0.073	0.005	0.060	0.015	
	[−0.131, 0.027]		[−0.009, 0.090]		[−0.126, 0.024]		[0.012, 0.109]		
#children/father's brothers	0.005	0.848	0.024	0.335	0.026	0.315	0.064	0.010	
	[−0.047, 0.057]		[0.025, 0.074]		[−0.022, 0.080]		[0.016, 0.113]		
Model 3:	<i>N</i> =1599		<i>N</i> =1614		Process:	Indirect effect		Indirect effect	
#children/mother's sisters	0.026	0.241	−0.029	0.203	Cousins via father's sister	−0.419	0.373		
	[−0.018, 0.071]		[−0.075, 0.016]			[−0.693, −0.149]		[0.146, 0.608]	
#children/mother's brothers	0.032	0.161	0.079	0.001	Cousins via mother's sister	0.410	−0.667		
	[−0.013, 0.076]		[0.034, 0.124]			[0.134, 0.681]		[−0.907, −0.424]	
#children/father's sisters	−0.034	0.131	0.008	0.728					
	[−0.079, 0.010]		[−0.038, 0.054]						
#children/father's brothers	−0.008	0.729	−0.009	0.709					
	[−0.052, 0.037]		[−0.054, 0.037]						
Time with paternal grandparents	0.554	0.000	−0.013	0.537					
	[0.513, 0.595]		[−0.055, 0.029]						
Time with maternal grandparents	−0.048	0.023	0.521	0.000					
	[−0.090, 0.007]		[0.478, 0.563]						

Biological Relatives Next, participants 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. Participants also reported their own gender and the number of brothers and sisters they have.

Study 2

Two thousand forty-eight prolific workers (different from those in Study 1) completed all measures as in Study 1. The data and pre-registration are available at https://osf.io/cu68f/?view_only=829f094252fd4ec19794b82c94c16a91.

Results

Study 1

Replication of Key Findings from Laham et al. (2005)

Consistent with previous work on grandparental certainty, participants felt closest to their maternal grandmother, then their maternal grandfather, then their paternal grandmother, and felt the least close towards their paternal grandfather (see Fig. 2). All of these mean differences were

significant; participants felt closer to their mother’s mother than their mother’s father, $F(1,1347) = 99.54$, $p < .001$, $\eta_p^2 = .069$, closer to their mother’s father than their father’s mother, $F(1,1170) = 14.97$, $p < .001$, $\eta_p^2 = .013$, and closer to their father’s mother than their father’s father, $F(1,1124) = 65.43$, $p < .001$, $\eta_p^2 = .056$.

Despite this clear replication of the standard ordering of grandparental closeness, we failed to replicate the marginal interaction from Laham et al. (2005). Closeness to fathers’ mothers vs mothers’ fathers was not moderated by the presence vs absence of cousins through fathers’ sisters, $F(1,1167) = .97$, $p = .325$ (see Fig. 3).

Exploratory Analyses

After failing to find the critical interaction from Laham et al. (2005), we ran a series of exploratory regression analyses in which we examined closeness to paternal and maternal grandparents. The results of these regression analyses were largely the same for grandmothers and grandfathers, so we collapsed across grandparental gender to predict closeness to maternal and paternal grandparents (see SOM for individual analyses of each grandparent).

The results in Table 1 (Model 1) show three very small effects. First, people felt closer to their paternal grandparents to the degree that those grandparents are not also

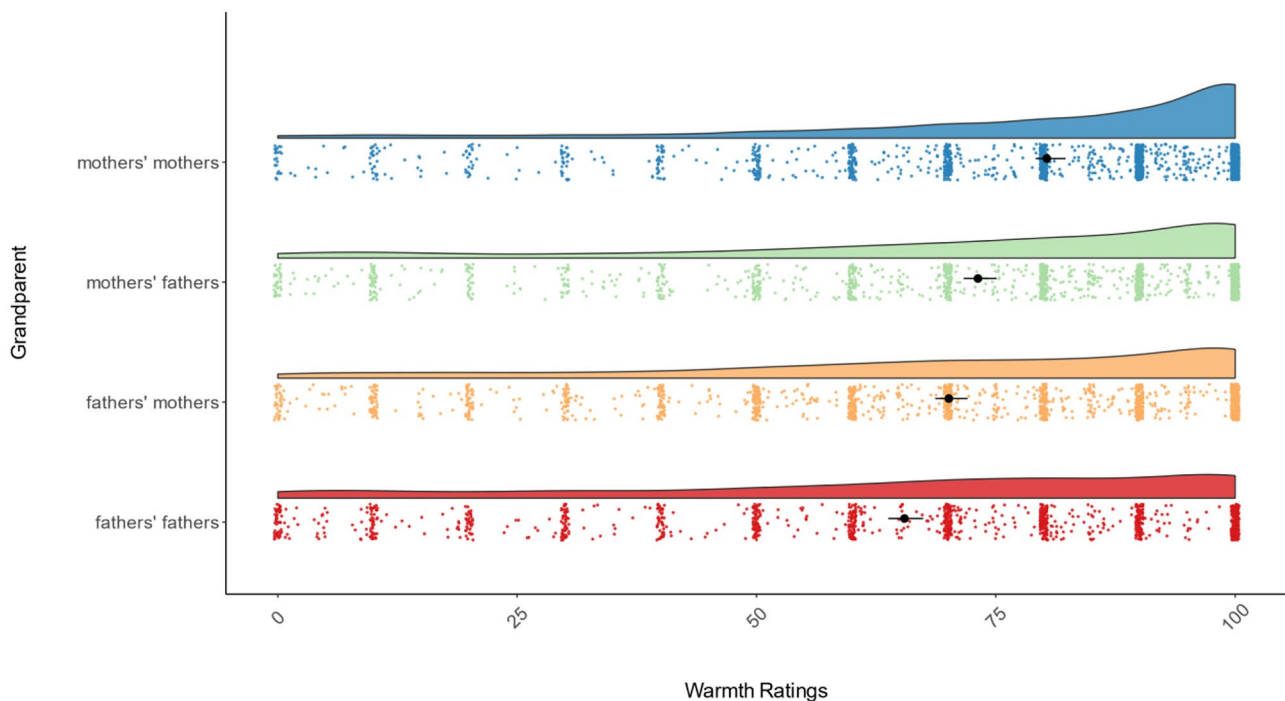


Fig. 4 Study 2 grandparental warmth ratings

maternal grandparents to someone else (i.e., more cousins through fathers' sisters are associated with less closeness to paternal grandparents). Second, people felt closer to their paternal grandparents to the degree that their maternal grandparents had more grandchildren through daughters other than their mother (i.e., more cousins through mothers' sisters are associated with more closeness to paternal grandparents). Third, people felt closer to their maternal grandparents to the degree that those grandparents were not also maternal grandparents to someone else (i.e., more cousins through mothers' sisters are associated with less closeness to maternal grandparents).

These results suggest that grandparental investment is sensitive to the presence of equally or more certain kin via three possible pathways: (1) if your father's parents are also grandparents via your father's sister(s), they might invest less in you (making you feel less close to them) because your father's sister's children are more certainly their descendants than you are. (2), (3) If your mother's parents have grandchildren from daughters other than your mother, they might invest less in you (making you

feel less close to them) because they have other equally certain descendants demanding their time and investment. As a consequence, your paternal grandparents might seem more investing by comparison. That is, because you experience more competition for your mother's parent's attention, you may turn to your father's parents for attention instead. Lastly, it is worth noting that because cousins through your parents' brothers are less certain descendants of your grandparents, these cousins appear to have less of an impact on the investment you receive from both maternal and paternal grandparents compared to cousins through your parents' sisters.

To test these possible explanations regarding grandparental investment, we included time spent with maternal and paternal grandparents as a potential mediator in the model. Consistent with predictions, the presence of cousins via parents' sisters had similar effects on time spent with maternal and paternal grandparents (although unexpectedly all four types of cousins had effects on time spent with maternal grandparents—not just cousins through mother's sisters; see Model 2, Table 1).

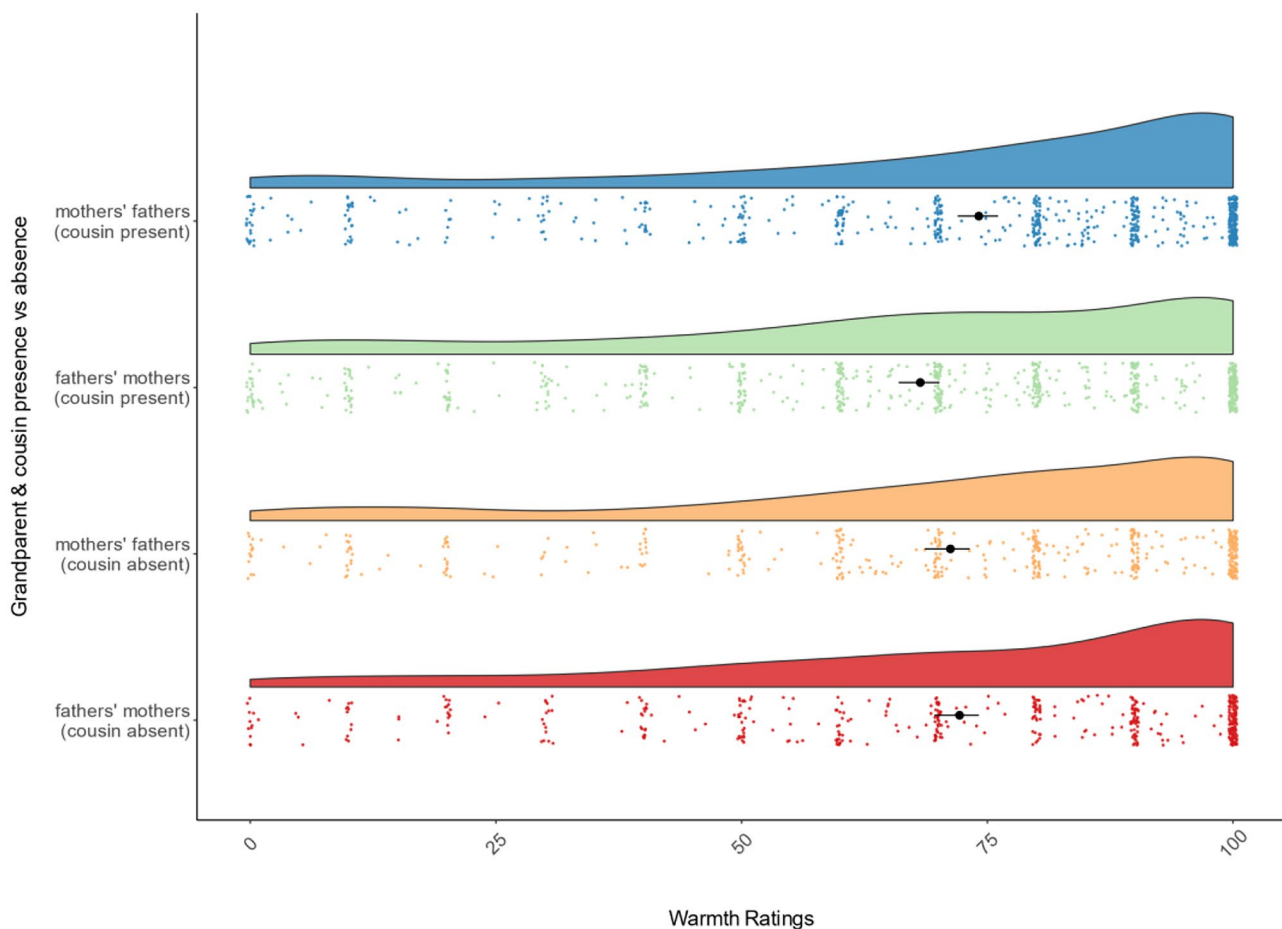


Fig. 5 Study 2 warmth ratings of fathers' mothers vs mothers' fathers in presence and absence of cousins through fathers' sisters

In the final step of the mediational analyses, we added time spent with maternal and paternal grandparents as predictors of closeness to these grandparents, after the various types of cousins had been included as predictors (see Model 3, Table 1). These models revealed that the various types of cousins no longer had a direct effect on closeness, as the variance was now accounted for by time spent with grandparents, suggesting complete mediation of the effect of cousins on grandparental closeness. Consistent with this interpretation, analyses via the PROCESS macro (Hayes, 2022) revealed that the effects of cousins through father’s and mother’s sisters on closeness to maternal and paternal grandparents were significantly mediated by time spent with these grandparents (see indirect effects in Table 1).

Study 2

In Study 2, feelings of closeness towards grandparents followed the same pattern as Study 1 (Fig. 4). Participants felt closer to their mother’s mother than their mother’s father, $F(1,1120) = 34.61, p < .001, \eta_p^2 = .030$, closer to their mother’s father than their father’s mother, $F(1,1166) = 8.86, p = .003, \eta_p^2 = .008$, and closer to their father’s mother than their father’s father, $F(1,1295) = 107.27, p < .001, \eta_p^2 = .077$.

In contrast to Study 1, Study 2 replicated the marginal interaction from Laham et al. (2005). Closeness to fathers’ mothers vs mothers’ fathers was moderated by the presence of cousins through fathers’ sisters, $F(1,1161) = 9.75, p = .002$ (see Fig. 5).

Table 2 Study 2 pre-registered replication of Study 1 exploratory analyses

DV:	Closeness to paternal grandparents		Closeness to maternal grandparents		Time spent with paternal grandparents		Time spent with maternal grandparents	
	β	<i>p</i>	β	<i>p</i>	β	<i>p</i>	β	<i>p</i>
Model 1:	<i>N</i> = 1697		<i>N</i> = 1849		Model 2:	<i>N</i> = 1761		
#children/mother’s sisters	0.038	0.144	−0.082	0.001	0.035	0.159	−0.133	0.000
	[−0.013, 0.088]		[−0.130, 0.033]		[−0.014, 0.085]		[−0.180, 0.085]	
#children/mother’s brothers	0.022	0.401	0.021	0.391	−0.041	0.102	−0.014	0.557
	[−0.029, 0.072]		[−0.027, 0.070]		[−0.008, 0.091]		[−0.062, 0.033]	
#children/father’s sisters	−0.108	0.000	0.050	0.048	−0.079	0.002	0.017	0.487
	[−0.159, −0.056]		[0.000, 0.099]		[−0.130, 0.029]		[−0.031, 0.066]	
#children/father’s brothers	−0.027	0.312	−0.043	0.092	−0.044	0.092	0.004	0.874
	[−0.078, 0.025]		[0.092, 0.007]		[−0.095, 0.007]		[0.053, 0.045]	
Model 3:	<i>N</i> = 1604		<i>N</i> = 1636		Process:	Indirect effect	Indirect effect	
#children/mother’s sisters	0.012	0.590	−0.013	0.558	Cousins via father’s sister	−0.434	0.158	
	[−0.031, 0.055]		[−0.058, 0.031]			[−0.727, −0.137]	[−0.088, 0.399]	
#children/mother’s brothers	−0.002	0.916	0.029	0.206	Cousins via mother’s sister	0.224	−0.475	
	[−0.045, 0.041]		[−0.016, 0.073]			[−0.082, 0.535]	[−0.724, −0.233]	
#children/father’s sisters	−0.062	0.005	0.041	0.076				
	[−0.106, 0.018]		[−0.004, 0.086]					
#children/father’s brothers	−0.002	0.921	−0.041	0.080				
	[−0.046, 0.042]		[−0.086, 0.005]					
Time with paternal grandparents	0.564	0.000	0.001	0.966				
	[0.523, 0.604]		[−0.041, 0.043]					
Time with maternal grandparents	−0.043	0.040	0.516	0.000				
	[−0.083, 0.002]		[0.474, 0.558]					

When participants did not have cousins through fathers' sisters, there was no difference in ratings of warmth towards fathers' mothers vs mothers' fathers, $F(1,472) = .29, p = .592$. However, when participants did have cousins through fathers' sisters, mothers' fathers received higher warmth ratings than fathers' mothers, $F(1,689) = 18.55, p < .001$.

Replication of Study 1 Exploratory Analyses

In Study 2, we pre-registered the exploratory analyses from Study 1 and subsequently replicated them, with the exception that paternal grandparental closeness was not related to cousins through mother's sisters. The results in Table 2 show that people felt closer to their father's parents when they had fewer cousins through their father's sisters. Participants also felt closer to their mother's parents when they had fewer cousins through their mother's sisters. As in Study 1, these effects were mediated by time spent with maternal and paternal grandparents. We also found that participants felt closer to their mothers' parents when they had more cousins through their father's sisters, presumably due to increased competition for their paternal grandparents' attention from more genetically certain paternal cousins—a finding that was not pre-registered as it did not emerge in Study 1.

Combined Analyses

Because we successfully replicated the key interaction from Laham et al. (2005) in Study 2 but not Study 1, we combined both studies into one dataset to conduct exploratory analyses of the complete sample. In the combined dataset, participants felt closer to their mother's mother than their mother's father, $F(1,2245) = 98.17, p < .001, \eta_p^2 = .042$, closer to their mother's father than their father's mother, $F(1,2337) = 23.55, p < .001, \eta_p^2 = .010$, and closer to their father's mother than their father's father, $F(1,2643) = 206.68, p < .001, \eta_p^2 = .073$ (see Fig. 6).

In the combined dataset, we also replicated the marginal interaction found in Laham et al. (2005). Closeness to fathers' mothers vs mothers' fathers was moderated by the presence of cousins through fathers' sisters, $F(1,2330) = 8.54, p = .004$ (see Fig. 7).

When participants did not have cousins through fathers' sisters, there was no difference in ratings of warmth towards fathers' mothers vs mothers' fathers, $F(1,890) = .29, p = .514$. However, when participants did have cousins through fathers' sisters, mothers' fathers received higher warmth ratings than fathers' mothers, $F(1,1440) = 31.83, p < .001$.

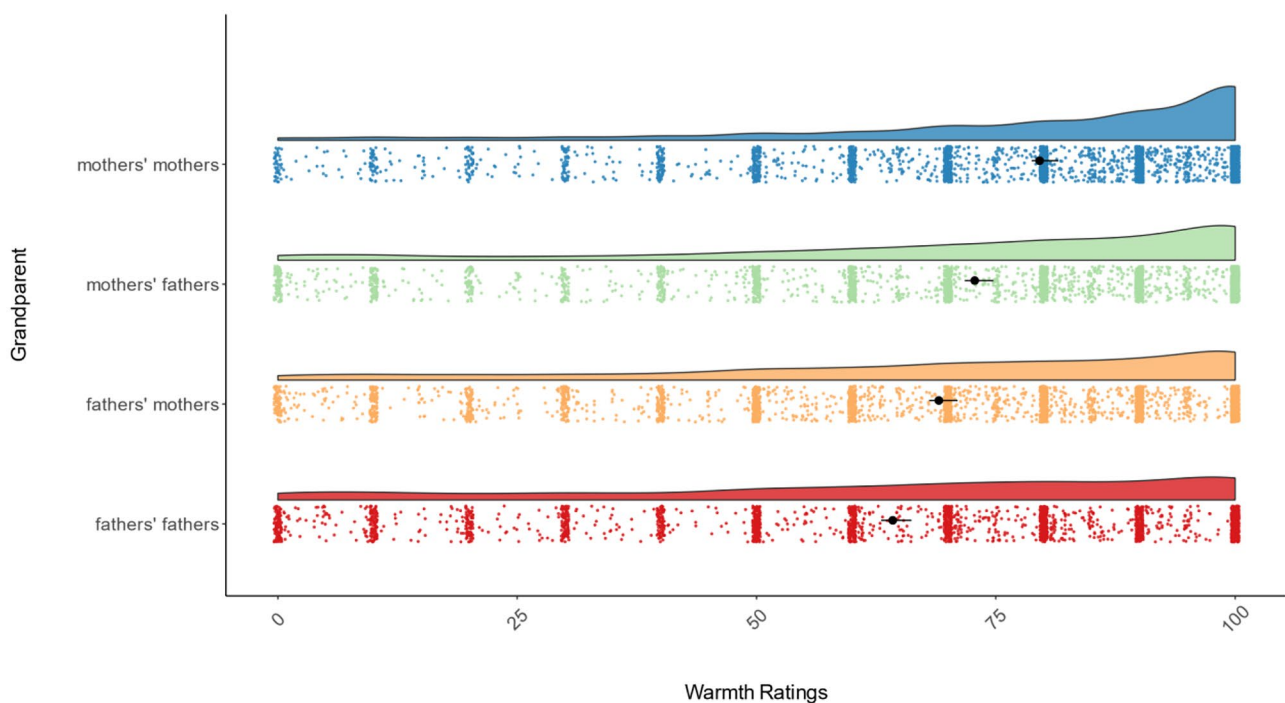


Fig. 6 Combined grandparental warmth ratings

Replication of Study 1 Exploratory Analyses

We replicated the results of all three exploratory analyses from Study 1 in the combined dataset. The results in Table 3 show that people felt closer to their father's parents when they had fewer cousins through their father's sisters or more cousins through their mother's sisters. In contrast, participants felt closer to their mother's parents when they had fewer cousins through their mother's sisters or more cousins through their father's sisters. These effects of cousins through parental sisters were mediated by time spent with maternal and paternal grandparents. Lastly, the presence of cousins through parents' brothers was not predictive of grandparental closeness.

Discussion

Study 1 failed to replicate the marginal interaction found in Laham et al. (2005). Closeness to fathers' mothers vs mothers' fathers was not moderated by the presence of cousins

through fathers' sisters. We found this failure to replicate convincing, as Study 1 had over twice the sample size of Laham et al. (2005). We were thus surprised when Study 2 successfully replicated this interaction. To test the reliability of this on-again off-again interaction, we created a combined datafile containing Studies 1 and 2, the results of which suggest that closeness to fathers' mothers vs mothers' fathers is indeed moderated by the presence of cousins through fathers' sisters. These results are bolstered by the regression analyses, which paint a very similar picture; closeness to grandparents is influenced by whether grandparents have equally or more certain grandchildren available.

The findings of the regression analyses are also an example of how self-replication efforts can lead to new insights when returning to existing research with fresh eyes. The exploratory analyses from Study 1, which we subsequently replicated in Study 2 and in the combined data set, revealed that people felt closer to their paternal and maternal grandparents to the degree that those grandparents were not also maternal grandparents to someone else. Presumably, people with fewer cousins via their parents' sisters face less

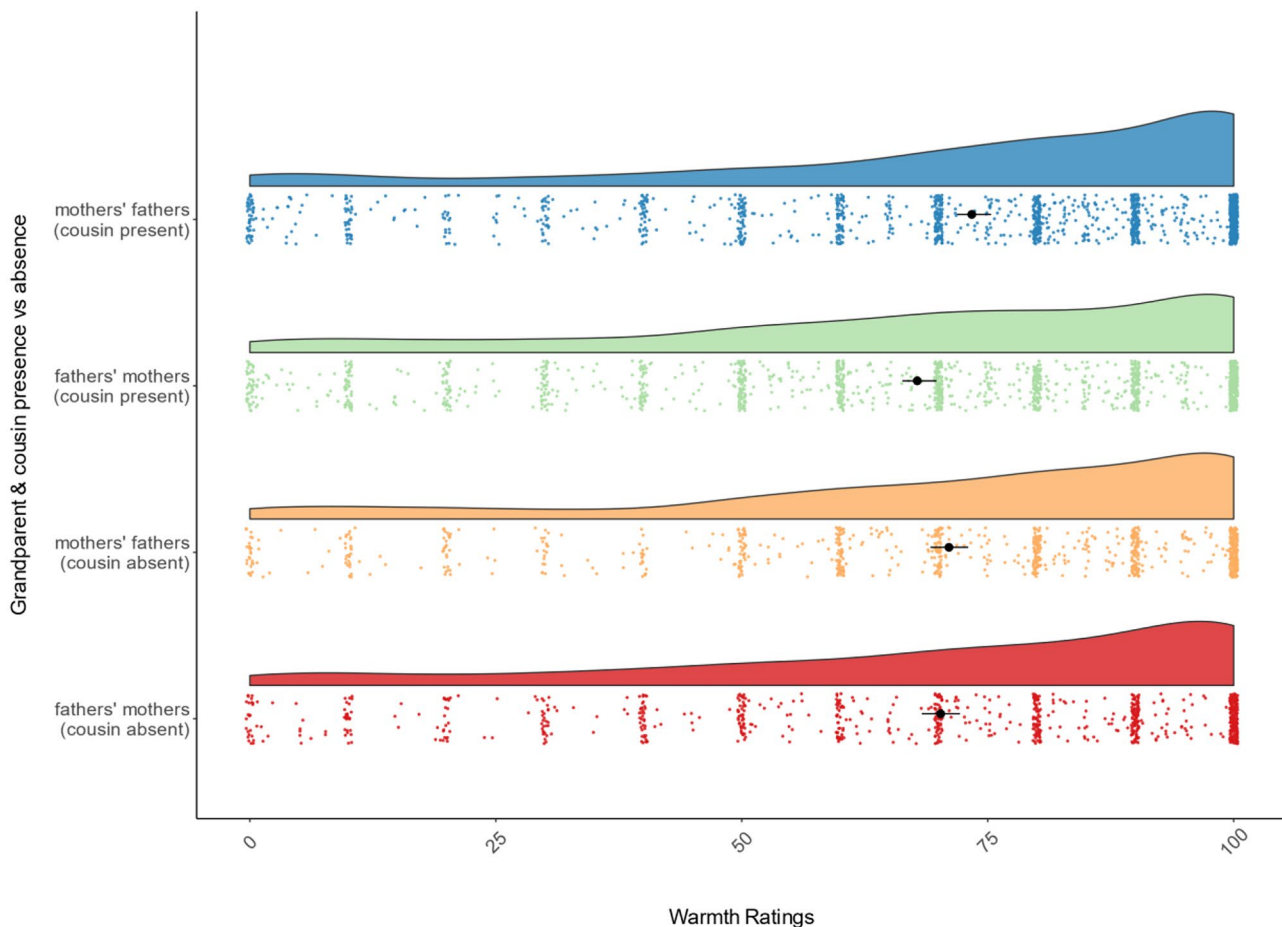


Fig. 7 Combined warmth ratings of fathers' mothers vs mothers' fathers in presence and absence of cousins through fathers' sisters

Table 3 Combined dataset replication of Study 1 exploratory analyses

DV:	Closeness to paternal grandparents		Closeness to maternal grandparents		Time spent with paternal grandparents		Time spent with maternal grandparents		
	β	<i>p</i>	β	<i>p</i>	β	<i>p</i>	β	<i>p</i>	
Model 1:	<i>N</i> = 3393		<i>N</i> = 3704		Model 2:	<i>N</i> = 3500		<i>N</i> = 3766	
#children/ mother's sisters	0.050	0.006	-0.092	0.000		0.045	0.012	-0.133	0.000
	[0.014, 0.086]		[-0.126, -0.057]			[0.010, 0.080]		[-0.167, 0.099]	
#children/ mother's brothers	0.021	0.262	0.028	0.117		0.006	0.722	-0.050	0.004
	[-0.015, 0.056]		[-0.007, 0.062]			[-0.029, 0.042]		[-0.084, 0.016]	
#children/father's sisters	-0.094	0.000	0.044	0.014		-0.079	0.000	0.037	0.033
	[-0.131, -0.058]		[0.009, 0.078]			[-0.115, -0.043]		[0.003, 0.072]	
#children/father's brothers	-0.010	0.581	-0.008	0.635		-0.007	0.685	0.030	0.093
	[-0.047, 0.026]		[-0.044, 0.027]			[-0.044, 0.029]		[-0.005, 0.064]	
Model 3:	<i>N</i> = 3204		<i>N</i> = 3251		Process:	Indirect effect		Indirect effect	
#children/ mother's sisters	0.019	0.232	-0.022	0.169	Cousins via father's sister	-0.435		0.258	
	[-0.012, 0.050]		[-0.054, 0.009]			[-0.639, -0.234]		[0.100, 0.422]	
#children/ mother's brothers	0.015	0.347	0.053	0.001	Cousins via mother's sister	0.313		-0.577	
	[-0.016, 0.045]		[0.002, 0.085]			[0.110, 0.519]		[-0.747, -0.407]	
#children/father's sisters	-0.048	0.002	0.024	0.145					
	[-0.080, 0.017]		[-0.008, 0.056]						
#children/father's brothers	-0.005	0.763	-0.024	0.146					
	[-0.036, 0.026]		[-0.056, 0.008]						
Time with paternal grandparents	0.559	0.000	-0.006	0.701					
	[0.531, 0.588]		[-0.035, 0.024]						
Time with maternal grandparents	-0.045	0.002	0.518	0.000					
	[-0.074, 0.016]		[0.488, 0.548]						

competition for grandparental attention. Indeed, the link between the number of cousins via their parents' sisters and grandparental closeness was mediated by time spent with the different grandparents, such that people spent more time with their maternal and paternal grandparents when they were not maternal grandparents to someone else, and consequently, felt closer to them. We also found that cousins through parents' brothers had no reliable impact on closeness to both maternal and paternal grandparents, which is consistent with the notion that descendants of male children are less likely to serve as alternative investment outlets in the eyes of their grandparents.

The between-cousin competition for grandparental attention implicated by our data raises testable ideas for future research on cousin rivalry, as well as the effects of birth order on cousin rivalry. For example, the eldest child of two parents has the opportunity to reproduce before his/her siblings. In so doing, (s)he should birth children into a family environment with less competition for grandparental resources compared to the children of siblings later in the birth order. In ancestral and food-stressed environments, such an effect may manifest in increased survival rates for children of eldest siblings, children of parents with fewer siblings and children of parents with predominantly male

siblings *when their grandparents are still alive*. The methodology of Lahdenperä et al. (2004), who explored the impact of grandparents on survival rates of their grandchildren in centuries old, states that multi-generational demographic records would be ideal for testing such possibilities.

Finally, our replication findings paint a mixed picture with regard to how statistical replicability coefficients such as the R-index should be interpreted. On the one hand, we agree with the basic point made by the R-index in the current context: efforts to replicate marginally significant interaction effects are likely to yield very few successful replications (even significant interactions were unlikely to replicate in the large scale replication effort of Nosek et al.; Open Science Collaboration, 2015). Although our successful replication of the marginal interaction from Laham et al. (2005) in Study 2 and the combined data set may simply be a fluke, it is also possible that the strength and parsimony of the underlying theory played a role.

Differences in grandparental investment have been replicated many times with many measures (Bishop et al., 2009; Pashos, 2000; Pollet et al., 2009; Salmon, 1999; Smith, 1988). The preferential investment hypothesis of Laham et al. (2005) was drawn a priori from the logic of paternal uncertainty that underlies the overall effects between maternal and paternal grandparents. Thus, the statistical weakness of the interaction found by Laham et al. (2005) may have been offset by the strength of the underlying theory, which was very well grounded in established evolutionary principles and findings. This possibility suggests that perhaps the predictive power of the R-index could be enhanced if it were combined with (A) evidence regarding the frequency with which an effect has been replicated in the past and (B) some estimate of the strength of the theory underlying the hypothesis. The latter estimate might be particularly difficult to create, but prediction markets have been used with great success in other replication efforts (Camerer et al., 2018), and hence might be of value in efforts to quantify theoretical strength.

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Declarations

Ethics Approval This work was cleared by the University of Queensland Low or Negligible Risk Review (project id: 2021/HE001094).

Consent to Participate Informed consent was obtained from all individual participants included in the study.

Consent to Publish NA

Competing Interests On behalf of all authors, the corresponding author declares no competing interests.

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