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Predicting Sibling Investment by Perceived Sibling Resemblance

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Using resemblance cues, people can identify highly related kin and treat them preferentially over less related or unrelated individuals, all else being equal. However, differences in degrees of resemblance can occur even within particular kin categories, such as siblings. We hypothesized that the level of perceived resemblance between siblings will predict sibling investment. Eighty Israeli students who had at least 2 full siblings filled out questionnaires regarding the younger sibling who was nearest to them in age. We found that sibling resemblance was positively associated with sibling investment, with emotional closeness serving as a mediator for the relationship between resemblance and investment. The results support the hypothesis that perceived resemblance to a younger sibling predicts investment in that sibling.

Keywords: altruism, kin selection, relationships, siblings, similarity

One of the most significant contributions to modern evolutionary theory is Hamilton's (1964a, 1964b) Kin Selection Theory. Hamilton formulated a cost–benefit rule which predicts the conditions under which kin investment can be selected for—specifically, $b * r > c$, where b is the benefit to the recipient, r is the level of genetic relatedness, and c is the cost to the actor. Hamilton's rule, therefore, predicts that altruistic acts should be most prevalent between close kin, then distant kin, and finally, nonkin (for reviews see Dawkins, 1979; Park, 2007). Studies on humans indeed show that people invest more in their kin than in nonkin, all else being equal. For instance, parental investment is higher in biological children than in stepchildren (Anderson, Kaplan, Lam, & Lancaster, 1999; Daly & Wilson, 1980; Tifferet, Jorev, & Nasanovitz, 2010). A physical and/or psychological resemblance between two people can activate a kin-detection system that increases investment (Lieberman, Tooby, & Cosmides, 2007). Hence, it is no surprise that resemblance predicts parental investment (e.g., Alvergne, Faurie, & Raymond, 2010; Platek et al., 2003; Volk & Quinsey, 2007). We propose that, in a similar fashion, resemblance will predict sibling investment.

Kin Recognition

Contextual Cues

To invest in kin, one first needs to recognize them. The two major categories of cues for kin recognition are contextual and phenotypic (Waldman, Frumhoff, & Sherman, 1988; reviewed in Penn & Frommen, 2010). Contextual cues include proximity in place or time. Lieberman et al., (2007) suggested two contextual cues for identifying siblings: coresidence and 'maternal perinatal association' (MPA; i.e., observing your mother caring for an infant will be a strong cue that the infant is your sibling). However, neither coresidence nor MPA can serve as useful cues for distinguishing between half- and full siblings (Bressan, Colarelli, &

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Cavalieri, 2009; Pollet, 2007). MPA and coresidence are perhaps also limited as a cue in that their variance is very low. For instance, almost all of the older siblings (84%) reported seeing their mother caring for their younger sibling (Lieberman et al., 2007).

Phenotypic Cues

Lieberman et al., (2007) suggested that resemblance could serve as another cue for kinship, but these authors did not measure it. Resemblance is a phenotypic cue, which is, as the term implies, based on phenotypic traits. In a process known as 'phenotype matching,' one can recognize a new individual as kin through his or her resemblance to known kin or to oneself, and also via comparisons with other individuals from the population (Krupp & Taylor, 2013). This is based on the fact that both morphological and psychological traits are substantially heritable (Bouchard, Lykken, McGue, Segal, & Tellegen, 1990; Hill, Goddard, & Visscher, 2008). Recognizing paternal half-siblings requires phenotype matching, as these individuals are typically not reared in proximity. In rhesus macaques, for instance, adult females were more affiliative toward paternal half-sisters than toward nonkin, a finding that the authors attribute to phenotype matching based on shared traits (Widdig, Nürnberg, Krawczak, Streich, & Bercovitch, 2001).

In humans, there are also claims for the role of phenotype matching in kin recognition. For example, adults were able to identify their siblings' shirts relying on olfactory signals only (Weisfeld, Czilli, Phillips, Gall, & Lichtman, 2003). Young children were able to recognize the odors of their full siblings, but not of half-siblings or stepsiblings, though all the siblings had coresided for the last two years (Weisfeld et al., 2003). These results suggest that coresidence alone is not sufficient for sibling odor recognition, and that the children may have compared their siblings' body odor to their own or that of other kin.

Relatedness and Sibling Investment

Hamilton's rule predicts that investment in half-siblings (with a genetic relatedness of $r = .25$) is likely to be less than in full siblings (with a genetic relatedness of $r = .50$). Indeed, sibling ties have been found to be weaker among half-siblings than among full siblings (Bressan et al., 2009; Deater-Deckard & Dunn, 2002; Hetherington, 1989; Pollet, 2007). In a large Dutch sample, half-siblings were significantly less likely than full siblings to even know whether their sibling was still alive (Pollet & Nettle, 2009). Interestingly, maternal half-siblings who grew up in close proximity to each other nevertheless showed less sibling investment in comparison to full siblings (Pollet, 2007). This suggests again that contextual cues, such as coresidence or MPA, cannot be the sole explaining factor for adult sibling ties. We hypothesized that the level of perceived resemblance between siblings will predict sibling investment, presumably because resemblance prompts stronger activation of a kin-detection system (Lieberman et al., 2007).

Resemblance and Sibling Investment

Studies assessing the relation between sibling resemblance and sibling investment are sparse, and in most cases have used only cues of physical resemblance as a predictor of investment. For example, Lampert (1999) reported that brothers who share specific genetic markers such as baldness or height report higher levels of friendship. A study of twins reared apart found that their level of physical similarity correlated with their emotional closeness after being reunited (Segal & Hershberger, 2003). In a study of students and their siblings, Lewis (2011) examined the effects of both self-reported and independent ratings of facial resemblance. He found that both measures predicted emotional closeness, but only self-reported facial resemblance predicted sibling altruism, suggesting that the link between resemblance and investment is a subjective one. We know of only one study measuring psychological similarity (Bressan et al., 2009), and the authors found there was no association between psychological similarity and 'extreme altruism' (e.g., donating a kidney) among full siblings. However, they found a significant positive association between psychological similarity and everyday altruism (e.g., giving a small gift).

Hypotheses

Hypothesis 1. Sibling resemblance is positively associated with routine investment.

Hypothesis 2. Sibling resemblance is positively associated with hypothetical investment.

Hypothesis 3. The relation between sibling resemblance and sibling routine investment is mediated by emotional closeness.

Method

Participants and Procedure

Eighty students (58% women) from a large college in Israel answered questionnaires regarding a younger biological sibling. All participants had at least two full siblings, at least one of whom was younger than the participant, and had no children of their own. Participants who had more than one younger sibling were asked to answer the questions with regard to the sibling who was nearest them in age. Participants' average age was 25.2 years (SD = 2.0), and 17% were married. Approximately half of the respondents still lived with their parents.

Measures

Demographics. Demographic details included sex, age, birth order, number of siblings, marital status, and place of residence. Participants were asked to grade their parents' income in comparison with the Israeli mean of $3,250 per month. Participants also indicated their sibling's age and sex, and the geographic distance between them (measured by the duration of a car ride, in minutes).

Sibling resemblance. Similarly to the scale used by Apicella and Marlowe (2004) to measure father-child resemblance, sibling resemblance was measured using three self-report questions on a scale of 0 (*not at all*) to 5 (*a great deal*) combined into a single scale. The items were *to what extent do you perceive that you and your brother/sister are similar in your physical appearance?* (M = 2.9, SD = 1.5), *to what extent do you perceive that you and your brother/sister are similar in your characteristics?* (M = 2.8, SD = 1.4), *in comparison to your other brothers and sisters, how similar is your brother/sister to you?* (M = 2.9, SD = 1.4). Principal Component Analysis (PCA) of the three items generated a single-factor solution (*Eigenvalue = 2.2*) which accounted for 72% of the variance, with loadings of .82 to .88, (Cronbach's alpha = .80).

Emotional closeness. One item asked participants how emotionally close they feel toward their younger sibling (0 = *not close at all*, 6 = *very close*). Similar single items have been used in the past to measure closeness (e.g., Korchmaros & Kenny, 2001, 2006; Pollet et al., 2013).

Routine investment. Routine investment in siblings was measured using four items, previously used to assess investment in cousins (Jeon & Buss, 2007) and grandchildren (Michalski & Shackelford, 2005). Participants were asked how much they care for the well-being of their younger sibling (0 = *not at all*, 6 = *a great deal*) and how often they communicate with their sibling by e-mail, phone, letters, or in person (0 = *not at all*, 6 = *a great deal*). Participants were also asked to rate how much time they invest in their younger sibling (0 = *not at all*, 7 = *a great deal*) and how much money they spend on him/her (including gifts, meals, cash, etc.; 0 = *none at all*, 7 = *a great deal*). Principal Component Analysis (PCA) of these variables generated a single-factor solution (*Eigenvalue = 3.3*) which accounted for 69% of the variance, with the four items loading between .73 and .90. Because the four original items used different scales, we computed z scores for investment in the younger sibling in terms of caring, communication, time, and money. An average z score was then calculated to reflect each participant's overall routine sibling investment.

Hypothetical investment. Two items assessed willingness to act altruistically toward the younger sibling in two hypothetical life-or-death situations: donating a kidney to the sibling and rescuing the sibling from a burning building (Curry & Dunbar, 2013; Jeon & Buss, 2007; Lieberman et al., 2007; 0 = *not willing at all*, 6 = *extremely willing*). Unexpectedly, 62 participants responded with the maximum score on both items, while 18 had at least one reservation. The variable was therefore dichotomized (0 = *conditional investment*, n = 18; 1 = *unconditional investment*, n = 62).

Table 1
Zero-Order Correlations, Means, and Standard Deviations

Variable	Mean	*SD*	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1. Sibling resemblance	2.86	1.24	—															
2. Emotional closeness	4.68	1.37	.30**	—														
3. Investment (routine)[a]	0	0.83	.38**	.69**	—													
4. Investment (hypothetical)[b]	0.78	0.42	.19	.36**	.27*	—												
Participant																		
5. Sex[c]	0.43	0.50	.05	−.06	−.23*	.16	—											
6. Age	25.16	1.96	−.11	.01	−.15	.08	.20	—										
7. Birth order	1.85	0.90	−.01	.09	.18	.08	.23*	.00	—									
8. Marital status[d]	0.16	0.37	−.26*	−.12	−.17	−.01	.03	.42**	−.08	—								
9. Residence[e]	0.51	0.50	−.16	−.09	−.26*	.01	−.12	.18	−.16	.23*	—							
Sibling																		
10. Sibling sex[c]	0.52	0.50	−.15	−.26*	−.21	−.15	.06	.08	.04	.01	.02	—						
11. Sibling age	20.56	3.36	−.09	−.13	−.24*	.01	.14	.62**	−.09	.36**	.06	−.04	—					
12. Sibling birth order	2.84	0.89	−.01	.08	.17	.07	.22	−.01	.99**	−.07	−.15	.05	−.08	—				
Family																		
13. Family income	3.14	1.03	.04	.17	.13	.16	.03	.25*	−.22*	.07	.03	.03	.12	−.22*	—			
14. Number of siblings	3.66	0.85	−.12	−.05	.02	.17	.25*	−.02	.65**	.02	.12	−.05	.11	.65**	−.15	—		
15. Same or different sex[f]	0.53	0.50	−.07	.03	−.03	.15	.06	.16	.01	−.06	.12	−.15	.11	.02	.01	.13	—	
16. Age difference	4.60	2.62	.03	.17	.19	.04	−.03	−.05	.11	−.15	.06	.10	−.81**	.10	.04	−.16	−.02	—
17. Distance (minutes)	32.21	52.23	−.06	.00	−.26*	−.12	.06	.17	.13	.09	.41**	.06	.13	.14	−.07	.11	.14	−.04

Note. $n = 80$.
[a] *z*-scored. [b] 0 = conditional investment, 1 = unconditional investment. [c] 0 = female, 1 = male. [d] 0 = not married, 1 = married. [e] 0 = with parents, 1 = not with parents. [f] 0 = different sex, 1 = same sex.
* $p < .05$. ** $p < .01$.

Table 2
Multiple Regression Statistics for the Prediction of Routine Investment in Younger Sibling

Predictors	*B*	*SE* (*B*)	β	*t*
Step 1				
Intercept	1.16			
Sex (0 = female)	−0.31	0.18	−.19	−1.73
Distance	−0.01	0.01	−.23	−2.11*
Sibling's age	−0.04	0.03	−.18	−1.67
Step 2				
Intercept	0.32			
Sex (0 = female)	−0.35	0.17	−.21	−2.10*
Distance	−0.01	0.00	−.21	−2.07*
Sibling's age	−0.04	0.03	−.15	−1.46
Resemblance	0.24	0.07	.36	3.61**

Note. $R^2 = .14$ for Step 1, $\Delta R^2 = .13$ for Step 2, $F(1, 75) = 13.04$, $p = .001$.
* $p < .05$. ** $p < .01$.

Results

Resemblance was positively correlated with routine investment, $r(78) = .38$, $p < .001$, but did not correlate with any of the demographic variables (after Bonferroni correction; see Table 1). To eliminate alternative explanations, the effect of resemblance on routine investment was tested using a hierarchical multiple regression analysis with geographical distance, participant sex, and sibling age as predictors in the first step. The analysis explained 14% of the variance, $F(3, 76) = 4.27$, $p = .008$, with distance negatively associated with investment (see Table 2). In the second step, we added resemblance to see whether it offered a unique contribution as a predictor. This second model explained 27% of the variance, $F(4, 75) = 6.97$, $p < .001$. Distance and being male (vs. female) were negatively associated with investment. Resemblance was positively associated with investment, and its addition to the model led to a statistically significant change in explained variance, $\Delta R^2 = .13$, $F(1, 75) = 13.04$, $p = .001$. A more detailed analysis showed that both physical, $r(78) = .37$, $p = .001$, and psychological, $r(78) = .33$, $p = .003$, resemblance predicted sibling investment.

To test hypothesis 2, we used the dichotomous variable (conditional (= 0) vs. unconditional (= 1) investment). Resemblance was not significantly related to unconditional sibling investment, $r_{pb}(78) = .19$, $p = .09$, though there was a statistical trend in the predicted direction.

Next, we tested the hypothesis that emotional closeness mediates the relationship between sibling resemblance and sibling routine investment. The mediated model (see Figure 1) was tested by bootstrapping (Preacher & Hayes, 2004) after centering the variables using *z* scores. As hypothesized, sibling resemblance predicted emotional closeness, $\beta = 0.30$, $p = .006$; and emotional closeness predicted investment, $\beta = 0.64$, $p < .001$. The effect of sibling resemblance on investment in the mediated model ($\beta = 0.18$, $p = .03$) was less than in the unmediated model ($\beta = 0.38$, $p < .001$). This significant reduction is reflected in the bootstrap estimate of the indirect effect ($\beta = 0.19$, 95%CI [0.05, 0.39], 1000 samples).

Discussion

We found that perceived sibling resemblance predicted routine investment in a younger sibling with a moderate effect size. This association appears robust, as it also held after statistically controlling for participant gender, sibling age, and geographic distance between the siblings. Mediation analysis revealed that older siblings who felt they were similar in character and appearance to their younger siblings were more likely to feel emotionally close to them, which in turn led them to report that they invest more in them in terms of time, money, communication, and affection.

Following kin selection theory, the association between sibling resemblance and investment may have resulted from stronger activation of a kin-detection system (Lieberman et al., 2007). Greater resemblance probably triggers a

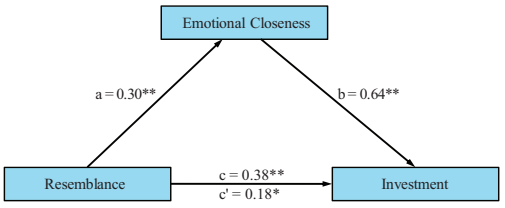

Figure 1. Standardized coefficients and hypothesized model of emotional closeness between siblings as a mediator of the effect of resemblance on investment. *c* = path coefficient before controlling for emotional closeness; *c′* = path coefficient after controlling for emotional closeness. * $p < .05$, ** $p < .01$. See the online article for the color version of this figure.

stronger unconscious feeling of kinship, which in turn leads to higher investment. Mediation analyses in this study and others (Korchmaros & Kenny, 2001, 2006) show that a possible mechanism for the association between perceived resemblance and investment is emotional closeness. The present study, however, cannot exclude the possibility that investing in a similar sibling is part of the wider phenomenon of homophily (see review in McPherson, Smith-Lovin, & Cook, 2001), that may—or may not—be based on evolutionary reasoning.

This study has two main limitations. First, because the study was correlational and relied on self-assessed resemblance, we are limited in our ability to draw strong conclusions on the causal relationship between actual sibling resemblance and investment. That said, using objective measures of resemblance has a number of disadvantages as well (see Volk & Quinsey, 2007). Second, our results are limited to Israeli families, which are relatively large (OECD, 2011) and show strong and stable ties (Lavee & Katz, 2003).

In summary, this study shows that perceived resemblance is associated with routine investment in a younger sibling. Participants who perceived their younger sibling as closely resembling themselves tended to report that they invest more in them in terms of time, money, communication, and caring. They also reported a somewhat greater willingness to risk their lives for them. These results support the proposition that resemblance triggers the kin-detection system. This, in turn, leads to higher emotional closeness, predicting sibling investment.

References

Alvergne, A., Faurie, C., & Raymond, M. (2010). Are parents' perceptions of offspring facial resemblance consistent with actual resemblance? Effects on parental investment. *Evolution and Human Behavior, 31,* 7–15. http://dx.doi.org/10.1016/j.evolhumbehav.2009.09.002

Anderson, K. G., Kaplan, H., Lam, D., & Lancaster, J. (1999). Paternal care by genetic fathers and stepfathers II: Reports by Xhosa high school students. *Evolution and Human Behavior, 20,* 433–451. http://dx.doi.org/10.1016/S1090-5138(99)00022-7

Apicella, C. L., & Marlowe, F. W. (2004). Perceived mate fidelity and paternal resemblance predict men's investment in children. *Evolution and Human Behavior, 25,* 371–378. http://dx.doi.org/10.1016/j.evolhumbehav.2004.06.003

Bouchard, T. J., Jr., Lykken, D. T., McGue, M., Segal, N. L., & Tellegen, A. (1990). Sources of human psychological differences: The Minnesota Study of Twins Reared Apart. *Science, 250,* 223–228. http://dx.doi.org/10.1126/science.2218526

Bressan, P., Colarelli, S. M., & Cavalieri, M. B. (2009). Biologically costly altruism depends on emotional closeness among step but not half or full siblings. *Evolutionary Psychology, 7,* 118–132.

Curry, O., & Dunbar, R. I. M. (2013). Do birds of a feather flock together? The relationship between similarity and altruism in social networks. *Human Nature, 24,* 336–347. http://dx.doi.org/10.1007/s12110-013-9174-z

Daly, M., & Wilson, M. (1980). Discriminative parental solicitude: A biological perspective. *Journal of Marriage and the Family, 42,* 277–288. http://dx.doi.org/10.2307/351225

Dawkins, R. (1979). Twelve misunderstandings of kin selection. *Zeitschrift für Tierpsychologie, 51,* 184–200.

Deater-Deckard, K., & Dunn, J. (2002). Sibling relationships and social-emotional adjustment in different family contexts. *Social Development, 11,* 571–590. http://dx.doi.org/10.1111/1467-9507.00216

Hamilton, W. D. (1964a). The genetical evolution of social behaviour. I. *Journal of Theoretical Biology, 7,* 1–16. http://dx.doi.org/10.1016/0022-5193(64)90038-4

Hamilton, W. D. (1964b). The genetical evolution of social behaviour. II. *Journal of Theoretical Biology, 7,* 17–52. http://dx.doi.org/10.1016/0022-5193(64)90039-6

Hetherington, E. M. (1989). Coping with family transitions: Winners, losers, and survivors. *Child Development, 60,* 1–14. http://dx.doi.org/10.2307/1131066

Hill, W. G., Goddard, M. E., & Visscher, P. M. (2008). Data and theory point to mainly additive genetic variance for complex traits. *PLOS Genetics, 4,* e1000008. http://dx.doi.org/10.1371/journal.pgen.1000008

Jeon, J., & Buss, D. M. (2007). Altruism towards cousins. *Proceedings of the Royal Society of London, Series B: Biological Sciences, 274,* 1181–1187. http://dx.doi.org/10.1098/rspb.2006.0366

Korchmaros, J. D., & Kenny, D. A. (2001). Emotional closeness as a mediator of the effect of genetic relatedness on altruism. *Psychological Science, 12,* 262–265. http://dx.doi.org/10.1111/1467-9280.00348

Korchmaros, J. D., & Kenny, D. A. (2006). An evolutionary and close-relationship model of helping. *Journal of Social and Personal Relation-*

ships, 23, 21–43. http://dx.doi.org/10.1177/0265407506060176

Krupp, D. B., & Taylor, P. D. (2013). Enhanced kin recognition through population estimation. *American Naturalist, 181,* 707–714. http://dx.doi.org/10.1086/670029

Lampert, A. (1999). With whom was Darwin supposed to fall in love? In J. van der Dennen, D. Smillie, & D. Wilson (Eds.), *The Darwinian heritage and sociobiology* (pp. 233–243). Westport, CT: Praeger.

Lavee, Y., & Katz, R. (2003). The family in Israel: Between tradition and modernity. *Marriage & Family Review, 35,* 193–217. http://dx.doi.org/10.1300/J002v35n01_11

Lewis, D. M. G. (2011). The sibling uncertainty hypothesis: Facial resemblance as a sibling recognition cue. *Personality and Individual Differences, 51,* 969–974. http://dx.doi.org/10.1016/j.paid.2011.08.002

Lieberman, D., Tooby, J., & Cosmides, L. (2007). The architecture of human kin detection. *Nature, 445,* 727–731. http://dx.doi.org/10.1038/nature05510

McPherson, M., Smith-Lovin, L., & Cook, J. M. (2001). Birds of a feather: Homophily in social networks. *Annual Review of Sociology, 27,* 415–444. http://dx.doi.org/10.1146/annurev.soc.27.1.415

Michalski, R. L., & Shackelford, T. K. (2005). Grandparental investment as a function of relational uncertainty and emotional closeness with parents. *Human Nature, 16,* 293–305. http://dx.doi.org/10.1007/s12110-005-1012-5

OECD. (2011). *The structure of families: Fertility rates*. Paris, France. Retrieved from http://www.oecd.org/dataoecd/51/1/42293894.xls

Park, J. H. (2007). Persistent misunderstandings of inclusive fitness and kin selection: Their ubiquitous appearance in social psychology textbooks. *Evolutionary Psychology, 5,* 860–873.

Penn, D. J., & Frommen, J. G. (2010). Kin recognition: An overview of conceptual issues, mechanisms and evolutionary theory. In P. Kappeler (Ed.), *Animal behaviour: Evolution and mechanisms* (pp. 55–85). New York, NY: Springer. http://dx.doi.org/10.1007/978-3-642-02624-9_3

Platek, S. M., Critton, S. R., Burch, R. L., Frederick, D. A., Myers, T. E., & Gallup, G. G. (2003). How much paternal resemblance is enough? Sex differences in hypothetical investment decisions but not in the detection of resemblance. *Evolution and Human Behavior, 24,* 81–87. http://dx.doi.org/10.1016/S1090-5138(02)00117-4

Pollet, T. V. (2007). Genetic relatedness and sibling relationship characteristics in a modern society. *Evolution and Human Behavior, 28,* 176–185. http://dx.doi.org/10.1016/j.evolhumbehav.2006.10.001

Pollet, T. V., & Nettle, D. (2009). Dead or alive? Knowledge about a sibling's death varies by genetic relatedness in a modern society. *Evolutionary Psychology, 7,* 57–65.

Pollet, T. V., Roberts, S. G. B., & Dunbar, R. I. M. (2013). Going that extra mile: Individuals travel further to maintain face-to-face contact with highly related kin than with less related kin. *PLoS ONE, 8,* e53929. http://dx.doi.org/10.1371/journal.pone.0053929

Preacher, K. J., & Hayes, A. F. (2004). SPSS and SAS procedures for estimating indirect effects in simple mediation models. *Behavior Research Methods, Instruments, & Computers, 36,* 717–731. http://dx.doi.org/10.3758/BF03206553

Segal, N. L., & Hershberger, S. L. (2003). Meeting one's twin: Perceived social closeness and familiarity. *Evolutionary Psychology, 1,* 70–95.

Tifferet, S., Jorev, S., & Nasanovitz, R. (2010). Lower parental investment in stepchildren: The case of the Israeli "Great Journey." *Journal of Social, Evolutionary, and Cultural Psychology, 4,* 62–67. http://dx.doi.org/10.1037/h0099300

Volk, A. A., & Quinsey, V. L. (2007). Parental investment and resemblance: Replications, refinements and revisions. *Evolutionary Psychology, 5,* 1–14.

Waldman, B., Frumhoff, P. C., & Sherman, P. W. (1988). Problems of kin recognition. *Trends in Ecology & Evolution, 3,* 8–13. http://dx.doi.org/10.1016/0169-5347(88)90075-4

Weisfeld, G. E., Czilli, T., Phillips, K. A., Gall, J. A., & Lichtman, C. M. (2003). Possible olfaction-based mechanisms in human kin recognition and inbreeding avoidance. *Journal of Experimental Child Psychology, 85,* 279–295. http://dx.doi.org/10.1016/S0022-0965(03)00061-4

Widdig, A., Nürnberg, P., Krawczak, M., Streich, W. J., & Bercovitch, F. B. (2001). Paternal relatedness and age proximity regulate social relationships among adult female rhesus macaques. *PNAS Proceedings of the National Academy of Sciences of the United States of America, 98,* 13769–13773. http://dx.doi.org/10.1073/pnas.241210198

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