Do babies resemble their fathers more than their mothers? A failure to replicate Christenfeld & Hill (1995)

Evolution and Human Behavior, 20(3), 129-135 (1999)

Serge Brédart
and
Robert M. French

Department of Psychology
University of Liège,
B-4000 Liège, Belgium

Abstract

Contrary to Christenfeld & Hill (1995), we find that children aged 1, 3, and 5 do not appear to resemble their fathers significantly more than their mothers. We provide an explanation as to why this should be. In addition, we note that any father-child resemblance that does exist, while indeed better than chance, is far from overwhelming.

Key Words: Monogamy, Paternity confidence, Facial resemblance, Parent-child resemblance, Father-child resemblance, Kin recognition, Extra-pair copulation.

Introduction

In a short article that received considerable attention, both in the scientific as well as the popular press, Christenfeld and Hill (1995) reported greater facial resemblance between one-year-old children and their fathers than between one-year-old children and their mothers. They argued that for one-year-old children there may be an evolutionary rationale (Gaulin and Schegel, 1980) for greater father-child resemblance than mother-child resemblance, viz.: "While a mother can be quite sure that the baby is hers, no matter what it looks like, the father cannot. It could then be to a baby's advantage to look like the father, to encourage paternal investment."

We will start by examining the consequences of greater facial resemblance between one-year-old children and their fathers than between these children and their mothers. According to the scenario outlined by Christenfeld and Hill, greater father-child resemblance would be to the baby's advantage because it would encourage the father's investment in its survival, since he would be able to clearly identify the child as his own. While this is no doubt correct, we believe this analysis is incomplete. To see why we must return to the fundamental postulate of Darwinian evolution, namely that the ultimate winners in the game of evolutionary competition are those individuals who succeed in passing on the greatest amount of their genetic material to subsequent generations. And the phenotypic characteristics of those genetic winners are what we see at any given time.

There is little obvious evolutionary pressure for a child to resemble its mother, since the maternity of a child is never in doubt. Thus, in terms of the degree to which a child resembles a parent, we can take the mother-child resemblance as a baseline. (It is reasonable to assume that children will look *something* like their parents, assuming there is some relationship between genotypes and phenotypes.) However, we will attempt to explain why evolution would *not* have produced greater resemblance between fathers and their children than the baseline resemblance observed between mothers and their children.

If one-year-old babies unambiguously resembled their fathers, the father would be certain when a child was his, but, by the same token, he would also be certain when a child was *not his*. In the event that a child was not his, the chances of his withholding resources from the child (or very possibly killing the child outright) would be high. Even today, step-children are far more likely to be killed by step-parents than by natural parents. In the U.S. in 1976, for example, Daly and Wilson (1988) found that children living with one or more substitute parents were *sixty-five times* as likely to be fatally abused as children living with their biological parents. Other related studies showed similar patterns of child mistreatment (for a recent short review see Daly and Wilson, 1996). Animal research has also clearly demonstrated the prevalence of infanticide by male rodents, carnivores and, in particular, primates (Hdry, 1979).

For much of the two-million year pre-agricultural course of human existence in the "environment of evolutionary adaptiveness" (EEA), three important conditions prevailed: male parental investment (Trivers, 1972) was necessary to ensure the survival of offspring, males were not able to completely control all possible sexual contact of their mates, and, finally, few individual males were able to provide resources for many females (Symons, 1987). Under these conditions, if babies had unambiguously resembled their fathers, a highly monogamous society would likely have emerged because few females would have risked the possibility of fathering another male's child, given that the bastard child would have been recognized as not belonging to her "official" (investing) mate (see also comments by R. Dawkins and other discussants following a paper by Wilson and Daly, 1997) and would thus have risked maltreatment and, quite possibly, death. In short, few females would have engaged in extra-pair copulation (EPC). However, in reality, this is contradicted by the fact that occasional EPCs by both sexes seems to be a universal feature of monogamous species (Mock and Fujioka, 1990), including humans. For example, rates of human misassigned paternity (based on blood typing tests) of 6-30% have been reported in studies done in southern England (Edwards, 1957; Philipp, 1973), 9% among the Venezuelan Yanomanö (Neel and Weiss, 1975; Smith, 1984), and 10% in rural Michigan, (Smith, 1984). Baker and Bellis (1995) have estimated a cross-cultural median EPC figure of 9%, with a range from 1.4-30%. Further, in a survey of 2078 English women, Bellis and Baker (1990) found that extra-pair copulations are significantly more likely to be timed just before ovulation than in-pair copulations. From his model of parent-infant resemblance, Pagel (1997) recently concluded that "even small amounts of paternity uncertainty are sufficient to select against parent-infant resemblance" (p.973).

We initially anticipated that we would replicate Christenfeld & Hill's empirical results and our aim was to examine the age at which greater facial resemblance between children and their fathers as opposed to their mothers began to disappear. However, the data reported below clearly support the conclusion that there is no significant difference in young children's resemblance to their fathers compared to their mothers.

Experiment

Method

Subjects

One hundred and eighty undergraduate students at the University of Liège participated in the experiment. Thirty subjects (15 female and 15 male) were randomly assigned to each condition. Their ages ranged from 18 to 30 years (mean age = 21.84).

Stimuli

Twenty-eight Caucasian families provided five photographs: three photographs of the same child at one year, three years, and five years, as well as one photograph of the mother and one photograph of the father taken when the child was approximately one year old. For fourteen families, the child was a girl, for the other fourteen families the child was a boy. The stimuli presented to subjects were scanned versions of these photographs (256 gray levels, 300 DPI, size = 5x4 cm) of faces. None of the faces had glasses, beards or moustaches.

Procedure

On each trial, participants were presented with the face of a child and, according to the condition, the faces of three women or three men. Their task was to identify the child's parent among the three presented adult faces. There were 28 trials (14 different girls and 14 different boys). The photographs were displayed in the same way as in the Christenfeld and Hill study: the child's face was presented in an upper position and the three adults' faces were placed beneath the child's face. The materials were designed to ensure with equal probability that the good match was the adult face placed on the left, placed in central position, or placed on the right. Participants were tested individually. Each participant was presented with the 28 sets including one child and three possible parents in a different random order.

Results

The design of the experiment was as follows. The age of the child (one-year-old, three-year-old and five-year-old) and the sex of the parent were between-subjects factors while the sex of the child was a within-subjects factor. A 3 (age of the child) X 2 (sex of the parent) X 2 (sex of the child) ANOVA with repeated measures on the last factor revealed a significant main effect of the age of the child ($F(2,174) = 6.614$, $p<.01$), no main effect of the sex of the parent ($F(1,174) < 1$) and no main effect of the sex of the child ($F(1,174) < 1$). The analysis revealed no significant interaction between the first two factors ($F(2, 174) < 1$), no significant interaction between the second and the third factor ($F(1,174) < 1$) and no three-way interaction ($F(2,174) < 1$). The main effect of the age of the child was qualified by a significant interaction between this factor and the sex of the child ($F(2,174) = 5.988$, $p < .01$), but the magnitude of this interaction effect is low ($\eta^2 = 0.06$). This interaction was analyzed using Tukey HSD post-hoc tests. These tests showed that, while the level of parent identification from pictures of girls did not change across the three ages, it did for pictures of boys. Parent identification was better for five-year-old boys than from one-year-old boys ($p <.0001$) and than for three-year-old boys ($p <.01$). No significant difference appeared between one-year-old and three-year-old boys ($p = .559$). Post-hoc tests indicated no significant effect of the sex of the child on parent identification at age one, three or five (all p's $> .10$).

A control analysis taking the items as the random factor was also carried out. This analysis did not reveal any significant main effect of the sex of the child ($F(1,26) < 1$), of the sex of the parent ($F(1, 26) < 1$) and of the age of the child ($F(2, 52) = 1.982$, $p = 0.148$). Nor did it reveal any interaction effect (all p's $> .20$). The results of this control analysis

confirmed that the significant interaction effect obtained in the preceding analysis was not a strong effect.

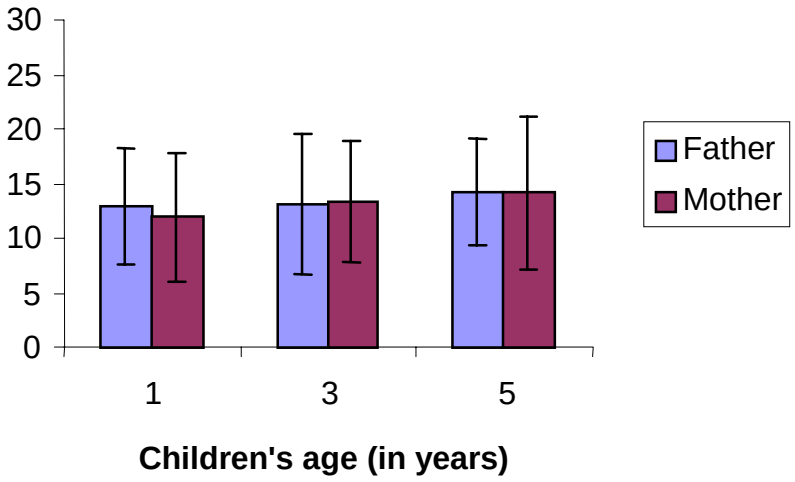

Figure 1. Mean number of correct identifications (out of 30) of parents of children at various ages (one-SD error bars). There is no significant difference in the level of correct identification of mothers versus fathers based on children's faces.

To reiterate, our analyses showed *no significant difference between the level of correct identification of mothers and the level of correct identification of fathers from children's faces* (Figure 1). Christenfeld and Hill (1995) did not perform a direct comparison between levels of identification of mothers and fathers. They simply compared the level of identification of mothers and fathers to the chance level of 33.3 percent by means of student t-tests, the items being the random factor. We also carried out this analysis for our data by comparing the mean number of identifications to chance (1/3 X 30 subjects = 10). Table 1 shows the mean number of correct identifications of mothers and fathers in the different conditions, as well as the corresponding t-tests and p-values. At all ages tested, our results indicate that, while correct identification of mothers and fathers was significantly, although not overwhelmingly, higher than chance, there is no significant difference between the degree of father-identification and mother-identification.

It is particularly important to note that while the degree of correct association of parents with children is anywhere between 7 and 14% higher than chance, it remains surprisingly poor. In all cases, *non-identification exceeds 50%*.

Discussion

Present results do not replicate those of Christenfeld & Hill's (1995) study. Young children aged 1, 3 and 5 do not appear to resemble their fathers significantly more than they resemble their mothers.

It could be objected that the sample of faces used in this experiment is not a representative one. In fact, there is no clear reason why our sample of items would not be representative of the larger Caucasian population in general, and, crucially would be less representative than Christenfeld and Hill's original sample. Indeed, we used photographs from 28 families, whereas Christenfeld and Hill's stimuli were drawn from 24 families. Our stimuli were collected in the same way as those in the Christenfeld and Hill study, i.e. by asking friends, colleagues and acquaintances for photographs. We do not see any a priori reason why such a procedure would lead to the construction of an unrepresentative set of faces.

Children's age	Parent	Mean no. of identifications (SD in parentheses)	Student *t*	*p*
One-year-old	Father	12.893 (5.363)	2.854	<.01
	Mother	11.929 (5.937)	1.719	<.05
Three-year-old	Father	13.178 (6.464)	2.602	<.01
	Mother	13.321 (5.644)	3.114	<.01
Five-year-old	Father	14.143 (4.859)	4.512	<.001
	Mother	14.143 (6.996)	3.134	<.01

Table 1. Mean number of correct identifications (out of 30) as a function of the children's age and the parent's sex. Standard deviations are in parentheses. Values of t-tests (df = 27) and corresponding p-values are also given. Note the absence of any significant difference in levels of correct identification of fathers and mothers based on a child's facial appearance.

Is our failure to replicate Christenfeld & Hill possibly attributable to an inappropriate sample of pictures that allowed *no* null hypothesis to be rejected? No, because in *all six cases* of mothers and fathers for 1, 3, and 5 year old children, we found that the resemblance of parent to child is, as one would expect, significantly better than chance. In other words, our sample *did* allow us to conclude that there was a significant resemblance between parents and children, but *not that there was a significantly greater* resemblance between fathers and their children compared to mothers and their children. This means that our failure to find a significant difference in the resemblance of fathers-to-children versus mothers-to-children was not simply due to an insufficient amount of detail to be able to make resemblance assessments of any kind.

Further studies are necessary, but there are also theoretical arguments which go against the existence of a father-child facial resemblance stronger than a baseline resemblance represented by mother-child resemblance. The main argument has been developed in the introduction. In short, if father-child resemblance is strong enough to enable a father to be certain when a child is his, it would presumably also permit a father to identify that a child is not his. Given the risk of maltreatment or resource-withholding for a "bastard" child, it is difficult to explain why engaging in EPC is an apparently universal feature of monogamous species, in particular, in humans, as demonstrated by a significant degree of misassigned paternity.

Moreover, if relatively high father-child resemblance were the norm, evolution would tend to produce progressively greater degrees of father-child resemblance because any degree of resemblance significantly below that norm would engender suspicions on the part of the resource-providing male concerning the child's paternity. This would likely lead to a higher degree of resource-withholding than if the child had unambiguously resembled the father, which would ultimately translate into a lower rate of survival among those children who did not closely resemble their fathers. In other words, once evolution had established a trend of father-child resemblance in excess of baseline resemblance, there would be evolutionary pressure towards ever greater resemblance. One would therefore expect, after three million years of selection, that there would now be a very *strong* tendency of father-child resemblance with respect to mother-child resemblance. However, both our results — as well as those by Christenfeld and Hill — demonstrate that this is not the case. Indeed, in Christenfeld and Hill's data correct identification of fathers from infant faces occurred only in 49.2 percent of

cases. In the present study, the mean rate of correct identification over all three ages of children is 44.7 percent. In both studies, misidentification of fathers is around 50 percent.

For these reasons, we believe that the original results reported by Christenfeld and Hill (1995) of greater father-child than mother-child resemblance in young children are most likely incorrect.

Acknowledgments

The authors would like to thank Martin Daly and Jim Friedrich for their helpful comments on an earlier version of the manuscript. Correspondence and requests for materials should be addressed to Serge Brédart (Serge.Bredart@ulg.ac.be) or to Robert French (rfrench@ulg.ac.be). This work was supported in part by a Belgian Science Foundation grant PAI/4-19.

References

Baker, R. and Bellis, M. *Human Sperm Competition*. London: Chapman and Hall, 142-144, 1995.

Bellis, M. and Baker, R. Do Females Promote Sperm Competition? Data for Humans. *Animal Behaviour 40*: 997-999, 1990.

Christenfeld, N. and Hill, E. Whose baby are you? *Nature 378*: 669, 1995.

Daly, M. and Wilson, M. *Homicide*. Hawthorne, NY: Aldine de Gruyter, 1988.

Daly, M. and Wilson, M. Violence against stepchildren. *Current Directions in Psychological Science 5*: 77-81, 1996.

Edwards, J.H. A critical examination of the reputed primary influence of ABO phenotype on fertility and sex ratio. *British Journal of Preventive and Social Medicine, 11*: 79-89, 1957.

Gaulin, S. and Schegel, A. Paternal confidence and paternal investment: a cross-cultural test of a sociobiological hypothesis. *Ethology and Sociobiology 1*: 301-309, 1980.

Hdry, S. Infanticide among Animals: A Review, Classification and Examination of the Implications for the Reproductive Strategies of Females. *Ethology and Sociobiology 1*: 13-40, 1979.

Mock, D. and Fujioka, M. Monogamy and long-term pair bonding in vertebrates. *Trends in Ecology and Evolution 5*: 39-43, 1990.

Neel, J.V. and Weiss, M. The genetic structure of a tribal population, the Yanomama Indians. XIII. Biodemographic studies. *American Journal of Physical Anthropology 42*: 25-51, 1975.

Pagel, M. Desperately concealing fathers: a theory of parent-infant resemblance. *Animal Behaviour, 53*: 973-981, 1997.

Philipp, E. Discussion: moral, social and ethical issues. In *Law and Ethics of A.I.D. and Embryo Transfer. Ciba Foundation Symposium* (Vol. 17), G.E.W. Wostenholme and D.W. Fitzsimons (Eds.). Amsterdam: Elsevier, Excerpta Medica, North-Holland, 1973, pp. 63-66.

Smith, R.L. Human sperm competition. In *Sperm Competition and the Evolution of Animal Mating Systems*, R.L. Smith (Ed.). London: Academic Press, 1984, pp. 601-660.

Symons, D. An evolutionary approach: can Darwin's view of life shed light on human sexuality? In *Theories of Human Sexuality*, J.H. Geer and W. O'Donohue (Eds.) NY: Plenum, 1987, pp. 91-125.

Trivers, R. Parental Investment and Sexual Selection. In *Sexual Selection and the Descent of Man*, B. Campbell (Ed.). Chicago: Aldine de Gruyter, 1972, pp. 136-179.

Wilson, M. and Daly, M. Relationship-specific social psychological adaptations. *In Ciba Foundation Symposium 208: Characterizing Human Psychological Adaptations*, G.R. Bock and G. Cardew (Eds.). Chichester, UK: John Wiley & Sons, 1997, pp. 253-268.