Arch Sex Behav (2012) 41:1423–1430
DOI 10.1007/s10508-012-9983-x


ORIGINAL PAPER

# Fathers See Stronger Family Resemblances than Non-Fathers in Unrelated Children's Faces

Paola Bressan • Stefania Dal Pos

Received: 11 March 2011 / Revised: 13 March 2012 /
Accepted: 12 May 2012 / Published online: 14 June 2012

**Even after they have taken all reasonable measures to decrease the probability that their spouses cheat on them, men still face paternal uncertainty. Such uncertainty can lead to paternal disinvestment, which reduces the children's probability to survive and reproduce, and thus the reproductive success of the fathers themselves. A theoretical model shows that, other things being equal, men who feel confident that they have fathered their spouses' offspring tend to enjoy greater fitness (i.e., leave a larger number of surviving progeny) than men who do not. This implies that fathers should benefit from exaggerating paternal resemblance. We argue that the self-deceiving component of this bias could be concealed by generalizing this resemblance estimation boost to (1) family pairs other than father-child and (2) strangers. Here, we tested the prediction that fathers may see, in unrelated children's faces, stronger family resemblances than nonfathers. In Study 1, 70 men and 70 women estimated facial resemblances between children paired, at three different ages (as infants, children, and adolescents), either to themselves or to their parents. In Study 2, 70 men and 70 women guessed the true parents of the same children among a set of adults. Men who were fathers reported stronger similarities between faces than non-fathers, mothers, and non-mothers did, but were no better at identifying childrens' real parents. We suggest that, in fathers, processing of facial resemblances is biased in a manner that reflects their (adaptive) wishful thinking that fathers and children are related.**

*Keywords* Confidence of paternity • Parental resemblance • Paternal investment • Phenotype matching • Cuckoldry

## Introduction

Should children resemble their fathers faithfully enough to broadcast their lineage? Men tend to invest more in children who (they believe) resemble them more (e.g., Apicella & Marlowe, 2004); thus, children who look like their social fathers fare better than those who do not. The problem is that a child's biological and social fathers are not necessarily the same person. Therefore, looking like one's social father is always beneficial whereas carrying the signature of the biological father is dangerous.

Babies do not, in fact, carry this signature. People who are asked to pick the true mother or father of an infant among three potential parents do barely better than chance (Brédart & French, 1999; Bressan & Grassi, 2004; McLain, Setters, Moulton, & Pratt, 2000). Even when

children are older, the average success rate in matching them to their true parents is far lower than what would be required for reliable parental identification (e.g., Nesse, Silverman, & Bortz, 1990). It has indeed been argued that, if extrapair paternity rates are high enough, neonatal anonymity is biologically adaptive—offspring are favored by ''concealing'' their identity so that they do not resemble their biological fathers (Pagel, 1997).

A comparison between the expected fitness (probability to successfully reproduce) of fathers who mark and do not mark their offspring suggests that, contrary to what common sense would dictate, producing babies who lack distinctive signature cues is also in the genetic interest of fathers (Bressan, 2002).

Let us assume that, in a population, k is the proportion of offspring that men father within their marriages whereas (1-k) is the proportion of offspring that they father outside their marriages. This is the same as saying that on average, in every family, (1-k) children are adulterine. Fathers who mark their children mark, of course, both the children they father within and the children they father outside their marriages. Such fathers will be able to identify (1-k) of their alleged offspring as foreign. Yet, their own (1-k) out-of-wedlock offspring will also be identified as foreign bytheir alleged fathers. Thus, the evolutionary benefit that fathers who mark their offspring gain—by rejecting adulterine children—is exactly counterbalanced by the evolutionary cost they pay, by having their own satellite offspring rejected by other men.

Of course, if babies do not carry paternal marks and look anonymous, their social fathers cannot be sure they are the biological fathers. Paternity uncertainty decreases paternal investment (Gaulin & Schlegel, 1980) and this, in turn, decreases babies' probabilities to thrive (Geary, 2000). The model shows that the evolution of paternal marks depends on three parameters: how much the baby pays if it looks like some other man, how much the baby pays if it looks anonymous, and how often babies are adulterine (1-k). The proportion of fathers who mark their children in the population (one, a few,many, all) is irrelevant.

In the simple case in which all babies carrying the wrong father's signature are left to die, paternal marks can evolve only when the babies' probability of dying because they look anonymous is larger than their probability of being adulterine—that is, larger than the non-paternity rate (1-k). The probability of non-paternity is, however, strongly related to paternity confidence. A survey of published estimates suggests that the median non-paternity rate is less than 2% for men with high paternity confidence, but raises to about 30% for men with low paternity confidence (Anderson, 2006). Men invest more willingly in anonymous-looking offspring when paternity confidence is higher (e.g., Gaulin & Schlegel, 1980). In the language of Bressan's (2002) model, this means that the paternal disinvestment due to a baby's anonymity decreases with increasing k. If this assumption is incorporated in the model, the conclusion is that paternal signatures will never evolve, regardless of the actual rate of non-paternity (1-k).

The point is not that men benefit from raising foreign young as much as from raising their own (they, of course, do not), but that they benefit from producing anonymous offspring. Thus, forms of progeny identification based on indirect cues, such as securing exclusive sexual access to one's partner, will be advantageous to the individuals that adopt them. In contrast, paradoxically, forms based on the direct cue of offspring marking will be deleterious.

Still, anonymous children pay the cost of paternal uncertainty— disinvestment by their social fathers (Gaulin & Schlegel, 1980). Disinvestment by the social fathers decreases the fitness of children (Geary, 2000) and, consequently, the fitness of mothers, fathers, and all genetically related individuals (Bressan, 2002). Hence, a truly efficient evolutionary strategy would combine a poor sensitivity to genetic relatedness with a strong effect of presumed relatedness. In this way, children can look like their social fathers.

Consistent with this argument, the effects of genetic relatedness on estimated resemblance are easily counterbalanced by belief in relatedness. On average, people judge pairs of faces that they erroneously believe to depict parents and children as resemblant as those of true parent–child pairs about which they have no information. Symmetrically, true parent–child pairs that happen to be labeled as unrelated are seen as dissimilar as pairs of strangers (Bressan & Dal Martello, 2002). Even more impressively, unrelated pairs that are believed to be related are seen as more resemblant than related pairs that are believed to be unrelated (Bressan & Dal Martello, 2002; independently replicated in Japan by Oda, Matsumoto-Oda, & Kurashima, 2005).

Given that maternity uncertainty is never an issue, here the vested interest of men is larger than that of women. To be sure, men do seem especially susceptible to bias when estimating children's resemblance to themselves. For example, when hypothetically choosing a child for adoption, men more than women report that the selected child resembles themselves (Volk & Quinsey, 2002). Also, men (but not women) inflate a child's facial resemblance to a male adult specifically when they are led to believe that this adult is the father of the child (Bressan & Dal Martello, 2002).

Cognitive adaptations have evolved to be contingent on environmental factors. For example, women's preference for masculine versus feminine male faces (Little, Jones, Penton-Voak, Burt, & Perrett, 2002) or for single versus attached men (Bressan & Stranieri, 2008) is influenced by women's situational factors, such as whether they have a partneror not. If it evolved to increase paternity confidence and thereby paternal investment, men's tendency to perceptually inflate parental resemblance might also be influenced by men's situational factors, most prominently by whether they have children. The present study tested the ensuing prediction that fathers may see, in unrelated children's faces, stronger family resemblances than non-fathers.

Unlike paternity, maternity is certain. If they have no reason to distrust their spouses, fathers benefit from believing that their alleged children are actually theirs; that is, they benefit from ''deceiving'' themselves. Mothers always benefit from reassuring their spouses that their alleged children are theirs, but in this context self-deception might not be necessary or even useful. Thus, we further compared mothers and non-mothers to see whether any family resemblance bias would be specific to fathers or apply to parents in general.

To address these issues we asked men and women who were, or were not, parents themselves to estimate the parental resemblance of children photographed at three different ages—as infants, as children, and as adolescents.

## Study 1: Estimation of Family Resemblance

We showed participants (who did or did not have children) pairs of photographs that depicted a child and his or her parent. Each child was paired, at three different ages—as an infant, as a child, and as an adolescent—with either mother or father. To test whether any

bias in resemblance estimation would concern parental resemblance only, or facial resemblance in general, we also paired each child to himself or herself at the three ages, i.e., infant with child, infant with adolescent, and child with adolescent.

## Method

### *Participants*

Atotal of 140 adults (70 men and 70 women), ranging in age from 18 to 70 years (median age, 35 years), participated in the study. They were recruited in public places, such as parks and outdoor cafes, and examined individually. Before participating, they gave informed consent. They were told that the study was about judging family resemblances, but not what the study hypothesis was. Information about their age and parental status was collected only at the end.

### *Material and Procedure*

We used a total of 60 color photographs, depicting the faces of 12 children (6 boys and 6 girls), at three ages each, and their 24 parents. The children's mean ages were 1 year (median, 14 months; range, 8–24), 8 years (median, 8 years; range, 6–10) and 16 years (median, 16 years; range, 13–21). Most photographs came from the family albums of friends and acquaintances of one of the authors; in the few cases in which the photographs of either a parent or an adolescent child were missing, they were taken especially for the study. All photographs were digitally elaborated in order to make them as uniform as possible, cropped from the shoulders up and printed on 9 x 12 cm photographic paper.

We paired each parent with his or her child at the three ages (24 x 3 pairs) and each child with himself or herself at the three ages (12 x 3 pairs). The resulting 108 pairs were distributed in two albums, three boys and three girls per album, one pair per page. Participants were divided into two groups of 70 (35 women, 35 men); each group evaluated one album. Page order was changed randomly for each participant. Participants were informed that each pair represented either a parent and his or her child or the same child at different ages, and were asked to estimate the resemblance between the two faces. Ratings were made on a scale from 0 (no resemblance) to 10 (very high resemblance).

## Results

We discarded the data of three participants whose mean overall rating was 2.5 SDs either below (n=1) or above (n=2) the sample mean. This left 137 participants; of these, 63 (32 men and 31 women) were childless and 74 (36 men and 38 women) had children. More than 80% of parents had either one or two children, which is typical in Italy; the average number of children was 1.8.

Because any effects of either child gender or child's parent gender are outside the theoretical scope of this article, we collapsed across both variables. Older participants gave higher child-parent resemblance ratings (Pearson's r=.24, N=137, p=.005) and were also more likely to have children; thus, age of participant was used as a covariate in all child-parent analyses.

For the resemblance ratings, we conducted a 2 (Sex of Participant) x 2 (Parental Status of Participant: parent vs. nonparent) x 3 (Age of Child in the Picture: 1 vs. 8 vs. 16 years) analysis of covariance (ANCOVA), with the first two factors between-subjects and the third factor within-subjects. Age of participant served as the covariate.

Age of Child interacted significantly with both Sex of Participant, F(2, 264)=5.8, p=.003, and Parental Status of Participant, F(2, 264)=4.3, p=.014. Because decomposing these interactions with simple effects analyses would not take the covariate of participant's age into account, we further investigated these interactions with separate ANCOVAs for the male and female participants. In particular, we tested the prediction that fathers see stronger family resemblances than non-fathers by conducting, on the resemblance ratings given by men, a 2 (Parental Status of Participant: father vs. non-father) x 3 (Age of Child in the Picture: 1 vs. 8 vs. 16 years) ANCOVA, with the first factor between-subjects, the second within-subjects, and age of participant as the covariate.

Being a father interacted significantly with child's age, F(2, 130)=4.3, p=.016. The interaction was due to the fact that men who were fathers reported stronger parental resemblances than men who were not, but only for older children, as shown in the left panel of Fig. 1. Univariate ANCOVAs, with parental status of participant as the fixed factor and age of participant as the covariate, showed that the difference between fathers and non-fathers was non-significant for 1-year-olds, F<1, marginally significant for 8-year-olds, F(1,65)=2.7,p=.10, and significant for 16-year-olds, F(1, 65)=4.4, p=.04.

Whereas our prediction focussed onmen, to get the complete picture we also investigated the same interaction in women. For women, there was a significant main effect of child's age, F(2, 132)=11.2, p<.0001, but no effect of being a mother and no interaction of being a mother with child's age, both Fs<1. That is,women perceived children as resembling their parents significantly more at 8 years old than at 1, paired-samples t(68)=5.6, p<.0001, and significantly more at 16 years old than at 8, t(68)= 5.0, p<.0001, but women who were mothers themselves never gave higher ratings than women who were not, as shown in the right panel of Fig. 1.

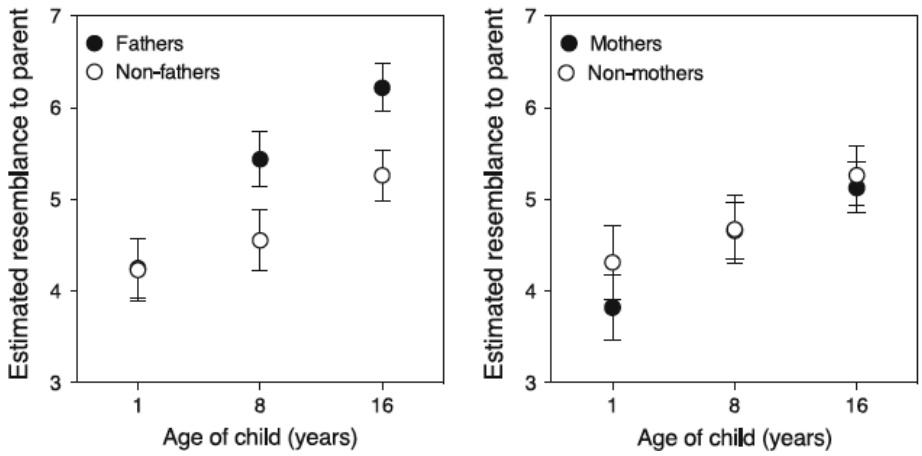


**Fig. 1** Covariance-adjusted mean parental resemblance of children aged 1, 8, and 16 years as estimated, on a 1–10 scale, by men (left panel) and women (right panel). Data are plotted separately for participants who are (closed symbols) or are not (open symbols) parents themselves. Bars indicate ±1 SEM.

We also explored whether fathers saw stronger family resemblances than mothers. We conducted, on the resemblance ratings given by parents, a 2 (Sex of Participant: father vs. mother) x 3 (Age of Child in the Picture: 1 vs. 8 vs. 16 years) ANCOVA, with the first factor between-subjects, the second within-subjects, and age of participant as the covariate. Sex of Participant interacted significantly with Age of Child, F(1, 71)=8.4, p=.005. The interaction was due to the fact that fathers reported stronger parental resemblances than mothers, but

only for older children, as shown in the left panel of Fig. 2 (the right panel depicts the corresponding data for non-parents). Univariate ANCOVAs, with sex of participant as the fixed factor and age of participant as the covariate, showed that the difference between fathers and mothers was non-significant for 1-year-olds (F<1), marginally significant for 8-year-olds, F(1, 71)=3.1, p=.08, and significant for 16- year-olds, F(1, 71)=8.7, p=.004.

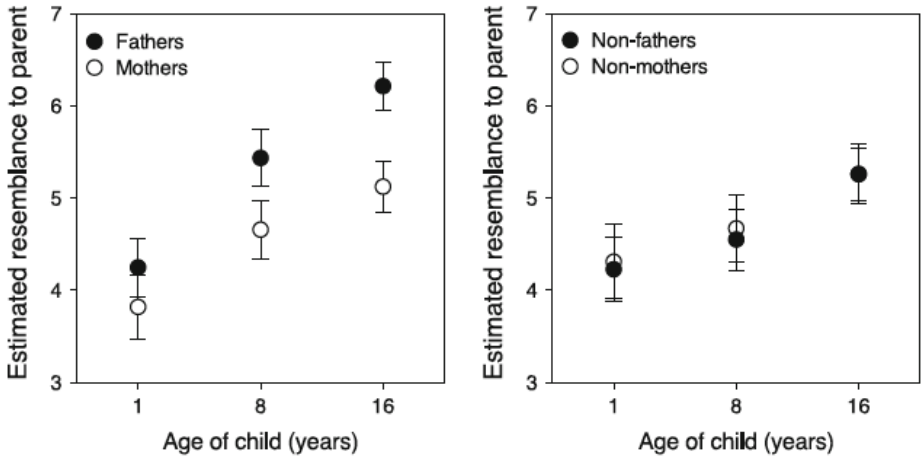


**Fig. 2** Covariance-adjusted mean parental resemblance of children aged 1 ,8, and 16 years as estimated, on a 1–10 scale, by participants who are (left panel) or are not (right panel) parents themselves. Data are plotted separately for male (closed symbols) and female (open symbols) participants. Bars indicate ±1 SEM.

Finally, we analyzed resemblance ratings for the children paired with themselves at different ages. A univariate analysis of variance (ANOVA) was performed on mean child–child resemblance ratings, using Sex of Participant and Parental Status of Participant as fixed factors. The Participant Sex x Parental Status interaction was significant, F(1, 132)=4.2, p=.04, as can be seen in Fig. 3. Relative to non-fathers, fathers perceived stronger similarities between the faces of the same child photographed at different ages, t(66)= 2.5, p=.01, whereas mothers and non-mothers did not differ, t(67)<1.

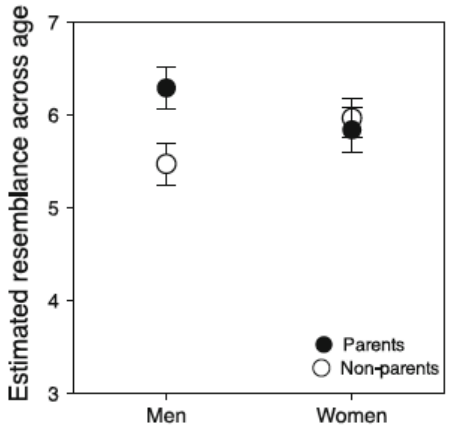


**Fig. 3** Overall mean resemblance of children to themselves across three different age pairings (1 with 8, 8 with 16, and 1 with 16 years) as estimated, on a 1–10 scale, by men and women. Data are plotted separately for participants who are (closed symbols) or are not (open symbols) parents themselves. Bars indicate±1 SEM.

## Study 2: Detection of Family Resemblance

Because our photograph pairs represented either two genetically related individuals or the same individual at different points in time, the higher similarity ratings given by fathers may actually reflect a superior ability to judge facial resemblances. In Study 2, we tested this possibility directly, by asking a new sample of parents and non-parents to indicate the correct father or mother of a child among a set of alternatives.

### Method

#### *Participants*

A total of 140 adults (70 men and 70 women), ranging in age from 18 to 70 years (median age, 31 years), participated in the study. None of them had participated in Experiment 1. They were told that they would be asked to select the true parents of a child from a number of choices; in all other respects, the method of recruitment was the same as in Experiment 1.

#### *Material and Procedure*

To avoid tiring participants and thereby increasing noise in the data, we used only part of Study 1's material: the photographs of the 12 children at two ages each (1 year and 16 years) and those of their 24 parents. The photographs of the 12 mothers were taped onto one side, and the photographs of the 12 fathers onto the other side, of a 40 x 60 cm stimulus board. The 24 photographs of the children were inserted in an album, one per page, and were presented one after the other and in a random order. Participants were asked to select the true mother or father; they were free to select the same parent more than once, regardless of their previous choices. Half of them completed the father task first and the mother task second; for the other half, the order was reversed. Each participant made a total of 48 choices (12 children x 2 ages x 2 parents).

### Results

We discarded the data of two participants whose mean overall accuracy was 2.5 SDs above the sample mean. This left 138 participants; of these, 77 (41 men and 36 women) were childless and 61 (28 men and 33 women) had children.

On mean accuracy scores, we performed a 2 (Sex of Participant) x 2 (Parental Status of Participant: Parent vs. Nonparent) x 2 (Age of Child in the Picture: 1 vs. 16 years) analysis of variance (ANOVA), with the first two factors between-subjects and the third factor within-subjects. Age of Child was highly significant, $F(1, 94)=50.2$, $p<.0001$, as 16-year-olds were matched more accurately to their parents than 1-year-olds. As can be seen in Fig. 4, fathers were no better than non-fathers at identifying the correct parent. Fathers and mothers did not differ significantly.

These findings allow us to discard the most obvious alternative explanation of Study 1's results, that is, that fathers might give higher ratings of parental resemblance than non-fathers (or mothers) simply because they are better at detecting facial resemblances. The results of Study 2 are consistent with the hypothesis that the amplification of parental resemblances in fathers is a cognitive bias.

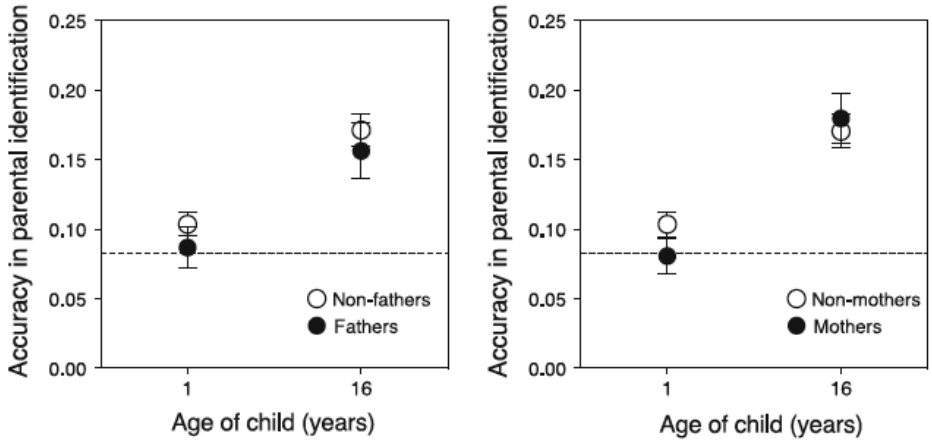


**Fig. 4** Mean probability of picking the correct parent of a child among 12 alternatives (chance level is 0.083, indicated by the dashed line), for men and women. Data are plotted separately for participants who are (closed symbols) or are not (open symbols) parents themselves. Bars indicate±1 SEM.

## Study 3: Indirect Supporting Evidence

Study 1 showed that the difference between fathers and mothers in parental resemblance ratings increased with children's age (Fig. 2, left panel). Unlike maternal investment, direct paternal investment is essentially nil before the child's weaning and steadily increases thereafter (Geary, 2000). Arguably, the larger paternal investment becomes, the more important a bias meant to reassure about paternity confidence becomes as well.

We searched for independent evidence for this incremental bias in a previously published work (Bressan & Dal Martello, 2002) that, like our Experiment 1, used pairs of parent/child pictures. Bressan and Dal Martello reported two separate experiments in which—for reasons unknown at the time—men gave higher family resemblance ratings than women. Unfortunately, no information about participants' parental status was ever collected in these, or any related, studies. However, it now appears quite likely that the slightly larger ratings given by men relative to women were due to substantially larger ratings given by men who were fathers, diluted by their being pooled together with the ''normal'' ratings of men who were not fathers. Consistent with this argument, no effect of participant's gender was found by Oda et al. (2005), although this work replicated all other main effects of Bressan and Dal Martello. Whereas Bressan and Dal Martello used a large sample of adults, median age 38 years (ranging up to 65), Oda et al.'s sample only included university students, median age 20 years (ranging up to 25). Because of their age and occupation, not many people in Oda et al.'s sample were likely to have children.

In Bressan and Dal Martello's (2002) study, participants were asked to estimate the facial resemblance between 8-year-olds and adult men and women. In one experiment, adults were labeled either as parents or as strangers (''mixed labels''); in another, all adults were labeled as parents (''all-related labels''). Labels were correct in half of the cases. Overall, men gave higher ratings than women (respectively, p=.049 and p=.076, with effect sizes d=0.51 and d=0.40, ''medium'' effects in Cohen's [1988] terms; Experiments 1 and 3 in Bressan & Dal Martello, 2002). Tellingly, no such difference was found when participants estimated the resemblance between 8-year-olds and adults in a context where the issue of genetic relatedness was not raised at all, although, again, in half of the cases these adults were the children's real parents (Experiment 2 in Bressan & Dal Martello, 2002).

Because paternal investment typically tends to increase until children are independent (Geary, 2000), the paternity reassurance argument would predict that, in our society, the difference between fathers and mothers in parental resemblance ratings becomes largest once children are adults. To investigate whether this could be the case, we analyzed data that were obtained, for a different purpose, in an independent study (Bellini, 2003). Part of this study was a replication of Experiment 1 in Bressan and Dal Martello (2002), but the children whose parental resemblance was assessed were young adults, rather than 8-year-olds. Although, again, no information about the participants' parental status was available, men did indeed give higher resemblance ratings than women (mean age of participants was 37 years; hence, many of them were likely to have children). This difference was significant (p=.003) and yielded an effect size d=0.80, a ''large'' effect in Cohen's (1988) terms. On the other hand, in a separate experiment where genetic relatedness was not mentioned, men did not give higher ratings than women, although participants were judging the very same photograph pairs as in the previous experiment (Bellini, 2003).

The effect sizes of the sex differences obtained in the various experiments are plotted in Fig. 5. To permit comparison, all data plotted here refer only to related pairs about which participants were given veridical information. The figure shows that men see larger resemblances between parents and children than women do and that this difference increases with child's age.

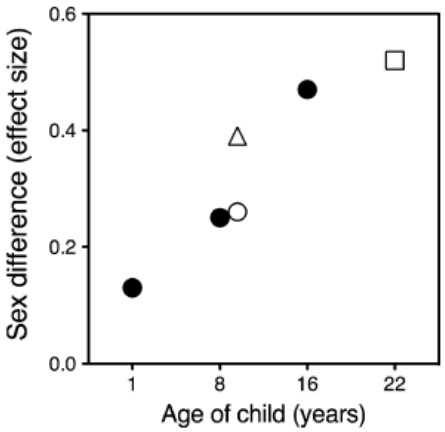


**Fig. 5** Standardized, bias-corrected (Hedges) effect sizes of the sex difference in estimating parental resemblance of children aged 1, 8, 16, and 22 years. The sex difference consists in higher ratings by men than by women. Closed circles: all-related labels (current study, Study 1); open circle: all-related labels (Bressan & Dal Martello, 2002, Experiment 3); open triangle: mixed labels (Bressan & Dal Martello, 2002, Experiment 1); open square: mixed labels (Bellini, 2003). All plotted data refer to related pairs about which participants were given veridical information.

## General Discussion

We found that men who were fathers perceived stronger similarities between the faces of parents and children than men who were not fathers. Is the effect simply due to the fact that fathers, more than non-fathers, might feel it is socially appropriate to stress parental resemblance? The answer is no, because fathers also perceived stronger similarities between facial photographs of the same child at different ages. Is, then, the effect due to the fact that fathers might be more accurate than non-fathers at detecting facial resemblances? Again, the answer is no, because fathers were no better than non-fathers at

picking the correct parent of a child among a number of potential parents.

A similar line of thought applies to the difference between fathers and mothers. Fathers saw stronger facial resemblances between the faces of parents and children than mothers did, but were no better than mothers at identifying the children's real parents.

We interpret this paternal boost in perceived family resemblance as a self-serving adaptation. The idea that fathers stand to gain from deceiving themselves in paternity matters seems contrary to common sense. Yet, it follows rationally from the counterintuitive—but logically sound—argument that, in general, fathers stand to gain from (1) producing unidentifiable offspring and (2) investing in their spouse's offspring, that is, treating them as though they are confident that they have fathered them (Bressan, 2002).

Provided he has no specific reasons to distrust his partner, then, it is in a man's genetic interest to act as though the child were indeed his. Symmetrically, it is in a woman's genetic interest to increase paternity confidence by remarking her child's resemblance to her mate. The available empirical evidence supports both points (for a brief review, see Bressan, 2002). Interestingly, our current study showed no difference between mothers and non-mothers. This suggests that, to deceive her social partner successfully, an adulterous mother does not need to deceive herself, that is, to convince herself that her child was actually fathered by her social partner. Correct information about the child's paternity, if not exposed to the social partner, may indeed turn out to be useful in several scenarios, and it implies the possibility of receiving additional social and material support from the extra-pair man.

We found that fathers amplified parental resemblances relative to non-fathers. This paternal adaptation may be seen as a form of self-deception. Because deception is more effective if the deceiving component is unconscious (see Trivers, 1985; von Hippel & Trivers, 2011), we may expect evolution to render fathers unaware that they are deluding themselves. This could be accomplished, for example, by making the bias more general, and thus less similar to the specific wishful thoughts that it protects. Hence, a bias of the form ''my children look like me'' could conveniently generalize to the form ''children and parents look alike,'' and even to the form ''related people look alike.'' As a result, the bias may come into action every time two allegedly related faces are compared for common traits, rather than being restricted to the faces of parents and children. Our data show that, in contexts where the concern of genetic relatedness has been activated, fathers amplify both the similarities between faces of parents and children and the similarities between faces of the same individual at different ages.

Consistently with the idea that a bias of this form is generally adaptive, people adopt, when assessing strangers' relatedness from photographs, what has been called a ''risk'' strategy by responding ''related'' more often than ''unrelated.'' This holds across ample degrees of resemblance and age differences between the faces (e.g., Kaminski, Dridi, Graff, & Gentaz, 2009). Such a strategy reflects a preference for false positives (believing that unrelated people are related) over false negatives (believing that related people are unrelated). In the context of progeny identification, such a ''risk,'' acceptance-error strategy may be less costly than a ''security,'' rejection-error strategy (as mathematically shown in Bressan, 2002).

In the studies reported here, the difference between fathers and non-fathers in rating the parental resemblance of children in separate age groups emerged somewhere between infancy and middle childhood. If paternal self-deception is an adaptive form of wishful

thinking, it must depend on the net costs and benefits of investing in the child versus abandoning the child, at any given point in time. Our finding suggests that, as the child grows, paternal investment may have increasing, rather than decreasing, returns.

The literature on parental effort in societies, such as ours, where infant mortality rates are low and paternal investment does not significantly affect child survival, is consistent with this conclusion. There is evidence that paternal investment increases children's social competencies and their later socioeconomic and cultural success. This happens mainly via paternal investment of time and/or income, such as helping with homework and/or paying for higher schooling (for a review, see Geary, 2000). These forms of paternal investment do not concern infants or toddlers but older children, and increase with their age. Even most obvious means, across societies, are transmission of property and social titles or ancient customs, such as dowry and bride price, which typically apply to adult children. Selection would have favored men who, by investing resources in the development of their children's social and cultural competitiveness, enhanced their probability to acquire further status and wealth in adulthood; this, in turn, would have increased the survival of the children's children— the investor's grandchildren (Geary, 2000).

We are not using the term ''self-deception'' to imply that men are *lying* to themselves about their children's paternity. It is possible to deceive the self by avoiding or altering the truth, but also by exaggerating it. What all forms of self-deception have in common is that people ''favor welcome over unwelcome information in a manner that reflects their goals or motivations'' (von Hippel & Trivers, 2011). We suggest that fathers favor processing of facial similarities over dissimilarities in a manner that reflects their wishful thinking that fathers and children are related.

## References


Anderson, K. G. (2006). How well does paternity confidence match actual paternity? Evidence from worldwide nonpaternity rates. Current Anthropology, 47, 513–520.

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.

Bellini, A. (2003). Like father, like son: The perception of family resemblances in an evolutionary perspective. Unpublished master's thesis, University of Padua, Padua, Italy.

Brédart, S., & French, R. M. (1999). Do babies resemble their fathers more than their mothers? A failure to replicate Christenfeld and Hill (1995). Evolution and Human Behavior, 20, 129–135.

Bressan, P. (2002). Why babies look like their daddies: Paternity uncertainty and the evolution of self-deception in evaluating family resemblance. Acta Ethologica, 4, 113–118.

Bressan, P., & Dal Martello, M. F. (2002). Talis pater, talis filius: Perceived resemblance and the belief in genetic relatedness. Psychological Science, 13, 213–218.

Bressan, P., & Grassi, M. (2004). Parental resemblance in one-year-olds and the Gaussian curve. Evolution & Human Behavior, 25, 133–141.

Bressan, P., & Stranieri, D. (2008). The best men are (not always) already taken: Female preference for single versus attached males depends on conception risk. Psychological Science, 19, 145–151.

Cohen, J. (1988). Statistical power analysis for the behavioral sciences (2nd ed.). Hillsdale, NJ: Erlbaum.

Gaulin, S. J. C., & Schlegel, A. (1980). Paternal confidence and paternal investment: A cross cultural test of a sociobiological hypothesis. Ethology and Sociobiology, 1, 301–309.

Geary, D. C. (2000). Evolution and proximate expression of human paternal investment. Psychological Bulletin, 126, 55–77.

Kaminski, G., Dridi, S., Graff, C., & Gentaz, E. (2009). Human ability to detect kinship in strangers' faces: effects of the degree of relatedness. Proceedings of the Royal Society, Series B, 276, 3193–3200.

Little, A. C., Jones, B. C., Penton-Voak, I. S., Burt, D. M., & Perrett, D. I. (2002). Partnership status and the temporal context of relationships influence human female preferences for sexual dimorphism in male face shape. Proceedings of the Royal Society, Series B, 269, 1095–1103.

McLain, D. K., Setters, D., Moulton, M. P., & Pratt, A. E. (2000). Ascription of resemblance of newborns by parents and nonrelatives. Evolution and Human Behavior, 21, 11–23.

Nesse, R. M., Silverman, A., & Bortz, A. (1990). Sex differences in ability to recognize family resemblance. Ethology and Sociobiology, 11, 11–21.

Oda, R., Matsumoto-Oda, A., & Kurashima, O. (2005). Effects of belief in genetic relatedness on resemblance judgments by Japanese raters. Evolution and Human Behavior, 26, 441–450.

Pagel, M. (1997). Desperately concealing father: A theory of parent-infant resemblance. Animal Behavior, 53, 973–981.

Trivers, R. (1985). Social evolution. Menlo Park, CA: Benjamin/Cummings.

Volk, A., & Quinsey, V. L. (2002). The influence of infant facial cues on adoption preferences. Human Nature, 13, 437–455.

von Hippel, W., & Trivers, R. (2011). The evolution and psychology of self-deception. Behavioral and Brain Sciences, 34, 1–16.