

Original Article

Paternal Care May Influence Perceptions of Paternal Resemblance

Anthony A. Volk, Department of Child and Youth Studies, Brock University, St. Catharines, Ontario, Canada. Email: tvolk@brocku.ca (Corresponding author).

Carolynn Darrell-Cheng, Department of Child and Youth Studies, Brock University, St. Catharines, Ontario, Canada.

Zopito A. Marini, Department of Child and Youth Studies, Brock University, St. Catharines, Ontario, Canada.

Abstract: Father-child resemblance is increasingly attracting attention from researchers interested in studying paternal investment. The current study sought to determine whether a quasi-experimental infant massage intervention would increase father's perceptions of resemblance. The study included a dozen fathers in each of two groups: the first received an intensive series of lessons on infant-father massage along with their infants, while the second group served as a neutral control. We failed to find significant correlations between paternal investment and resemblance, but we found that fathers who participated in the infant massage intervention reported significantly larger post-study ratings of resemblance and lower ratings of paternal stress. This suggests that the relationship between father-child resemblance and paternal investment may be bidirectional.

Keywords: resemblance, infant facial cues, paternal care

Introduction

Amongst mammals, paternal care is rare (Clutton-Brock, 1991). Amongst humans, paternal care is much more common, although fathers typically provide far less parental care than mothers (Hewlett and Lamb, 2005; Hrdy, 1999). One reason for this is that men are believed to invest more time in pursuing additional status and mating opportunities than women (Geary, 2010). Another reason may be that men are less certain of their investment due to concerns of paternal certainty. Unlike women, men are faced with the possibility of unwittingly raising a child that is not biologically related to themselves (Anderson, 2006). Thus men should face different decisions and weigh different factors than women when it comes to parental investment (Volk and Quinsey, 2002). One such factor is believed to be cues of infant-father resemblance (Daly and Wilson, 1982).

Evolutionary theory states that adults should be primarily interested in investing in related infants, and thereby favoring the fitness of shared genes (Trivers, 1972). Given their concern with investing in related offspring, adults may attempt to determine the degree to which they share genes with a given child. Perhaps the simplest way of doing this (and certainly one of the methods most available to our ancestors) is to look for shared phenotypical traits (i.e., resemblance) that may indicate shared genotypes that underlie the expression of the shared phenotypes (Volk and Quinsey, 2002, 2007). Theoretically and all else being equal, a man who invests more in children who resemble him, versus children who do not, should have a lower chance of investing in unrelated children (Volk and Quinsey, 2007). A growing body of literature has found just such a positive male-bias towards cues of resemblance with respect to hypothetical paternal care decisions (Platek, Burch, Panyavin, Wasserman, and Gallup, 2002; Platek et al., 2003; Platek, Keenan, and Mohamed, 2005; Volk and Quinsey, 2002, 2007). Further research has also revealed that reports of actual paternal care are related to ratings of paternal resemblance (Alvergne, Faurie, and Raymond, 2009, 2010; Burch and Gallup, 2000; Heijkoop, Dubas, and van Aken, 2009).

However, there remain several concerns regarding paternal resemblance and paternal care. In general, the findings to date have been based on indirect paternal reports or reports from non-fathers, and/or they have not been done experimentally with actual fathers. For example, it is generally presumed that the relationship between resemblance and paternal care is unidirectional, but there is no evidence supporting this claim. Indeed, Bressan and Dal Martallo (2002) found that perceptions of resemblance were susceptible to social ascriptions. So it is possible that paternal ascriptions of resemblance may also be influenced by social behaviors. Furthermore, amongst many mammalian species adult exposure to infants can alter adults' neurological circuits that in turn alter adults' perceptions of infants and parental care (Rosenblatt, 2002). So besides social/cognitive mechanisms of change, human fathers' resemblance perceptions may also be altered by exposure to a particular infant. As human paternal care in general is facultative (Gray and Anderson, 2010; Marlowe, 1999), these perceptual changes may be part of the mechanism that allows for facultative paternal care.

To address these concerns, we propose a quasi-experimental study of father-infant resemblance that manipulates the level of paternal involvement. This will allow us to examine whether the relationship between parental care and resemblance is bidirectional. We predict that father-infant resemblance will significantly negatively correlate with father's ratings of parental stress both pre- and post-intervention and that increased paternal investment will be positively correlated with paternal perceptions of father-infant resemblance.

Materials and Methods

Participants

Twenty-four infant-father dyads were recruited for a study of father-infant massage and bonding (resemblance was not mentioned). Experience with fatherhood ranged from first time fathers to one father who had twelve children. Previous experience as a father and

sex of the infant were not controlled for as previous research suggests these factors may not be statistically insignificant (Volk, Lukjanczuk, and Quinsey, 2007; Volk and Quinsey, 2002). Fathers were assigned to one of two groups, and both groups had five male and seven female infants for a total of ten male infants and fourteen female infants. The infants ranged in age from five months to fourteen months of age with a mean age of 8.08 months. Fathers ranged in age from 24 to 50 years of age with a mean age of 33.6 years of age. The majority of fathers had an undergraduate or graduate degree ($n = 18$, or 66.7%), considered themselves of average wealth ($n = 19$, or 79.2%), and had no previous infant-massage experience ($n = 19$, or 79.2%). All the participating fathers were the biological fathers of the infant. They all lived with their infant and 83.3% ($n = 20$) were married to the infant's biological mother. The average duration of their relationship with the infant's mother was 6.75 years ($SD = 4.25$). While we did not ask direct questions of paternity certainty (to avoid biasing participants), one of the questions asked in the Parental Stress Index at the beginning of the study (see below) asked fathers if they agreed with the following statement: "My child knows I am his or her parent and wants me more than other people." All of the fathers either agreed (79%) or strongly agreed (21%) with this statement, suggesting a reasonable degree of confidence in their paternity. Fathers were recruited locally through posters and a large newspaper article on the topic as well as through Internet advertisement sites such as Kijiji.com.

Measures

The Parent Stress Index: The PSI is a commercially available tool designed to measure parent stress (Abidin, 1995). It was used to gather pre and post intervention data for both the control and experimental groups. The PSI is a highly validated test that was developed for use as both a diagnostic tool as well as a research tool aimed at studying the effects of stress on parent-child interactions (Abidin, 1995). The test consists of 120 items standardized for use with parents of children 1 month – 12 years of age, and it consists of three domains: child, parent, and general stressors. The first domain is child stresses which include: the child's distractibility/hyperactivity, adaptability, reinforcement of the parent, mood, and acceptability. The second domain of parent stresses includes: parent-child attachment and parental competence, role restriction, depression and spousal support. The third domain of stressors is called situational/demographic life stress, and it measures external life stresses such as a personal or financial loss, legal problems, moving, and other general problems. Parents who earn a high life stress score find themselves in stressful situational circumstances that are often beyond their control (Abidin, 1995). Prior to analysis all subscales were tested for internal consistency reliability, for which they all rated $\alpha > .70$. The participants' stress scores fell within the sub-clinical range of the PSI (normative $M = 92$, 108, and 8 for child, parent, and life stresses; Abidin, 1995). Fathers also provided qualitative answers regarding their stress experiences; these are analyzed in a concurrent paper on the fathers' experiences of infant massage (Darrell, Volk, and Marini, 2010).

Facial cues: The facial cues rating scale has been developed and evaluated by the first author (e.g., Volk and Quinsey, 2002, 2007). It is a series of Likert scales that ask adults to rate infants on measures including perceived resemblance, cuteness, health, and

happiness. For example, fathers were asked to rate their resemblance to their infant. A resemblance score of 1 indicates “no resemblance at all” and a score of 7 indicates “perfect resemblance.”

Intervention: The intervention was based on infant massage techniques described by the International Association of Infant Massage (IAIM) in this study. The IAIM instructor never touches the infant; rather they demonstrate the strokes on a doll for the parent to mimic with their own child (Simpson, 2001). The IAIM suggests 4-5 sessions of infant massage teaching to cover the entire body. Teaching often occurs in a class setting, which can also benefit the infant-parent dyad by reducing isolation. The IAIM also suggests that in a class setting, the certified infant massage instructor (CIMI) can facilitate parent support on a variety of infant development issues such as colic, bonding and feelings of efficacy (Adamson, 1996).

Procedure

The experimental condition: The experimental part of the study took place in a warm, carpeted laboratory at Brock University with plenty of floor space. At the first class, the fathers were reminded of the goals and methods of the study and were asked to provide consent for their and their infant's participation. Prior to instruction in infant massage, the fathers were asked to complete a brief demographic form, the full PSI, and to rate their infants' health, cuteness, and paternal resemblance. The experimental condition ran for four consecutive weeks. At the end of the four weeks, fathers completed a second round of the PSI and infant ratings. Three groups of classes (with four father-infant pairs in each) were held in order to recruit the desired number of participants.

As previous research has shown the power of social ascriptions of resemblance can influence perceptions of resemblance (Bressan and Dal Martallo, 2002), we made an effort to avoid biasing language whenever possible. Thus, we referred to fathers and infants in one of two ways. First, as a group, it was impractical to refer to infants as anything other than “your”. For example, when asking the group to place their infants on the ground, the instructor said to the entire group: “Please place your infants gently on the carpet.” The alternate use of: “Please place the infants gently on the carpet.” was avoided as it sounded cold and impersonal. However, unlike at the group level, at the individual level (where much of the instruction took place) fathers and infants were referred to by their actual names in order to avoid direct, personal attributions of relatedness. For example, instead of saying to an individual father: “Please place your infant gently on the carpet,” the instructor asked: “[Father’s name], can you please place [infant’s name] gently on the carpet?” Thus we were able to avoid direct individual verbal attributions suggesting relatedness. No statements were made at any time regarding resemblance (physical or behavioral) between the fathers and the infants.

The control condition: This group operated similar to a wait-list control group. Once identified, fathers provided their home or work mailing address. They received an information package containing the informed consent document and the first set of questionnaires. The fathers were instructed to fill out the documents and send them back in the return pre-paid envelope. After a period of four weeks the fathers were sent a second package of information to complete and return.

At this end of the study, fathers in both conditions received a \$50 honorarium and were thanked for their participation.

Results

Given the small sample size and the attendant limitations of statistical power, we decided to focus solely on three variables of interest: resemblance, paternal stress, and life stress. The remaining variables (e.g., father age, child stress index, cuteness ratings, etc.) did not significantly mediate or moderate the results presented in this paper (Darrell, 2009). We thus focused on resemblance and paternal stress with life stress was kept as a useful control variable. The data was analyzed between the two groups: experimental and controls.

The Spearman’s correlations for the two groups are presented in Figure 1. The only significant correlations for resemblance were the strong, positive, pre-post resemblance correlations for both groups. Amongst the control group, there were large, significant correlations between all of the stress ratings. Amongst the experimental group, a similar pattern existed with the exception of non-significance for the pre-paternal stress – post-life stress ratings and the post-paternal stress and pre-life stress ratings. There was a trend towards the experimental group having stronger correlations between resemblance and the stress indices (particularly post-intervention stress). However, a comparison of the two groups’ correlations (using Fisher’s *z*’ transformation; Cohen and Cohen, 1983) failed to reveal any significant differences.

Table 1. Control and experimental group pre-intervention and post-intervention ratings of resemblance, paternal stress, and life stress (*n* = 12 per group)

	2	3	4	5	6
1. Pre-Resemblance	.77**	-.26	-.30	.05	.03
	<i>.66*</i>	-.22	-.38	<i>.07</i>	<i>-.20</i>
2. Post-Resemblance	-	-.09	-.05	-.08	-.01
		-.22	-.46	-.15	-.47
3. Pre-Paternal Stress		-	.88**	.85**	.84**
			<i>.74**</i>	<i>.65*</i>	<i>.57</i>
4. Post-Paternal Stress			-	.65*	.82**
				<i>.41</i>	<i>.78**</i>
5. Pre-Life Stress				-	.92**
					<i>.75**</i>
6. Post-Life Stress					-

Note: Experimental values are listed below the control values and are italicized. * = *p* < .05, ** = *p* < .01.

We followed the correlational analyses with a 2x2x3 Repeated Measures MANOVA. Simulation studies have shown that MANOVAs with small sample sizes remain robust with regards to Type I error, although they still suffer from low power (Tiger, Kosinski, Barnhard, and Kleinbaum, 1998). The multivariate results are presented in Table 2 below. There was a significant, moderately-sized difference between pre-post group scores as well as a significant, moderately-sized interaction between pre-post scores and group membership.

Table 2. Multivariate analysis of group versus pre-post intervention

Source	<i>df</i>	<i>F</i>	Partial η^2	<i>p</i>
Between subjects				
Experimental – Control Group	3	.57	.08	.64
Within subjects				
Pre-Post	20	3.21*	.33	.04
Pre-Post x Group	20	3.91*	.37	.02

Note: * = $p < .05$

We then examined the univariate analyses, as presented in Table 3 below.

Table 3. Univariate analysis of group versus pre-post intervention for ratings of resemblance, paternal stress, and life stress

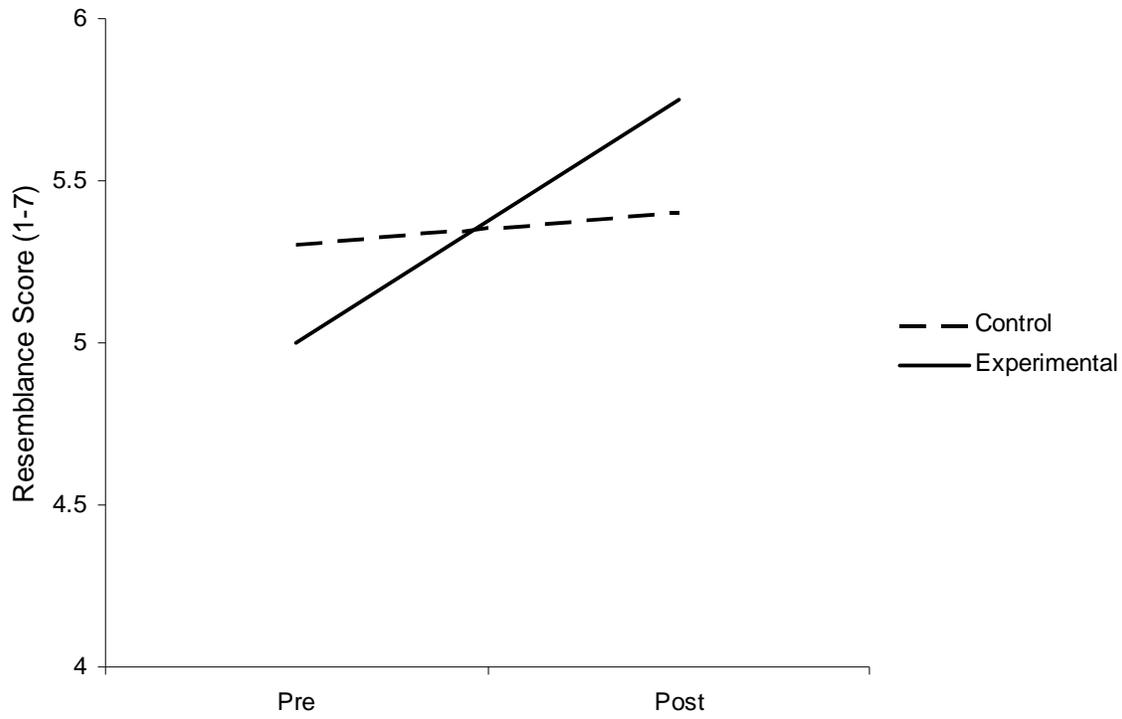
Source	<i>Measure</i>	<i>df</i>	<i>F</i>	Partial η^2	<i>p</i>
Pre-Post	Resemblance	1	4.78* ¹	.18	.02
	Paternal Stress	1	6.00*	.21	.02
	Life Stress	1	.09	.00	.92
Pre-Post x Group	Resemblance	1	3.06* ¹	.12	.05
	Paternal Stress	1	7.27*	.25	.01
	Life Stress	1	3.42	.13	.07
Error	Resemblance	22	(2.55)		
	Paternal Stress	22	(478.38)		
	Life Stress	22	(83.50)		

Note: Values enclosed in parentheses represent mean square errors. * = $p < .05$, *¹ = $p < .05$ one-tailed.

There were significant pre-post differences for resemblance and paternal stress and significant pre-post x group interactions for resemblance and paternal stress (although the former interaction was only significant one-tailed). The average ratings for resemblance are

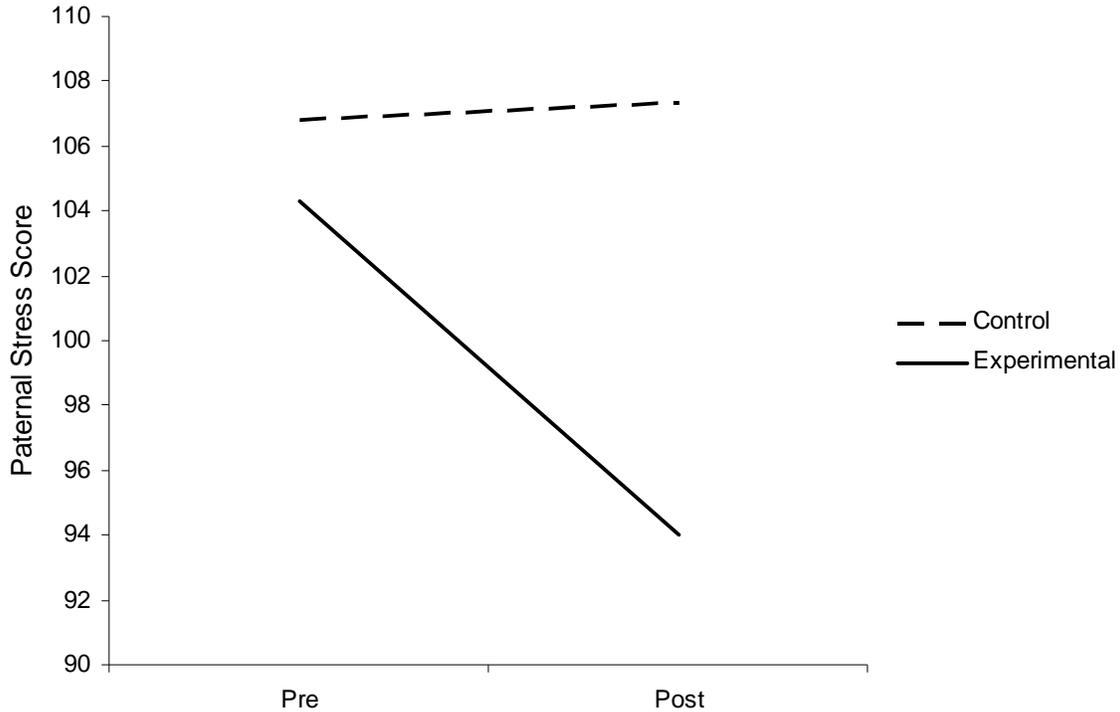
presented in Figure 1.

Figure 1. Pre-post resemblance ratings by group



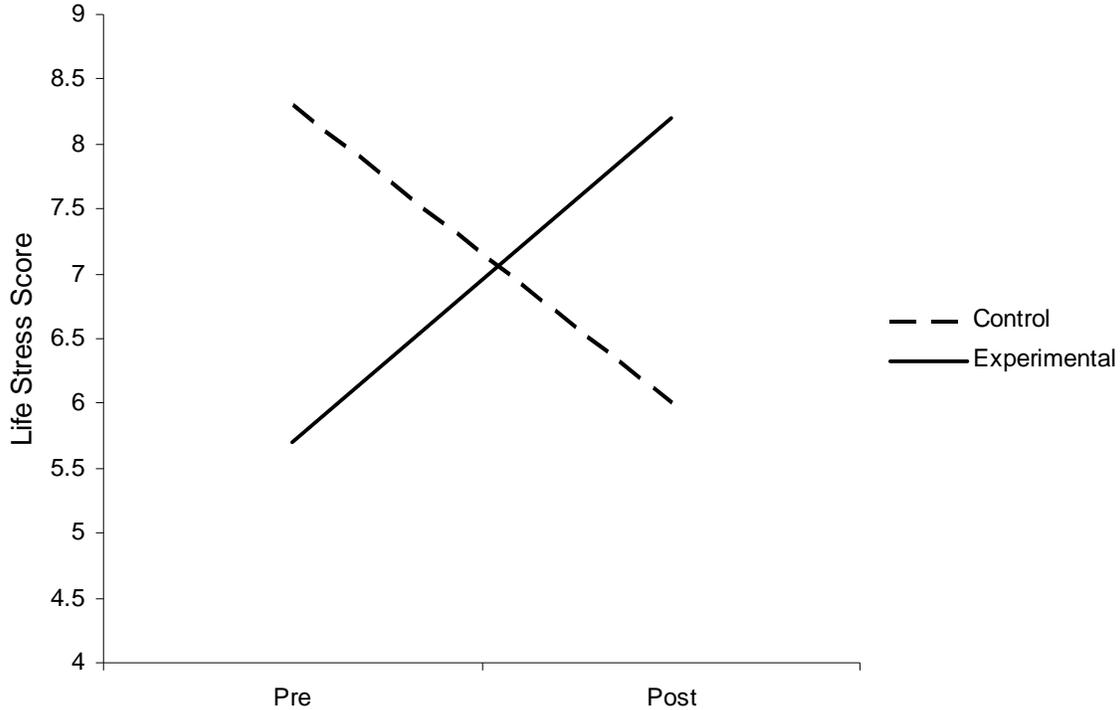
Along with the results of the MANOVA, this figure shows that there was a significant increase between pre-post scores that was significantly greater for the experimental ($M_{pre} = 5.00$, $SD = 1.27$; $M_{post} = 5.75$, $SD = 1.28$) group than for the control group ($M_{pre} = 5.33$, $SD = 1.15$; $M_{post} = 5.47$, $SD = 1.16$). The average ratings for paternal stress are presented in Figure 2 below.

Figure 2. Pre-post paternal stress ratings by group



Again, in combination with the MANOVA, this figure illustrates how paternal stress significantly decreased post-intervention, but only in the experimental condition ($M_{pre} = 104.33$, $SD = 14.79$; $M_{post} = 94.00$, $SD = 13.86$). The control condition experienced slightly increased paternal stress post-intervention ($M_{pre} = 106.75$, $SD = 19.11$; $M_{post} = 107.25$, $SD = 16.67$). The pre-post ratings for life stress are presented in Figure 3. They resemble a classic interaction pattern with the control group experience initially high life stress followed by a drop in life stress ($M_{pre} = 8.25$, $SD = 5.87$; $M_{post} = 6.00$, $SD = 6.03$), while the experimental group showed the opposite pattern ($M_{pre} = 5.67$, $SD = 7.61$; $M_{post} = 8.17$, $SD = 8.82$). However, while this interaction approached significance ($p = .07$; see Table 3), it was not actually statistically significant.

Figure 3. Pre-post life stress ratings by group



Discussion

We conducted a quasi-experimental study of father-infant resemblance that manipulated the level of paternal involvement by teaching fathers infant massage techniques. This study was designed to test two predictions: that father-infant resemblance would significantly predict father's ratings of parental stress and that increased paternal investment would increase paternal perceptions of father-infant resemblance.

Our first prediction, that father-infant resemblance would significantly negatively correlate with paternal stress, was not supported. An obvious limitation of the correlational analyses was the low statistical power available to them, which limited the study to reliably detecting significance only for correlations greater than .6 in effect size (Faul and Erdfelder, 1992). Nevertheless, these correlations still offer some descriptive value. It is worth noting that the correlations were both in the right direction (negative) and roughly of the same effect size as has been found in previous studies of both hypothetical and reported paternal investment (e.g., Alvergne et al., 2009; Heijkoop et al., 2009; Volk and Quinsey, 2002, 2007). The correlations were also larger (but not significant) in the experimental group, which is consistent with the hypothesis that there was a relationship between resemblance and paternal care.

Our second prediction, that increased paternal investment would correlate positively with paternal perceptions of father-infant resemblance, was supported. It appears that our experimental paternal intervention had the desired effect on the experimental group and not

the control group. Fathers who learned infant massage reported experiencing significant less paternal stress post-intervention than fathers in the control group. This is particularly worth noting given the opposite appeared to be true for their total life stress. That is, fathers in the experimental group appeared to experience coincidentally greater levels of general life stress during the post-study phase, yet they reported lower levels of paternal stress. Fathers in the control group showed a coincidental drop in their general life stress, but did not report a drop in their paternal stress levels. This interaction was technically not significant, but even interpreted in that light, it is clear that the drop in paternal stress experienced by the experimental group cannot be attributed to a simultaneous significant drop in their life stress, or the reverse for the control group.

Further to the second prediction, fathers in the experimental group reported a significant increase in their post-intervention ratings of resemblance to their infant, unlike fathers in the control group. This suggests that the relationship between resemblance and paternal care may be bidirectional. Not only might fathers use resemblance as a cue for guiding their paternal investment decisions, but paternal investment may alter perceptions of resemblance. There are several possible explanations of this, one or more of which may be true. First, as in many other mammals (Rosenblatt, 2002), mere exposure to infants may alter fathers' perceptions of those infants. Fathers in the experimental group may have simply exposed themselves to their infants' cues more than fathers in the control group, resulting in a perceptual change regarding their resemblance to their infant. A second possibility is that fathers who invest heavily in their infants may be experiencing a form of cognitive dissonance that motivates them to give their child high ratings of resemblance (Festinger, 1957). In other words, rather than admit that they are investing heavily in a child with low resemblance to them, these fathers change their perceptions of the infant to believe that they are investing heavily in an infant that resembles them. A third possibility is that fathers become more accurate in perceiving cues of resemblance when they have spent more time with the infant. Their greater familiarity with the infant might allow them to pick up resemblance cues that they previously were unaware of. Combined with either cognitive dissonance or a general bias towards cues that promote resemblance, this would account for the experimental group's increased resemblance ratings. A fourth possibility is that the fathers' investment in their infant created cues of resemblance, particularly behavioral cues. Fathers who are involved with their infants (i.e., have secure attachment) may be better at dyadic interactions than less-involved fathers (Feldman, 2003), which could in turn increase father's perceptions of behavioral resemblance.

From an adaptive perspective, one plausible explanation for our results is that exposure to infants triggers paternal perceptions of resemblance in order to promote facultative paternal investment. In this scenario, fathers who have chosen to care for an infant receive a perceptual boost to their efforts by the recruitment and promotion of the neural circuitry involved with resemblance and paternal care (Platek et al., 2005). For example, a father with an infant who does not resemble himself physically may decide for other reasons (e.g., social cues, behavior of mother, or other factors) that the infant is indeed his own and thus choose to invest in it. A mechanism that promoted resemblance as he cared for the infant could help promote and maintain his investment in that child, to the benefit of their shared genes. The obvious drawback of this explanation is that it leaves

fathers vulnerable to generating false-resemblance to unrelated infants. What would be needed is for this to be adaptive is for fathers to benefit more from creating increased resemblance with related offspring than they would potentially lose from creating increased resemblance with unrelated offspring. Given that recent estimates for paternity certainty in humans are generally quite high (Gray and Anderson, 2010), this is a plausible scenario, making flexible perceptions of resemblance a plausible adaptation in fathers, particularly in circumstances where fathers already have confidence that the child is theirs (e.g., the fathers in this study).

The alternative is that the increase in perceptions of paternal resemblance is a non-adaptive by-product of other adaptations, including (but not limited to): familiarity, infant mimicry, and/or cognitive dissonance. Of course, one or more of these other adaptations could also be part of the adaptive response outlined above. At this stage, we simply lack the evidence for determining whether this perceptual shift is adaptive or not. For example, would fathers who have low paternity certainty also change their perceptions of resemblance as a function of paternal investment provided? Is this effect stronger at a particular age of infant? Is this shift influenced by other cues of resemblance (e.g., maternal ascriptions of paternal resemblance)? What kinds of paternal care can influence perceptions of resemblance? The answers to these questions, and others, should help determine whether the perceptual shift observed in this study is adaptive or simply a by-product of other adaptations.

Limitations

As has already been acknowledged, the current study has relatively low statistical power due to its low sample size. This was of particular concern for the significance testing of the correlations. Fortunately, synchrony between the correlations presented in the study and the correlations found in the literature offer some confidence in the descriptive nature of the current correlations. The experimental, repeated-measures design of the study offers further confidence about the results, particularly for the MANOVA. While it would have been ideal to recruit more fathers, it should be noted that fathers of infants are a difficult group to recruit in general (Mitchell et al., 2007), while they are particularly challenging to recruit for a lengthy out-of-home commitment such as the current study (Mackereth, 2003; Matthey and Barnett, 1999). The relatively large compensation we awarded to our father participants was a reflection of this challenge.

Another limitation is that we did not have a direct measure of parental care. Instead, we relied on paternal self-reports of stress levels. While these are a valid indication of numerous parent-child outcomes (Abidin, 1992, 1995), it would have been ideal to also include actual observations of father-infant interactions in order to confirm that the experimental intervention was successful, as well as to provide an alternate measure of paternal investment.

Conclusions

Father-child resemblance is increasingly attracting attention from researchers interested in studying paternal investment. The current study sought to determine whether a quasi-experimental infant massage intervention would increase father's perceptions of

resemblance. Although we did not find significant correlations between paternal investment and resemblance, we did find that fathers who participated in the infant massage intervention reported significantly larger post-study ratings of resemblance and lower ratings of paternal stress. This suggests that the relationship between father-child resemblance and paternal investment may be bidirectional. This adds a further layer of complexity to our understanding of father-infant interactions and it suggests that fathers' responses to infant cues of resemblance may be more flexible to environmental cues than previously thought.

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