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Effects of parenting quality on adolescents' personality resemblance to their parents. The TRAILS study

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ABSTRACT

This study considers the development of resemblance between 741 adolescents and their biological parents, across six NEO-PI-R personality traits known to be important in psychological problems: anger-hostility, impulsiveness, vulnerability, assertiveness, excitement-seeking, and self-discipline. We modelled the association between perceived parental warmth and rejection at age eleven and personality resemblance to parents at about age sixteen. Parenting experienced during early adolescence was related to the degree and direction in which adolescents resembled their parents five years later in life. Rejection, especially from fathers, significantly predicted a smaller resemblance to both the parents. Girls were more strongly affected by parental quality than boys, and there was some indication that adolescents responded in opposite ways to parenting from mothers and fathers. This study is a first step in uncovering the complex interplay between parenting, gender, and the current generation's ability to develop personality traits independent from the previous generation.

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Introduction

That parental characteristics are transmitted to offspring is one of the underlying tenants of evolutionary biology, and has been thoroughly documented over the past century (Fisher, 1930; Huxley, 1942). The mechanisms underlying this transmission, however, still constitute an area of much discussion in both evolutionary biology and developmental psychology. Consequently, it is still largely unclear to what extent, or through which pathways, parental forces during ontogeny affect behaviour during adulthood.

While there is widespread agreement that genetics are important carriers of information from one generation to the next, it has become increasingly clear that the Mendelian-genetic model of inheritance is incomplete and that genes are not the exclusive agent of heredity (Bonduriansky & Day, 2009; Mameli, 2004; Mesoudi et al., 2013). Environmental factors can impose transgenerational effects and generate heritable variation for a broad array of traits (Bonduriansky & Day, 2009). As a result of this new understanding, evolutionary biologists are now reconsidering concepts of inheritance and

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intergenerational transmission (Mameli, 2004), and have formulated an Extended Evolutionary Synthesis (EES), which moves away from an overly gene-centric theory of evolution (Laland et al., 2015; Mesoudi et al., 2013; Pigliucci, 2009). This has important implications for the way we think about parent–child transmission of behavioural traits. Especially given advances in epigenetics (Bird, 2007), the distinction between genes and environment in the study of generational effects is becoming increasingly blurry, and concepts such as cultural evolution and social learning are becoming inseparable with evolutionary theory (Danchin & Wagner, 2010).

The process through which, genetically or otherwise, an earlier generation influences parenting attitudes and behaviour of the next generation (Van Ijzendoorn, 1992), is most commonly referred to as intergenerational transmission. This by necessity results in parent–offspring resemblance (Mameli, 2004). Resemblance has been studied extensively in many aspects of human functioning. The focus has mostly been on physical traits such as facial resemblance (Alvergne, Faurie, & Raymond, 2007; Brédart & French, 1999; Conrad, 1931; Oda, Matsumoto-Oda, & Kurashima, 2002), intelligence (DeFries et al., 1976, 1979; Honzik, 1957, 1963; Jones, 1928) and links between resemblance and parental investment (Alvergne, Faurie, & Raymond, 2009; Apicella & Marlowe, 2004; Chang, Lu, Lee, Li, & Sui, 2010; Dolinska, 2013; Heijkoop, Semon Dubas, & van Aken, 2009; van Tuijl, Branje, Semon Dubas, Vermulst, & Van Aken, 2005). Many of those studies reported conflicting results: some suggested mothers respond to personality resemblance while fathers respond more to physical resemblance (Heijkoop et al., 2009), some found differences between genders (Feather, 1978; Sward & Friedman, 1935) or personality aspects (Hill & Hill, 1973; Loehlin, Willerman, & Horn, 1985), while others found only small heritable components to parent–child resemblance, and no differences in this between personality traits or genders (Ahern, Johnson, Wilson, McClearn, & Vandenberg, 1982; Troll, Neugarten, & Kraines, 1969). More recently, studies have analysed the extent to which emotional and behavioural problems are carried from parents to offspring (Gagne, Spann, & Prater, 2013), especially in dietary habits (Raynor et al., 2011; Wang, Beydoun, Li, Liu, & Moreno, 2011), emotional disorders (Bornovalova, Hicks, Iacono, & McGue, 2010) and abuse patterns (Peled, 2011). From adoptive and twin studies, it has become clear that parent–offspring resemblance is highly variable across ontogeny (Caspi, Roberts, & Shiner, 2005; Plomin, Fulker, Corley, & DeFries, 1997; Saudino, 2009) as well as highly trait dependent (Carey & Rice, 1983). Within the area of parent–child resemblance, studies into parent–offspring resemblance in personality are underrepresented (Eley et al., 2015), and resemblance has rarely been linked to underlying transmission mechanisms (Silberg & Eaves, 2004) other than genetics (Bouchard & Loehlin, 2001; Goldsmith, 1983).

Yet, as personality influences the way individuals deal with opposition and challenges in life (Sentse, Ormel, Veenstra, Verhulst, & Oldehinkel, 2011), a better understanding of the way personality traits are transmitted from one generation to the next is called for (Bonduriansky, Crean, and Day (2012)). The study of parental effects on parent–child resemblance in behavioural traits and personality enables deeper understanding of the dynamics of development, and provides an opportunity to explicitly integrate development and evolution (Badyaev & Uller, 2009). Especially in the light of the many challenges associated with living in modern society (Bentley & O'Brien, 2015), the development of personality resemblance with the previous generation is relevant to comprehending behavioural responses of a generation living in a world that is changing faster than in humanity's evolutionary past.

Parents constitute important environmental influences on the children they raise. They provide physical resources and a family environment, as well as the affection children need to develop healthily (Gerhardt, 2006; McFarlane et al., 2005). They are targets for imprinting (Hoffman & Ratner, 1973), role models (Euler, Hoier, & Rohde, 2001), and teachers as adolescents develop their thoughts, emotions and behaviours. Parental trauma or stress affects physical, behavioural and cognitive outcomes of offspring (Bowers & Yehuda, 2016). Although most parents try to give their children opportunities that they themselves missed, a variety of biological mechanisms in child development push towards resemblance across multiple traits. Through many conscious and unconscious processes, children are influenced by their primary caregivers on a physical (Alvergne et al., 2007), emotional (Distel et al., 2010) and behavioural (Bowles, Gintis, & Groves, 2008) level. Genetic factors (Goldsmith, 1983; Saudino, 2005), maternal effects (Broadhurst, 1961), imprinting (Bolhuis & Honey, 1998) and social learning (Dohmen, Falk, Huffman, & Sunde, 2012; Roulin, Dreiss, & Kölliker, 2010) all influence a young individual's behavioural development towards similarity with the previous generation.

From an evolutionary perspective, children who resemble the previous generation in behaviour have several advantages. Understanding these advantages provides a clearer picture of the developmental processes shaping adolescent personality. First, under stable conditions, young individuals have an advantage in responding to their environment by mimicking the behaviour that allowed their parents to survive and reproduce. To experiment with new responses based on environmental variables can be both risky and costly (DeWitt, Sih, & Wilson, 1998; Steiner & Van Buskirk, 2008). Second, children who resemble their parents can often expect a higher quality of parental care (Alvergne et al., 2009; Apicella & Marlowe, 2004; Platek, Burch, Panyavin, Wasserman, & Gallup Jr., 2002). The link between resemblance to fathers and increased paternal investment has been repeatedly evidenced (Alvergne, Faurie, & Raymond, 2010; Apicella & Marlowe, 2004; Dolinska, 2013), and surprisingly, mothers have been found to provide care dependent on resemblance as well (Dolinska, 2013; Heijkoop et al., 2009). There is some indication that fathers may base parental investment more on physical resemblance, whereas mothers may base it more on personality resemblance (Heijkoop et al., 2009). These factors suggest that the relative advantage of resemblance to parents is dependent on an interplay of multiple processes, and is affected by the family circumstances during childhood.

Parental care is one of the most important influences on development, and one of the most sought-after resources for offspring. Adequate parental presence and provisioning during the formative years is essential in ensuring offspring's survival and success in life (Rao et al., 2010). Evolutionary theory predicts that in a species like ours, where maternity is

certain but paternity is not, developmental mechanisms have developed to secure parental investment and promote closer resemblance regardless of a genetic connection to the parents. However, the direction in which parental care affects parent–child resemblance is difficult to predict, as there are multiple evolutionary forces working on the underlying mechanisms that drive the development of behaviour. The costs and gains of mechanisms driving parent–child resemblance depend on both the stability and the quality of the environment (Auld, Agrawal, & Relyea, 2010; Bradshaw & Holzapfel, 2008; Chown et al., 2010; Fuller et al., 2010; Meyers & Bull, 2002; Meylan, Miles, & Clobert, 2012), and as such positive and negative influences from the environment will have additive effects, and under certain conditions trigger opposite responses within developmental mechanisms. When offspring experience a positive environment from their parents, they can be expected to mimic the example of their parents more strongly and increase resemblance to the previous generation in order to be equally successful themselves. However, offspring who feel safe in a warm and positive environment can equally be expected to experience the security and freedom necessary to explore their own identity separate from that of their parents, which would decrease resemblance. Similarly, when offspring experience a negative environment from their parents, they can be expected to disassociate from their parents' behaviour, but could also increase resemblance in order to gain better parental care, if they are in a situation where obtaining better parental care outweighs avoiding the acquisition of undesirable traits. It is likely that processes generating both positive and negative resemblance occur within each individual and that the resulting degree of resemblance is dependent on the trade-off between the need to obtain additional parental care, the need to pattern after a positive role model, and the need to develop a personality that is well-adjusted to developmental circumstances.

The relationship between parental investment and parent–offspring resemblance is complicated further in that it is not necessarily one-directional; high resemblance may both influence and be influenced by parenting. In addition, parental personality affects childrearing variables (Kendal, Coolen, van Bergen, & Laland, 2005; Losoya, Callor, Rowe, & Hill, 1997), and the effects parents have on their offspring depend on the personality traits of the offspring (Kiff, Lengua, & Bush, 2011). Furthermore, there is indication both from theory (Feather, 1978; Geary, 2000; Lessels, 1998) and empirical work (Alvergne et al., 2007) that the relationship between parental care and parent–offspring resemblance is affected by both parent and offspring gender. While intergenerational personality resemblance has been poorly studied in humans and to our knowledge never in relation to parenting quality, in mice, the influence of mother's parenting style and resemblance was found to be greater on boys than on girls (Calatayud & Belzung, 2001). In humans, parental effort has been shown to differ between mothers and fathers (Quinlan, 2007), and in some cases father's but not mother's behaviour may be predictive of the corresponding behaviour in girls but not boys (Kim, Capaldi, Pears, Kerr, & Owen, 2009).

It is clear that there is yet much work to be done before we understand the relationships between parenting quality, maternal and paternal effects, and subsequent offspring personality resemblance to their parents. This study takes an evolutionary and developmental approach to intergenerational transmission of personality and aims to be an exploratory step towards understanding the processes leading to intergenerational personality resemblance. It provides to our knowledge a first test between parenting quality and the subsequent personality resemblance between adolescents and their parents. To this end, the study is centred around the degree of parent–child resemblance in personality traits, rather than on comparing personality values for individual traits. Specifically, we investigated the influence of positive and negative parental care on the degree of personality resemblance between adolescents and their biological parents – both fathers and mothers. For this, we used a large population-based longitudinal survey (Oldehinkel et al., 2015) and six personality traits with key relevance to adolescent health and well-being (Coasta & McCrae, 1992) to ask the following questions: (1) To what extent do adolescents resemble the personality traits of their parents, and (2) Can this resemblance be predicted by perceived parental warmth and rejection in the formative period leading up to adolescence? In this, we expected rejection to show a stronger effect than warmth, as rejection (rather than warmth) has been shown to be more important in adolescents' emotion regulation (Sarıtaş, Grusec, & Gençöz, 2013) and to have stronger effects on coping styles (Meesters & Muris, 2004).

For both research questions, we examined gender differences by comparing boys and girls, as well as resemblance with mothers and fathers, respectively. A difference between maternal and paternal resemblance, as well as the effects of maternal and paternal care is expected based on evolutionary theories relating to parental care and investment. Given the often conflicting results presented in the literature, it is difficult to predict in which manner maternal and paternal effects are likely to differ. Because fathers, as opposed to mothers, depend on resemblance to determine paternity (Heijkoop et al., 2009) and as such are more likely to respond to resemblance with higher quality parenting (Alvergne et al., 2009; Apicella & Marlowe, 2004; Platek et al., 2002), we hypothesised that paternal warmth and rejection have a stronger effect on parent–child personality resemblance than maternal warmth and rejection. Overall, we expected girls to resemble their parents more (Feather, 1978; Sullivan, Bortorff, & Reid, 2011), and girls' personality to be influenced by parenting more strongly (Seginer, Vermulst, & Shoyer, 2004) than boys.

Methods

Sample

This study is part of the TRacking Adolescents' Individual Lives Survey (TRAILS), an ongoing prospective cohort study based on a sample representative of the Dutch population, investigating the emotional, social and mental development from

preadolescence into adulthood. Parental informed consent was obtained after the procedures had been fully explained. Detailed information about sample selection and analysis of non-response bias has been reported elsewhere (de Winter et al., 2005). The four assessment waves completed so far ran from March 2001 to July 2002 (T1), September 2003 to December 2004 (T2), September 2005 to December 2007 (T3), and October 2008 to September 2010 (T4). At T1, 2230 children (response rate 76.0%; mean age = 11.1, SD = 0.6) enrolled in the study of whom 2149 (96.4%; mean age 13.6, SD = 0.5) participated at T2, 1816 (81.4%; mean age 16.3, SD = 0.7) at T3, and 1881 (84.3%; mean age 19.1, SD = 0.6) at T4. For more details on study design, data collecting and sampling procedures, see de Winter et al. (2005), Huisman et al. (2008).

In the present study, we used a subsample consisting of 741 adolescents who had filled out a personality questionnaire at T3 along with both their biological mother (mean age 46.8, SD = 4.1) and their (self-reported) biological father (mean age 49.0, SD = 4.5), from here on referred to as mother and father. Only adolescents whose biological parents were both part of the family at T1 were selected, which created a relatively homogeneous group with respect to parental influence during childhood. All adolescents within our subsample who participated at T1 (mean age 11.1, SD = 0.6), also participated at T3 (mean age 16.2, SD = 0.7) along with their mothers (mean age 46.8, SD = 4.1) and fathers (mean age 49.0, SD = 4.5). These selection criteria may have led to an overrepresentation of specific parenting styles. The Socio-Economic Status was low for 11.9% of the families in this subsample, in the middle range for 47.6%, and high for 40.5%. In the total sample, these percentages were 25%, 50%, and 25%, respectively. The adolescents had on average 1.6 siblings. Within their family, 42.5% of the adolescents were the oldest child, 17.7% were a middle child and 35.5% were the youngest child. Only 4.3% of this subsample were only child.

Personality

To assess adolescent and parent personality, we used six facets of the Revised Neuroticism-Extroversion-Openness Personality-Inventory (NEO-PI-R), measured at about age sixteen (T3), when personality is reasonably stable (Costa Jr. & McCrae, 1994). The NEO-PI-R consists of thirty facets covering all dimensions of the Five-Factor Model of personality (Costa & McCrae, 1992), of which six were included in the TRAILS questionnaires based on their relevance to emotional and mental functioning. Facets from NEO-PI-R have been extensively studied, and heritabilities have been reported elsewhere (Bouchard & Loehlin, 2001). From the broad domain of neuroticism, we used the facets anger-hostility (Cronbach's $\alpha = .71$), impulsiveness ($\alpha = .51$), and vulnerability ($\alpha = .77$). Anger-hostility relates to the tendency to experience anger and frustration, impulsiveness to a low inhibition control and a strong activating response to cravings and urges, and vulnerability to susceptibility to stress. From the broad domain of extraversion, we used the facets assertiveness ($\alpha = .75$) and excitement-seeking ($\alpha = .58$). Assertiveness reflects social dominance; excitement-seeking the need for high-intensity stimulation. From the broad domain of conscientiousness, we used the facet self-discipline ($\alpha = .76$), which measures the capacity to begin and complete tasks despite distractions. Each facet had eight items, each with scores ranging from 1 (fully agree) to 5 (fully disagree). The scales scores represent mean item scores and hence also have a (theoretical) range from 1 to 5.

Parent–child resemblance is traditionally studied in evolutionary biology through interfamily correlations (Bayley, 1954; Jones, 1928) and regressions (Brown, Phillips, & Shine, 2014; Kralj-Fišer & Schneider, 2012; Pruitt & Goodnight, 2014; Schuett, Dall, Wilson, & Royle, 2013). For this, mid-parent scores may be used (Bayley, 1954; Drent, van Oers, & van Noordwijk, 2003; Jones, 1928; Smith & Dhondt, 1980; Woodfield & Caradus, 1990), calculated here as the mean of the maternal and paternal score. Mid-parent scores provide a buffer for the “double dose” of experience offspring receive from both parents (Dunbar, 2010): an adolescent who receives high amounts of warmth from one parent but rejection from the other, is experiencing a different kind of parental investment than one who receives rejection from both parents. To create a complete picture, mid-parent resemblance scores are presented alongside maternal and paternal resemblance scores. For each personality facet, parent–child difference was operationalized as the absolute difference between the (mean) parents' and the adolescent's score. The use of such scores allowed us to investigate developmental influences on degree of resemblance, regardless of direction of that resemblance (i.e. measure of alike-ness). Differences in the six facets were combined into a single measure of personality difference by summing the facet-specific absolute differences across all six personality traits. Please note that high difference scores represent a low degree of resemblance.

Perceived parenting

Parenting was assessed by a short version of the Egna Minnen Beträffande Uppfostran for Children (EMBU-C) developed by Markus, Lindhout, Boer, Hoogendijk, and Arrindell (2003), which queries maternal and paternal parenting behaviours as perceived by the child. Perceived parenting was preferred over parental assessments of parenting, as the child's perception is likely more indicative of the child's adaptive response than the parent's perception (Wingfield & Mukai, 2009). While offspring's perceptions of parental acceptance and rejection may be influenced in part by their personality traits (Khaleque & Rohner, 2012) and are inherently subjective – for example, anxious or vulnerable adolescents may score more negatively than assertive adolescents with regard to the same parental behaviour – such “artefacts” may in fact be meaningful to the adaptive response: This notion is described, for instance, in the literature on different susceptibility to the environment (Boyce & Ellis, 2005; Ellis & Boyce, 2008; Herbert, 2011).

We used the scales Rejection (12 items, Cronbach's $\alpha = .84$ for fathers and $.83$ for mothers) and Emotional Warmth (18 items, $\alpha = .91$ for both fathers and mothers), which are perceived similarly across cultures (Deković et al., 2006). Rejection is characterised by hostility, punishment (physical or otherwise), derogation, and blaming of subject. Emotional warmth is

characterised by giving special attention, praising for approved behaviour, unconditional love, and being supportive and affectionately demonstrative.

Statistical analyses

The data were analysed using SPSS Statistics software, version 20. A two-sided p -value $< .05$ was considered statistically significant. We used paired-sample t -tests to compare mother–child and father–child differences, and independent t -tests to examine differences between boys and girls.

Three linear regression models were used to estimate the effects of perceived parental warmth and rejection on personality differences with parents in general, and with fathers and mothers separately. In the first model, we estimated the effect of parental warmth and rejection on parent–child differences. In the second model, we separated maternal and paternal parenting. In the third model, we added an interaction between parenting and adolescent gender. In this, girls were coded as 0, boys as 1. Post-hoc, we repeated these models for all individual personality facets separately. In all models, we corrected for age, gender, and socio-economic status of the family.

As parents' personality traits were correlated with parent–child differences (i.e. adolescents differed more from parents with extreme scores than from parents with average scores), each model also corrected for the corresponding personality score(s) of the parent(s). Warmth, rejection and the covariates were all entered into the models simultaneously.

Results

Descriptive statistics

Within the 741 families studied, fathers on average scored higher on assertiveness, excitement-seeking and self-discipline than mothers, while mothers scored higher on vulnerability. Boys scored higher on excitement-seeking than girls; girls scored higher on impulsiveness, vulnerability and self-discipline (Table 1). Both girls ($t = 9.03$, $p < .01$) and boys ($t = 10.05$, $p < .01$) perceived more warmth from mothers than from fathers. Neither girls ($t = -1.37$, $p = .17$) nor boys ($t = -1.85$, $p = .07$) perceived a significant difference between mothers and fathers in rejection. Girls overall perceived more warmth ($t = 3.19$, $p = .05$) and less rejection ($t = -3.23$, $p < .01$) from both their parents than boys. Perceived warmth and rejection correlated significantly with each other for both parents (mothers: $r = -.31$, $p < .01$, fathers: $r = -.39$, $p < .01$), and mothers' and fathers' scores were highly correlated for both parenting variables (warmth: $r = .89$, $p < .01$, rejection: $r = .76$, $p < .01$).

Parent–adolescent resemblance

Our first question was how the adolescents in this sample resembled their parents in personality traits, while taking into account parental and adolescent gender differences. For all personality facets, adolescents differed significantly from their parents ($t = 2.02 - t = 37.82$, $p < .01$), although it should be noted that the mean overall differences were relatively small. The difference scores presented in Table 2a and the correlations presented in Table 2b show differences ranged from 0.43 to 1.03 on a scale from 1 to 5. Parent–child correlations were significant for all personality facets, yet the correlations themselves were relatively weak ($r = 0.13-0.19$). We found no significant difference between adolescents' difference from their fathers and their mothers ($t = 1.86$, $p = .06$). Adolescents' differences from mothers correlated moderately with the differences from fathers ($r = .33$, $p = .01$). Girls differed from their parents somewhat less than boys ($t = -2.14$, $p = .03$).

Adolescents differed the least from their parents in impulsiveness and the most in excitement-seeking. Girls differed more from fathers than from mothers in vulnerability, and less from fathers in excitement-seeking. Boys differed more from fathers than from mothers in self-discipline, and, compared to girls, less from fathers in excitement-seeking (Table 2a). Compared to boys, girls differed less from both fathers ($t = -4.14$, $p < .01$) and mothers ($t = -3.54$, $p < .01$) in excitement-seeking, and from fathers ($p < .01$) but not mothers ($p = .06$) in self-discipline.

Parental personality traits correlated significantly with parent–child differences, for both fathers and mothers. That is, adolescents showed more difference with parents who scored extreme values on personality traits than with parents who scored average (Table 2c). Apart from for excitement-seeking, these correlations were relatively weak, but still could lead to

Table 1
Scores (mean, SD) for six key personality traits in the adolescents and their biological parents.

	Parents	Adolescents	Mothers	Fathers	Girls	Boys
Anger-hostility	2.4 (0.3)	2.5 (0.5)	2.4 (0.5)	2.4 (0.5)	2.4 (0.5)	2.5 (0.5)
Impulsiveness	2.8 (0.4)	2.9 (0.5)	2.8 (0.5)	2.8 (0.5)	2.9 (0.5)*	2.8 (0.4)
Vulnerability	2.3 (0.3)	2.4 (0.5)	2.3 (0.4)*	2.2 (0.5)	2.5 (0.5)*	2.3 (0.5)
Assertiveness	2.9 (0.4)	3.0 (0.6)	2.8 (0.6)*	3.1 (0.6)	3.0 (0.6)	3.0 (0.5)
Excitement-seeking	2.8 (0.3)	3.5 (0.5)	2.6 (0.5)*	2.8 (0.5)	3.4 (0.5)*	3.6 (0.5)
Self-discipline	3.7 (0.4)	3.3 (0.6)	3.6 (0.4)*	3.7 (0.5)	3.4 (0.6)*	3.3 (0.6)

Note: Based on self-reported NEO-PI-R scores, range 0–5. *: Significant gender difference ($\alpha < 0.05$), paired (parents) and unpaired (adolescents) t -tests. N (parents) = 741, N (girls) = 377, N (boys) = 364.

Table 2a

Absolute parent–child differences (mean, SD) in personality scores.

	Girls		Boys	
	Mothers	Fathers	Mothers	Fathers
Anger–hostility	0.52 (0.39)	0.55 (0.48)	0.53 (0.41)	0.53 (0.38)
Impulsiveness	0.49 (0.39)	0.49 (0.36)	0.49 (0.37)	0.48 (0.39)
Vulnerability	0.51 (0.41)*	0.56 (0.42)	0.45 (0.37)	0.50 (0.40)
Assertiveness	0.64 (0.48)	0.59 (0.46)	0.63 (0.48)	0.59 (0.48)
Excitement–seeking	0.88 (0.55)*	0.71 (0.51)	1.03 (0.60)*	0.86 (0.53)
Self-discipline	0.55 (0.45)	0.58 (0.45)	0.62 (0.46)*	0.69 (0.49)
Sum	3.59 (1.36)	3.47 (1.37)	3.76 (1.45)	3.66 (1.38)

Note: Based on self-reported NEO-PI-R scores, range 0–5. *: Significant difference between difference with mothers and fathers ($\alpha < 0.05$), paired t-tests. The sum score was calculated as the sum of the trait-specific differences. High difference corresponds to low resemblance. N (parents) = 741, N (girls) = 377, N (boys) = 364.

Table 2b

Correlations between adolescent and parental personality scores.

	Adolescents	Girls		Boys	
	Parents	Mothers	Fathers	Mothers	Fathers
Anger–hostility	0.16	0.14	0.05	0.09	0.19
Impulsiveness	0.13	0.10	0.13	0.11	0.05
Vulnerability	0.18	0.12	0.18	0.21	0.03
Assertiveness	0.19	0.15	0.21	0.15	0.05
Excitement–seeking	0.18	0.15	0.25	0.16	0.22
Self-discipline	0.17	0.16	0.22	0.15	–0.01

Note: N (parents) = 741, N (girls) = 377, N(boys) = 364. Bold values are significant at the $\alpha = 0.05$ level.

Table 2c

Correlations between parental personality scores and parent–child personality differences.

	Parent–child personality differences				
	Adolescents	Girls		Boys	
	Parents	Mothers	Fathers	Mothers	Fathers
Parental scores					
Anger–hostility	–0.02	–0.10	0.02	–0.06	0.19
Impulsiveness	–0.11	–0.10	–0.09	–0.09	0.01
Vulnerability	–0.09	–0.16	–0.12	0.19	–0.05
Assertiveness	–0.10	–0.18	0.08	0.35	–0.08
Excitement–seeking	–0.45	–0.58	–0.55	–0.66	–0.56
Self-discipline	0.17	0.17	0.05	–0.31	0.22

Note: High difference corresponds to low resemblance. N (parents) = 741, N (girls) = 377, N(boys) = 364. Bold values are significant at the $\alpha = 0.05$ level.

spurious associations with parent–child differences and were therefore controlled for in the subsequent models by including the relevant parental personality scores.

Parenting and overall parent–child resemblance

Our second question was to what extent perceived parenting at about age eleven was associated with adolescents' personality resemblance to their parents at about age sixteen. In general, parental warmth and parental rejection were both positively associated with father–child personality differences, while parental rejection was also associated with the measure of parent–child difference based on both parents' personality (Table 3). In the models that distinguished between maternal and paternal parenting, we found no effects of maternal parenting on parent–child differences, but paternal rejection was associated with a greater parent–child difference. In the third model analysing differences between boys and girls, we still found no effects of maternal parenting on resemblance, and paternal rejection once again was associated with a smaller resemblance to parents – both mothers and fathers. We found no significant interactions with adolescent gender for any of the effects, although the results suggest that for boys, paternal rejection is associated with a greater resemblance to mothers ($p = .08$) and fathers ($p = .07$) than for girls. Table 3 presents the results of multiple tests. Out of the 42 effects tested, seven (i.e., 17%) were significant ($p < .05$). In case of no associations in the population, two significant findings at the most would be expected. Parenting and parent–child resemblance in specific personality facets.

Post-hoc, we analysed the effects of warmth and rejection on resemblance in individual personality facets, in order to better understand the factors contributing to the overall resemblance measure. Parallel analyses were conducted for boys and

Table 3

Linear regression of parent–child personality differences at adolescence on preadolescent perceived parental warmth and rejection.

Model	Predictor	Adolescents' overall personality difference with					
		Parents		Mothers		Fathers	
		Beta	p	Beta	p	Beta	p
1	Parental warmth	0.07	.09	0.06	.14	0.08	.04
	Parental rejection	0.11	.01	0.04	.26	0.13	.01
2	Maternal warmth	0.06	.51	0.09	.30	0.03	.75
	Maternal rejection	−0.02	.72	−0.08	.19	0.04	.50
	Paternal warmth	0.01	.87	−0.03	.77	0.06	.51
	Paternal rejection	0.14	.03	0.12	.06	0.09	.13
3	Maternal warmth	0.04	.73	0.14	.25	−0.09	.47
	Maternal rejection	−0.12	.19	−0.16	.07	−0.09	.35
	Maternal warmth * gender	0.04	.73	−0.64	.31	0.52	.41
	Maternal rejection * gender	0.51	.12	0.46	.15	0.62	.06
	Paternal warmth	−0.02	.78	−0.07	.57	0.10	.42
	Paternal rejection	0.23	.02	0.23	.02	0.22	.02
	Paternal warmth * gender	0.49	.37	0.55	.31	0.01	.99
	Paternal rejection * gender	−0.46	.13	−0.53	.08	−0.56	.07

Note: Bold values are significant at $\alpha = 0.05$ level. All predictor variables were entered into the models simultaneously. All models were corrected for gender, age, family social status, and relevant parental personality scores; girls were coded as 0, boys as 1. N = 741.

girls; gender interaction effects were calculated separately (indicated with * in Table 4). We found most associations for assertiveness, followed by vulnerability and excitement-seeking. Parenting was not associated with parent–child differences in self-discipline in any of the models. In four out of six personality traits, there were significant differences between boys and girls. In those cases, boys and girls often responded in opposite ways to both parental warmth and rejection. Although this trend seems consistent, some of these significant associations could well be chance findings, considering the number of statistical tests performed. In general, 12 out of the 96 effects presented in Table 3 were significant (12%), while at most 5 significant findings would be expected in case of no associations at the population level.

Discussion

Personality resemblance between adolescents and parents

Most studies on personality resemblance only report comparative findings (e.g., children resemble biological parents more than adoptive parents (Scarr, Webber, Weinberg, & Wittig, 1981)), which makes it difficult to relate our findings quantitatively to the existing literature. Our study indicated a relatively close resemblance of adolescents to their parents, despite age differences between both groups and the fact that today's adolescents grow up in socially and culturally very different worlds than their parents did. High resemblance scores (in this study indicated by low difference scores) may partially be due to assortative mating and to shared environment effects: people belonging to the same family may have shared perceptions about themselves as a family, and similar social ideas on how to answer personality questions.

It is interesting to notice that the difference scores across the six personality facets were fairly consistent, around 0.5 points difference on a 0–5 scale, even though they spanned three different domains from the big-five personality questionnaire. The only exception was found in the trait excitement-seeking, where adolescents scored much higher than their parents, which is not a surprise and can likely be attributed to the age difference: increased levels of excitement-seeking or sensation-seeking have been observed to occur in young adolescents (age 10–15) compared to adults (Machin & Sankey, 2008; Nederhof, Creemers, Huizink, Ormel, & Oldehinkel, 2011; Steinberg et al., 2008). Consistency across facets implies that the forces shaping parent–child personality resemblance do not work on a trait-by-trait basis, but rather across contexts. A similar conclusion can be drawn from our finding that adolescents who resembled one parent, generally also resembled the other. However, adolescents did resemble one parent more than the other when considering specific personality traits (such as vulnerability or excitement-seeking), which suggests that the development of personality can be influenced by factors such as gender and parental traits.

Effects of parental warmth and rejection on resemblance

Perceived rejection, especially from fathers, at about age eleven was consistently predictive of less personality resemblance with parents. The significance of parental rejection is congruent with a study relating parenting behaviours to coping styles (Meesters & Muris, 2004), and may be partially explained by the aforementioned importance of rejection (rather than warmth) in adolescents' emotion regulation (Saritaş et al., 2013). A reason for the stronger influence of paternal than maternal rejection may be that paternal rejection is often based on the children's behaviour and actions, and as such easier to moderate by meeting father's standards (i.e. increase the resemblance), while maternal rejection is often based on other factors than

Table 4

Linear regression models showing the effects of parental warmth and rejection on parent–child personality differences in specific personality facets.

Personality trait			Absolute personality difference			
			Mothers		Fathers	
			Girls	Boys	Girls	Boys
Anger-hostility	Maternal	Warmth	0.23	0.20	0.01	0.11
		Rejection	0.01	–0.08	–0.03	0.14
	Paternal	Warmth	–0.34	–0.17	–0.08	0.05
		Rejection	–0.08	0.12	0.09	–0.05
Impulsiveness	Maternal	Warmth	0.05	–0.09	0.06	–0.16
		Rejection	–0.05	0.10	0.08	0.04
	Paternal	Warmth	0.02*	0.08*	–0.06*	0.30*
		Rejection	0.11	–0.02	0.04	0.04
Vulnerability	Maternal	Warmth	0.04	0.08	–0.14	–0.03
		Rejection	–0.07	0.01	0.01	0.12
	Paternal	Warmth	–0.01	–0.01	0.14	0.15
		Rejection	0.19	–0.04	0.20*	–0.04*
Assertiveness	Maternal	Warmth	0.29*	–0.16*	–0.13*	0.27*
		Rejection	–0.02	0.04	–0.23*	0.11*
	Paternal	Warmth	–0.29*	0.19*	0.18*	–0.29*
		Rejection	–0.01	–0.14	0.17*	–0.18*
Excitement-seeking	Maternal	Warmth	–0.03	–0.10	–0.02	–0.10
		Rejection	–0.24*	0.05*	–0.12	–0.01
	Paternal	Warmth	0.10	0.17	0.08	0.14
		Rejection	0.28*	0.03*	0.11	0.12
Self-discipline	Maternal	Warmth	–0.11	0.02	–0.10	0.04
		Rejection	–0.04	0.10	–0.02	0.01
	Paternal	Warmth	0.18	–0.02	0.09	0.03
		Rejection	0.11	0.11	0.09	0.14

Note: Numbers represent beta values. Bold values are significant at $\alpha = 0.05$ level. Values marked with * indicate significant gender effect in model 3. All predictor variables were entered into the models simultaneously. All models were corrected for gender, age, family social status and relevant parent personality scores. N = 741.

personality differences and so cannot be adjusted for by greater mimicking in personality. Additionally, because men, unlike women, cannot be certain about parenthood, resemblance may influence fathers more than mothers when making investment decisions (Bressan, 2002; Heijkoop et al., 2009). Our findings do not support literature suggesting that mothers link investment to personality resemblance while fathers link it to physical resemblance (Heijkoop et al., 2009), or that personality similarity is linked to the quality of the parent–adolescent relationship for mothers, but not for fathers (van Tuijl et al., 2005). The stronger effect of parental rejection than parental warmth is congruent with findings that both maternal and paternal rejection, but not warmth, were significantly associated with adolescent use of passive coping styles (Meesters & Muris, 2004).

Although we could not show clear evidence for any of the possible evolutionary reasons for a link between parent–child resemblance and quality of parental care, our findings do show a pattern that suggests that positive parenting (much warmth, little rejection) from fathers may be associated with a greater resemblance, while positive parenting from mother is associated with a greater difference in personality. A possible explanation might be that adolescents consider fathers' personality as an example to mimic, a role model to teach them how to interact with their surroundings, providing that fathers' parenting is positive. Mothers' positive parenting may rather represent a safe and warm environment in which adolescents are relatively free from evolutionary pressures to ensure maternal care and can develop their personality in any way favourable to them.

Post-hoc analyses showed that the effects of parenting on resemblance in specific personality facets are not completely comparable to each other. For self-discipline, we found no relationship between parenting and resemblance at all, while for anger-hostility, impulsiveness and assertiveness, parental warmth was a significant predictor of at least some resemblance parameters. For four out of the six personality facets, we found significant gender interactions that did not show up in the main models. Personality traits that were significantly associated with parenting effects did not necessarily show a strong parent–child resemblance. While initially these results seem inconsistent, understanding what makes one trait different from another may give us a handle on better understanding the different pressures involved in shaping personality resemblance.

Effects of gender

It is interesting here to consider the direction of the associations between boys' and girls' resemblance to parents (Table 4). While the significance levels of these effects are low and some of the effects are mild, and any conclusions must therefore of necessity be cautious, it is nevertheless worth noticing that the effects for boys and girls were opposite in each facet where

gender effects were significant. This suggests that boys and girls respond in opposite ways to parental care, rather than only differing in the strength of the association. For example, it is interesting to note the opposite effects of parental care in assertiveness: while maternal warmth has a positive effect on resemblance, paternal warmth has a negative effect. This is shown for girls' resemblance to mothers and boy's resemblance for fathers, but opposite for boy's resemblance to mothers and girl's resemblance to fathers. While this pattern of opposite associations between mothers' and fathers' parenting and effects on boys and girls is most clear in assertiveness, it also shows to a lesser degree in the other facets: for example, in excitement-seeking, maternal rejection is a negative predictor of mother–girl resemblance, while paternal rejection is a positive predictor of the same. These post-hoc results may be indicative of underlying patterns in the selective forces affecting development of resemblance, notably differential selective pressures affecting males and females, and differential pressures being exerted upon individual personality facets, which are certainly worth further investigation.

Earlier work on family resemblances in conservatism found that sons were less similar to their parents than were daughters, and that father–daughter resemblance was reduced in lower SES families (Feather, 1978). If parenting quality affects subsequent resemblance differently in boys and girls, in some traits but not all, it can be deduced that the developmental trajectories leading to personality resemblance are not fixed nor strongly canalised, but have a degree of developmental freedom. We conclude that there is likely at least some plasticity, the degree to which individuals can adjust their phenotype in response to environmental conditions, available to children during their developmental process to allow them to adjust their personality adaptively to their surroundings. Whether this is the case should be considered by analysing the consequences of parent–child resemblance for adolescents.

Strengths and limitations

Strengths of this study include the availability of an identical, self-assessed measure of personality for adolescents and both of their biological parents, which allows for a reliable intergenerational comparison as well as investigation of gender interactions. There are also limitations. As resemblance scores in this sample were very similar between parents and offspring, and effect sizes were relatively small, interpretation of these findings needs to be cautious. Some of the NEO-PI-R scales have a low internal consistency. In general, low reliability indicates that the scale items make up a rather heterogeneous set, with relatively low intercorrelations. On the one hand, this indicates that they cover a diverge range of indicators, which can be considered a good thing, but it also means that their common component is not very strong. Low reliabilities generally imply lower effect sizes and reduced power to detect associations. This suggests that associations may have been stronger if we had used more reliable scales. Although parenting was measured at about age 11 and personality resemblance at about age 16, we cannot exclude reverse causality: parents may provide better care to those children who resemble them. Recent work suggest that the relationship between paternal investment and father–child resemblance may be bi-directional (Volk, Darrell-Cheng, & Marini, 2010). Similarly, reports on parental warmth and rejection may be biased if children perceived parenting as more positive when their parents respond similarly to themselves. Furthermore, it should be taken into account that we included only adolescents whose biological parents were still a part of their family at age 11, and that most families included were from middle or high socio-economic classes. As such, these adolescents grew up in comparatively stable environments, both emotionally (no divorces) and financially (sufficient means to fulfil basic needs). Whereas the homogeneity of our sample makes interpretations more straightforward, it also calls for caution on drawing population-wide conclusions. It is possible that the personality development of adolescents from broken homes or poor families is more strongly affected by their parent's rejection and warmth, or affected in a different direction than was found in this study.

Implications

Our findings indicate that parenting quality is important not just for offspring well-being and functioning, in which context it is often studied, but also for the development of personality resemblance with the previous generation. The results presented in this paper provide, to our knowledge, a first evidenced of the much presumed relationship between parenting quality and intergenerational personality resemblance. More than that, results emphasise the importance of the role of fathers in personality development, and show interesting differences between gender, between individual personality facets. There appears to be a relationship between parenting and personality resemblance for some personality traits (most notably assertiveness) and not at all for others (such as self-discipline), and strongly for one gender (paternal rejection, which is significant at a 0.01 or 0.02 level in all tests (Table 3)) but not another (for example maternal warmth, which shows as significant in no test except assertiveness). There is some indication of directionality to these differences, but patterns are as of yet unclear and not entirely consistent. A primary goal for future research in this area is to examine relevant covariates, so that these patterns can be better understood.

The association between parent–child resemblance and parenting is further complicated by several factors, such as the fact that there are two parents involved who may be giving opposite or reinforcing stimuli, and that influences can be bidirectional.

Our findings indicate that the study of intergenerational resemblance should include gender effects for both generations, and should include maternal and paternal effects simultaneously. The interesting differences in the way these six personality traits relate to parenting also serves as a warning that a broader context is necessary.

An continued evolutionary and ecological perspective on the development of human behavioural resemblance is desired to shed new light on adaptive challenges currently faced by current human society (Gosling, 2001). While this study is a step in that direction by targeting the development of resemblance rather than development of personality, it has also opened up new questions with regards to the process during which resemblance is established, the role of parental influences and the interaction between parent and adolescent gender. For future study, it would be useful to assess personality assessments for parents and their offspring at different ages, and to determine whether children develop their personality resemblance to their parents fairly consistently (always more like mom than dad), or mimic their parents differently depending on their age (more like mom as a toddler, but more like dad as a teen). There is some evidence that this does happen with physical resemblance (Alvergne et al., 2009). And of course: will these adolescents still resemble their parents similarly when they reach the age their parents are now? Although some studies claim personality assessments are fairly stable throughout life, it is still unclear to what extent personality is truly stable (Akse, Hale III, Engels, Raaijmakers, & Meeus, 2007), and how much can – if circumstances call for it – be changed later in life.

Conclusions

Adolescents resembled their biological parents fairly consistently across six personality traits, suggesting that early-life epigenetic and environmental forces influence the development of personality towards a greater resemblance, and that these forces work across contexts rather than on a trait-by-trait basis. We found a significant association between the quality of parenting that children perceive, and the degree to which they come to resemble their parents in five out of six key personality traits later in life. Perceived paternal rejection at about age eleven consistently predicted less personality resemblance with parents five years later. Both parental and adolescent genders were relevant contributors in the analysis: girls seemed to be more strongly affected by both parental warmth and rejection than boys, and there is some indication that adolescents respond in opposite ways to parenting from mothers and fathers. While there are several factors confounding a cause-and-effect conclusion, this provides perhaps the first indication that the quality of parental care may play a role in intergenerational similarities in behaviour.

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