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Personality Resemblance in Adoptive Families

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Adoption studies provide an opportunity to check on twin-study inferences about genetic and environmental effects on personality. The Texas Adoption Project obtained personality tests and ratings from members of 300 adoptive families: MMPIs and 16PFs for adults, and Cattell scales and parents' ratings for children. Overall there was little personality resemblance among family members, either biologically or adoptively related. Median correlations were typically positive, but under 0.10. Elimination of a rating bias and the use of multiple correlations did not yield notably higher levels of prediction, but restriction to a subsample of well-measured children provided higher correlations and more evidence of heritability, particularly in the extraversion domain.

KEY WORDS: adoption; personality; heredity; environment; MMPI; 16PF; HSPQ; CPQ.

INTRODUCTION

Monozygotic (MZ) twins tend to be considerably more similar on personality measures than are dizygotic (DZ) twins. This is usually taken as evidence of the effect of the genes upon personality. A summary of 13 twin studies between 1935 and 1967, involving altogether some 2000 MZ and 1400 same-sexed DZ pairs, yielded median correlations on personality inventory scales of 0.48 for MZ pairs and 0.24 for DZ pairs (Loehlin, 1977). A traditional heritability analysis of these average figures, based on simple-minded assumptions, produces the estimate that about half of

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the variance of personality traits, on the average, is genetic in origin [i.e., $h^2 = 2(r_{mz} - r_{dz}) = 0.48$]. A less often noted but much more surprising implication of such an analysis is that the typical resemblance in personality of members of either MZ or DZ pairs can be entirely explained by their genetic resemblance, that is, that common environmental influences (c^2) contribute nothing whatever to the personality resemblance of twins (i.e., $c^2 = r_{mz} - h^2 = r_{dz} - \frac{1}{2}h^2 = 0$). In this respect typical personality measures differ strikingly from typical ability measures, for which c^2 estimated from a twin study tends to be substantially positive (e.g., Loehlin and Nichols, 1976, Table 7-2). A zero c^2 is a startling result because it suggests that the environments of twins of a pair, so far as their effects on personality are concerned, are no more alike than the environments of any two individuals of the same age and sex selected at random from the population. This tends to give rather short shrift to such variables as the atmosphere of the home; the number, gender, and spacing of siblings; the parents' personalities; the family socioeconomic status; child-rearing practices; and a host of others for which twins of a pair are correlated approximately 1.0, and which have often been supposed to influence personality development.

Such an unexpected finding suggests a close scrutiny of the assumptions on which it is based. Perhaps most often scrutinized is the assumption that the environments shaping personality are equally similar for members of MZ and DZ twin pairs. A number of studies evaluating different aspects of this assumption have been reported in recent years (e.g., Scarr, 1968; Scarr and Carter-Saltzman, 1979; Lytton, 1977; Matheny *et al.*, 1976; Loehlin and Nichols, 1976; Plomin *et al.*, 1976). On the whole, these studies have tended to sustain the viability of the equal-environments assumption for personality, although they do not close the issue completely.

Thus there is some reason to take seriously the notion that environmental variables which family members share may not play an important role in personality development (or at least if they do, that they do so in unsystematic ways). There remains, of course, good reason for examining this proposition by approaches other than the twin study. The adoption method especially commends itself. In adoptive families, genetically unrelated individuals are exposed to shared environmental influences. If the twin studies are correct, this should produce little or no resemblance among them on personality traits. Adoption studies may also provide biologically related but environmentally separated individuals, such as a mother and her adopted-away child. Furthermore, parents that adopt sometimes have children of their own as well. If the twin studies are taken at face value, biologically related individuals of both kinds should show

personality resemblances on the order of those shown by DZ twins, i.e., personality trait correlations averaging about 0.24.

The Texas Adoption Project offered an opportunity to address these issues. In this study, members of 300 families who had adopted one or more children through a church-related residential facility for unwed mothers in the Southwestern United States were given IQ and personality tests. In addition to the 469 adopted children in these families, there were 167 biological children of the parents, some born before and some after the adoptions. The adoptive children entered the families within a few days of birth, and all were adopted permanently. These adoptive families, like most such, were a selected group. They tended to be of above-average socioeconomic status. The fathers were about 1σ above the mean of Texas males on occupational status and 1.3σ on education. The couples were selected by the agency as good prospective parents and were, of course, self-selected by a desire for children. The biological mothers of the adopted children were also a somewhat select group. For example, their mean IQ on the Revised Beta Examination was about 109 (Horn *et al.*, 1979). (The mean IQ of the adoptive parents on the same test was about 114.) One reason for this selection, in all likelihood, was the agency's policy of asking families to contribute toward the financial support of their daughters' residence at the home. While this was not a requirement for admission, it probably acted to bias referrals toward middle-class families.

The testing was carried out by local psychologists in several Texas cities. Further details of the sample and the testing procedure, and the results for IQ, are given elsewhere (Horn *et al.*, 1979).

MEASURES

The Minnesota Multiphasic Personality Inventory (MMPI) was available from the agency files for many of the unwed mothers of the adoptive children in the study. The MMPI was therefore administered to the parents in the adoptive families as well. A shortened, 373-item version of the test had been employed for the unwed mothers and was used for the adoptive parents. This version contains all the items that are scored on the nine regular clinical scales and the three validation scales, but does not contain the social introversion scale.

Since the MMPI is not suitable for testing children in the age range of most of those in the study (only about 20% of the biological children and 2% of the adopted children were 15 or older), the adoptive parents and children were given age-appropriate versions of the Cattell personality scales: the Sixteen Personality Factor (16PF) test for adults and

Table I. Numbers of Individuals Receiving Different Personality Measures, Texas Adoption Project

	MMPI	16PF	HSPQ	CPQ	Rating
Adoptive fathers	285	282	—	—	—
Adoptive mothers	285	283	—	—	—
Unwed mothers	337	—	—	—	—
Adopted sons	—	1	25	92	244
Adopted daughters	—	1	16	84	210
Biological sons	—	2	32	20	78
Biological daughters	—	2	23	22	62

children over 18, the High School Personality Questionnaire (HSPQ) for children aged 13–18, and the Children's Personality Questionnaire (CPQ) for children aged 8–12 (Cattell *et al.*, 1970; Cattell and Cattell, 1969; Porter and Cattell, 1972). Questionnaire scale scores were obtained as specified in the test manuals and converted to standardized form (Cattell's "stens," which are half-standard-deviation units from 1 to 10, with mean = 5.5 in the normative population). Children under age 8 were not given a personality questionnaire, but received parental ratings as described below. Table I shows the number of individuals in the sample for each of the measures.

The present paper focuses on correlations among the ratings and the Cattell scales in the adoptive families, leaving discussion of mean differences and correlations with the unwed mothers' MMPIs for a separate report.

Ratings. One of the adoptive parents, usually the mother, was asked to rate all the children in the family on 24 nine-point bipolar trait scales, selected a priori to provide two traits representing each of 12 Cattell factors. The rater was asked to consider each trait scale and locate each child in the family on it, judged relative to other children of his age. (Appendix Table A contains the adjectives identifying each end of each scale, as well as the Cattell factor it was intended to represent.)

Preliminary examination of the rating scale intercorrelations revealed that the two ratings aimed for the same factor typically correlated more strongly with scales intended for other factors than they did with each other. However, the high correlation tended to be with other scales loading on the same one of Cattell's second-order factors, so that a resolution into broader dimensions appeared feasible. Separate rough factor analyses[2] for males and females suggested that four factors were replicable

[2] SPSS PA2 with Varimax rotation.

Table II. Adjectives Characterizing the Factors in Parents' Ratings of Children[a]

	Factor 1 (Extraversion)	Factor 2 (Socialization)	Factor 3 (Emotional Stability)
Positive end	Warmhearted	Controlled	Emotionally stable
	Outgoing	Self-disciplined	Calm
	Talkative	Conscientious	Unfrustrated
	Full of zest	Moralistic	Composed
	Happy-go-lucky	Earnest	Complacent
	Enthusiastic	Sensitive to threats	Untroubled
	Socially bold	Compulsive	Self-assured
	Adventurous	Mature	Secure
	Easygoing	Faces reality	Relaxed
	Participates		
Negative end	Reserved	Uncontrolled	Emotionally less stable
	Detached	Follows own urges	Easily upset
	Restrained	Disregards rules	Frustrated
	Serious	Expedient	Fretful
	Sober	Frivolous	Worries
	Shy	Unresponsive to threats	Guilt prone
	Timid	Careless	Apprehensive
	Critical	Affected by feelings	Insecure
	Aloof	Changeable	Tense

[a] Factor 4 (Dominance) characterized by assertive, competitive versus easily led, accomodating. Adjectives listed are from descriptions of scales loading 0.50 or more on respective factors—see Appendix Tables A and B.

across the sexes: one in the extraversion domain, one reflecting good or poor socialization, one concerned with emotional stability, and one related to dominance. A four-factor oblique rotation was therefore undertaken for the sexes combined, on a total of 574 cases.[3] Appendix Tables B and C present the factor structure loadings and the interfactor correlations from this analysis. Factor scores for the four factors were estimated in the standard way by the computer program and used as the basis for a number of the analyses reported below.

Table II presents adjectives from the rating scales loading highest on each of the factors.

Factor 1 appears to resemble Cattell's second-order factor Exvia-Invia, or Eysenck's Extraversion factor. It contains both sociability and impulsivity aspects, with restraint and shyness at the opposite pole. We refer to it as Extraversion.

Factor 2 appears to contrast well-socialized with poorly controlled behavior. It resembles Cattell's second-order factor of Good Upbringing. We refer to it as Socialization.

[3] SPSS PA2 with direct Oblimin rotation, delta = 0.

Factor 3 contrasts stable with poor emotional adjustment. It resembles Cattell's second-order Anxiety factor, or Eysenck's Neuroticism. We call it Emotional Stability.

Factor 4 is less well defined than the others, but we label it Dominance.

Factors like 1 and 3, Extraversion and Emotional Stability, are nearly always found, at some level, in factor analyses of rating or questionnaire data. A dimension of conscientiousness or self-control like factor 2 is frequently reported in factor analyses of rating scales [for example, such a factor was identified in all 10 factor analytic studies of ratings of children reviewed by Dielman (1977)]. Finally, an assertiveness or dominance factor is often reported in factor analytic studies, although less regularly than the preceding three (and less clearly here).

RESULTS

Table III shows the general characteristics of the sample, as compared to those of the standardization populations of the Cattell tests. The adoptive parents tend to be relatively high in self-control (Q3) and emotional stability (C). The fathers are low in guilt (O) and the mothers high in sensitivity (I). In the extraversion domain (A, F, H) both parents average close to population norms. In general, these seem plausible characteristics for such a group as this. The standard deviations of the scales mostly lie fairly close to the population value of 2.0, suggesting that restriction of individual variation will not be a serious problem in interpreting correlations.

Table III. Means and Standard Deviations on Cattell Scales—Adoptive Families[a]

	Fathers 16PF		Mothers 16PF		HSPQ		CPQ	
Scale	Mean	SD	Mean	SD	Mean	SD	Mean	SD
A (warmhearted)	5.62	2.24	5.53	1.88	5.84	2.19	4.69	1.76
F (enthusiastic)	5.45	1.97	5.32	2.00	5.60	2.06	4.61	2.02
H (venturesome)	5.87	2.34	5.90	2.53	5.92	2.24	5.86	2.03
G (conscientious)	5.95	1.81	5.99	1.74	6.41	1.99	4.92	1.44
Q3 (controlled)	7.62	1.99	7.07	2.00	5.64	1.89	4.80	1.78
C (emotionally stable)	6.76	2.08	6.24	1.83	5.76	1.99	5.83	1.50
O (guilt prone)	4.49	2.16	4.90	1.96	4.25	2.21	5.17	2.15
Q4 (tense)	5.74	2.00	5.99	1.97	5.82	2.29	5.23	1.81
E (dominant)	4.95	2.10	5.20	2.18	5.68	1.93	6.42	1.90
I (sensitive)	4.97	1.98	6.83	2.04	6.15	3.11	6.04	1.74
Number	282		283		96		217	

[a] Scores in stens—normative population mean, 5.50; SD, 2.00.

Table IV. Parent–Child Correlations on Cattell Scales in Adoptive Families

	Biological				Adoptive			
	Father		Mother		Father		Mother	
Factor	Son	Daughter	Son	Daughter	Son	Daughter	Son	Daughter
A	0.16	−0.12	0.12	−0.12	−0.02	0.04	−0.07	0.04
F	0.33	−0.12	−0.06	0.26	0.12	0.07	0.14	0.12
H	−0.12	0.09	0.04	0.16	0.10	0.06	0.05	0.03
G	−0.03	0.39	0.01	0.18	−0.04	0.23	0.11	0.10
Q3	−0.20	−0.11	0.01	0.12	−0.08	0.23	0.19	−0.07
C	0.08	0.24	−0.12	0.09	0.06	0.11	0.00	0.07
O	0.41	0.38	−0.02	0.08	0.04	0.18	0.12	0.26
Q4	0.21	0.01	−0.01	0.18	0.17	0.14	−0.07	−0.06
E	−0.00	0.20	−0.12	−0.09	−0.05	−0.02	−0.02	−0.07
I	0.23	0.01	0.11	−0.11	0.05	0.13	0.25	−0.00
Pairs	44	44	47	43	111	94	111	93

The older children measured with the HSPQ are high in conscientiousness (G) and sensitivity (I) and low in guilt (O). Again, there seems to be an essentially normal range of individual variation, as reflected by the standard deviations, except for a markedly elevated SD on sensitivity (I).

The results for 8- to 12-year olds measured by the CPQ seem somewhat peculiar, with departures from the population mean in unexpected directions on several scales and standard deviations departing more from the norms than in the other three groups. Since the ratings of these same children do not show analogous differences (see Appendix Table D), we are inclined to suspect that the CPQ norms may be at fault.

Tables IV, V, and VI present parent–child and sibling correlations in the adoptive families, separately for adoptive and biologically related pairings. Substantial correlations for adoptively related pairs would be evidence (in the absence of selective placement) for environmentally produced resemblance. Higher correlations for biologically related pairs than adoptively related pairs would be evidence for the influence of genes.

Table IV presents correlations between 16PF scale scores of the parents and the correspondingly named factor scales on the Cattell questionnaire taken by the child—either the 16PF, the HSPQ, or the CPQ, depending on age. Results are given for the 10 personality factors common to all three instruments. For convenience the factors are grouped in the table according to second-order factors: extraversion (A, F, and H), socialization (G and Q3), and emotional stability (C, O, and Q4), with a fourth miscellaneous grouping of dominance (E) and sensitivity (I). The

Table V. Correlations of Child Rating Factors with Parent 16PF Scales in Adoptive Families[a]

	Biological				Adoptive			
	Father		Mother		Father		Mother	
	Son	Daughter	Son	Daughter	Son	Daughter	Son	Daughter
Extraversion with								
A	0.19	0.15	−0.03	−0.02	−0.06	0.13	−0.03	0.06
F	0.32	0.09	0.15	0.11	0.05	0.17	−0.03	0.18
H	0.20	0.04	0.09	0.13	−0.09	0.17	0.02	0.09
Socialization with								
G	0.10	0.02	−0.05	0.19	0.00	0.01	0.05	0.04
Q3	0.24	−0.14	0.11	0.14	0.07	0.13	0.20	0.06
Emotional Stability with								
C	0.13	0.06	−0.08	0.07	−0.01	0.08	0.12	−0.04
O^-	0.13	0.01	−0.03	0.24	−0.02	0.04	0.09	−0.02
$Q4^-$	0.08	0.07	−0.03	0.29	0.09	0.04	0.08	0.02
Dominance with E	0.16	−0.10	0.15	0.09	0.12	0.14	0.14	0.23
Pairs	67	59	70	58	223	188	225	188

[a] O (guilt proneness) and Q4 (tension) scales reflected so as to be in the emotional stability direction.

Table VI. Sibling Correlations on Cattell Scales in Adoptive Families

Factor	Biological pairings, sexes combined	Adoptive male–male pairings	Adoptive female–female pairings	Adoptive male–female pairings
A	0.31	0.12	0.00	−0.11
F	0.01	0.26	0.33	−0.02
H	0.04	0.13	0.05	−0.08
G	0.19	0.04	0.23	−0.04
Q3	−0.21	0.68	0.26	−0.05
C	0.15	0.02	0.21	0.13
O	−0.20	0.21	0.43	0.03
Q4	−0.05	0.21	0.01	0.08
E	0.05	0.38	−0.06	−0.01
I	0.10	−0.11	−0.03	−0.02
Degrees of freedom within families	24	18	16	88

numbers of pairs on which the correlations are based are given at the bottom of the table.

Several points may be noted concerning Table IV. First, the correlations are generally low. About three-fourths lie within the range ±0.15. Second, they are positive slightly more often than negative. The median correlation in the table is 0.06. Do the correlations involving biological pairs tend to exceed those involving adoptive pairs? No. Of the 40 such pairings in the table, in 21 cases the biological correlation is higher and in 19 cases the adoptive correlation is higher. The median correlations for biological and adoptive pairs are both 0.06. Thus there is a very modest tendency for family members to resemble one another on the Cattell scales, but it seems to be no greater for family members who are biologically related than for those who are not. This does not suggest much genetic influence on the scores on these tests.

Nor does it appear that a few factors of strong heritability or environmental influence are being lost in a sea of weak ones. For none of the 10 factors do all four adoptive-biological differences lie in the heritability direction or are all eight of the correlations positive. There are 8 or 10 correlations in the table that achieve nominal levels of statistical significance, but since a few would be expected anyway by chance when 80 significance tests are made, and since the observed instances tend not to replicate across the sexes or from biological to adoptive families or to other related traits, individual interpretation of them will not be attempted.

Ratings present a generally similar picture. In Table V, correlations are shown between the factor scores derived from the parents' ratings of their children and the corresponding scores of the parents on related 16PF

scales. The median correlation on the right-hand side of the table remains 0.06, but on the left it is a trifle higher, at 0.10. However, there is still no very consistent tendency for biological parent–child correlations to be higher than the corresponding adoptive ones: 20 are and 15 are not, with 1 tie. There still is no row in the table in which all correlations are positive, and no row in which all four biological-adoptive differences lie in the heritability direction. Table VI shows sibling correlations for the Cattell scales. The median correlations lie between 0.04 and 0.05 for both the biological and the adoptive pairings. The adoptive pairings are subdivided into male–male, female–female, and opposite-sex pairings—there were too few biological siblings to justify such a breakdown for them. Note that same-sex pairings are relatively uncommon in adoptive families, owing to a preference in most such families for adopting a boy and a girl, or a single child of sex opposite to that of an existing child. Despite the small numbers of cases, there appears to be a fairly clear tendency for same-sex correlations to exceed cross-sex correlations among the adoptive pairs, providing some evidence of a sex-specific effect of common environment. Sibling correlations based on ratings were computed but are not presented—they proved to be consistently negative, apparently due to an artifact in the rating procedure. Both children in a two-child family were entered on a single scale on the rating form, and this seems to have led to a contrast effect between them.

In short, the correlations in Tables IV, V, and VI agree in presenting a picture of overall low correlations on personality measures, suggestive of a very modest effect of shared environment, with biological correlations little if any higher than adoptive correlations, suggestive of little if any effect of the genes.

Before accepting such a conclusion as definitive, several points need to be considered. In particular, measurement problems must be addressed. Because of time limitations, only a single form was used for each of the Cattell scales, and the reliabilities of such short scales are quite low. According to the test manuals, the correlations of these scales with alternate forms typically fall in the 0.4 to 0.5 range for children, and 0.5 to 0.6 for adults. The parent–child and sibling correlations in Tables IV and VI may thus be only about half as large as they would be, given the quality of measurement of (say) a good IQ test. The rating factors are probably of a level of reliability only slightly better than that of the scales: individual correlations in the 0.50s to 0.70s of ratings with factors suggest a reliability of about 0.75 for a composite chiefly defined by five or six such rating scales. The rating factors are also subject to various rating response biases, including the contrast effect mentioned earlier.

In addition to problems of reliability, there exists the equally vexing

question of whether the trait that is called, say, extraversion or ego strength at age 8 is the same as a correspondingly named trait measured at age 15 or age 35. Cattell and his associates have done a fair amount of cross-questionnaire matching of the 16PF and the HSPQ, by giving both questionnaires to intermediate age groups (Cattell, 1973). The situation for the CPQ is less clear. Unpublished cross-questionnaire studies involving the CPQ suggest that the matching may be poorer than for the HSPQ and 16PF (Schaie, personal communication).

To evaluate these issues, three control analyses are reported. First, the contrast effect is assessed by examining parent–child correlations in one-child families, in which this particular rating artifact does not operate. Next, the issue of cross-age correspondence of measures is dealt with by multiple-regression analysis, in which we can ask whether a given child measure is related to *any* parent scale or scales, not just the nominally corresponding one. Finally, correlations are reported that are based only on those children for whom rating and questionnaire measurements agree, i.e., children with presumptively valid measurement.

Table VII examines the consequences of removing the rating artifact. It presents correlations between the rating factors and the 16PF scales for one-child families only. Given the mode of selection of our sample, this one child is necessarily an adopted one, so only adoptive parent–child correlations can be compared. The level of correlations does appear to

Table VII. Correlations of Child Rating Factors with Parent 16PF scales, One-Child Families Only[a]

	Adoptive	
	Father–child	Mother–child
Extraversion with		
A	0.12	0.05
F	0.06	−0.02
H	−0.12	0.12
Socialization with		
G	0.12	0.25
Q3	0.19	0.23.
Emotional Stability with		
C	−0.04	0.10
O^-	0.03	0.15
$Q4^-$	0.07	0.14
Dominance with E	0.13	0.18
Pairs	54	54

[a] O (guilt proneness) and Q4 (tension) scales reflected so as to be in the emotional stability direction.

be slightly higher in the single-child families—the median r is 0.12, compared to 0.06 for the adoptive correlations in Table V. The most substantial change is in the direction of higher correlations in the Socialization domain. Elimination of contrast effects should raise estimates of heritability a little, and estimates of common family environment a little more, but would not require a drastic revision of the conclusions suggested by Tables IV to VI.

An analysis based on multiple regression is presented in Table VIII. Such an approach allows for the possibility of mismatching of childhood and adult measures—that, for example, what is measured as extraversion in childhood may not be the same trait as what is measured as extraversion in adulthood, but may correspond instead to (say) dominance or emotional stability. This could reflect either poor definition of measures or genuine developmental discontinuities. In genetic terms one could describe this as an age-dependent effect of the genes on personality, that is, the genes that determine a given trait in childhood do not determine the same trait in adulthood. On the environmental side, correspondingly, one might look for relationships between childhood and adult traits, but not necessarily identity. Dominance in parents might tend to produce introversion in their children, or whatever. With adoption data, one can consider both genetic and environmental possibilities.

Table VIII shows the outcome of multiple regressions of parental 16PF scales on each of the four child rating factors, separately for biological and adoptive children. The results are presented as squared multiple correlations, R^2, adjusted for inflation due to chance. The adjusted R^2 estimates R^2 in the population and is more comparable across different-sized samples than is the raw R^2. (The significance tests are, however, based on the raw R^2 values.)

Table VIII. Multiple Correlations of Child Rating Factors with 16PF Scales of Parents

	Biological		Adoptive	
Personality domain	Father Adj R^2	Mother Adj R^2	Father Adj R^2	Mother Adj R^2
Extraversion	0.01	0.04	−0.01	0.00
Socialization	0.01	−0.00	0.03*	0.01
Emotional Stability	0.03	0.05	0.01	0.00
Dominance	−0.01	−0.07	0.02	0.05**
Pairs	126	128	411	413

* $P < 0.05$.
** $P < 0.01$.

Table IX. Correlations Between Rating Factors and Personality Scale Composites, All Children[a]

Composite	Rating factor			
	Extraversion	Socialization	Emotional Stability	Dominance
HSPQ (N = 82)				
A + F + H	0.34	−0.05	0.09	0.22
G + Q3	−0.06	0.25	0.27	0.10
C − O − Q4	0.13	0.01	0.15	0.04
E	−0.07	0.14	0.09	0.24
CPQ (N = 200)				
A + F + H	0.01	0.06	0.06	0.25
G + Q3	−0.07	0.06	−0.04	−0.05
C − O − Q4	0.06	0.10	0.22	0.08
E	0.15	0.04	0.10	0.18

[a] N's less than those shown for tests in Table I, because rating factors based only on cases with complete data, and parent ratings omitted or incomplete in a few cases.

The adjusted R^2 values appear quite equivalent for adoptive and biological pairings—the median is 0.01 for each. A couple of the R^2 values in the adoptive pairings—Dominance for mothers and Socialization for fathers—reach nominal levels of statistical significance, but it is clear that the predictability of the major dimensions of rated personality in children from the 16PF scales of their parents is slight at best for these data and shows no noteworthy difference between adoptive and biological parent–child pairs. These are, of course, squared correlations. The relationships in Table VIII are comparable to those in the preceding tables—the median R^2 of 0.01 corresponds to an R of 0.10, and the high R^2 values of 0.03 and 0.05 correspond to R values of 0.17 and 0.22, respectively. The point is that the multiple correlations are not notably higher. The low correlations in the earlier tables do not seem merely to reflect the poor agreement of individual variables across ages.

The third hypothesis to be considered is that only some children's personalities are being well measured in this study, whether as a result of deficiencies in the measurement techniques or because personalities in many preadolescent children are not yet clearly defined. That some problem of this sort may exist is suggested by the correlations presented in Table IX, between rating factors and composites of putatively corresponding questionnaire scales. High correlations in the principal diagonals and low off-diagonal correlations would be evidence of valid measurement. While the correlations in Table IX provide *some* evidence of convergent and discriminant validity, particularly for extraversion and so-

cialization for the older children and emotional stability for the younger ones, the evidence of validity is far from impressive. The extraversion and socialization scales and rating factors show essentially no agreement at all for the CPQ. Limited agreement between Cattell scales and ratings is not a new finding: Schaie (1962) obtained a median correlation of 0.14 for eight scales overlapping with the present study, using the HSPQ and ratings made by cottage parents of delinquent girls.

Parent–child correlations were obtained based only on children whose tests and ratings agreed. Composite scores based on the groups of scales shown in Table IX were obtained for each child and standardized over all children receiving Cattell tests. These composities were then compared to the rating factor scores, also in standard-score form. Only children whose two extraversion scores were less than one standard deviation apart were used for correlation with the parental scales in the extraversion domain.[4] The average of the rating and the scale standard scores was used as the child's score. The same procedure was repeated for each of the other three domains. About 55% of the children for whom both scores were available fell into the consistently measured category on each dimension. The selected children did not differ markedly by age, sex, or adoptive status from the total group receiving both ratings and questionnaires, and the selections in the four domains were only slightly intercorrelated. Thus there was not just a single group of children well measured on all four dimensions, but a separate group for each one, overlapping by only a little more than chance.

Table X shows the parent–child correlations based on the selected children. Several points stand out. First, the correlations tend to run appreciably higher than those in Tables IV and V. The medians in Table X are 0.19 and 0.14 for biological and adoptive pairs, as compared to the 0.10 and 0.06 when all children were analyzed with the ratings alone, or 0.06 and 0.06 for the scales. Second, the extraversion domain seems to be largely responsible for the excess of biological over adoptive correlation in Table X and, thus, for what evidence there is of genetic effects. As the figures stand, emotional stability seems mostly to reflect common environmental influence, and socialization and dominance show neither genetic nor common environmental effects. The limited sample size precludes making such claims with complete confidence. Nevertheless, the correlations in Table X strongly suggest that where personality traits are

[4] Two other criteria of consistent measurement were also examined. A tighter restriction (to $\frac{1}{2}\sigma$) yielded higher biological correlations in the extraversion domain, but they were based on much smaller samples. A variant of this criterion which allowed more latitude at the extremes yielded intermediate sample sizes and produced somewhat lower extraversion correlations than those reported here.

Table X. Correlations of Child's Test and Rating Composite with Parent's 16PF Scales, Consistent Children Only[a]

	Biological		Adoptive	
	Father–child	Mother–child	Father–child	Mother–child
Extraversion with				
A	0.36	0.07	0.13	−0.02
F	0.40	0.39	0.26	0.15
H	0.47	0.44	0.16	−0.01
(Pairs)	(37)	(38)	(117)	(115)
Socialization with				
G	−0.07	0.17	−0.01	0.18
Q3	−0.16	0.15	−0.00	0.12
(Pairs)	(46)	(49)	(110)	(109)
Emotional Stability with				
C	0.20	0.13	0.05	0.10
O⁻	0.26	0.18	0.16	0.22
Q4⁻	0.24	0.26	0.22	0.14
(Pairs)	(45)	(46)	(108)	(109)
Dominance with E	0.13	−0.04	0.13	0.05
(Pairs)	(40)	(40)	(118)	(116)

[a] Consistency defined as absolute standard score difference less than 1.0 between rating factor and scale composite. Consistent children selected separately in each domain.

well measured in children, appreciable parent–child correlations and evidence of heritability can emerge, at least in the extraversion domain.

DISCUSSION

One prediction from the twin studies is reasonably well borne out by these adoption data: the features of the environment that biologically unrelated family members share do not make them much alike in personality. On neither tests nor ratings did adoptive family members resemble one another to any great degree. Overall, the average parent–child and sibling correlations were positive, but typically under 0.10. The same-sex adoptive sibling correlations provide a possible exception, although the samples on which they were based were quite small.

A second prediction from the twin studies was less clearly borne out. That prediction was that the genes which biologically related family members share will produce correlations among them on the order of 0.24. In

fact, we tended to observe mostly much lower correlations, about the same for both related and unrelated pairs, although for a subsample of children selected for consistency of measurement, the median biological parent–child correlation was 0.19.

How do these findings conform to the results of other studies in the literature?

First, have others found non-biologically related family members to be correlated close to zero?

Here only the Minnesota adoption studies provide relevant data. In two studies by Scarr and her colleagues, the average adoptive parent–child correlations were 0.05 and 0.04, and the average adoptive sibling correlations were 0.01 and 0.07 (Scarr *et al.*, 1981). In the present study, these figures were 0.06 and 0.04, respectively. The former rose to 0.14 in the well-measured subsample, and the latter to 0.17 for same-sex pairs. The twin studies do not have to be qualified much by these data, but they may have to be qualified a little. There does appear to be evidence for at least a small effect of common environment on personality.

What about the second prediction? Is there evidence that biologically related family members are correlated about 0.24 on personality measures via shared genes?

Ordinary parent–child and sibling correlations on personality scales reported in the literature have typically averaged well under 0.24. Crook, some 40 years ago, summarized a number of early family studies as follows: parents and children, an average correlation of about 0.16; and siblings, about 0.18 (Crook, 1937). Twenty years later, Anastasi quoted an average figure of about 0.15 for the latter (Anastasi, 1958, p. 278). Recent data suggest that such correlations remain quite low. Table XI presents some representative findings. Some of the early studies, and the British studies, tended to find higher mother–child than father–child correlations, but most of the others, including ours, have not. The average correlation among nontwin first-degree relatives in the recent studies is about 0.15. Shared genes *plus* shared environments do not seem to make family members much alike. Thus the second prediction from twin studies, that first-degree relatives should be correlated about 0.24, is not well supported in the literature, at least if we assume comparability of measurement in the twin and family studies. That this last may be a critical assumption is suggested by the fact that in the well-measured subgroups in our study, the average biological parent–child correlation rose to 0.19, and in the extraversion domain it approached 0.40.

What general conclusions should be drawn from these results?

First, the evidence for substantial heritability of personality traits is weaker than one might have expected from typical twin-study findings.

Table XI. Average Ordinary Biological Family Correlations on Personality Inventory Scales

Sample	Parent–child[a]	Siblings[a]	Questionnaire[b] and source
Various early studies, mostly U.S.	0.16	0.18	Bernreuter and others; Crook (1937)
Neurotics and relatives, Britain	0.18	0.09	MPI; Coppen *et al.* (1965)
Two generations at same age, Minnesota	0.16	—	MMPI; Hill and Hill (1973)
Three generations, different ages, Britain	0.14	0.34	PEN, JPI; Insel (1974)
Adolescent boys, Ohio and Illinois	—	0.08	HSPQ; Klein and Cattell (1976)
Hawaii study of Cognition sample	0.13[c]	0.13	16PF, Comrey, EPI; Dixon and Johnson (1980)
Mixed-race adoption study, Minnesota	0.01	0.19	EPI, JEPI; Scarr *et al.* (1981)
Adolescent adoption study, Minnesota	0.15	0.20	DPQ, APQ, EPI; Scarr *et al.* (1981)
Twins, singletons, parents, Britain	0.15	—	EPQ, JEPQ Neuroticism; Eaves *et al.* (1978)
Unweighted mean of above	0.14	0.17	

[a] Correlations are the medians over the personality scales and subsamples reported, except for Crook's, which are unweighted means, and the mixed-race Minnesota study, which are weighted means. Studies of twins excluded.
[b] MPI, PEN, JPI, EPI, JEPI, EPQ, and JEPQ are various versions of Eysenck's questionnaires; DPQ and APQ are Tellegen and Lykken questionnaires.
[c] Estimated from reported midparent midchild regressions and spouse correlations.

If the well-measured subgroup of children is taken as representative, however, the discrepancies are less. Such comparisons need to be made with some caution, since one does not know what selecting a comparable subgroup would do to twin-study figures.

Second, sib correlations seem in general to be lower than fraternal twin correlations, and in the present study opposite-sex sib correlations tend to be lower than same-sex sib correlations. Congruences of age and sex may contribute appreciably to commonality of experience, and this in turn may make a modest contribution to personality resemblance. It is a little surprising, in this event, that twin studies do not give more evidence than they do of common environmental effects, since such studies normally match age and sex. Perhaps other factors in twin studies, such as contrast effects, the presence of nonadditive genetic variance, or a marginal failure of the equal environments assumption, may be responsible for this apparent lack of effect.

Third, and finally, adequate measurement remains a critical issue in behavior genetic studies of personality. The relatively low reliability of single Cattell scales and the problems of the parental ratings in the present study place considerable restriction on the size of parent–child correlations that may reasonably be anticipated. Limitation to a subsample of children for whom parental ratings and questionnaire responses agreed led to higher correlations and, in some cases, to larger differences between biological and adoptive relationships. Moreover, to the extent that genes may be differently expressed in phenotypic traits at different ages, the correlations from twin studies will tend inherently to exceed ordinary parent–child or sibling correlations. Add to this the less-than-perfect comparability of existing measuring instruments for widely differing age groups, and the low correlations found in typical family studies of personality are all too understandable. Some of these problems might be alleviated in an adoption study carried out when all family members were adult. Even better would be to measure them all at the same age, but this probably represents an impossible ideal. In any event, many challenging problems of measurement remain in assessing the resemblances among members of families in behavior genetic studies.

APPENDIX

Table A. Parent Rating Scales

Rating No.	Target Factor	Designation of low end	Designation of high end
1	A	Reserved, detached	Warm-hearted, outgoing
2	C	Emotionally less stable, easily upset	Emotionally stable, calm
3	D	Deliberate, inactive	Unrestrained, changeable
4	E	Obedient, submissive	Stubborn, dominant
5	F	Serious, sober	Happy-go-lucky, enthusiastic
6	G	Disregards rules, expedient	Conscientious, moralistic
7	Q4	Relaxed	Tense
8	D^-	Impatient, excitable	Patient, subdued
9	F^-	Talkative	Reserved
10	H	Shy, timid	Socially bold, adventurous
11	I	Realistic	Sentimental
12	J	Full of zest	Restrained
13	O	Self-assured, secure	Apprehensive, insecure
14	Q3	Uncontrolled, follows own urges	Controlled, self-disciplined
15	I^-	Dependent	Self-reliant
16	$Q3^-$	Compulsive in following social rules	Careless of social rules
17	A^-	Easygoing, participates	Critical, aloof
18	$Q4^-$	Frustrated, fretful	Unfrustrated, composed
19	G^-	Earnest	Frivolous
20	O^-	Worries, guilt prone	Complacent, untroubled
21	E^-	Assertive, competitive	Easily led, accommodating
22	J^-	Individualistic	Likes group activity
23	H	Sensitive to threats	Unresponsive to threats
24	C^-	Mature, faces reality	Affected by feelings, changeable

Table B. Factor Structure Matrix (Factor–Variable Correlations): Four Oblique Factors Derived from Intercorrelations of 24 Rating Scales

Rating[a]	Factor 1	Factor 2	Factor 3	Factor 4
1. Warm-hearted	*0.76*	0.02	0.28	0.02
2. Emotionally stable	0.08	0.27	*0.74*	0.03
3. Unrestrained	0.40	−0.25	−0.07	0.13
4. Stubborn	0.09	−0.45	−0.28	0.40
5. Happy-go-lucky	*0.68*	−0.32	0.24	−0.04
6. Conscientious	−0.06	*0.73*	0.27	−0.04
7. Tense	−0.22	−0.15	*−0.58*	0.04
8. Patient	−0.31	0.46	0.41	−0.22
9. Reserved	*−0.75*	0.10	−0.02	−0.11
10. Socially bold	*0.66*	−0.12	0.12	0.22
11. Sentimental	0.11	0.03	−0.10	−0.27
12. Restrained	*−0.70*	0.18	−0.09	−0.20
13. Apprehensive	−0.40	−0.27	*−0.58*	−0.37
14. Controlled	−0.17	*0.76*	0.29	−0.09
15. Self-reliant	0.21	0.29	0.28	0.36
16. Careless of social rules	−0.04	*−0.52*	−0.17	0.04
17. Critical	*−0.51*	−0.18	−0.32	0.05
18. Unfrustrated	0.13	0.34	*0.70*	0.04
19. Frivolous	0.17	*−0.53*	−0.01	−0.07
20. Complacent	0.24	−0.11	*0.63*	0.12
21. Easily led	−0.25	−0.02	0.12	*−0.54*
22. Likes group activity	0.33	0.13	0.17	−0.17
23. Unresponsive to threats	0.09	*−0.52*	−0.01	0.37
24. Affected by feelings	0.00	*−0.50*	−0.33	−0.26

[a] For full specification, see Table A.

Table C. Intercorrelations Among Rating Factors[a]

	Extraversion	Socialization	Emotional Stability	Dominance
Extraversion	1.00	−0.09	0.16	0.09
Socialization	−0.12	1.00	0.26	−0.07
Emotional Stability	0.21	0.33	1.00	0.03
Dominance	0.16	−0.09	0.05	1.00

[a] Factor intercorrelations above the diagonal. Intercorrelations among factor scores below the diagonal.

Table D. Means and Standard Deviations on Rating Factors for Children Tested with HSPQ and CPQ[a]

Factor	Children with HSPQ		Children with CPQ		*P* of difference	*P*, age partialed
	Mean	SD	Mean	SD		
Extraversion	−0.27	1.09	−0.12	0.87	0.23	0.66
Socialization	0.12	1.04	0.13	0.92	0.98	0.66
Emotional Stability	0.02	1.01	−0.10	0.89	0.32	0.80
Dominance	0.18	0.78	−0.06	0.86	0.03	0.91
Number	82		201			

[a] Factor scores are standard scores (mean = 0, SD = 1.00) based on all children rated (N = 574).

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