

Resemblance in Appearance and the Equal Environments Assumption in Twin Studies of Personality Traits

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The equal environments hypothesis of twin methodology was examined for the variable of similarity of appearance as it affects the personality ratings of young twins. There were two separate samples, the first with 95 pairs of same-sex twins and the second with 111 pairs. The average age of the twins in both samples was 3½ years. Mothers rated their twins on four personality traits and on confusability of appearance. Not surprisingly, identical twins were markedly more similar in appearance than fraternal twins. The effect of this inequality on the personality ratings of the two types of twins was examined by correlating ratings of similarity of appearance with the absolute difference on the four personality traits for each pair of twins. None of the correlations was significant for the identical twins, suggesting that greater resemblance in appearance in identical twins does not make them more similar in personality. Indeed, the data suggested a contrast effect in which identical twins who were easily mistaken in appearance tended to be rated as less similar in personality. Thus, although similarity of appearance may create unequal environments for the two types of twins, it does not appear to bias twin studies in the direction of inflated heritabilities, at least for rating studies of the personality of young twins.

KEY WORDS: twins; personality; heritability; twin methodology.

INTRODUCTION

Critics of twin methodology in human behavior genetics have frequently charged that members of identical (MZ) twin pairs are treated more alike

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and exposed to more similar environments than are members of fraternal (DZ) twin pairs, and that differences in degree of personality resemblance between the two kinds of twins may thus be caused by environmental rather than genetic factors. While there are considerable data supporting the first part of this proposition (Jones, 1955; Smith, 1965; Koch, 1966; Loehlin, 1973), other data suggest that the more similar environments of MZ twins may not necessarily produce a greater similarity on personality traits. In the two existing studies in which personality questionnaires were administered to MZ twins reared either together or apart (Newman *et al.*, 1937; Shields, 1962), those reared together obtained *less* similar scores than those reared apart. Other studies comparing twins not separated in childhood but who lived apart later yield similar results. Some suggest that both MZ and DZ twins living apart for more than 5 years are *more* similar in some aspects of personality than are twins living together (Canter in Claridge *et al.*, 1973; Wilde, 1964; Price in Shields, 1973). All of these studies involved small samples and the differences were often statistically insignificant, but the data clearly cannot be construed as offering much support for the hypothesis that the common environment of MZ twins makes them more alike in personality.

Additional information concerning this issue comes from a comparison of two large twin studies using the California Psychological Inventory (CPI). One (Nichols, 1966) studied high school twins and the other (Horn *et al.*, 1976) studied 55-year-old adult male twins. The average MZ and DZ correlations for the 18 CPI scales for the 333 pairs of adolescent male twins were 0.51 and 0.25, respectively. For the adult sample, the correlations for the 198 pairs of adult male twins were 0.44 and 0.19. The adolescent twins were living together and were probably somewhat selected for similarity, but the adult twins had been separated for as long as 35 years. Yet the correlations for the adult twins were only slightly lower than for the adolescent twins. Moreover, the adult MZ *and* DZ correlations were equally lower than the adolescent twin correlations, suggesting no differential influence of the environment on the two types of twins.

Loehlin (1973; Loehlin and Nichols, in press) applied a more direct test of the effect of differential experience of MZ and DZ twins. Working with the data of Nichols' National Merit Twin Sample, he found that adolescent MZ twins were rated more similarly than DZ twins on six items related to differential experience in childhood. The items involved the extent to which the twins were dressed alike, played together, spent time together, were treated similarly by the parents, slept in the same room, and had the same teachers in school. For all of these items, the MZ twins were more similar than the DZ twins, although the effect was weaker for the last two items. Although MZ twins experience more similar environments than DZ twins, the

assumption that these unequal environments *cause* greater personality similarity in MZ twins is not warranted. It is possible that the unequal environmental treatment is an effect rather than a cause of the greater similarity of the identical twins. Loehlin examined this possibility by correlating the rated similarity of treatment of MZ twins—all equally similar genetically—with the absolute difference within each twin pair on the 18 scale scores of the California Psychological Inventory. Loehlin found that MZ twins whose parents tried to treat them the same, who dressed alike, played together more, etc., were no more similar in personality than identical twins who were treated less similarly. The average correlation between the six similarity-of-treatment items and the MZ intrapair differences on the 18 CPI scales was 0.02. He concluded that “there is no reason to believe that this differential treatment [of identical and fraternal twins] accounts to any appreciable degree for later personality differences among the pairs.”

One factor that has not been much explored as a possible mediating variable in twin studies of personality is confusability of appearance. MZ twins are generally quite similar in appearance, while DZ twins vary in appearance in much the same manner as singleton siblings. Indeed, with blood-typing data as the criterion, physical similarity has been used to determine zygosity of twins with 93% accuracy in one study of adolescent twins (Nichols and Bilbro, 1966) and with comparable accuracy in another study of twins in early childhood (Cohen *et al.*, 1973). In the latter study, 99% of the mothers of blood-typed identical twins said that it is hard for strangers to tell the twins apart, 94% said that their twins are sometimes confused by other members of the family, 78% said that the mother or father sometimes confuses the twins, and 47% said the twins look as alike as two peas in a pod. The comparable percentages for mothers of fraternal twins were only 16%, 15%, 10%, and 0%. Thus the MZ twins were clearly much more similar in appearance, to the point of being mistaken often by members of their own families.

Thus similarity of appearance, like similarity of treatment, is greater for MZ than for DZ twins. Like similarity of treatment, we cannot assume that the greater similarity of appearance of MZ twins causes them to experience more similar environments and thus causes them to be more similar in personality. It is, of course, possible that similarity of appearance has no influence on personality. It is also possible that the greater confusability of appearance of MZ twins causes them to be *less* similar in personality, because MZ twins who are very similar in appearance may strive to differentiate themselves from each other behaviorally in an effort to forge separate identities. Similar MZ twins may also be contrasted by others, causing personality differences between the twins to be accentuated or perhaps even creating differences. These speculations are compatible

with the data on separated twins reviewed earlier which suggested a contrast effect. The present report examines some evidence pertinent to these issues.

METHOD

Measures

In two separate studies, the parents of young twins rated their twins on four personality traits: Emotionality, Activity, Sociability, and Impulsivity (EASI). In the first study, only the mothers rated the twins; in the second study, both mothers and fathers rated the twins. The first study used a 20-item EASI questionnaire described in Buss *et al.* (1973) which included five 5-choice items for each of the four traits. The second study used a 56-item EASI questionnaire described in Plomin (1974) which included several components of each trait. For example, four components of Impulsivity were considered: inhibitory control, decision time, persistence, and sensation-seeking. In order to increase comparability between the two studies, the subscales for each trait in the second study were summed so that there were 15 Emotionality items, 10 Activity items, 11 Sociability items, and 20 Impulsivity items. The four traits were generally uncorrelated, but Impulsivity in both studies correlated with Emotionality (0.34 in the first study and 0.32 in the second) and Activity (0.54 and 0.49). Also, in the first study but not the second, Emotionality was correlated significantly with Sociability (-0.30); and in the second study but not the first, Activity was correlated significantly with Sociability (0.41).

The test-retest reliabilities of these scales are satisfactory. In the first study, a test-retest correlation over 1 month yielded an average reliability of 0.83; in the second study, the average 2-3 month test-retest reliability was 0.72. However, the second study allowed interrater agreement comparisons because both parents rated their children. The interrater agreement was low, 0.36 on the average. For this reason, a midrater (or "midparent") estimate was used as an estimate of each child's EASI in the second study. The second study was thus a replication of the first, with two exceptions—the rating questionnaire was considerably longer and midrater estimates were used in the analysis.

Sample

In the first study, questionnaires were sent to local Mothers of Twins Clubs, who distributed the questionnaires to the mothers of twins, who then

returned the questionnaires by mail. Usually the questionnaires were distributed at a meeting of the mothers of twins. In the second study, rosters of the mothers of twins were obtained through the cooperation of the National Organization of the Mothers of Twins Clubs and questionnaires were mailed directly to the parents and were returned by mail. The first study used the data reported by Buss *et al.* (1973), which included 127 pairs of same-sex twins ranging in age from 1 to 16 years. The present study analyzed the data from a subset of 95 pairs of twins who were from 2 to 6 years of age. The second study used data collected by Plomin (1974) and included 111 pairs of same-sex twins from 2 to 6 years of age.

The two samples did not overlap but they were very similar. The average age of the twins in both samples was $3\frac{1}{2}$ years; the average age of the mothers was 31 years. The samples were generally middle to upper-middle class with an average maternal education of nearly 2 years in college and a total family income of about \$14,000.

Zygosity Determination

In both studies, the zygosity of the twins was determined using a questionnaire modified by Willerman (1973) from Nichols and Bilbro (1966). The original questionnaire yielded 93% accuracy of diagnosis as compared with serological techniques, and its success has been replicated in similar studies of young children (e.g., Cohen *et al.*, 1973). The zygosity questionnaire includes items about physical characteristics such as eye color, hair color, other hair characteristics (growth rate, pattern, texture, and curl), ear lobes, middigital hair, height, and weight. Twins were classified as fraternal if they were markedly different in eye color or hair color or if they were different on two of the other characteristics. Twins who did not differ appreciably on any of these physical characteristics were classified as identical.

This procedure for determining zygosity yielded more MZ than DZ twins. In the first study, 60 pairs were classified as MZ and 35 as DZ; in the second study, 60 pairs as MZ and 51 as DZ. The relative shortage of fraternal twins appears to be characteristic of Mothers of Twins Clubs, as estimated by the organization. It may be that fraternal twins are felt to be less "twinlike" by their mothers, who are thus less likely to join or remain in a Mothers of Twins Club. If this explanation is correct, then it is possible that the DZ twins included in these samples are more similar than DZ twins as a whole, but the selection of MZ twins should not be biased in this respect. The most critical analysis of the present report is based only on MZ twins.

Confusability of Appearance

Mothers rated their twins on four items related to confusability of appearance: when young, twins were mistaken by parents; recently, twins have been mistaken by parents; twins are mistaken by close friends; and twins are mistaken by casual friends. Each item was rated on a 3-point scale as "frequently" (2 points), "occasionally" (1 point), or "rarely or never" (0 points). The possible range of scores was thus 0-8.

RESULTS AND DISCUSSION

It is no surprise that the MZ twins in both studies were markedly more confusable in appearance than DZ twins. Similarity of appearance was in fact used to diagnose zygosity. However, one would predict almost as great a difference had the diagnosis been based on blood-grouping, since the similarity criteria used have been shown to be highly accurate in other studies.

Means and standard deviations of the composite scores on the four confusability items for the two studies are reported in Table I. Three conclusions may be drawn from these data. First, as noted, the MZ twins have much higher ratings on confusability of appearance than the DZ twins. Second, the data show good agreement between the two studies. Finally, there is variation in confusability within both the MZ and DZ groups. This last point is crucial for the present study. If there were no differences in confusability of appearance among MZ or DZ twins, it would not be meaningful to ask the extent to which their confusability of appearance is related to their similarity in personality.

Absolute differences on the EASI traits were obtained for each pair of twins and these differences were correlated with the confusability of appearance of the twins (see Table II). These correlations represent the

Table I. Means and Standard Deviations for Confusability of Appearance for Two Types of Twins in Two Studies

	First study			Second study		
	N	Mean	S.D.	N	Mean	S.D.
MZ twins	60 pairs	5.8	1.3	60 pairs	6.1	1.5
DZ twins	35 pairs	2.1	2.0	51 pairs	2.9	2.4
All twins	95 pairs	4.4	2.4	111 pairs	4.6	2.5

Table II. Correlations Between Confusability of Appearance and Absolute Differences Within Pairs of Twins on Four Personality Traits

	First study			Second study				
	Emotionality	Activity	Sociability	Impulsivity	Emotionality	Activity	Sociability	Impulsivity
MZ twins	-0.23	-0.23	-0.02	-0.20	0.24	0.01	0.03	-0.22
DZ twins	0.10	0.35 ^a	0.06	0.28	-0.05	0.23	0.10	0.32 ^a
All twins	0.18	0.36 ^a	0.25 ^a	0.20 ^a	0.19 ^a	0.31 ^a	0.21 ^a	0.30 ^a

^a $p < 0.05$.

extent to which twins who are more confusable in appearance are more similar (i.e., have smaller intrapair differences) in personality.

A positive correlation indicates that twins who are more confusable in appearance are more similar in personality. The correlations are presented separately for MZ and DZ twins. To determine whether an environmental variable is a likely source of bias in twin studies, it is necessary to correlate that variable with differences within pairs of MZ twins, because intrapair differences for MZ twins can be caused only by environmental factors, but differences within pairs of DZ twins can be due to both genetic and environmental factors.

None of the correlations for the MZ twins in Table II is significant, suggesting that greater resemblance in appearance does not make MZ twins more similar in personality and thus does not seriously bias twin studies in personality. Indeed, the negative correlations of the first study suggested that if similarity of appearance affects MZ twins, the effect is to make them *less* similar in personality. The results for the second study suggested a contrast effect for one trait, Impulsivity, but did not replicate the contrast effects suggested in the first study for Emotionality and Activity. The differences between the two studies may well be due to sampling fluctuations, but it is possible that the item differences in the questionnaires of the two studies or the use of midrater estimates in the second study was somehow also involved. The studies, however, are consistent in suggesting that similarity of appearance does not seem to lead to similarity of personality, and hence does not represent a serious source of bias in twin studies of personality.

The correlations for the DZ twins and all the twins considered together suggest that greater resemblance in appearance is related to smaller differences in personality, particularly for Activity and Impulsivity. However, differences within pairs of DZ twins may reflect genetic as well as environmental differences. We know that MZ twins do not differ genetically, but that DZ twins vary in their genetic similarity around an average of 50%. Assuming that similarity of appearance among DZs has a substantial genetic component, the correlations in Table II can be most parsimoniously explained by the hypothesis that DZ twins who are more alike in appearance are also more similar in personality because they are more similar genetically. This interpretation of the data of the DZ twins is consistent with that of Pakstis *et al.* (1972), who suggested that physically similar DZ twins have more genes in common and therefore are more similar on heritable personality traits than those who are less physically similar.

An alternative interpretation of these data which should be considered is error in the twin diagnosis. It is rendered rather improbable at the outset by the very low rate of misdiagnosis previously found in twins of this age,

using methods similar to ours, by Cohen *et al.* (1973), as well as in somewhat older twins by Nichols and Bilbro (1966). The erroneous inclusion of some MZ twins among the DZ twins could serve as a plausible alternative explanation for the DZ findings. However, it seems unlikely that in our sample *any* MZs were misdiagnosed as DZs, because this would require MZs with marked differences in eye or hair color or other physical differences. It is more plausible that some DZs got in among the MZs. But it is not at all obvious how this would account for the present findings. It could explain physical resemblance going with personality resemblance in this group—but hardly the lack of such an association, which was what was found.

Thus we can tentatively conclude from these data that similarity of appearance, although markedly unequal for MZ and DZ twins, probably does not act to inflate estimates of heritability, at least in twin studies of personality using ratings of young twins. Of course, self-report data of older twins might yield different results. However, the scanty data in the literature suggest that here, too, contrast is at least as important as the commonality of twin environments in shaping the personalities of twins. Clearly, research to elucidate the operation of factors such as these remains very much in order.

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