

An Experimental Study of Mutual Behaviour Imitation and Person Perception in MZ and DZ Twins

*Implications for an experimental-psychometric analysis
of heritability coefficients*

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In an earlier study (Wilde, 1964) on 88 MZ and 42 DZ twin pairs in Holland, DZ pairs, who had been separated for a minimum of five years, were compared with DZ twins living together on measures of neuroticism, extraversion, test-taking attitude and masculinity/femininity. The striking observation was made that separated DZ twins were systematically more similar than DZ twins living together across all personality traits concerned. No such difference was found between MZ pairs living together and MZ pairs living separately. In order to account for these findings, the hypothesis was put forward that the persons in the direct environment of a twin pair have certain behavioural expectancies with regard to the twin members, which depend upon the observation whether the twins are MZ or DZ. As soon as the twin pairs leave the parental home these behavioural expectancies come to a halt and the "true personalities" of the twins will emerge. This might explain why DZ pairs were found to be more similar after separation, and this reasoning also shows that it is inadequate to say that "the environment is the same" or "the environment is different", without specifying which environmental variable is the same and which one is not. In some respects the environments of separated DZ pairs may have been more similar than the environments of DZ pairs living together.

If the above findings are considered together with those observed by Pire (1966), Shields (1954), Jones (1955) and Smith (1965), with regard to sociometric position, bonds of attachment, similarity of treatment by parents, and behaviours such as eating, clothing, studying and friendship choices, one can hardly overemphasize the importance of the differences between the *social interaction patterns* within MZ pairs and those within DZ pairs. In this respect, the within-pair environmental variance may differ considerably between MZ and DZ pairs. More specifically, one might expect MZ twins to conform to one another more than DZ twins do in everyday types of behaviours, as a consequence of the original behavioural expectancies on the part of the parents, and over and above the similarity of behaviour due to genetic factors.

In order to verify this theory two related hypotheses were tested in the present study:

- 1) MZ twins believe that they are more similar than they actually are to a greater extent than DZ twins do;
- 2) MZ twins imitate one another more than DZ twins.

Subjects were 2 ♂♂ and 10 ♀♀ MZ pairs, and 5 ♂♂ and 4 ♀♀ DZ pairs. The ages of MZ pairs ranged between 12 and 46 years; those of DZ pairs, between 14 and 39. Zygosity was determined by finger and palm prints, as well as by means of blood groups.

To test the first hypothesis, the Eysenck Personality Inventory (EPI, Eysenck and Eysenck, 1963), consisting of 57 questions, was administered to each subject; first under standard self-report instructions, and subsequently with the instruction to answer the questions as he thought his cotwin would do. Thus, from each twin, a self-report, as well as a prediction of the cotwin was obtained.

Line AB in Fig. 1 represents the actual similarity in self-reports and was measured in terms of the number of questions answered identically by both members, A and B of the twin pair. Line Aa indicates the assumed similarity between A and B according to A; line Bb, the assumed similarity according to subject B. The other lines will not be considered here. To test the hypothesis that MZ twins overestimate their similarity more than DZ twins do, it was predicted that the average value of the Aa and Bb would exceed the values of AB in MZ twin pairs to a greater extent

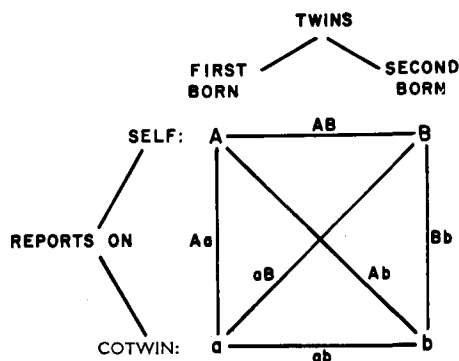


Fig. 1. Model of perception of self and of cotwin.

than in DZ pairs. The measure of overestimation of actual similarity, i. e., $Aa + Bb - 2(AB)$, was indeed significantly higher in MZ than DZ twins. A Mann-Whitney U-test on the raw data yielded a one tailed P value of 0.028. If one does not consider the twins as pairs, the same was found for the first-born, as well as the second-born members of the twin pairs. A weak relationship was found between sex and overestimation of actual similarity, female pairs showing more overestimation

than male pairs, which might account for some of the difference between MZ and DZ pairs, as females were overrepresented in the MZ sample. If the sex difference is partialled out, the correlation between overestimation of similarity and zygosity is somewhat reduced.

In order to test the hypothesis that MZ twins imitate one another more than DZ twins, an experimental procedure derived from Milgram (1961) was employed (Fig. 2). The equipment included two booths, each equipped with a panel with two yellow task lights, two corresponding information lights which were green, and two corresponding response buttons. By means of the task lights, 60 pairs of lights were presented one after the other with a 1 sec difference in duration. The subject was required to press the response button belonging to the light that appeared to have the longest duration. In one of the two testing conditions the information lights under the task lights were being used, and the subject was told that they corresponded to the response buttons of his cotwin. If they were used, the subject was required to delay his judgement response until one of the information lights had turned on. In actual fact, however, the sequence of the information lights was under the control of the experimenter and had been preprogrammed, so that the subject would obtain correct information in 40 of the 60 trials and incorrect information in 20 trials. A measure of conformity to the cotwin was obtained by subtracting the number of errors made on the 20 critical trials when the subject was performing the task in the alternate condition (i. e., with the information lights off), from the number of errors made when the subject was under the impression that the information lights indicated his cotwin's judgments. In half of the twin pairs, the first-born performed the task first with information lights off, while his cotwin made his judgements being exposed to the make-believe information. In the other half of the twin pairs, this order was reversed.

Although the observed differences between conformity scores are all in the expected direction, only those obtained from the first-born (A) subjects are significant. Again, a sex difference was found: female pairs imitate one another more than male pairs.

Although the statistical evidence for both hypotheses is marginal indeed, the results do give some further support to the general picture of particular social interactions in MZ and DZ twins, as outlined in the beginning of this paper. To an earlier statement by Zazzo (1960), that twins are developmentally so atypical that the meaningfulness of quantitative heritability coefficients is greatly reduced, we would, therefore, like to add that the meaningfulness of heritability coefficients of personality traits is also severely limited by the specific social perception and imitation which occurs in MZ twins, as contrasted to DZ twins. This is because the tendency toward conformity or nonconformity can be expected to have a strong influence upon concordance in behaviour.

Consequently, it appears that, apart from sampling inadequacies, the greatest problem in the interpretation of heritability coefficients is located in the absence of sufficient control over environmental variables. In other words, the twin method, designed to overcome the flaws in the pedigree method, essentially suffers from the same shortcomings. In order to obtain better control over environment, new twin research methods need to be designed.

One such method, which we labelled the "experimental-psychometric" procedure, studies the effect of ongoing practice upon the level of the heritability coefficient. The main features of this method may be explained by means of an investigation which is currently being carried out. In a study of musical ability and visuo-motor coordination, twins are trained and tested individually on a pitch discrimination task and on pursuit rotor performance. Practice sessions continue until

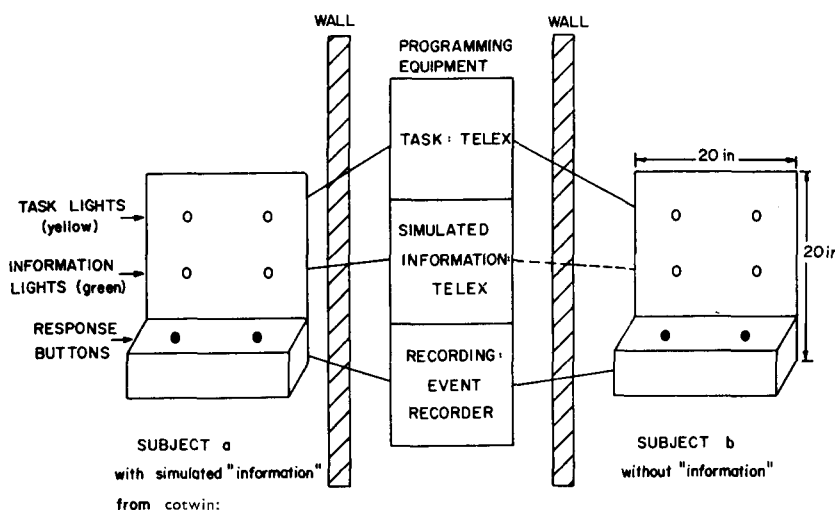


Fig. 2. Equipment used in conformity study.

asymptotic performance is reached. At every trial, concordance and heritability coefficient are calculated and they are plotted for the consecutive trials. Some of the possible configurations that may arise when this method is employed are shown in Fig. 3.

It would appear that such an analysis will give rise to a more accurate and detailed evaluation of the contributions of heredity and environment to phenotypic behaviour.

The study of pitch discrimination and pursuit rotor performance has not yet been completed, but some empirical features of this procedure may be exemplified by a reanalysis of earlier data published by Brody (1937) on a task of mechanical ability, and by McNemar (1933) on a motor task. As can be seen from Fig. 4, MZ concordance for motor skill increased more than DZ concordance over six consecutive trials. The value of h^2 at the first trial is insignificant; at the sixth trial, it is significant at the 0.01 level. If, therefore, measurements had been obtained at the first trial only, by the common "instant picture" approach, the heritability of the trait would have been underestimated. Our reanalysis of McNemar's data led

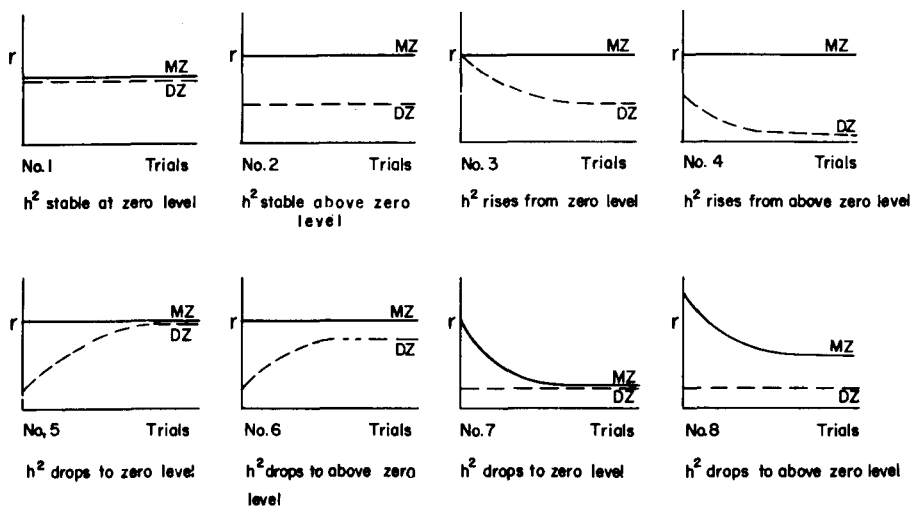


Fig. 3. Patterns of r_{mz} and r_{dz} and effects upon the heritability coefficient h^2 as a function of practice or experimental manipulation running from trial one to asymptotic performance. (Fictitious data).

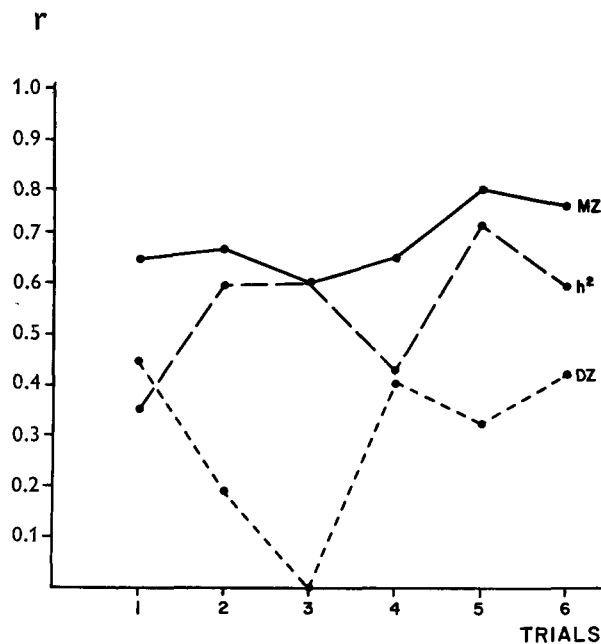


Fig. 4. Changes in h^2 as a function of practice in a test for motor skills. (After McNemar, 1933).

to an entirely different pattern. As can be seen from Fig. 5, heritability of the trait is suggested in the first trial, but the "moving picture" approach shows that h^2 approximates zero, as more experience with the task is obtained, because DZ twins eventually become as concordant as MZ twins.

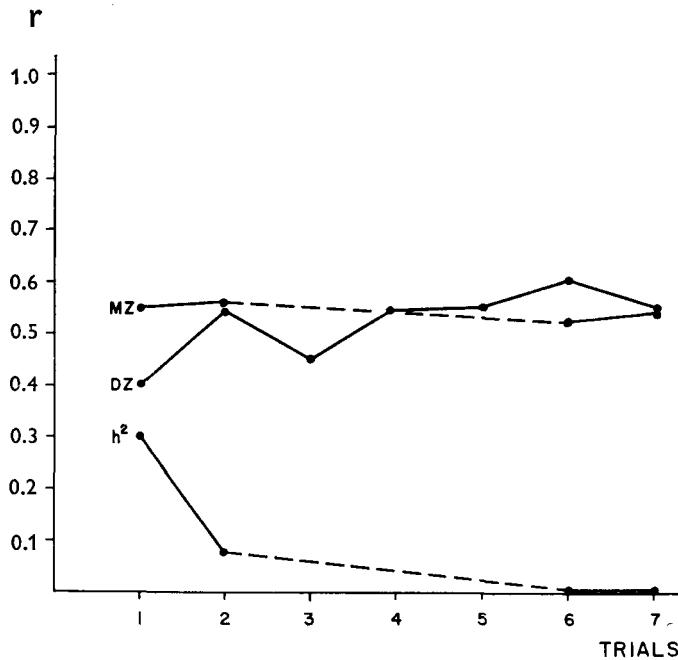


Fig. 5. Changes in h^2 as a function of practice in a test for mechanical ability. (After Brody, 1937).

Summing up, it seems fair to conclude that future twin research should pay more attention to the particular social interaction patterns in MZ and DZ twins and their implications for the evaluation of heritability estimates. The proposed experimental-psychometric procedure seems to hold considerable promise as an additional research design.

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