A CRITICAL RE-EVALUATION OF THE VALUE OF TWIN STUDIES IN CRIMINOLOGICAL RESEARCH

INTRODUCTION

The effect of genetic factors on human behaviour has been recognised for a long time. One of the methods that has been used extensively to study the relationship between heredity factors and the exhibiting of criminal behaviour is the twin study. A critical re-examination and re-evaluation of this method will be the focus of this article.

A HISTORICAL PERSPECTIVE ON THE UTILISATION OF TWIN STUDIES

The first attempts to determine the relationship between heredity and criminal behaviour or the genetic basis of certain human characteristics were undertaken by means of twin studies. Studies in which identical (monozygotic or enzygotic) and non-identical (dizygotic or fraternal) twins are compared were used as early as 1876 by Galton (Von Hentig 1979:31; Willemse & Rademeyer 1933:64).

The difference between identical and fraternal twins can be attributed to the fact that identical twins are the product of a single fertilised egg, while fraternal twins develop from two separate eggs, fertilised by two different sperm cells. In the case of monozygotic twins, the fertilised egg splits into two daughter cells at an early stage of embryonic development with the result that each develops into an independent individual. The two embryos share the same genes which make them identical in genetic composition. When both members of the twin pair exhibit behavioural similarities it is postulated that heredity has had a significant influence on their behaviour. On the other hand dizygotic twins do not have the same genetic make-up because of the different combinations that are possible with separate fertilisation. Therefore, the behaviour of these twins will be no more similar than that of their brothers and sisters (Brown, Esbensen & Geis 1996:226-227; Taylor 1984:36).

Twin studies are based on the assumption that monozygotic twins, because of their identical genetic endowment, will exhibit greater behavioural concordance than dizygotic twins. Concordance rate refers to the degree in which twins concur with regard to a specific characteristic or behaviour. The higher the concordance rate the more significant is the proof that behaviour can be explained genetically. The presence of disconcordance (or differences between members of a twin pair with regard to a specific trait or behaviour) in monozygotic twins can therefore be attributed to non-genetic factors (Johnson 1978:143).

The first pioneering studies involving twins were undertaken at the beginning of the nineteenth century by the German psychiatrist Franz Kallmann. His interest in ascertaining how mental disorders such as schizophrenia developed, and what role was played by heredity factors, led him to make use of the twin study method. On the basis of his research it was shown that if one member of a monozygotic twin pair developed schizophrenia or any other serious mental disorder, the concordance rate for the other member developing the same disorder was approximately 85 percent. In non-identical twins the concordance rate was established to be merely 14 percent (Taylor 1984:36).
A large number of twin studies were undertaken during the twentieth century in countries such as The Netherlands, Russia, Japan, Germany, Great Britain and the United States of America. These studies mainly focused on the influence of heredity factors on variables such as intelligence, alcoholism, depression and schizophrenia. In general the above-mentioned studies concluded that psychological and psychiatric problems of this nature are significantly related to heredity factors. Thus while attention was given to this method of research in the field of psychology, relatively no research was undertaken from a criminological perspective (Hollin 1989:25).

The first criminological study which involved twins was undertaken in 1929 by Johannes Lange, a German psychiatrist. Lange's twin study focused on both imprisoned male offenders and offenders who had been committed to a psychiatric hospital in Germany. In order to draw a comparison an attempt was made to locate the non-institutionalised member of each twin pair and to subject him to the same tests. Lange succeeded in locating 30 pairs of twins that were made up of 13 pairs of monozygotic and 17 pairs of dizygotic twins. In the case of the 13 pairs of monozygotic twins, the concordance rate for committing crime was found to be 77 percent. In ten of these cases both members of the twin pair were in prison. On the other hand it was found that of the 17 pairs of dizygotic twins only two (12,9%) were in prison. In his book Verbrechen al Schicksal: Studien an Kriminellen Zwillingen (Crime as destiny) which was published in 1929, Lange comes to the conclusion that the concordance rate for monozygotic twins who show criminal tendencies is much higher than for dizygotic twins. According to Lange these findings supply adequate proof that heredity plays an important role in the causation of crime. Criticism of the fact that the concordance rate for the monozygotic twins was not 100 percent is explained as follows by Lange: In two of the three cases the twin showing criminal behaviour suffered from serious brain damage, which could have been the cause of the criminal behaviour (Mannheim 1964:231-232; Steyn 1978:70; Sutherland & Gressey 1960:101).

Various other studies conducted by Lange up to 1941 support his viewpoint that heredity factors play a role in the committing of crime. On the basis of his research the conclusion is made that if one of a monozygotic twin pair shows criminal behaviour the chance that the other one will exhibit similar behaviour is 75 percent. On the other hand, the concordance rate for fraternal twins is 24 percent. Research done by Rosanoff and his co-workers as well as Dalgard and Krøgli (in Cloninger & Gottesman 1987:97-98, Eysenck & Godfredson 1989:96-97, 99; Glaser 1978:132-133) support the findings of Lange. In Tables 1 and 2 the findings of these studies are set out:

Table 1: Overview of twin studies involving juveniles

<table>
<thead>
<tr>
<th>Juvenile delinquency</th>
<th>Monozygotic</th>
<th>Dizygotic</th>
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<tr>
<td></td>
<td>N</td>
<td>Concor-</td>
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<td></td>
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<td>dence</td>
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<tr>
<td>Krantz (1937)</td>
<td>16</td>
<td>69,0%</td>
</tr>
<tr>
<td>Rosanoff, Handy and Plessit (1941)</td>
<td>41</td>
<td>97,6%</td>
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<tr>
<td>Sugmantl (1954)</td>
<td>10</td>
<td>80,0%</td>
</tr>
<tr>
<td>Hayashi (1967)</td>
<td>15</td>
<td>80,0%</td>
</tr>
<tr>
<td>Sugamata (1967)</td>
<td>06</td>
<td>83,0%</td>
</tr>
<tr>
<td>Shields (1977)</td>
<td>05</td>
<td>80,0%</td>
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Table 2: Overview of twin studies involving adults

<table>
<thead>
<tr>
<th>Adult criminality</th>
<th>Monozygotic</th>
<th>Dizygotic</th>
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<tr>
<td></td>
<td>N Concor-</td>
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<td>dance</td>
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<tr>
<td>Krantz (1937)</td>
<td>18 64,5%</td>
<td>19 36,8%</td>
</tr>
<tr>
<td>Rosanoff, Handy</td>
<td>39 65,6%</td>
<td>48 53,5%</td>
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<tr>
<td>and Plessit (1941)</td>
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</tr>
<tr>
<td>Sugmanti (1954)</td>
<td>04 75,0%</td>
<td>05 40,0%</td>
</tr>
<tr>
<td>Hayashi (1967)</td>
<td>45 77,8%</td>
<td>27 22,2%</td>
</tr>
<tr>
<td>Sugamata (1967)</td>
<td>28 61,0%</td>
<td>18 11,0%</td>
</tr>
<tr>
<td>Shields (1977)</td>
<td>31 25,8%</td>
<td>54 14,9%</td>
</tr>
</tbody>
</table>

Although the above-mentioned researchers utilised different research methods, it appears from Tables 1 and 2 that monozygotic twins show a higher concordance rate for criminal behaviour than dizygotic twins.

An important contribution was made to criminological research by Shufu Yoshimasu, professor in criminal psychology and forensic psychiatry in Tokyo, Japan. In a longitudinal study undertaken from 1941-1961, he studied 28 pairs of identical and 18 pairs of fraternal twins. Concordant criminal behaviour was found in 50 percent of the identical twin pairs, while none of the dizygotic pairs showed similarities with regard to crime. During the period following World War II, concordance rates increased to 60 percent and 11 percent respectively, an increase that Yoshimasu contributes to a general post-war increase of crime in Japan (Mannheim 1965:233-234). He also indicates in his research that a significant percentage of the unconforming identical twin pairs who showed criminal behaviour were first offenders who had started their criminal careers at an early stage which could implicate that they were not inclined to recidivism. In contrast to this, the identical twins whose behaviour was concordant, committed crime before the age of 25 years and were repeatedly found guilty of committing crime.

Criticism lodged against twin studies is that identical twins are treated similarly, therefore it is understandable that they will show similar behaviour. To ascertain whether this is indeed the case, two case studies were undertaken with identical twins who had been separated and brought up independently of each other. In one of these studies both the twins showed a similar pattern in their crime careers. Despite this finding, Yoshimasu, points out that both attended the same primary school which could have contributed to the similarity in their behaviour. The behaviour shown by the identical twins in the other case study was dissimilar, a fact which could be attributed to the different environmental circumstances they were exposed to since birth. Differences were also found with regard to personality traits and health. These two case studies are of scientific value because the contribution of both environmental and genetics factors in the causation of crime is taken into consideration (Mannheim 1965:233-234).

The twin study that was undertaken in 1977 by Christiansen also deserves special attention. By making use of the Twin Register, The National Police Register and the Penal Register, he located twins that were born in Denmark between 1881 and 1910. With the aid of these registers 218 twin pairs (older than 15 years) of whom at least one member showed criminal behaviour could be selected. Of the 67 pairs of male monozygotic twins that were included in this investigation, 24 (35,8%) were both in prison. However, the concordance rate for the 114 pairs of male dizygotic twins was 12,3 percent. In the case of female twins, three (21,4%) of the 14 pairs of
monozygotic twins were concordant with regard to crime, while only one (4.3%) pair of the female dizygotic twins were both in prison. Christiansen also indicates that the concordance rate for serious crimes is higher than for crimes of a less serious nature. While the concordance rates noted by Christiansen is notably lower than that of his predecessors, his sample is also more representative as he included all twins that were born during a specific period (Glaser 1978:132-133; Vold 1979:105).

EVALUATION OF TWIN STUDIES

A major point of criticism is that with the exception of Christiansen’s study, the samples used by researchers are too small and non-representative of the twin population to be able to generalise the findings. In this regard Mannheim (1965:232) points out that in some of the studies the participants were obtained from psychiatric clinics. A possibility that cannot be disregarded is that the criminal behaviour may not have been the result of genetic factors alone, but also of psychiatric problems (Reid 1976:137). Furthermore, the similarities in the so-called criminal behaviour of the identical twins (which were not significant due to the fact that incarceration was sometimes utilized as a criteria for criminality) and convicted criminals reflect only a small percentage of felons. As a result of the large dark figure in crime, it can happen that criminals are presented as non-criminals in society, while they could have committed crimes for which they were not convicted. If this aspect is taken into consideration, the concordance rate between monozygotic as well as dizygotic twins could change significantly (Eysenck & Godfredsson 1989:98). A further point of criticism is that different meanings are attached to the concept of ‘crime’. Different degrees of criminality exist which were not taken into consideration during early twin studies, eg those done by Lange and Legras (Hurwitz & Christiansen 1983:61).

Researchers such as Stumpf and Christiansen, however, attempt to show that the criticism aimed at twin studies is not necessarily correct. In this regard Stumpf distinguishes between different degrees of criminality by indicating that concordant behaviour in the case of identical twins are to a large extent limited to serious offenders with inherited psychopathic tendencies. He concluded that inheritance plays an important role in serious offences, while environmental factors are more relevant in less serious crimes (Mannheim 1965:233).

Mannheim (1965:232) postulates that most identical twins, because of their similarity in appearance, elicit similar social reactions and are frequently exposed to the same environmental factors. Parents are inclined to treat identical twins in the same way by, for example, dressing them alike. As a result it is difficult to determine how and to what extent their behaviour is influenced by genetic and/or environmental factors (Conklin 1981:153; Mednick, Moffit & Stack 1987:74).

Research that Loehlin and Nichols (in Eysenck & Godfredsson 1989:97-98) undertook in 1976, however indicates that when a comparison is made between twins who are treated similarly and those who are not, no significant differences occur with regard to intelligence and personality. Similarities in the treatment of identical twins are related to relatively artificial similarities such as dressing them the same. Thus, the implication that environmental factors such as treating them similarly could give rise to significant changes in intelligence, personality and criminality is not acceptable.

Since there are too few monozygotic twins that are raised separately deductions with regard to concordance and the role of inheritance are limited (Eysenck & Godfredsson 1989:102). Research findings in this regard are therefore based on a few case studies like that of Yoshimasu in 1961, and
significant deductions can therefore not be made (Mannheim 1965:233-234). Reckless (in Bloch & Flynn 1956:108) further indicated that when biological determinism is a reality, unconformity with regard to monozygotic twins is impossible. Most twin studies (the study of Legras in 1932 excluded), produced unconforming cases (See Korn & McCorkle 1960:201). Mannheim (1965:232), however, postulates the following: 'Though Reckless' criticism is theoretically sound, it seems to require a perfection not generally demanded of similar studies with human subjects'.

Burt (in Vetter & Silverman 1986:413) advanced in conjunction with this that monozygotism does not necessarily ensure absolute identical inheritance, because the possibility exists that one member of a monozygotic twin pair could be the result of the less developed half of an embryo. One of the twins can therefore be smaller and weaker in development than the other one. Significant congenital differences were also found with regard to all the identical twins. Syphilis was for example found in only one member of a twin pair. This places the fundamental assumption of identical, equal and/or similar inheritance under suspicion (Mannheim 1965:232).

Although two individuals with identical genetic characteristics can display similar criminal behaviour, it sometimes happens that individuals with different genetic characteristics can be criminal because of similar environmental circumstances to which they were exposed (Johnson 1978:143). The validity of concordance rates in the case of dizygotic twins are therefore still, on account of the influence of environmental factors, called into question.

Criticism was also verbalised with regard to the manner in which the distinction was initially made between identical and fraternal twins. External observation was used as criterion for the distinction, with the result that monozygotic and dizygotic twins were distinguished on the basis of sight. It was therefore impossible to determine if a twin pair looked alike or if they were monozygotic. This distinction on the basis of appearance, as found in research done by Lange, Rosanoff, Kranz, Stumpff and Borgstorm (in Cloninger & Gottesman 1987:97-98), can therefore possibly contribute to a number of mistakes with regard to concordance rates. Because of technological progress in the field of fingerprinting, the classification of blood and serum protein analysis, the distinction between monozygotic and dizygotic twins is more accurately determinable and the above-mentioned objections can be excluded with regard to modern twin studies (Bartol 1991:36; Vold 1979:106).

In spite of the fact that a 100 percent concordance rate could not have been determined with monozygotic twins in the above-mentioned research, twin studies have indicated that genetics play an important role in the causation of crime.

A RECENT EXAMPLE OF THE USE OF TWIN STUDIES IN THE DETERMINATION OF THE BIOLOGICAL ORIGIN OF CERTAIN PHENOMENA

Twin studies have also been used since 1964 to determine the genetic origin of Tourette syndrome (TS). TS is a neurological brain disorder that is caused by a chemical imbalance between the serotonin and dopamine levels in the brain. According to the Diagnostic and Statistical Manual of Mental disorders (DSM-IV) (American Psychiatric Association 1994:71) this imbalance is characterised by the uninterrupted presence of chronic motor and vocal tics that have been present for at least one year, before the age of 21 years. Various other symptoms such as attention deficit disorder, obsessive-compulsive behaviour, learning disorders, speech problems, sleep disturbances, emotional and behavioural problems (such as stealing, lying and
aggressive behaviour that may lead to violence), may occur in Tourette sufferers in conjunction with the tics.

Although Ellison published the first report with regard to TS in monozygotic and dizygotic twins, he was strongly criticised on account of the fact that no provision was made for criteria for the distinction between monozygotic and dizygotic twins (Robertson 1989:162; Shapiro, Shapiro, Bruun & Sweet 1978:105). Convincing proof that TS has a genetic origin, was also obtained with the aid of twin studies by Escalor, Majeron and Finavera in 1972, Shapiro in 1978 and 1980, Jenkins and Ashby in 1983, Comings in 1990, as well as Segal, Dyskem, Bachard, Pedersen, Eckert and Heston in 1990 (Kurian 1993:494; Robertson 1989:162). The study that was executed by Shapiro in 1980 included nine pairs of identical and four pairs of fraternal twins, of which seven (78%) of the monozygotic and one (25%) of the dizygotic twin pairs showed a concordance with regard to TS (Comings 1990:46).

The most extensive study that was executed with twins that suffer from TS, is the study of Price, Kidd, Cohen, Pauls and Leckman (Chase, Friedhoff & Cohen 1992:16). In this study, 30 pairs of monozygotic and 13 pairs of dizygotic twins were compared with each other. The concordance rate for the monozygotic twin pairs was 53 percent, while only eight percent of the dizygotic twin pairs were concordant with reference to TS. Due to the fact that only 53 percent of the monozygotic twin pairs were concordant with reference to TS, Price and his co-workers stated that certain non-genetic factors can play a role in the manifestation of TS (Hyde, Aaronson, Randolph, Rickler & Weinberger 1992:652).

Researchers such as Leckman, Price, Walkys, Ort, Pauls and Cohen (in Hyde et al 1992:652) also studied the influence of factors such as the birth weight of twins. In this study it was found that in the case of monozygotic twins where at least one is a TS sufferer, the TS sufferer will have a significantly lower birth weight than the one who does not manifest the TS symptoms. The researchers declared the following in this regard: 'The difference in body weight strongly predicted the magnitude of the intrapair tic score difference. These findings suggest that crucial events affecting the phenotypic expression of TS occur in utero and that the factors causing the birth weight difference are also related to tic severity' (Hyde et al 1992:652).

Hyde and his co-workers also undertook a similar study where 16 pairs of monozygotic twins, of which at least one is a TS sufferer, were studied. Twelve pairs of male and four pairs of female twins, between the ages of eight and twenty six years, were included in the study in order to determine the concordance rate for TS and tic disturbances. Results indicated that the twins showed a concordance rate of 56 percent with regard to TS, while a 94 percent concordance with reference to tic disturbances was found. These findings correlate satisfactorily with Price, Kidd, Cohen, Pauls and Leckman's results, and support the assumption that TS has primarily a genetic origin (Hyde et al 1992:652).

In a follow up study by Hyde, Fitzcharles and Weinberger (1993:178-179) in 1992, 18 pairs of monozygotic twins, of which at least one was a TS sufferer, were studied. Seventeen pairs were concordant with regard to motor tics. Research indicated that when these tics commence at an early age, the manifestation and course of TS is of a more serious nature. Eleven pairs showed a concordance with reference to vocal tics, but the age at which these tics commenced have no influence on the eventual manifestation of TS. This study is an example of the way in which a long-standing research
method can be utilised in the new millennium.

CONCLUSION

Although the above-mentioned studies confirm a concordance with regard to TS in monozygotic twins, researchers such as Hyde et al (1992:656-657) are of the opinion that these numbers do not necessarily reflect the concordance rate for twin pairs in the general population. The fact that parents are more prone to becoming members of organisations such as the Tourette Syndrome Association and their children are therefore involved in research studies where both the twins manifest TS symptoms, can possibly influence the concordance rate as indicated in the mentioned studies. In spite of this criticism, the research on TS reconfirms that twin studies are even today a valuable tool in determining the genetic origin of crime-related phenomena. The potential of these type of studies should not be underestimated and should be developed to its maximum by researchers in the natural, biological and human sciences.

REFERENCES


