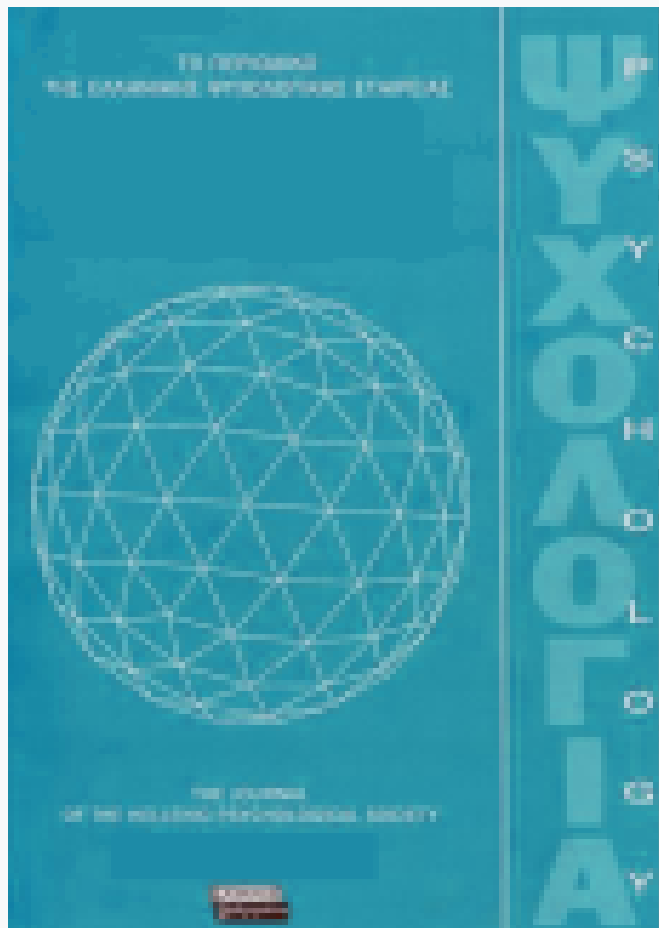


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Britta Alin Akerman

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Twins at puberty: A follow-up study of 32 twin pairs

BRITTA ALIN AKERMAN

Stockholm Institute of Education, Sweden

ABSTRACT

Thirty-two twin pairs were followed by means of ability tests and semi-structured interviews at regular intervals from birth to adolescence in order to study their cognitive development. The tests consisted of a verbal, a spatial, a number series, and a mathematical test. In addition, a questionnaire was administered regarding interests, attitude toward school and relationship with parents and co-twins. Relationships were also studied in semi-structured interviews, usually with both twins present. Twins born at or near term and with a normal birth weight showed normal development, while prematurity and growth retardation were associated with a predisposition toward a slow cognitive development, even at the age of 13. Also, twins compared to singletons seemed to have more difficulty in developing independence and achieving a positive self-esteem (identity), possibly as a result of their struggle to emancipate themselves from both parents and co-twins.

Key words: Cognitive development, Prematurity, Twins.

Introduction

A considerable amount of research has been conducted on populations of young twins, most of which has been oriented towards the genetic aspects of twinship. Only a few empirical studies have examined the twin situation itself, i.e., "how it is to be a twin". Twins present specific challenges in the realms of physical, emotional, social, interpersonal, and cognitive domains. Several studies during the last 30 years have found differences in cognitive performance between twins and singletons, especially with respect to verbal ability (Alin Akerman & Fischbein, 1991; Bryan, 1983; Mittler, 1970; Wilson, 1975; Zazzo, 1976). Wilson (1975), for example, compared twins with low birth weights from different social environments and found that

those from higher SES groups after 36 months had a near normal level of cognitive performance. The low birth weight twins from lower SES groups continually showed a lag in cognitive and language development up to 36 months. Hay, Prior, Colette, and Williams (1987) found that twin boys at 30 months of age showed an eight month delay in expressive language development compared to a matched singleton group. Watts and Lytton (1981) also found a lag in language development in twins compared to singletons. They observed that the twins' parents talked less with their children compared to parents of singletons. Many observations, thus, seem to point to the fact that the lag in language development is large in the early stages of development, but diminishes as the twins mature. There has been a difference of opinion

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Address: Britta Alin Akerman, Department of Human Development and Special Education, Stockholm Institute of Education, Box 47308, 100 74 Stockholm, Sweden. E-mail: britta.alin-akerman@lhs.se

as to whether this is a feature inherent to twins, whether it is a result of prematurity or birth trauma, or whether it could be due to postnatal factors (Alin Akerman & Fischbein, 1991; Savic, 1980).

What happens then in the period of adolescence? Hay (1999) has raised two important questions: (a) do twins experience the same stressors and triggers as other young adults or are there extra pressures and benefits, and (b) what really influences their building of a separate identity? Only a few studies of adolescent twins adequately address the question of whether this period of development is more difficult for twins than for singletons. Moilanen, Piha, Kumpulainen, Tamminen, and Almqvist (1999) compared twins with singletons in the National Epidemiological Child Psychiatric Study, which included 122 twins and 5455 singletons, born in 1981 and selected at random. According to their parents, twin boys were slightly more often likely to be emotionally disturbed than singleton boys, while the teachers evaluated twins to be disturbed *less* often. The authors concluded that this discrepancy might be caused by the twin boys' specific behaviour in different situations; at school they might tend to be supportive of each other, while at home rivalry for parental attention could lead to behavioural or emotional symptoms. This conflict might constitute a negative influence on their identity and self-esteem development.

Monozygotic twins seem to be regarded as a unity, while dizygotic twins are treated differently by their environments (Fischbein, Guttman, & Nathan, 1999). Fischbein et al. (1999) also found that a more restrictive environment reduces the influence of hereditary factors, and, by contrast, a more permissive environment increases the impact of these factors. These factors (restrictive or permissive treatment) may also influence the twins' identities and attitudes, both toward themselves and toward others.

Since the beginning of the 1980s, when ultrasound screening of all pregnant women was

introduced, almost all multiple pregnancies are identified during early pregnancy, allowing better supervision of twin mothers-to-be. This leads to preventing or alleviating pregnancy complications. In spite of this, many twins are born prematurely. Prematurity is a known risk factor predisposing for delayed development, even under the best circumstances (Alin Akerman, 1987, 1995; Alin Akerman & Thomassen, 1991, 1992).

From 1981 on, a group of 32 twin pairs have been followed closely using a developmental test and interviews. The aim of this paper is to describe these twins' mental ability from birth up to 16 years of age, to point out gender differences, and, finally, to discuss the twins' adjustment to the school situation. The focus will be on the twins' mental ability and identity at 13 years of age.

Method

Study group

The study began at the Women's Clinic of the Karolinska Hospital in Stockholm, Sweden. One obstetrician supervised all the twin pregnancies. Ultrasonic observation and medical check-ups of the mothers and the fetuses took place at regular intervals. When the mother-to-be was called to her first physical check-up, she received written information. One to two weeks later, a first contact was made by telephone and all parents agreed to participate. The group consisted of both first-time parents ($n = 16$) and parents who already had children ($n = 19$). Six of the pregnancies were the result of various types of assisted conception.

The families were enrolled in the study between December 1981 and July 1983. The group originally consisted of 35 pairs of parents-to-be and, later, their twins. One twin was stillborn and two families left the country and could not be located later on. The study group

therefore finally consisted of 13 monozygotic (MZ) and 19 dizygotic (DZ) twin pairs. Thirty-five were girls and twenty-nine were boys. Most of the MZ twins were girls (9 female and 4 male pairs). Six children were born with physical impairments. One had a distal myelomeningocele (MMC), one twin pair had craniosynostosis of a sagittal suture, and three infants showed significant skeletal malformations. None of the twins had any signs of cerebral injury. Most families lived under average socio-economic conditions. The families were examined when the twins were new-born, and then again at 9 months, 18 months, 4 years, 8 years, 13 years, and 16 years of age.

Developmental tests

In order to be able to compare the present samples with those of other studies, developmental scales were used, which measure general development and specific areas of development, as well as social adjustment. The Griffiths Mental Development Scale (GMDS, Griffiths, 1970) was used at 9 months, 18 months, and 4 years of age. The Wechsler Intelligence Scale for Children (WISC, Wechsler, 1991), was used at 8 years of age. At 13 years of age, four ability tests constructed by Härnqvist and Svensson (Härnqvist, 1968), which measure verbal ability (opposites), spatial ability (metal folding), logical abstract ability (number series), and mathematical achievement were employed. These tests have shown a high degree of consistency (Emanuelsson & Svensson, 1990), and have been used in Swedish school research for several decades.

For comparison reasons, the above mentioned study from Gothenburg, Sweden was used (Emanuelsson & Svensson, 1990) as well as the Metropolitan Project (Alin Akerman & Fischbein, 1991). Project Metropolitan (Janson, 1984) is a longitudinal study comprising 15,117 individuals (7,719 boys and 7,398 girls) born in

1953 and living in the Stockholm area. The project included 145 twin pairs. They entered the study in 1963. The cohort was studied in 1966 at the time they attended grade 6 and were 13 years of age. In the Gothenburg project, mental ability was studied from grade 6 onwards. One of the goals of that study was to ascertain whether the level of intelligence was falling or rising. Therefore individuals born in 1972, 1977 and 1982 have been followed (a total of 9,000).

In the follow-up study presented in this paper, the respondent at 13 years of age had to find the opposite of a given word among four alternatives in the verbal test (40 items, 10 minutes). In the spatial test, the respondent was asked to find a three-dimensional object among four alternatives that could be made from a flat piece of metal with bending lines marked on the drawing (40 items, 15 minutes). In the spatial abstract test, the respondent had to complete a series of numbers (six of which were given) with two additional numbers according to a logical rule (40 items, 18 minutes). The mathematical test, which is an achievement test, consisted of 19 different items. Participants were allowed to use paper and pencil to solve the problems.

Further procedure in the 13 year follow-up.

After completion of the testing, the twins were interviewed in order to determine who in the twin pair was the more dominant. The twins themselves were also asked to answer the question as to whom they considered to be the most dominant. The interview then focused on the twins' interests, friendships, school situation, relationship to each other, and dependency on each other. It also addressed which of the twins was more active, who had the most of initiative, and what was their relationships to their parents.

The children's teachers were asked to rate the twins' behaviour at school on a scale from 1 to 4 (Fischbein, 1984). This rating was done to investigate whether the teachers could distinguish between twins and gives to them different scores when they behaved differently. The teachers had to respond to statements like:

"The pupil seems to need more help than normal to begin new tasks in school".

"The pupil usually works with persistence and concentration in monotonous, but important exercises".

"The pupil seems to daydream during the lessons or think of other things than school tasks".

A higher rating implied a more deviant behaviour than a lower rating.

Results

Test scores

Independent samples *t*-tests of group differences were employed in all comparisons. Statistical significance was set at the 0.05 level.

Table 1 shows the ability test scores for male and female twins at 13 years of age. The three ability tests showed no gender differences. In the mathematical test, however, girls performed better than boys, $t(62) = 1.97, p < .05$. No differences were found between first-born and second-born twins at any time.

The comparison between monozygotic and dizygotic twins is shown in Table 2. No differences were found between MZ and DZ twins, except for the mathematical ability at 13 years of age, in which MZ twins performed

significantly better than DZ twins, $t(62) = 1.96, p < .05$. (It should be pointed out that there are more females than males among the MZ twins.)

Thirty-two twins had a birth weight of less than 2,500 grams. Test differences between low birth weight twins vs. those of normal birth weight (more than 2,500 grams) were not significant. The study group was too small to compare twins born small for gestational age (SGA) with those who were not. But when comparing the *premature* twins with those who were born at or near term (< 37 gestational weeks), there was a significant difference in two of the achievement tests (number series, $t(62) = 1.01, p < .05$ and mathematical achievement, $t(62) = 1.99, p < .05$) at 13 years of age (Table 3).

A comparison between data from the Metropolitan Project and the Gothenburg study of non-twins using the same ability tests is shown in Table 4. The mathematical test is not included, as it was not used in the Metropolitan Project.

Significant differences were observed between female twins in the current study group and female twins in the Metropolitan study in logical abstract ability, $t(58) = 2.44, p < .05$.

The teacher questionnaire showed no difference between twin boys and twin girls at 13 years of age concerning adjustment at school and general knowledge of school subjects, compared with singletons. Teachers showed a tendency to give the same rating for both siblings

Table 1
Ability and achievement test scores for male and female twins

	Male			Female			<i>t</i> -test
	<i>N</i>	<i>M</i>	<i>SD</i>	<i>N</i>	<i>M</i>	<i>SD</i>	
Verbal	29	20.9	6.6	35	21.3	8.1	0.19
Spatial	29	21.2	7.2	35	22.4	5.6	0.76
Number series	29	21.4	8.8	35	22.1	10.1	0.28
Mathematics	29	11.2*	5.2	35	13.4*	4.2	1.97

Note: * $p < 0.05$.

Table 2
Ability and achievement test scores for monozygotic and dizygotic twins

	Monozygotic			Dizygotic			t-test
	N	M	SD	N	M	SD	
Verbal	26	22.0	8.8	38	20.5	8.8	0.78
Spatial	26	22.6	5.2	38	21.4	7.1	0.69
Number series	26	23.2	10.2	38	20.8	9.0	1.01
Mathematics	26	13.6*	4.1	38	11.3*	5.0	1.96

Note: * $p < 0.05$.

in a twin pair, regardless of whether they were MZ or DZ twins. On the contrary, their rating of opposite-sex twins was usually divergent.

Twin interviews and general observations

A recurring observation was that one of a pair was always the first to answer during the interviews. The same one usually took the initiative to develop and emphasise his or her experiences and thoughts, while the other twin accepted this. When this behaviour was brought to the twins' attention, both answered that they had never thought about this role taking (which was so obvious to others). In the case of dizygotic opposite-gender twins, females tended to be more dominant, and they also tended to act protectively of their twin-brothers.

The interviews showed that the twins had very close bonds with each other. These strong bonds, difficult to break, made it difficult to develop a feeling of identity. The process of liberation often resulted in violent fights and controversies. At the same time they were very much aware that they were being difficult; they were often in a kind of love-hate relationship. "Peter and I are constantly fighting. We always disagree. We have been wearing and tearing on each other all these years", were the words of a 13 year old twin boy. This behaviour was similar

in MZ and DZ twins of the same gender (both males and females), but different in twins of opposite gender. Despite all this, the twins thrived in each other's company. The co-twin was often a twin's best friend, even if she/he had other friends. A common pattern, especially among twin girls, was that one of them teased, and the other, feeling provoked, fought back. When they were asked to explain why these fights took place so often, they were usually unaware of the reason, but the reply could be: "Sometimes I have to be left alone, I get so tired of not being allowed to be alone. I simply can't help fighting then". Quarrels and fights with others may lead to broken friendships, but twins know that their co-twin will always be there. "Twins need each other", was a common explanation the twins themselves offered.

Twins at the age of 13 usually do not want to be similar, but are often reminded by their environment of different aspects of similarity, something which they seem to detest. On the other hand, twins often choose the same friends, because they share the same values and qualities. It was obvious that the twins did not want to look like their siblings. They often dressed in a different way and coloured their hair differently. Thus, in a way they enjoyed being twins, but still they tried to differentiate from each other in order to try to develop their own identity.

Table 3
Ability and achievement test scores related to premature birth

	Prematurely born twins			Twins born at term			t-test
	N	M	SD	N	M	SD	
Verbal	26	20.7	5.3	38	21.3	5.3	0.20
Spatial	26	21.6	6.8	38	22.0	6.1	0.23
Number series	26	20.3	7.3	38	22.4	10.6	1.01
Mathematics	26	11.0*	4.0	38	13.1*	5.1	1.99

Note: * $p < 0.05$.

Table 4
Ability and achievement test scores related to the Metropolitan Project and the Gothenburg control group

	Stockholm Twin male			Stockholm Twin female			Metropolitan Twin male			Metropolitan Twin female			Gothenburg Male singletons			Gothenburg Female singletons			t-score
	N	M	SD	N	M	SD	N	M	SD	N	M	SD	N	M	SD	N	M	SD	
Verbal	29	20.9	6.6	35	21.3	8.1	135	22.9	6.7	125	22.4	6.7	1880	20.9	5.5	1863	21.5	5.6	ns
Spatial	29	21.2	7.2	35	22.4	5.6	135	22.8	7.4	125	21.3	6.6	1880	23.3	7.7	1863	22.9	7.1	ns
Numerical	29	21.4	8.8	35	22.1*	10.1	135	20.1	8.5	125	18.3*	7.5	1880	23.3	8.8	1863	21.8	8.0	2.44

Note: * $p < 0.05$. ns = nonsignificant.

One event experienced as difficult for the twins, as well as for their parents, was when puberty occurred at different times for each twin. This often happens in DZ twins, and it may have a profound influence on the twins' self-image and identity.

Twins who had been in the same school class struggled to be placed in separate classes when they were transferred to high school. This applied particularly to those twin pairs with large differences in development and knowledge. Those who view of themselves as equally talented did not have the same need to take different roles or to compete, and they usually found it more practical to remain in the same class. This phenomenon was more frequently observed in the MZ twins. But these twins also believed that they would be treated differently and as special individuals when placed in separate classes.

Discussion

The earlier measurements of this twin group using Griffiths scales showed that female twins performed better than male twins at the age of 9 and 18 months as well as at 4 and 8 years (Alin Akerman, 1987, 1994; Alin Akerman & Thomassen, 1991, 1992). In twins, as well as in singletons, girls achieved a certain degree of maturity earlier than boys during the preschool years. These gender differences are general and related to the fact that physical growth of the brain is slower in boys than in girls (Morgan, 1956; Nordberg, 1994). In the present study, twin boys up to 4 years of age were slower than their female siblings in skills involving locomotor ability and perception. No other longitudinal study has been found which describes mental development in twins over such a long period. In the present study, certain differences in mental development were observed in a group of premature twins even at the age of 13, a finding which is consistent with the results of the Metropolitan Project (Alin Akerman & Fischbein, 1991).

In a number of studies, twins have been found to have a significantly increased risk of neurological disability compared to singletons (Bryan, 1983; MacGillivray, Campbell, & Thomson, 1988). Twins may receive a lower score on developmental tests compared to singletons because a large proportion of twins are born prematurely (see Table 4). An increased risk for prenatal and perinatal damage could be a contributing factor for the poor achievements in twins as a group. In this presented group of twins, measures of mental development showed significant differences between the premature and the normal group during the school period. The prematurely born children had poorer scores in some areas. Number series tests and mathematic achievement seemed to be most difficult tasks for these prematurely born twins. Normal-weight twins, born at term, had results comparable to those of the group of singletons.

Between the ages of 11 and 14 years, major physical and psychological changes take place including bodily changes and changes in logical-abstract thinking. During these years the adolescents are expected to create an identity of their own, i.e., a deepening feeling of who they are as individuals and what their values, attitudes and goals are. Many family conflicts arise due to parents' failure to see that young people have a need to be left alone in order to be able to develop autonomy. From the point of view of adolescence, previous openness towards the parents can turn into silence and sulking.

This process is different in twins. Not only do they have to liberate themselves from their parents, but also from their co-twin with whom they usually have very close bonds. These strong bonds are difficult to break, and they probably make it more difficult to develop an identity separate from the co-twin.

Strong competition, fights and controversies between the twins provoke parents as well as teachers. From the twin's point of view, this is a way to find out who is the strongest. However, above all, it is the expression of a liberation

process. In spite of this, the feeling of closeness to the twin sister or brother never disappears. Twins know that they will always have each other.

The role of being either the clever or the weak one, which has been built up during the years, can be accentuated during puberty. However, the individuals now dare to revolt and express the difficulties involved in adopting this role.

Twin girls from mixed pairs mature earlier than male siblings. Self-awareness was favourably influenced by early puberty because it was easier for the girls to get older friends, including boys. Boys, on the other hand, showed a tendency to feel inferior, physically as well as psychologically. This is consistent with the findings in another longitudinal Swedish twin study (The SLU-project, Fischbein, 1979). This study also confirms Fischbein's theory (1986) that, by treating twins as individuals, they have a much better chance of remaining independent and becoming mature adults.

Conclusions

Although the children in the present study had a good start with special caretaking and follow-ups, about one third of the twins lagged a little behind in different developmental tests even up to 13 years of age. Moreover of the 64 twins, 20 had some problems in their school situation. Almost all those who had either been born prematurely, or weighted less than 2,500 grams at birth were in this group of poor performers. The observed higher incidence of retardation in mental development in twins appears to be related to biological factors, such as prematurity and birth injury, rather than to the twinning itself.

It also seems to be more difficult for twins to develop independence and a positive identity. This may be a result of their struggle to differentiate themselves from both their parents and their co-twins.

Finally, this study showed the length of time that prematurity at birth can influence individual

development and school achievement in this tested twin group.

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