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The Role of Parental Attitudes in the Development of Temperament in Twins at Home, School and in Test Situations

D.A. Hay, P. J. O'Brien

Department of Genetics and Human Variation, La Trobe University, Bundoora, Australia

Abstract. In the La Trobe Twin Study, data are collected on temperament and social development in 3-15 year old twins and singletons from four different sources: questionnaires to parents covering development from birth to the present plus the Bristol Social Adjustment Guide completed by the teacher, Sattler's Behavior and Attitude Checklist completed by the tester, and the Qualitative Score on the Porteus Maze Test. Particular stresses are identified which the parents perceive as distinguishing a multiple from a singleton birth. Whereas they perceive no differences between the first and second-born in birth complications, the second-born is judged less favourably particularly in MZ pairs. The distinction continues in the later assessments by the teacher and tester, where in addition the male twins are seen as being different from other children both in cognition and in temperament. It is proposed that social and cognitive development of twins are interrelated and have two unique components, one related to the greater problems accompanying a multiple birth and the other to comparisons between cotwins.

Key words: Twins, Development, Temperament, Social behavior, Cognition, Bristol Social Adjustment Guide, Porteus Maze Test

INTRODUCTION

"Children and parents develop within the context of social forces and their perceptions of the stress to which they are exposed relative to others in their own experienced group. In our intensive, clinical studies of individual twinships, we have delineated patterns of vulnerability. In intact, well-functioning, middle-socioeconomic-class families, subtle differences in early endowment or in parental perception of a child as vulnerable or fragile may lead to enduring patterns of interaction emphasizing children's difficulties or sensitivities" [11, p. 101].

This quotation emphasises the importance for multiple birth children of considering their behavioral development in the broader content of both their biological and family environment. The multiple birth situation creates a complex of factors whose effects may depend largely on what the parents and children perceive of them. Apart from the many examples of real or imagined differences between the twins forming the basis for parental perception [7,8,11], one specific case is the practice of keeping one newborn twin in hospital after the other is released [5,18]. There may be permanent effects on how the family accepts that second child, resulting not from the biological event which necessitated that hospital stay so much as from the reactions of the family to this event. Similarly, while birthweight in itself may not be a major determinant of subsequent behavior, parents may show more positive responses and less anger and rejection to the higher birthweight twin with the one exception of low-birthweight sons to whom the mother responds the most [7]. Therefore, indirectly birthweight may mediate behavior in a complex fashion.

Apart from comparisons between twins, the multiple-birth situation constitutes a unique rearing environment in other respects. By necessity rather than by choice, some degree of parental neglect is inevitable in the family with twins [10], the situation being worse in higher multiple births. Whereas mothers of six-month-old singletons report as much as 240 minutes of play daily with their child, mothers of twins manage no more than 110 minutes split between the two children. When she does divide her attention, it is the more favored twin who is more precocious. In an observational study of two-year-old twin boys and singleton boys [20], parents spoke far less to the twin children, controlled their behavior less, were less consistent in enforcing rules and less affectionate. A survey of Australian parents of twins [14] identifies features of the social environment even more specific to the twin situation, such as the reaction of siblings to the birth of twins and the issue of closeness vs. individual development especially as in separating twins at school or keeping them together.

The La Trobe Twin Study of Behavioural and Biological Development is a longitudinal study of behavioral growth from a genetic and environmental perspective. Although twins are crucial in genetic analyses of development, an obvious safeguard is to be aware of those areas in which they may differ from singletons and the specific variables which may influence their development. While an approach which considers behavior in such a general broad perspective is frequently advocated in developmental psychology in general [24], it becomes almost obligatory with twin children. To illustrate this point, data are presented here from two areas:

1. Perceived differences during pregnancy and at birth between twins and singletons and the reaction of the parents to the newborn twins;
2. The behavior of older children during testing and in school.

The first illustrates the sources of some of the early differences which parents perceive between twins and singletons and among twins, while the second examines the permanence of such differences and their influence outside the family situation.

MATERIALS AND METHODS

The La Trobe Twin Study began recruiting families in late 1978 and currently includes 418 families comprising 375 sets of twins, 7 sets of triplets, 464 siblings, 114 cousins of the twins, and 7 survivors from twin pairs where one had died, a total of 1356 children. The children enter the program between the ages of 3 and 15 years and thereafter are tested on successive years with a comprehensive physical and behavioral test battery [14,15].

Data on noncognitive aspects of behavior are assessed in four ways:

1. Questionnaires completed by parents, by the twins and by the siblings, dealing with specific issues in the *multiple-birth family*. Various aspects of the use of these questionnaires have been considered elsewhere [14,15].
2. The Bristol Social Adjustment Guide [29] which the teacher completes. The BSAG was developed specifically for the needs of maladjusted children and offers a convenient means of assessing the nonacademic aspects of a child's school behavior. It has also been used to examine the effects of prematurity on behavior in seven-year olds [12]. Disturbances are more common in children who experience complications of pregnancy and/or birth and subsequent stressful family situation, all of which are relevant to the circumstances of twins.
3. The Behavior and Attitude Checklist [27] completed by the tester to give an indication of how the child approaches the test situation and responds during the testing. In the La Trobe Twin Study, twins are always seen by separate testers [14], so that there is no problem of comparison between the twins.
4. Qualitative scores on the Porteus Maze test. While the maze test suggests some cognitive differences between twins and singletons [14,15], the qualitative scoring provides distinct measures of errors in drawing and execution. It is intended "to reveal any haphazard, impulsive or overconfident habits of action" [26, p. 253] and like the BSAG can distinguish maladjusted and delinquent children from normals.

RESULTS

1. Characteristics of the Multiple-Birth Family

Table 1a summarizes basic information on participating families, excluding families with cousins or triplets. The sibship size in the families with cousins of the twins (excluding those with twins themselves) is 2.6, the same value reported [1] for singleton births.

Only 16% of the families have had another child after the twins. Some of this may be due to the connection between parity and DZ twinning [1], so that the twins are most likely to be the later children in the family. However, there remains 32% of the sample who have had only twins where the absence of further children cannot be explained this way and where it is more likely to be a conscious decision. Families report that they feel they could not cope practically with another child after the twins, as well as being concerned about the possibility of another multiple birth.

Table 1(b,c,d) summarizes the medical stresses accompanying a multiple pregnancy in terms of prematurity, lower birthweight and an increased risk of complications. As regards average gestation length (37.7 weeks) and birthweight (38% below 2500 g), the sample corresponds to published figures [4,21]. In the light of the different birth problems and mortality risks experienced by first- and second-born twins [4,5], it is interesting that the parents perceived no differences in the incidence of complications.

How did parents respond to the information that they were expecting twins with the attendant risks? It is necessary to exclude the 17.6% where the multiple pregnancy was not diagnosed until labor, a figure which may appear high but which is much less than the 31% reported elsewhere [4]. Where mothers knew in advance, 63.3% reported their initial reaction to the diagnosis of twins was very positive. By the time of delivery, 60.6% were still very happy even though 75.4% found their multiple pregnancy more uncomfortable than their previous singleton ones. The anxieties which mother had in that period are summarized in Table 2a. As measured on a four-point scale, some 40% of mothers were fairly or very concerned about the extra work and the health of the twins, with almost the same percentage being concerned about the effects on other siblings. There was far less concern about potential emotional problems for the twins and the parents.

TABLE 1 - Characteristics of Families with Twins in the La Trobe Twin Study *

(a) Family structure	Twins only	Older children than twins	Twins then younger children	Older children, twins then younger	Total
Number of families	120	190	42	16	368
Sets of twins	122	194	42	17	375
Other children		364	52	48	464
(b) Length of pregnancy					
		Less than 28 weeks	29-32	33-36	37-43
Percentage of twins		1.7	7.5	20.1	68.4
Percentage of singletons		0	2.7	9.1	83.1
(c) Birthweight					
	Below 1500 g		1500-2500 g		Above 2500 g
Percentage of twins	2.4		35.7		61.9
Percentage of singletons	0		2.7		97.3
(d) Problems perceived by mothers at the births of their twins and singletons					
Percentage with	Twins		Singletons		
	First-born	Second-born	Overall		
No physical problem at all	40.8	38.6	39.7	59.6	
Slight problem (eg, eye infection)	12.7	11.4	12.0	8.9	
Transient problem (eg, jaundice)	29.1	31.8	30.5	27.0	
Serious problem (eg, major blood transfusion needed)	10.8	10.9	10.9	3.1	
Significant problem (eg, prolonged difficulty in breathing)	6.6	7.3	6.9	1.4	

* Varying number of mothers answered questionnaire items b-d. In all cases the data are based on over 200 twin pairs and 300 singletons.

What happened when the twins were born? Table 2b indicates that mothers were correct in their perception that the birth of twins would lead to far more work. While many of them were happy about their twins, significantly more (both $P < 0.01$) reported

Table 2 - Reactions of Parents to a Multiple Birth

(a) Concerns by mothers after learning they were expecting twins (Data are percentage of 262 mothers checking each category)								
	Not at all	Just a little	Fairly much	Very much				
Extra expenses	30.1	43.8	17.0	9.1				
Extra work	22.9	35.9	21.6	19.6				
Not enough time to love two	72.1	12.9	6.8	8.2				
Emotional stress on parents	61.0	25.5	9.2	4.3				
Difficulties for the children in being twins	59.4	26.6	11.2	2.8				
Where applicable:								
Strain on other siblings	43.0	25.8	14.8	16.4				
Health of the twins	28.8	32.0	21.6	17.6				
(b) Reaction in the first three months (Percentage of mothers checking these nonexclusive categories, based on 199 twin births and 296 singleton births)								
	Exhausted	Tired	No time	Frantic	Anxious	Depressed	Reasonably OK	Very happy
Birth of twins	76.2	81.2	79.2	10.9	42.6	29.7	38.1	39.1
Birth of singleton	7.9	28.1	13.1	3.4	15.8	5.8	28.4	31.5

anxiety and depression. It is unknown whether these are the biological results of post-partum depression being more severe after a multiple birth or are a consequence of the practical difficulties to do with caring for the twins. Although 47.7% received some local or state government aid toward assistance in the home, 73.6% reported that they never or hardly ever had an opportunity to go anywhere without the twins and 91.8% that they were rarely or never able to go out with their partner in the first three months. One consequence of this disruption to the household routine was that 63.8% reported problems with older siblings in this period, ranging from regression (enuresis was the single most commonly reported symptom) through to (in three cases) severe physical aggression directed against the twins.

In the light of concern [5,18] over keeping one twin in the hospital, we can consider the 45.4% of cases where one twin came home before the other. Only a small proportion of mothers had no definite views on this practice. One-third, 33.4% would much rather have had both babies home at the same time, because they found the repeated trips to the hospital meant that a routine could not be established with the first homecomer. In contrast, 51.2% of the mothers were very pleased with the arrangements in reducing their workload and helping them adjust to one baby.

Table 3 - Reaction to First- and Second-Born Twins*

Question	First-born	Second-born	Both	In same-sex pairs there was more preference for the first-born
1. To which twin did you (the mother) feel closest?	16.9	9.4	73.7	In MZ pairs ($P = 0.05$)
2. To which twin did your partner feel closest?	17.0	9.4	73.6	In girls ($P = 0.05$) especially DZ (zygosity \times sex $P = 0.01$)
3. Which twin required more attention?	31.7	40.7	27.6	In girls ($P < 0.05$)
4. Which twin was easier to manage?	40.3	27.7	32.0	In girls ($P < 0.05$)
5. Which twin was fussier?	29.9	34.8	35.3	No difference
6. Which twin was healthier?	28.1	14.6	57.3	In MZ ($P < 0.05$)
7. Which twin was more active and alert?	27.0	28.0	45.0	No difference
8. Which twin was more responsive to you?	23.8	16.0	60.2	In MZ ($P < 0.01$)
9. Which twin was more responsive to others?	24.5	23.4	52.1	In MZ ($P < 0.01$) and in males ($P = 0.01$)

* Data are percentage of 262 mothers checking each category

2. Parental Perceptions of Differences Between Twins

Once both twins were at home, did the mothers perceive any differences between them? Table 3 presents comparisons of first- and second-born twins.

Although mothers were less likely to discriminate between the twins on the value-loaded items concerning to which twin they or their spouse felt closest or which twin responded more to them, the picture emerges of both parents feeling closer to the first-born who is also easier to manage, less fussy and healthier (all these first-second born differences are significant at $P < 0.05$ except the last where $P < 0.01$).

There were differences between the types of twins in the extent to which the first-born were preferred. Among opposite-sex DZ pairs, there were no birthorder differences. Across the nine measures, the first-born was preferred in 31.8% of the cases and the second-born in 29.4%. Differences between MZ and the same-sex DZ twins were analyzed using the functions of categorical response procedure of the Statistical Analysis System [17] which uses generalized least squares methods to produce minimum chi square estimates in the same syntax as ANOVA, in this case of zygosity, sex, and zygosity \times sex. With two exceptions, preferences for the first-born are more likely in girls or in MZ pairs. Comparable analysis of the proportion of mothers making any birthorder distinction or rating both as equal gave no significant results on any of the nine variables. So, mothers of MZ or female twins are no more or less likely than other mothers to make distinctions between their twins and it is the basis for their distinction which differs.

Remembering from Table 1d that there were no birthorder differences in the incidence of birth complications, a behavioral explanation is that parents are using birthorder

as a means to identify the twins when nothing else is available. In opposite-sex DZ twins, they can use sex and in same-sex DZ twins there are often sufficient physical or behavioral differences by which the twins can be categorized. Therefore, any connections with birth-order are fortuitous and equally likely in first- or second-born.

They have to use birthorder only in MZ and in girls who are generally more resilient than males to the stresses of a multiple pregnancy [5] and where differences between the twins are less likely to result from this cause. Birthorder differences in Apgar scores in favor of the first-born have been found [4] more often in twins < 1500 g, a category into which more MZ than DZ twins fall [20]. Birthweight is unlikely to be the explanation in the present case because of the small proportion of twins in this category (see Table 1b) and because it is inconsistent with the birthorder effects being greater in girls.

Birthorder differences in twins' early behavior have been described elsewhere [8, 32] including the Louisville Twin Study [31]. In the Louisville Study the data concerned such issues as feeding, sleeping and temper problems, and with the exception of sleeping problems, it was the second-born who exhibited more problems. However, it was also reported that the second-born "laughs, smiles more readily", similar to the La Trobe Twin Study [14] on school age twins where the second-born was rated as more affectionate but as inferior in other respects. Some zygosity differences have been reported [31] albeit on very small samples. As regards feeding, sleeping and temper problems, birthorder differences were more consistently found in MZ than in DZ twins.

Examination of Child Personality Scale responses on 377 sets of 1-6-year-old twins [8] identified birthorder effects only on the factor of sociability which has an introversion-extraversion dimension. Among first-born, MZ boys were the most extraverted, MZ girls the most introverted, with DZ and girls being intermediate. Among second-born, the pattern was reversed with DZ boys and girls being the two extremes and MZ twins in the middle.

No explanations are offered for any of these birthorder differences. In the Louisville Twin Study [31], birthorder effects were unrelated to birthweight differences, in contrast to other situations [18,30] where such a correlation has been found. More detailed analyses, comparable to those [11] of the pregnancy and birth data in the La Trobe Twin Study, are planned to see if any connections with birthorder, sex and zygosity do emerge. At present, the effect seems to be an illustration of the "subtle differences" between the twins which may have lasting effects on the parents' perceptions [11].

These results provide an overview of some of the features surrounding a multiple birth. The biological problems are greater than in a singleton pregnancy but the difficulties do not stop at birth and continue with the extra practical concerns in caring for newborn twins. While this period is usually considered as a critical time for the child, the stress of a multiple birth makes this an equally critical time for the establishment of parents' impressions of their children. Apart from the questionnaire data indicating the negative aspects of a multiple birth, the few families who have had any children subsequent to the twins (Table 1a) is an objective indication of the parents' attitudes. They may be good parents to the twins, but they do not wish to repeat the experience or add to the family stresses by having other children.

3. Bristol Social Adjustment Guide (BSAG)

The normal scoring of the BSAG is by cumulative totals of index items which identify a variety of syndromes along the major dimensions of underreacting maladjustment (unforth-

comingness, withdrawal, depression and nonsyndromic underreaction) and overreacting maladjustment (hostility, in consequence, peer maladaptiveness and nonsyndromic overreaction). A category of neurological disorders is common to both dimensions. A factor analytic study with schoolchildren in Victoria, Australia [3], confirms the existence of four factors of inconsequence, hostility, unforthcomingness and lack of confidence.

However, a much less satisfactory pattern emerged from the factor analysis of BSAG data from 672 children in the La Trobe Twin Study (Table 4). Six factors had eigenvalues greater than 1 and together accounted for 70.7% of the variance. While it is reassuring that both school achievement (factor 3) and physique (factor 6) are independent of the temperament variables on which teachers rate the children, factor 1 overlaps considerably with factor 2 as does factor 4 with factor 5 even after rotation. One indication of this is that only 17 of the 38 questions correlate < 0.4 with any of the first six factors. Further data are being obtained to determine whether the difference from the Victoria study [3] reflects merely a sampling difference or as suggested by Koch [19] an inherent difference in how twins (and their siblings) are perceived by teachers.

Inspection of the individual questions contributing to each factor indicated twin-singleton differences on some but not all of the questions. Given the inconclusive factor analysis, each question was examined separately and those with significant twin-singleton differences are shown in Table 5. Questions 37 and 38 confirm the academic deficits of male twins [16] and Question 31 indicates these are accompanied by more health problems [5]. Questions 2 and 5 show that twins try harder to interact with the teacher, but that male twins may be handicapped by their frequently observed language disabilities [20,34]. Twin girls may cooperate with the teacher, but are less able to interact competently with other children (Question 21) and like the boys have a less mature style of play (Question 19). Immature play has been noted in younger twins in the La Trobe Twin Study and linked to language delays [9], while the problems with other children have been termed the "prima donna effect" [19] to denote the problems twin girls find in relying on anything other than the uniqueness as twins to attract and maintain friends.

The one significant ($P < 0.01$) birthorder effect was on Question 14 where, apart from male twins generally finding it more difficult to work by themselves, the second-born was particularly affected. This result parallels the birthorder effects seen with both digit and visual memory where the second-born also are very easily distracted [13].

Teachers' perceptions of twins are not subject to the same early stresses and biases which establish parental perceptions. Nevertheless, they do observe several differences between twins and singletons, some of which relate to the unique cognitive and language situation of twins [20,34] and some of their unusual social circumstances. Their behaviour with other children is different as is their interaction with the teacher where the competition for attention parallels the earlier competition for the mothers' attention with its possible, causative role in language delay [28]. One cannot say that twins are maladjusted at school, but rather that they are adjusted to coping with a different situation in ways which may be less appropriate in the school situations.

4. Behavior and Attitude Checklist (BAC)

Sattler [27] divided his 37-item checklist (each item rated on a seven-point scale) into ten behavior categories, and factor analysis (Table 6) of the responses from 1119 tests essentially confirms his division. The first ten factors account for 73.6% of the total variation and after Promax rotation, at least the first eight of these relate quite closely to his categories.

Table 4 - Factor Pattern of the Bristol Social Adjustment Guide

Factor	Description of factor	Proportion of variance	Items correlating >0.4 with factor
1	Cooperation with teacher and attention in class	25.6%	2,3,5,8,13,27
2	Attention and distraction	13.8%	7,13,14,28
3	School achievement	10.4%	37,38
4	Antisocial behavior	8.5%	18,29
5	Bad company and malicious damage	6.5%	21,30
6	Physique	5.9%	32,35

Table 5 - Twin-singleton differences on the Bristol Social Adjustment Guide (significance levels shown in brackets)

Question 2	Twins are more willing to help the teacher (P < 0.01)
Question 5	Female twins talk more to the teacher than singletons, while male twins talk less (sex interaction P < 0.01)
Question 14	Male twins are less able to work by themselves (P < 0.001)
Question 19	Twins have a different, less mature style of play (P < 0.01)
Question 21	Female twins are more likely than female singletons to have problems making or keeping friends (P < 0.01)
Question 31	Twins, especially males, have more health problems (P < 0.05)
Question 37	Male twins are poorer readers (P < 0.001)
Question 38	Male singletons are better at arithmetic than male twins and all females (P < 0.05)

Table 6 - Factor Pattern of Sattler's Behavior and Attitude Checklist*

Description of factor	Checklist items correlating >0.6 with factor	Regression on age
1. Reaction to praise and failure	19,21-24	P < 0.01
2. Attitude to test situation	4-7	P = 0.05
3. Tester's overall impression of the results	36,37	not significant
4. Strategies in working	14,15	P < 0.0001
5. Language	25-27	not significant
6. Attitude toward self	10,11	P < 0.0001
7. Attitude to examiner	2,3	P < 0.05
8. Visual-motor skills	31-35	not significant
9. Speed and understanding of directions	12,16	P < 0.001
10. Extent to which tester's questions help	18	not significant

* Numbers refer to the checklist given in [27]

These factors are based on children of 3-15 years and as Table 6 shows, the scores on most factors are age-related. This is in contrast to the BSAG where there were few consistent age changes. Including age as a variable in the analysis led, after rotation, to age having a correlation of 0.92 with one factor and less than 0.09 with all the others. The only BAC items correlating to any major degree with this factor were numbers 10 and 11 to do with attitude to self ($r = 0.22$ and 0.20 respectively). The other two factors in Table 6 where the scores change markedly with age are strategies of working (Factor 4) and speed and understanding of directions (Factor 9) which reflect cognitive changes seen in the preadolescent [15]. Since age did not otherwise contribute to the factor patterns, it was excluded from the factor analysis and used as a covariate in the analysis of factor scores. A separate manuscript on these is in preparation, incorporating an analysis of differences between testers and a genetic analysis.

To identify the twin-singleton and birthorder effects hypothesized above, factor scores were analysed using the unequal observations facility of the general linear models procedure of SAS [17], with age as a covariate. In factors 2 and 5 there were sex differences in the twins ($P < 0.01$ and $P < 0.05$, respectively) which were absent in the singleton siblings and cousins. Compared with female twins, all twin males (MZ and DZ) were less interested, less eager, found the testing less enjoyable and did not try their best (factor 2), and were less fluent, less articulate and made more vague responses (factor 5). These results are consistent with the pattern of cognitive results [14] and with the emphasis on language as a major contributor to twin-singleton differences [35].

Birthorder effects were found only on factor 3 ($P < 0.01$) with the tester regarding the results of the second-born as less valid and more unreliable. That only this factor is involved would suggest that it is in adults' perception of the twins as well as in the child's actions that birthorder effects appear. The effect is partly contributed by the child, since on factor 7 (attitude to the examiner) there was a birthorder \times sex \times zygosity interaction ($P < 0.001$), exactly the same as that observed [8] on the sociability factor (see earlier). First-born MZ females were the most hostile and tense towards the examiner, first-born MZ males the least, with first-born DZs of both sexes intermediate. In second-borns, the zygosity differences were reversed.

Unlike the data on newborn twins (Table 3), the birthorder \times zygosity interaction on factor 3 did not quite reach significance ($P < 0.08$), although the results were in the predicted direction with birthorder effects being largest in MZ and minimal in opposite-sex DZ twins. In MZ twins, the standardized factor score of the first-born was 0.49 units less than the second-born (where a higher score indicates less valid and reliable results), while the difference was 0.22 in same-sex DZ and 0.06 in the reverse direction in opposite-sex DZ.

One significant difference between siblings and cousins was found. On factor 7 (attitude to the examiner) the siblings were more hostile and tense ($P < 0.05$). There was also a sex difference among the siblings ($P < 0.05$) with the males being less cooperative than the females. This result is consistent with data [14] from the questionnaire for siblings, "How I see having twins in the family", where siblings indicated they resented attention being drawn to themselves just because of the twins (which is precisely the aim of the Twin Study). Boys were more negative than girls in that, compared with girls, they were less likely to have a close relationship with one of the twins, they felt less important than the twins and considered the parents fussed over the twins too much.

To go through analyses of factor scores searching for significant differences is a hazardous process and it should be emphasized that all the results here were consistent

with earlier hypotheses and with data obtained in other questionnaires and tests. They demonstrate the noncognitive differences among twins and siblings which influence their performance on cognitive tests indirectly through their attitudes to the tests and the tester. Only the poorer language skills of the male twins can be considered as a more direct influence. These results must thus be distinguished from those attempts [22,33] to make a functional connection between the perceived degree of closeness (“twinness”) and field dependency with its loading on such cognitive measures as the Embedded Figures Task.

The “How I see being a twin” questionnaire in the La Trobe Twin Study should enable this issue to be addressed with a far larger sample than either of these studies. However, it has been shown [14] that twin children, irrespective of zygosity, are rarely prepared to distinguish themselves from their cotwin on any value-loaded item, with the additional complication that boys are much more likely ($P < 0.001$) to make a neutral response or no response at all. At that time the reason was unclear, but the present BAC results would indicate it may be both a lack of interest and a language problem with an inability for the boys to understand the verbal concepts involved.

5. Porteus Maze Test Qualitative Scores

Qualitative scores of the Porteus Maze reinforce the overlap between cognitive and temperament processes in the behavior of twin boys. Restricting the sample to children tested on the Year XII maze gave the results shown in Table 7. Only the cumulative qualitative error score [26] is given which weights seven possible errors such as cutting corners, lifting the pencil or making “wavy lines”. Males make more errors ($P < 0.01$) and twins make more errors than singletons ($P < 0.001$ for females, $P < 0.05$ for males). Parallel differences exist for the number of children unable to complete the maze, emphasising the difficulty male twins find with this task [14,35].

Some birthorder effects have been found, but they differ with zygosity and across the different components of the qualitative score. Given the outdated norms for the Porteus Maze (most 14-15-year olds record an IQ of 135+) and the absence of any adequate qualitative norms, more detailed consideration of this task must await analysis of all the Porteus maze tests completed by children in the La Trobe Twin Study.

DISCUSSION

The results confirm the contention [10,11] that twins are a natural experiment for the study of the long-term consequences of small, early differences among children. Apart from illustrating the range of potential sources of twin-singleton differences, parallels

Table 7 - Qualitative Error Scores (Mean ± Standard Deviation) on the Porteus Maze Year XII Test

	Female		Male	
	Singleton	Twin	Singleton	Twin
Number completing maze	33	31	33	23
Number failing to complete maze	0	5	6	11
Qualitative score	7.15 ± 0.47	8.9 ± 0.37	9.06 ± 0.31	9.43 ± 0.22

exist between the results of formal tests and of questionnaires to the parents, testers and teachers. That is, cognitive development cannot be distinguished from behavioural development in general.

The question is whether the differences in temperament and adjustment seen between twin boys and other children on the BAC, BSAG and Porteus Qualitative score reflect anything more than the problems these boys experience at school and in the test situation. Is it because these boys do not do well that they are more distractable, less cooperative etc? It is interesting that detailed studies of smaller samples of young twins make the same point. Two-year-old male twins spoke less and in a more immature fashion than singletons, were less active, spent less time in symbolic play and were less aware of the rules of conduct in the family [20]. A review [28] of other studies indicates that in the preschool years, twins, apart from the language delays, displayed fewer affectionate and aggressive behaviors, generally interacted less frequently with other children in a kindergarten situation and engaged more in solitary play.

For clinical work with twins it is important to know if these developmental delays in twins are a consequence of poor language development or represent a more general pattern of cognitive and social disruption caused by the twin situation. The same question can be asked of siblings whose articulation proficiency is impaired by the twins [23]. Nor is it clear how long this pattern persists. One study [30] of adult male twins suggests a connection between birthweight, social position in school, school performance and adult performance on personality and word association tests, but is limited by the extensive reliance on retrospective reporting of childhood events. There are age changes on the BAC attitude towards self and reaction to praise and failure where the twin scores increase more than do those of singletons. Whereas in the complex family situation after the birth of twins the children develop specific strategies to obtain adult attention [20, 28], the need for such strategies diminishes as the twins become accustomed to other social situations.

But birthorder effects do not diminish. They occur not only in newborn twins where they might be expected, but also right through the 3-15-year-old sample on which the BAC and BSAG results are based. Since birthorder effects occur also for some specific cognitive skills but not general intelligence in this age-range [14], more needs to be understood about the mechanism for the birthorder distinction. Is there some biological basis overlooked in the parent's reports (Table 2a) but suggested by some of the obstetric literature [4,5], or is it based solely upon parents' needs to differentiate between their twins? A relevant observation [25] is that whereas environmental influences on objective personality measures with twin children mainly reflect between-family influences, analyses of personality by questionnaire show mainly within-family effects. Although unreliability may also contribute to within-family effects, this distinction is consistent with birthorder or some similar variable influencing the parents' perceptions of the twins and the twins' perceptions of themselves. Comparable differences for teachers' and twins' rating of school adjustment have been found in the SLU project [13], with the exception of opposite sex twins as the data here would predict.

CONCLUSIONS

These results demonstrate that twins are born into and create an unusual family situation

which contributes not only to them being different from singletons but also from each other. The effects are greater on male twins where the negative consequences of being a twin are enhanced by the greater vulnerability of males [5]. While the phenomenon of competition between twins has often been recognised in genetic analyses of adult personality, the birthorder effects observed here indicate that the influence of the parents is equally as permanent. But in contrast to competition which lowers the correlation between DZ twins leading to an overestimate of the genetic variance, the prevalence of birthorder effects leading to differences between MZ twins will do the opposite.

However, genetic analysis of temperament may be premature until more is known about the specific influences on twins and how these change during development. At the present time it may be wisest [35] to get away from the classical approach in genetics where "data derived from twin studies have no general value unless the peculiarities of twins are denied" and to realize that "it is precisely their peculiarities that give us information on the most complex processes of our personality".

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Correspondence: David A. Hay, Department of Genetics and Human Variation, La Trobe University, Bundoora, Victoria 3083, Australia.