The teachers were also asked how often the children had received various types of help during the preceding few years. These are listed in Table 3.27.

Table 3.27

Help received during the past few years

	Frequently	Occasionally	Total
Child Guidance - psychological counselling	0.2%	2.1%	2.3%
Physicatric counselling or treatment	0.1%	0.2%	0.3%
Speech therapy	0.7%	1.5%	2.2%
Sensory disability help - visual	0.4%	1.5%	1.9%
Sensory disability help - auditory	0.3%	1.3%	1.6%
Physical therapy for disabilities	0.4%	0.4%	0.8%
Educational welfare intervention	0.3%	1.2%	1.5%
Social work intervention	0.4%	1.1%	1.5%
Attendance at a nurture centre for behavioural difficulties	$<0.1\%$	$<0.1\%$	$<0.1\%$
Attendance at a remedial centre for educational difficulties	0.2%	0.3%	0.5%
Probation officer guidance or care	$<0.1\%$	-	$<0.1\%$
Other types of help	0.6%	0.7%	1.3%

The amount of remedial reading received by the different groups of readers is shown in Table 3.28. Over forty percent of poor readers with reading scores more than 1½ standard deviations below the mean and intelligence scores below the mean received regular remedial reading. Of the 2,585 children with reading and BAS scores between -1½ and 0 standard deviations, group IV, 14.7 percent received regular remedial reading; in the high intelligence-poor reader group, group v, 8.3 percent received remedial reading help.

Individual remedial tuition was confined for the main part to the very poor readers of low intelligence, as shown in Table 3.29.

Table 3.28

Remedial reading received by different groups of readers

Standardised Total Score Edinburgh Reading Test		Total Standardised Score: -3 to -1.5 SD	-1.5 to O SD	O to +3 SD
		Group I	Group III	Group V
-3 to -1.5 SD	Regular	41.4%	43.3%	
	Occasional	5.6%	9.9%	
	None	53.0%	46.8%	
		Group II	Group IV	
-1.5 to O SD	Regular	32.8%	14.7%	8.3%
	Occasional	3.6%	3.5%	3.5%
	None	63.6%	81.7%	88.2%
		Group VI		Group VII
O to 3 SD	Regular	3.4%		1.0%
	Occasional	1.0%		0.4%
	None	95.5%		98.7%

Table 3.29

Individual remedial tuition received by different groups of readers

Standardised Total Score Edinburgh Reading Test		BAS Total Standardised Score: -3 to -1.5 SD	-1.5 to O SD	O to +3 SD
		Group I	Group III	Group V
-3 to -1.5 SD	Full time	0.7%	0.8%	
	Regular part time	5.0%	6.1%	
	Occasional	7.9%	7.6%	
	None	86.4%	85.6%	
		Group II	Group IV	
-1.5 to O SD	Full time	0.3%	0.0%	0.0%
	Regular part time	3.6%	1.3%	0.7%
	Occasional	5.3%	2.8%	2.0%
	None	90.7%	95.8%	97.3%
		Group VI		Group VII
O to +3 SD	Full time	0.0%		0.0%
	Regular part time	0.0%		0.1%
	Occasional	0.9%		0.3%
	None	99.0%		99.6%

Table 3.30 Hours of Instructional Reading received by different groups of readers

<table>
<tr><th rowspan="2">Standardised Total Score Shortened Edinburgh Reading Test</th><th colspan="3">BAS Total Standardised Score</th></tr>
<tr><th>-3 to -1.5 SD</th><th>-1.5 to 0 SD</th><th>0 to +3 SD</th></tr>
<tr><td>-3 to -1.5 SD</td><td>Group I
2.54</td><td>Group III
2.36</td><td rowspan="2">Group V
1.86</td></tr>
<tr><td>-1.5 to 0 SD</td><td>Group II
2.31</td><td>Group IV
1.98</td></tr>
<tr><td>0 to 3 SD</td><td colspan="2">Group VI
1.79</td><td>Group VII
1.85</td></tr>
</table>

The number of hours devoted to instructional reading received in a week by the different groups of readers varied considerably. Groups I, II and III received well over two and a quarter hours a week. The poor readers with high intelligence scores, Group V, received the same amount of instructional reading as the good readers with high intelligence, Group VII; this was forty minutes a week less than Groups I, II and III, (Table 3.30).

Note that this table does not include information about the number of hours spent on reading for pleasure/information, on literature and poetry, or on creative writing. Later analyses will examine these areas in depth.

Table 3.30

Remedial group work for mathematics received by different groups of mathematicians

Standardised Total score on mathematics test		BAS Total Standardised Score: -3 to -1.5 SD	-1.5 to 0 SD	0 to +3 SD
-		Group I	Group III	Group V
-3 to -1.5 SD	Regular	15.6%	13.0%	
	Occasional	3.3%	4.1%	
	None	80.8%	83.0%	
		Group II	Group IV	
-1.5 to 0 SD	Regular	11.3%	4.7%	2.0%
	Occasional	4.3%	2.7%	1.3%
	None	84.3%	92.6%	96.7%
		Group VI		Group VII
0 to 3 SD	Regular	1.5%		0.3%
	Occasional	0.2%		0.2%
	None	98.1%		99.5%

The remedial group work for mathematics received by the different groups of readers is shown in Table 3.30. Much more remedial help was received by children with low intelligence levels. Twice as many children with mathematics scores and BAS scores which were -1½ to 0 standard deviations below the mean (group IV) received remedial group work for mathematics as children with similar mathematics scores but higher intelligence scores (group v), Table 3.30.

The amount of time devoted each week in the curriculum to mathematics between the different groups of mathematicians (Table 3.31). showed the reverse of the similar table of instructional reading for groups of readers (Table 3.29). The better mathematicians received the most instruction in mathematics, Groups VI and VII. Even within the high intelligence Groups, V and VII, the good mathematicians received about 10 minutes more a week than the poor mathematicians.

Table 3.31

Hours during each week devoted to mathematics for the different groups of mathematicians

<table>
<tr><th rowspan="2">Standardised Total score on mathematics Test</th><th colspan="3">BAS Total Score</th></tr>
<tr><th>-3 to -1.5 SD</th><th>-1.5 to 0 SD</th><th>0 to +3 SD</th></tr>
<tr><td>-3 to -1.5 SD</td><td>Group I
4.13</td><td>Group III
4.53</td><td rowspan="2">Group V
4.59</td></tr>
<tr><td>-1.5 to 0 SD</td><td>Group II
4.49</td><td>Group IV
4.62</td></tr>
<tr><td>0 to 3 SD</td><td colspan="2">Group VI
4.79</td><td>Group VII
4.72</td></tr>
</table>

There is a great danger of being misled by the simplicity of these tables. In order to appreciate the true picture additional information from the data needs to be added on the types of schools involved, other aspects of the curriculum and other characteristics of the children. An examination of the hours of instructional reading received each week by children with different levels of severity of speech defects serves to illustrate the point. Within each group of readers the number of hours instructional reading varies with the severity of the defect.

In Groups I and III less time is spent on instructional reading with children with more severe speech defects, although overall these groups appear to receive more instructional reading than any of the others (Table 3.32). In groups III, IV and V, more time is spent with children with the more severe speech defects. In Group VII, less time is spent.

Table 3. 32

Hours instructional reading per week received by children with 'other' speech defects in different groups of readers

Total Reading Score		Total BAS Score: - 3 to -1.5 SD		-1.5 to O SD		O to 3 SD	
		Group I		Group III		Group V	
	Speech defect	Number of children	Hours per week	Number of children	Hours per week	Number of Children	Hours per week
-3 to 1.5 SD	Severe	11	1.55	4	1.22		
	Moderate	24	2.60	12	1.35		
	Not easily noticed	27	2.57	8	2.03		
	No speech defect	227	2.51	224	2.32		
		Group II		Group IV			
-1.5 to O SD	Severe	5	4.10	13	2.03	3	1.92
	Moderate	16	2.59	76	2.09	29	1.92
	Not easily noticed	15	2.28	112	1.90	49	1.67
	No speech defect	256	2.25	2276	1.93	847	1.84
		Group VI				Group VII	
O to 3 SD	Severe	1	-			7	1.09
	Moderate	21	2.19			57	1.57
	Not easily noticed	33	1.58			124	1.94
	No speech defect	799	1.78			3062	1.82

We have seen that the amount of weekly instructional reading and mathematics received by different groups of poor and good readers, and poor and good mathematicians varies in perhaps unsuspected ways. Children with speech and language difficulties, in particular, seem to lose out on instructional reading.

The remedial reading received by poor readers varies but is largely concentrated on poor readers of low intelligence. 12.4 percent of the CHES children received remedial reading help. This is a substantial educational enterprise. It has been suggested recently[11] however, that much remedial reading help is essentially ineffective at bringing about 'remediation'. The most common research finding is one of short-term gains in reading skills among children given remedial help, followed by extensive, if not complete, 'washing out' of those gains over the following months and years.[12,13]

Most teachers engaged in remedial education believe in the usefulness and value of their activities but Hewison,[11] Yule[12] and Tobin and Pumfrey[13] throw considerable doubt on this belief. Before we became concerned about the uneven distribution of reading remediation demonstrated in this Section we need to establish how much variance in reading attainment scores is explained by attendance at remedial reading groups. We also have to examine the long term prospects in reading for children who attend remedial groups. The next follow-up of the CHES children at school leaving age should also shed some light on this vexed question.

3.50 Specific Learning Difficulties

Children with specific learning difficulties have always been present in our classrooms. Teachers used to describe such children as having a 'mental block' in a particular area of learning. Today different words such as 'specific reading retardation', 'dyslexia', 'dysphonia' or 'dyscalculia' are used, but the difficulties remain. Children whom teachers expect on the basis of their intelligence level, to be able to read or perform other skills fail to do so. They have average or above average intelligence and yet apparently fail to acquire skills mastered by less able children. They are 'underachievers'.

These children, however, form a very heterogenous group and examination of their difficulties has been approached in many different ways. Much of the recent research has been critically reviewed by Tansley and Panckhurst,[10] but confusion persists across the professions about the nature of the difficulties such children experience.

Part of the confusion of terminology results from the separate historical development of the 'syndrome of dyslexia'. Originally described in the Lancet of 1895 by Hinshelwood, a Glasgow eye surgeon, as a medical syndrome, 'congenital word blindness', it was subsequently reported in Holland in 1903, by Foerster in Germany, Wernicke in Buenos Aires and by Jackson and Shrapinger in the USA in 1906.[14]

Scientific attitudes towards the problem of failing to learn to read have oscillated like a pendulum over the last 80 years. Following Hinshelwood, there grew up an idea of a specific type of inherent aphasia but Potzl, in 1924, suggested that a developmental delay of function rather than a neurological pathology was responsible, and a concept of 'maturational lag' was evoked to explain 'dyslexia'.

In 1925, Orton[15, 16] began to study retarded readers and noted apparent relationship between handedness or ambidexterity and a tendency towards reversals when attempting to read or write. Orten believed that 'ambiguous occipital dominance' was responsible for the difficulties of retarded readers. This was physiological in nature and represented faulty patterning of brain functioning.

A paper by Hollingsworth in 1918 on the psychology of special disability in spelling in which she suggested environmental and emotional origins of children's reading difficulties marked the beginning of the development of a reluctance to consider a constitutional specific disability. Retardation in reading became envisaged more as a problem in sociology and education than a distinctly medical issue.

In 1968, the Research Group on Developmental Dyslexia of the World Federation of Neurology produced a definition of dyslexia which they recommended for general acceptance.

Dyslexia was defined as 'a disorder in children who, despite conventional classroom experience, fail to attain the language skills of reading, writing and spelling commensurate with their general abilities', but, they also defined a Specific Developmental Dyslexia. This was 'a disorder manifested by a difficulty in learning to read despite conventional instruction, adequate intelligence, and socio-cultural opportunity. It is dependant upon cognitive disabilities which are frequently of constitutional origin'.

The arguments for a specific developmental dyslexia of constitutional origin were based on four premises: persistence into adulthood; the peculiar and specific nature of the errors in reading and spelling; the familial incidence of the defect, and the greater incidence in males. To these can be added the absence of signs of serious brain damage or of perceptual defects, the absence of significant psychogenesis; the continued failure to read, and the association with average if not high intelligence.

We are not concerned, in this First Report on the 10 year follow-up study, with a search for specific developmental dyslexia, nor with identifying clusters of characteristics that children with such a difficulty might show. Considerable attainment test data and information about the children's educational background and characteristics their home, family and their medical histories have been collected to examine this issue at a future date. The national data of the 10 year follow-up offers many opportunities for such an investigation, such as examining and comparing with other groups the spelling of poor readers, their strategies and difficulties, sequencing, body image, and laterality, fine and gross motor co-ordination, writing, vocabulary, language development, articulation, short term memory. From data collected when the CHES children were five years old, information is available on the reading difficulties of the parents. Clay[8] has argued that for remediation to be most effective it must begin as soon as children's reading difficulties are detected, preferably as they begin to learn to read. It would be possible to examine the data on vocabulary and visuo-motor co-ordination that was collected when the children were five years old to see if there is any way in which it predicts to later reading difficulty.

We are concerned in this present report with the question: How can children with reading difficulties be recognised? It has become customary to differentiate between children who, irrespective of their ability, are at the bottom end of a continuum of reading attainment, Yule[17] called them 'backward readers', and those children who are underachieving in relation to their chronological age and general level of intelligence. Yule called these underachieving children 'retarded readers' but the adjective here has unfortunate connotations. The point about these children is that they are not mentally retarded. They usually have average or above average intelligence. For this reason we prefer to call them 'underachievers'.

In the sections which follow we examine the application of the regression technique to define underachievement statistically. This however is the beginning of the analysis: First we have to identify 'underachievers' and to distinguish them from backward readers. The next step will be to examine the characteristics of the two groups of children and to establish, in this national population sample, how they differ and in what ways they are similar. We can then examine how much instructional reading both groups are receiving and look at the allocation of remedial help to them. Eventually we should examine the data for evidence of the school factors such as remedial provision, posts of special responsibility for reading, particular teaching styles which may influence attainment of these children for good or ill.

Compared to research on reading, work on the learning of mathematics has been sparse. There are considerable difficulties involved in assessing mathematics at a national level, not least because of the variety of emphasis and attention that is placed on different aspects of the mathematics curriculum in primary schools. Landsdown[18] argued that the introduction of New Maths, with its vectors, sets and bases, has led to a situation where primary schools within a couple of miles of each other can be following quite different curricula. He has also suggested that the lack of attention to assessment is due in part to the low social standing of mathematics. Most people would try to hide an inability to read, but many freely admit to difficulty with mathematics.

It has been argued over the last few years[19,20,21] that certain learning disorders consistently manifest themselves in children who have fallen well behind in their attempts to cope with school mathematics. These disorders, collectively termed 'developmental dyscalculia', are found in children of all intelligence levels.

Six varieties of developmental dyscalculia were described by the Czechoslovakian mathematics educator and psychologist Ladislav Kosc.[22] 'Verbal dyscalculia' involved an inability to understand and respond to mathematical demands given verbally (eg. 'show me 3 fingers'). 'Lexical dyscalculia' involved inability to read mathematical symbols. 'Graphical dyscalculia' involved inability to write down mathematical statements in conventional symbolic form. 'Practognostic dyscalculia' involved the inability to relate mathematical ideas to practical situations. 'Ideognostical dyscalculia' involved inability to perform easy mental calculations and 'operational dyscalculia' involved the inability to perform the simplest arithmetical calculation; this involves a confusion between addition, multiplication, subtraction and division.

In the teaching of mathematics two crucial elements need to be grasped. First mathematics is largely a hierarchical skill and secondly it involves no redundancy. The hierarchical nature of the subject implies that learning one step is dependant on an understanding of earlier steps. The lack of redundancy means that children have to apply to every bit of information given. This can be contrasted with reading where it is possible to skim over letters or whole words and still make adequate sense of a passage.

Kruteski[23] suggested that poor memory was related to attainment and noted that poor pupils have a poor memory for 'schemes of reasoning'. MacFarlane Smith[24] suggested that spatial ability was a very important factor in learning mathematics. He defined it as the capacity to perceive and hold in mind the structure and proportions of a form or figure, grasped as a whole.

In a factor analysis of the mathematical and intellectual characteristics of over 300 thirteen to fourteen year olds, Barakat[24] isolated both memory and spatial ability as well as general intelligence and noted the existence of a factor of verbal ability. In fact, educationalists frequently claim that the main reason why some children fail to develop mathematical skills is that they do not understand the language which is used in mathematics classes.

Mathematical ability appears to be no exception to the frequently noted association between attainment and socio-economic factors.[24] There has also been much concern about the relationship of mathematics difficulty and the quality of teaching. It may well be that the difference between dyscalculia and specific mathematics retardation is similar to the difference between dyslexia and specific reading retardation. Dyslexia and dyscalculia imply distinct syndromes but children with specific learning difficulties form an extremely heterogeneous group whose difficulties appear to be multifactorial in origin. This led Lansdown[18] to conclude that there is an urgent need to identify such children in an epidemiological rather than an anecdotal framework and then to investigate some of the factors that contribute to their difficulty.

3.51 The distributions of under-achievement in reading within the CHES 10 year data: some preliminary findings

This section sets out, briefly, a few of the many issues that will need to be taken into account when fuller and more complex analyses are carried out on all the data relating to reading problems, however these might be defined.

Any review of the literature will indicate the difficulty which various authors have had in defining categories of reading deficit. The references will not be examined here, other than to point out that more recent studies have understandably relied on regression methods to define under-achievement in reading. Yule's paper in 1973[17] on the differential prognosis of reading backwardness and specific reading retardation and the paper by Rutter and Yule on the concept of specific reading retardation in 1975[25] are among the well known references which are frequently cited on this issue.

It is rather unfortunate that the term 'hump' was ever used by these and other authors to describe the important phenomenon of under-achievement. The rather mechanistic view of reading disability as something which appears as a little hillock at the bottom of the residual reading distribution (after regressing on non-verbal intelligence), has little to support it, unless one is prepared to view all physiological and psychological processes in terms of on-off models; the reality is that most processes are part of a continuum, although markovian jumps can precipitate an organism into a different continuum of functioning, such as occurs for example when disease overwhelms a system. The arguments about reading disability and the attempts to identify a dyslexia syndrome tend to treat this condition as a specific entity rather than as the most visible end of a long continuum.

In brief, if there is a condition which might be termed specific reading retardation, however defined and whatever the aetiology, it would be a condition covering the whole residual distribution but having its most serious effects in the lower half where the interaction between poorer environment and physiological or psychological disability exacerbate the reading deficit. Thus one might be looking for a sharply skewed distribution of residual reading, rather than a hillock or other oddity at the bottom of a normal distribution.

These points may be illustrated by some analyses based on the Yule and Rutter interpretation of the original study by Thorndike on concepts of over and under-achievement in 1963, [26] Yule and others regressed reading scores on non-verbal intelligence scorés, using the residuals to examine whether the number of children whose observed reading level was more than two standard deviations below the predicted level, was higher than expected. (It should be noted that non-verbal intelligence is used rather than total intelligence, since the former is by definition less closely related to the verbal skills which go to make up reading; some of the latter skills might themselves be subject to the same under-achievement factors as are thought to influence under-achievement in reading.)

Clearly, however, there will be poor, medium and good readers on both sides of the zero score, in other words, readers at almost any level of reading could be found to be reading well below or well above their predicted reading scores, based on what might be expected from the regression relationship with non-verbal intelligence as the predictor variable.

What isof interest to educational research, and in particular to those interested in children faced with reading difficulties, is whether the distribution of the residual reading score around the stastical mean of zero indicates any evidence that there are some children whose reading deficit (in relation to the level predicted by their non-verbal intelligence) is above what might be expected within a normal distribution. One assumes that this is a serious educational problem, whether or not the readers in question are poor, average or even above average readers. If some children are grossly under-achieving and are not simply part of a normal distribution of over and under-achievers, there are important consequences for the kinds of remediation which can or should be offered to them.

The accompanying distributions are taken from the initial set of data available on 8836 children within the CHES 10-year cohort.

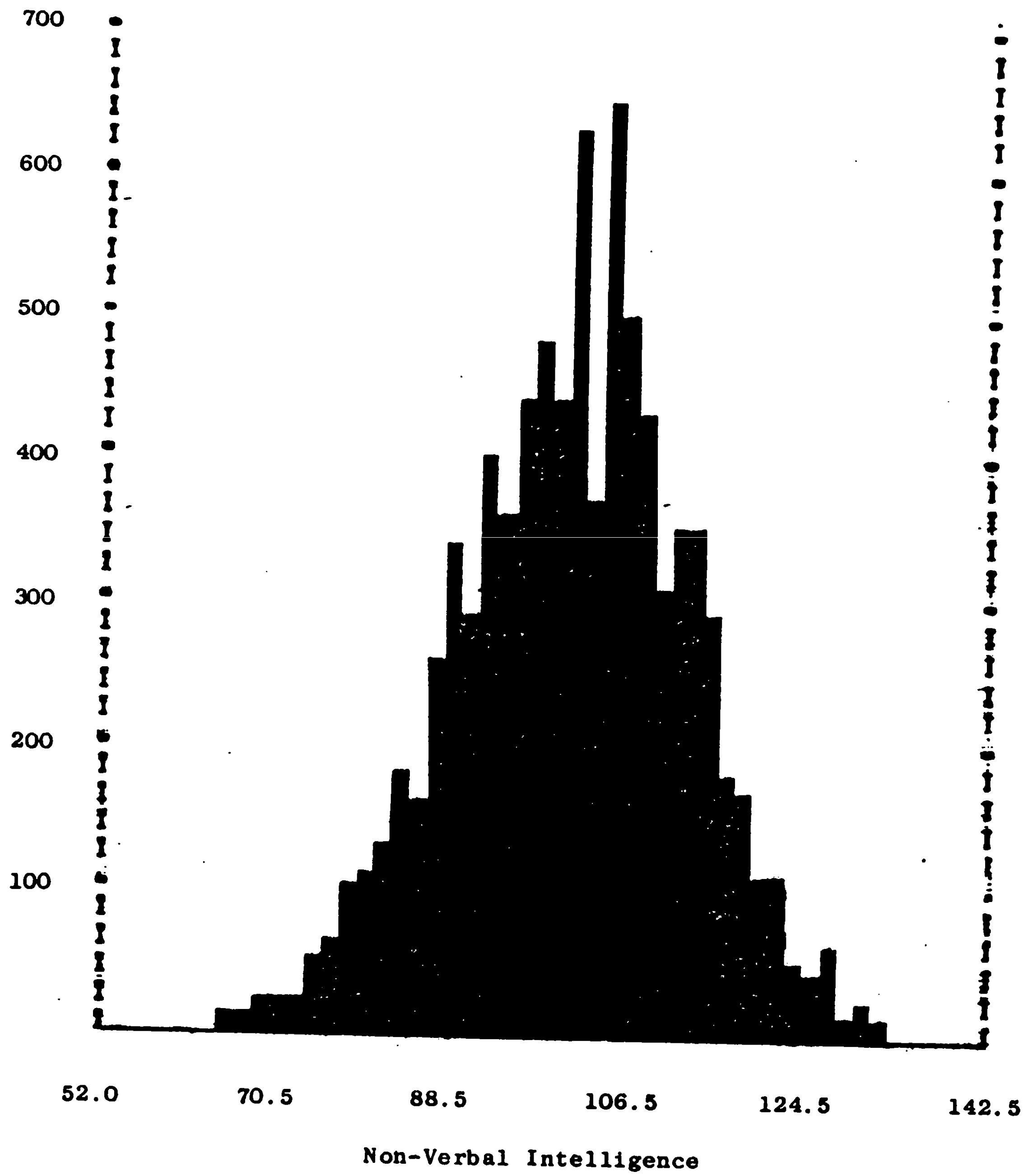
Figure 3.5 presents the distribution of the non-verbal intelligence scores (BAS Digit Recall and BAS Matrices, combined) for the 8,704 children remaining in the sample after excluding children who did not have complete records on the set of tests being examined here. Figure 3.6 presents the distribution of the normalised and standardised Shortened Edinburgh Reading test scores.

The next figure (Figure 3.7) shows the actual distribution of the raw reading scores. The difference between this and the previous distribution should be noted. Although the correlation of the two reading scores is 0.984, as one might expect, the raw scores are considerably skewed and stretch out the lower end of the distribution. This skew was deliberately introduced when the items for the test were selected, so as to focus as much attention as possible on children with relatively poor performance. A test with a normal distribution would have compressed the scores of poor readers and offered less insights than does an extended distribution at the lower levels.

By way of a preliminary examination of those readers whose achievements were well above or well below their level of cognitive functioning, the raw reading scores of all the 256 children with standardised reading levels more than 1½ standard deviations <u>above</u> their standardised non-verbal intelligence levels were isolated and plotted in the distribution shown in Figure 3.8. It is reasonable to expect that the raw scores of over-achievers in reading should follow, approximately, the skewed distribution of the raw scores for the whole sample, if it is assumed that over-achievers can be found at almost any level other than close to the bottom of the distribution. This appears to be the case, and the distribution curve of the over-achievers closely parallels that of the whole sample.

There is a surprising difference, however, in the distribution of the reading scores of those 272 children whose standardised reading levels are more than 1½ standard deviations <u>below</u> their

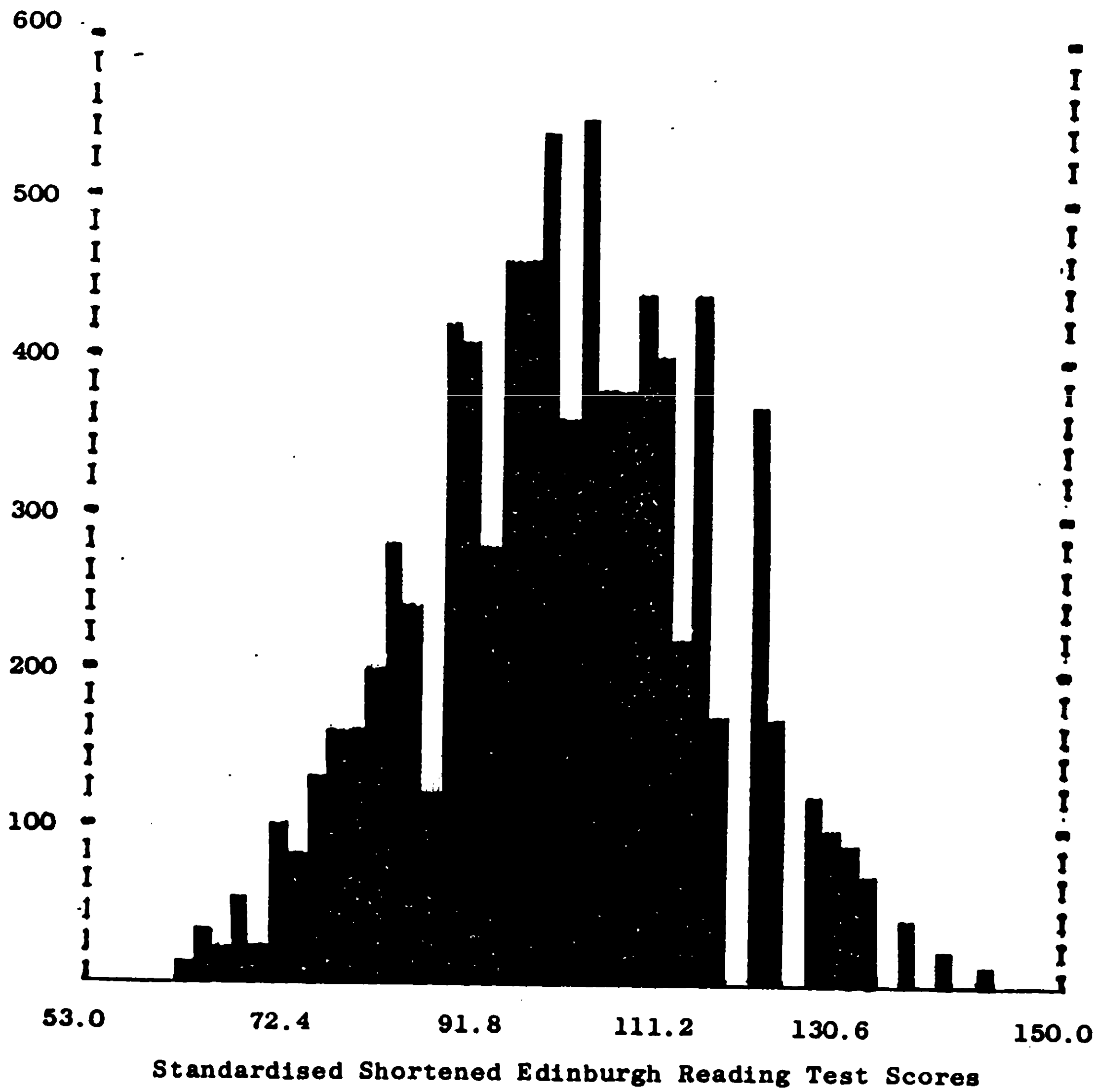
Figure 3.5 Distribution of standardised Non-Verbal Intelligence



N = 8704

Note: Discrete values are spread over equal 50-point scales and can be expected to show broken histograms. This will not affect results.

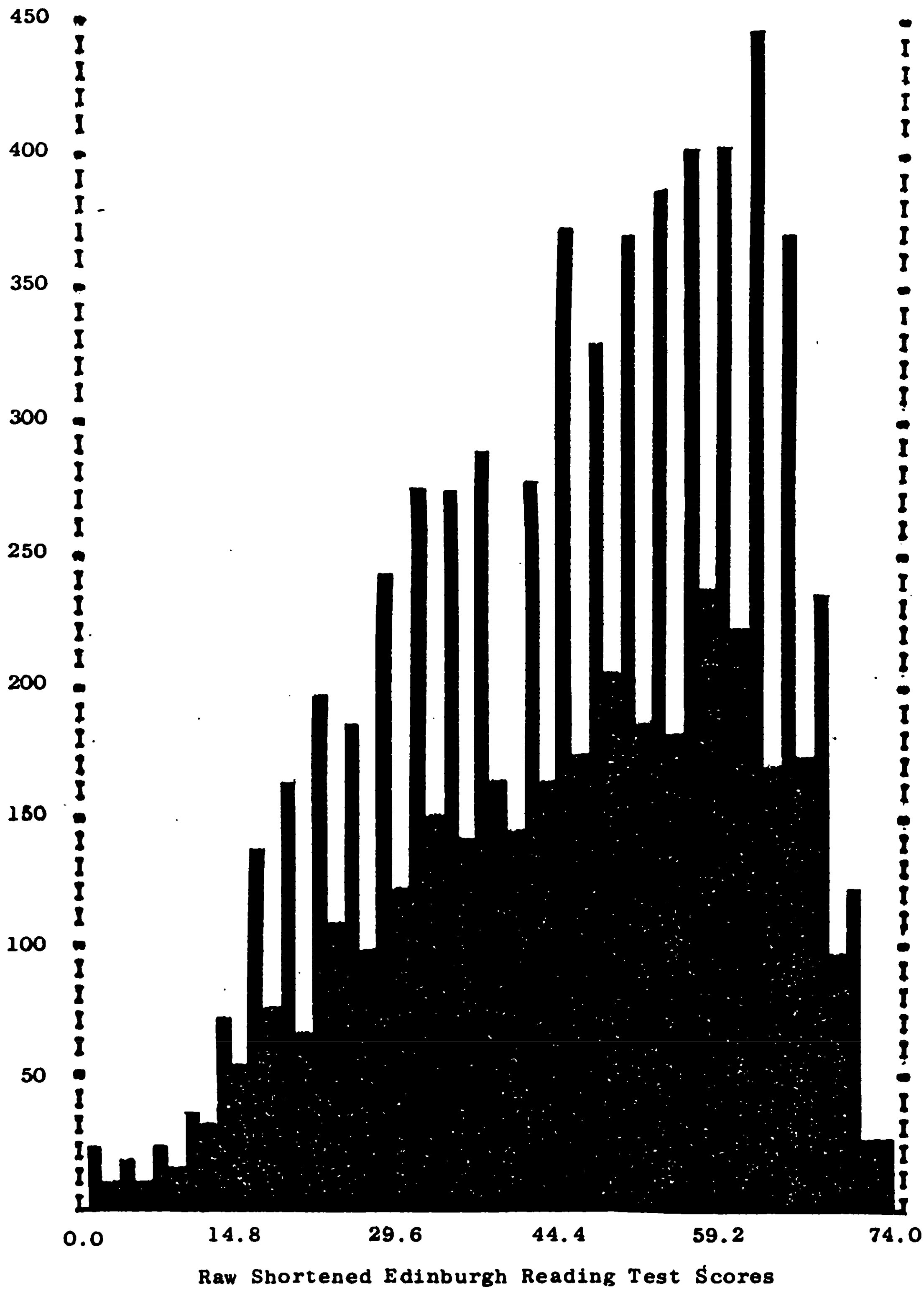
Figure 3.6 Distribution of normalised and standardised Shortened Edinburgh Reading Test scores



Mean = 100.1
SD = 14.9

Note: Discrete values are spread over equal 50-point scales and can be expected to show broken histograms. This will not affect results.

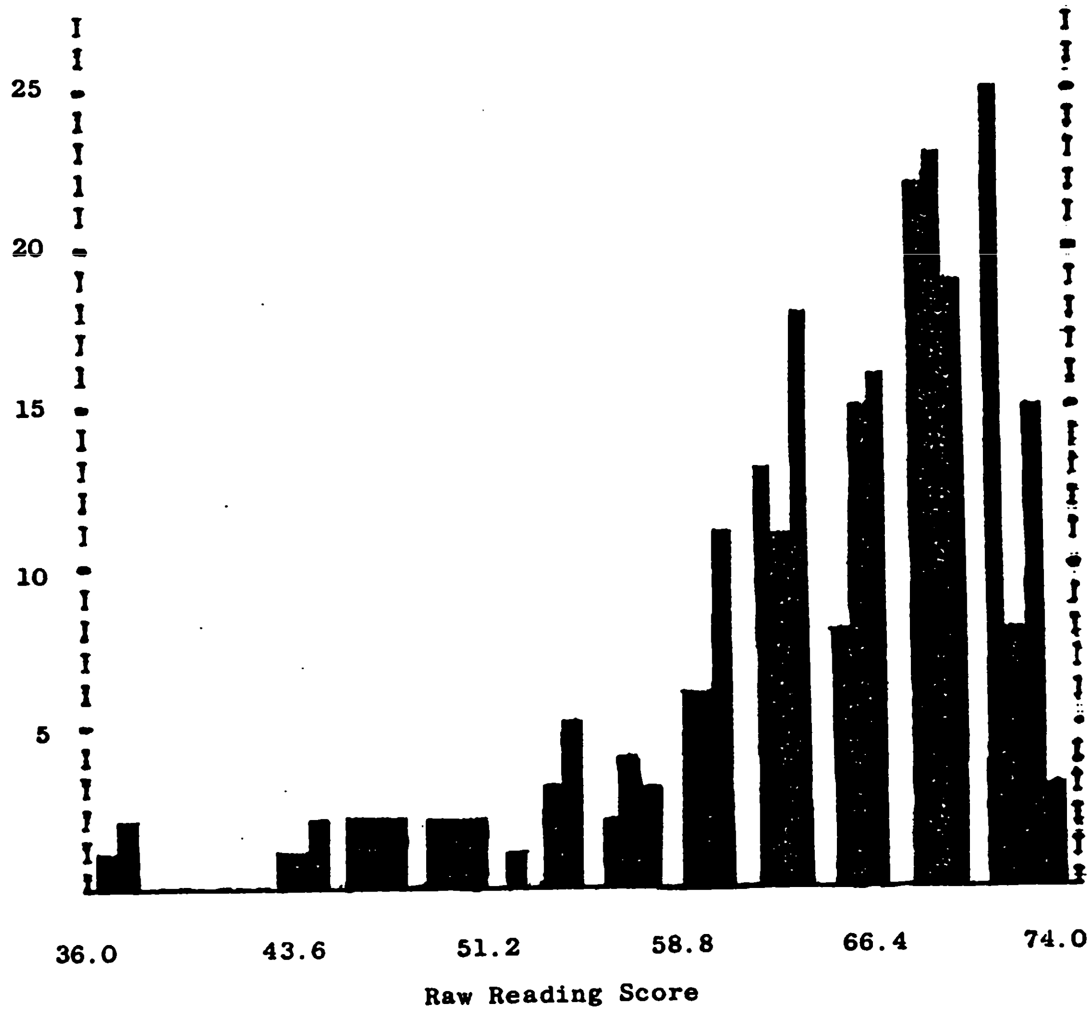
Figure 3.7 Distribution of raw Shortened Edinburgh Reading Test scores



Mean = 44.92, SD = 15.9

Note: Discrete values are spread over equal 50-point scales and can be expected to show broken histograms. This will not affect results.

Figure 3.8 Distribution of raw reading scores of 256 children whose standard normal reading level is more than 1½ standard deviations above their standard non-verbal intelligence level



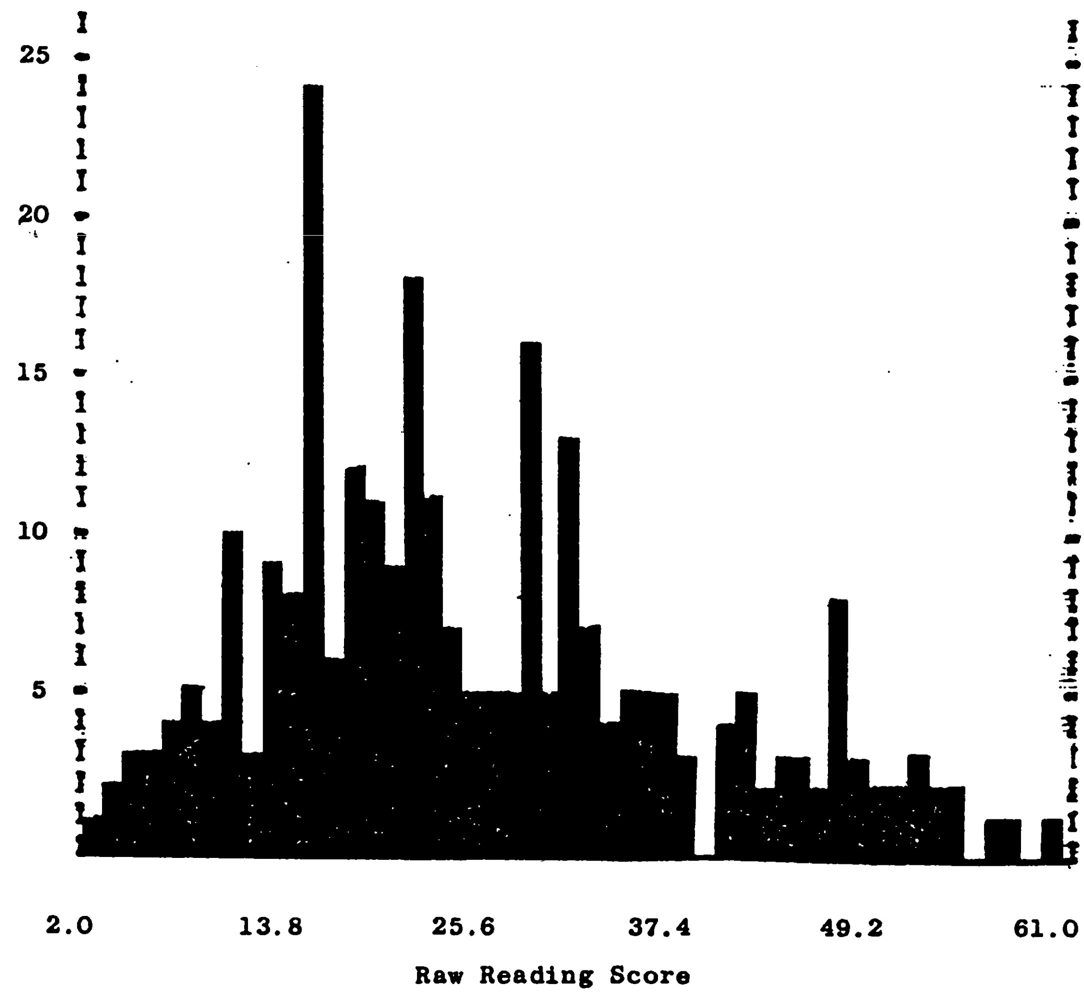
Note: Discrete values are spread over equal 50-point scales and can be expected to show broken histograms. This will not affect results.

standardised non-verbal intelligence lėvels. Even if one accepts that there will be few of the top scoring readers who could be defined as reading at 1½ or more standard deviations below their level of non-verbal intelligence, it could have been expected that there would be at least some parallel with the distribution of the whole sample. Instead of this, Figure 3.9 shows that the raw reading scores of the under-achievers are generally very low, bearing no relationship to the full distribution of raw scores.

The small difference in sample sizes, between 256 over-achievers and 272 under-achievers, based on the criterion of an absolute deviation of standardised scores of reading from those of non-verbal intelligence is, as can be expected statistically, a serious under-estimate of the actual difference. The paper by Rutter and Yule (ibid) shows how regression effects have the result that children well above the mean on one score (non-verbal intelligence in this case) will tend to be less superior on the other (reading) score, though this is not of course always the case; meanwhile the reverse will apply to children well below the cognitive mean, whose reading scores will tend to be relatively higher. Thus the simple comparison, while showing important distributional differences, does not yield a tangible measure of the difference in numbers between the samples of over and under-achievers.

For this we turn to the regression methods previously discussed. A regression of the raw reading scores on the non-verbal intelligence scores will offer a more reliable indication of whatever differences there might be between over and under-achievers. Since the presence of those cases where reading and non-verbal intelligence scores differed sharply would attenuate the regression relationship, a senior statistical consultant suggested that these cases should be excluded from the regression itself, but included in the final prediction exercise. Thus all the cases where standardised reading levels were more than 1½ standard deviations <u>above</u> or <u>below</u> the standardised non-verbal intelligence levels were excluded from the regression, leaving 8,176 cases.

Figure 3.9 Distribution of raw reading scores of 272 children whose standard normal reading level is more than 1½ standard deviations below their standard non-verbal intelligence level



Note: Discrete values are spread over equal 50-point scales and can be expected to show broken histograms. This will not affect results.

The regression parameters derived from this equation were used to form a set of predicted raw reading scores for the whole sample, including the groups excluded from the regression itself.

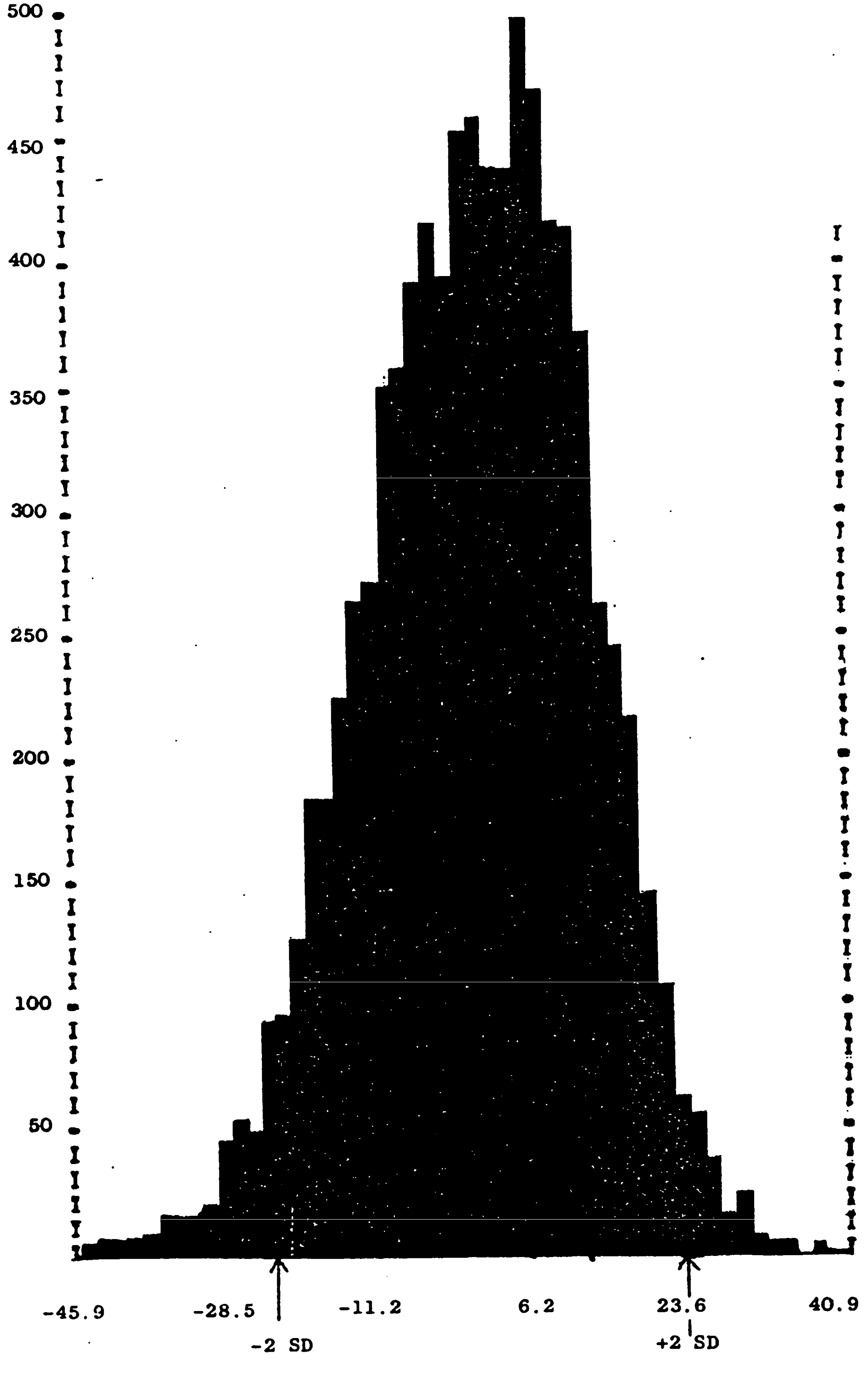
The distribution of the residuals from this exercise, the raw reading score minus the predicted reading score, is presented in Figure 3.10. It is seen that the distribution is negatively skewed, with a larger number of cases in the left-hand (negative) tail. The skewing effect is a normal phenomenon where an excess of cases occurs in one tail, leading to a bending of the whole distribution in the way that is seen here.

It should be emphasised that the derivations represent a preliminary examination, and that a great deal more work has yet to be carried out on the data. However an approximate division of the distribution in Figure 3.10, based on a standard deviation of 12.32 for the residual scores, shows that the residual scores of some 271 children fall more than two standard deviations below the mean, compared with only 141 children whose scores are more than two standard deviations above the mean. (The limits appearing on the distribution are close to, though not exactly at the 2 standard deviation mark.) Further work on these data will yield more exact results.

The numbers given here do indicate, however, that approximately 3.1 percent of children fall into the region of more than 2 standard deviations below the mean compared with only approximately 1.6 percent of children in the region of more than 2 standard deviations above the mean. (Statistically there should be 2.28 percent in each region.) This difference is unlikely to be related to the skewness of the original distribution of raw reading scores, since, as already pointed out, if the distribution of differences between reading and non-verbal intelligence scores was randomly distributed, there should be no particular bias on either side.

These preliminary analyses of the data do, therefore, offer some modest support for the work of Yule, Rutter and others who have claimed that there are a disproportionate minority of children

Figure 3.10 Residuals of regression of raw reading on non-verbal intelligence (Note: regression parameters based on 8176 cases where standard normal reading levels were within 1½ standard deviations of standard non-verbal intelligence levels.)



whose reading levels are well below their expected levels, taking into account their non-verbal intelligence scores. It is these children, in addition to the equally disturbing number of children whose poor reading is closely associated with a level of poor intelligence, who are the subjects of particular concern in the present and planned studies of the CHES 10-year cohort.

3.52 Differences between predicted and attained scores in mathematics

Considerable energy has been expended by a number of researchers on the problems of defining under achievement in reading but relatively few have considered under-achievement in mathematics. Yet if underachievers in reading constitute a challenge to policy with respect to remedial and special educational provision then surely to some extent underachievers in mathematics must do so also.

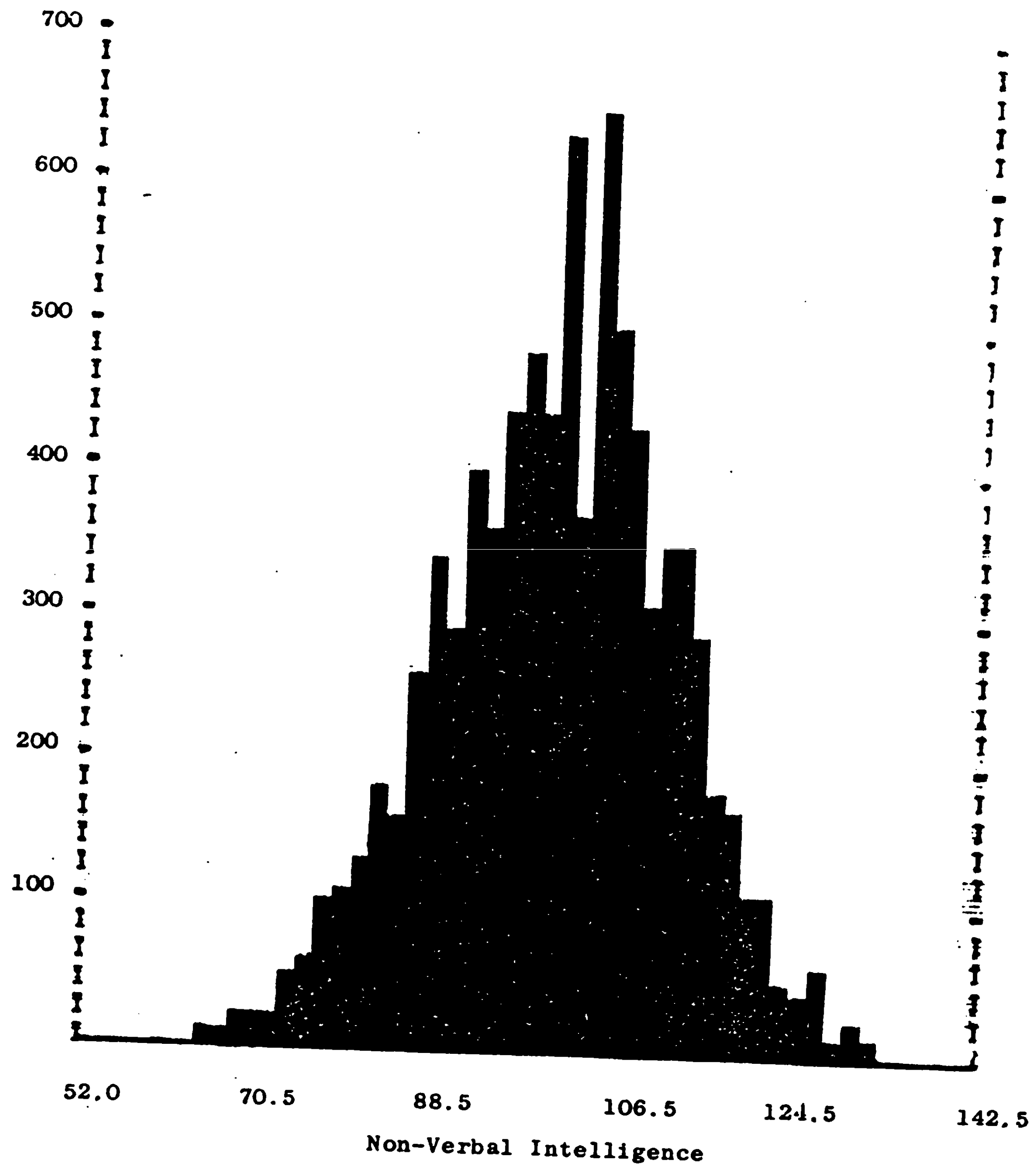
By the same argument as previously cited for children with a condition which could be defined as specific reading retardation, we may contend that if there were a condition of specific mathematics retardation it would be a condition covering the whole residual distribution but having its most serious effects at the lower end ofthe distribution where the interaction between environment, physiological or psychological impairment or disability might be expected to exacerbate any mathematics deficit. Thus again we are looking for a sharply skewed distribution of residual mathematics rather than a hump at the bottom of a normal distribution.

The following distributions are also taken from the first report sample of 8,836 children within the CHES 10 year cohort.

Figure 3.11 shows again the distribution of non verbal intelligence scores (British Ability Scales, Recall of Digits and Matrices combined) for the 8,704 children remaining in the sample after excluding children who did not do all the tests examined here. The distribution of the normalised and standardised mathematics test is given in Figure 3.12 and th distribution of raw mathematics scores is given in Figure 3.13.

The correlation of the raw and standardised mathematics score is 0.994 and similar to the correlation between the raw and standardised reading scores. As with the raw reading score, the raw mathematics scores are skewed and have a long tail at the lower end of the distribution. Again this skew was deliberately introduced when the mathematics test items were selected to allow as many poor mathematicians as possible to score on the test.

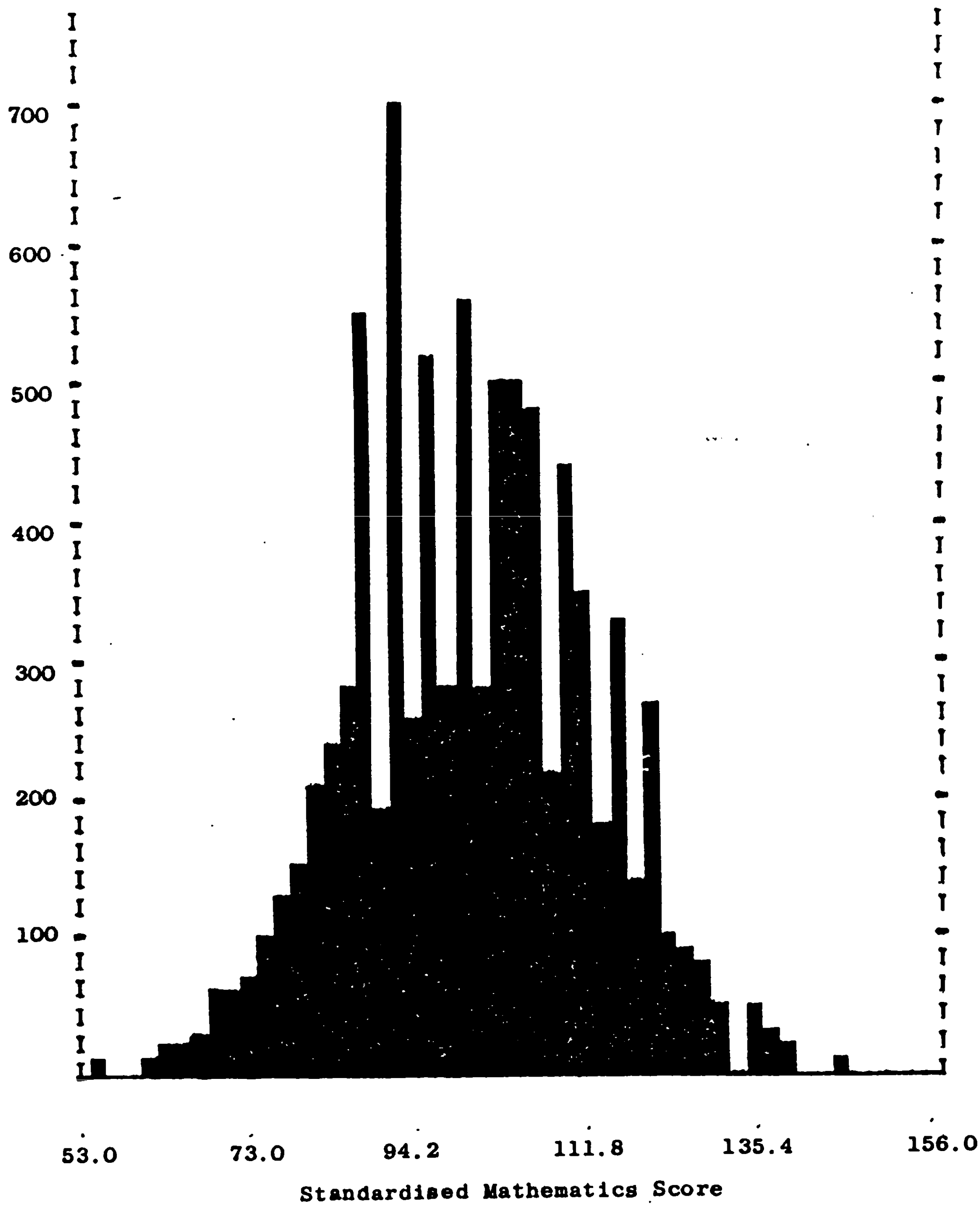
Figure 3.11 Distribution of standardised Non-Verbal Intelligence



N = 8704

Note: Discrete values are spread over equal 50-point scales and can be expected to show broken histograms. This will not affect results.

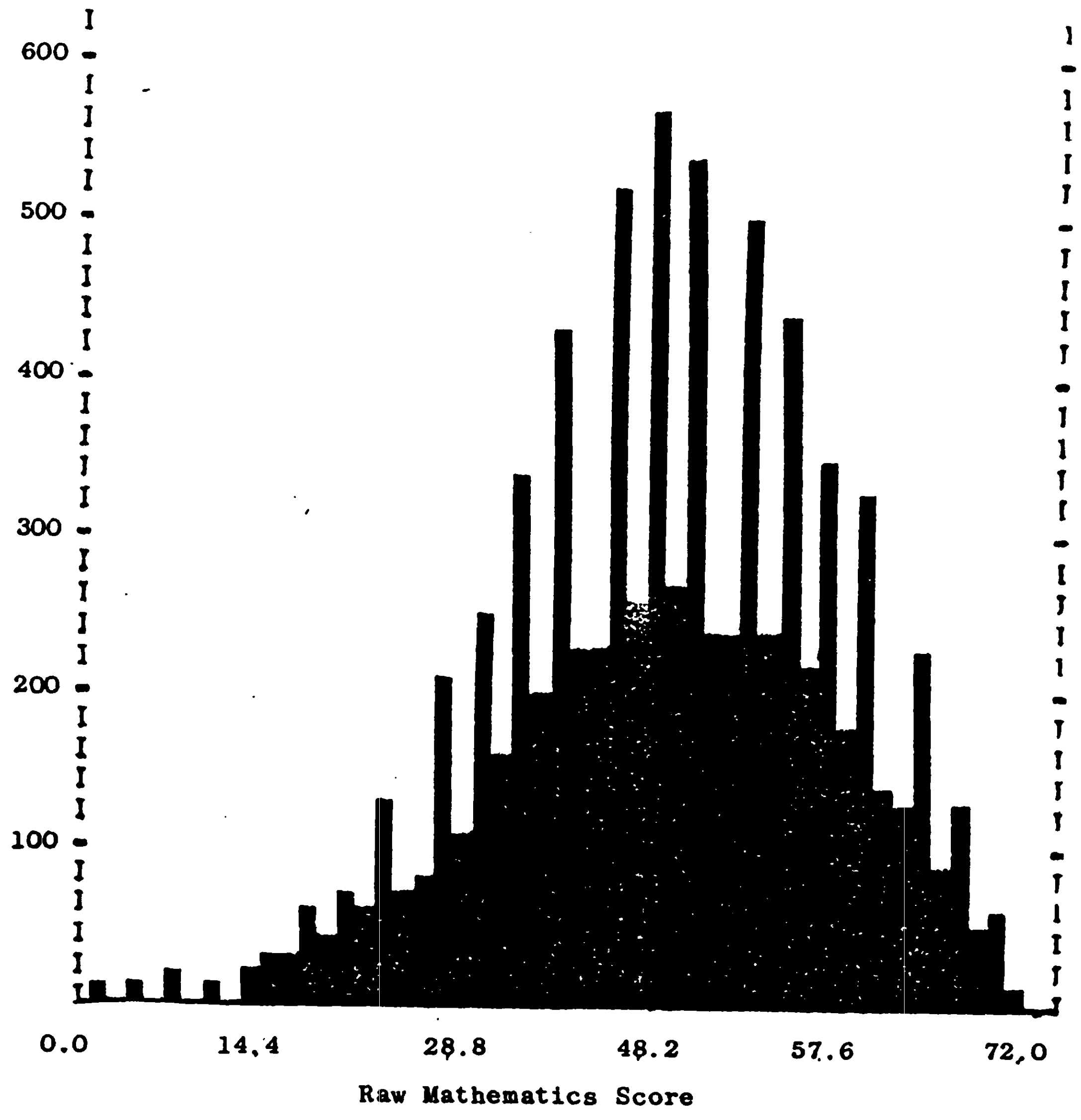
Figure 3.12 Distribution of standardised Mathematics Score



Mean = 100.0
SD = 15.0

Note: Discrete values are spread over total 50-point scales and can be expected to show broken histograms. This will not affect results.

Figure 3.13 Distribution of Raw Mathematics Score



Mean = 43.4
SD = 12.6

Note: Discrete values are spread over equal 50-point scales and can be expected to show broken histograms. This will not effect results.

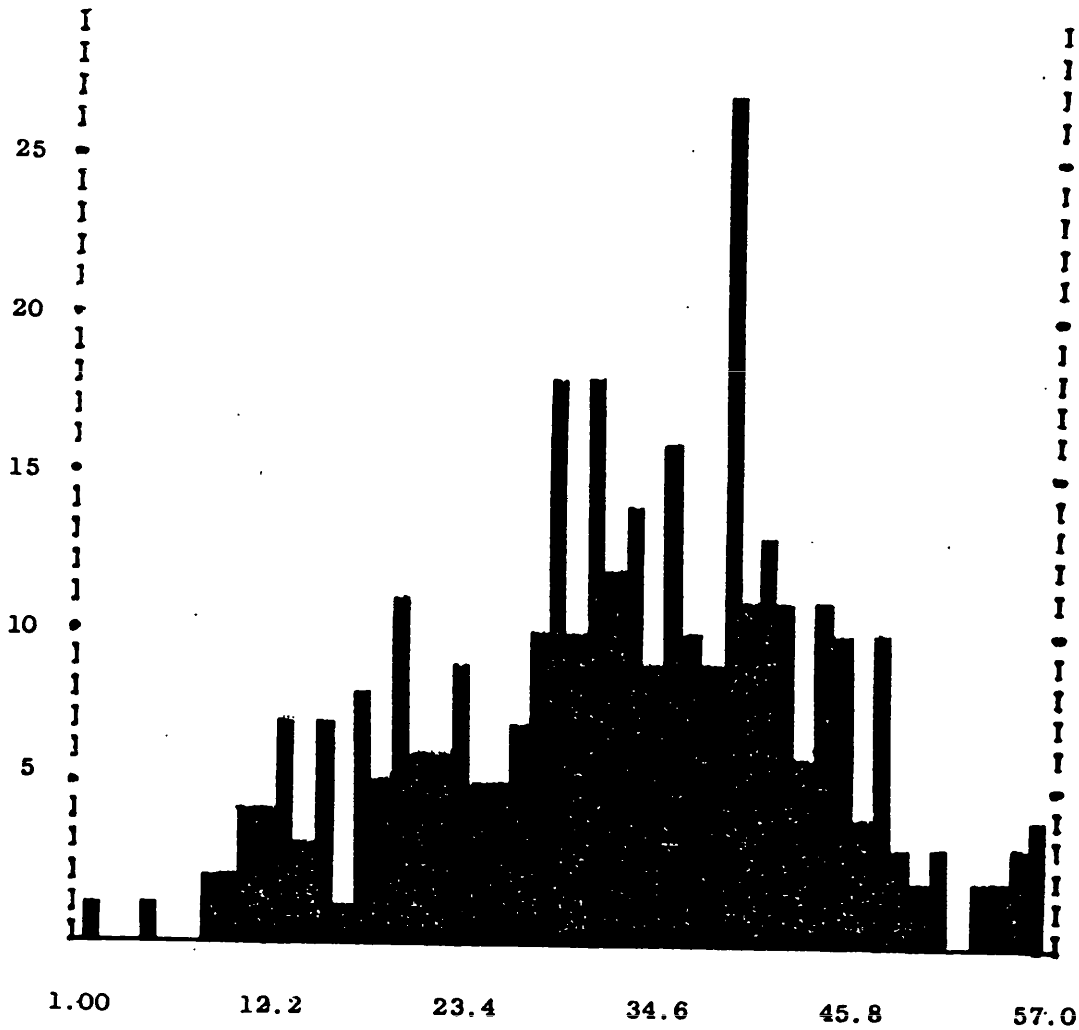
The examination of children with considerable differences between their predicted and attained mathematics scores follows a similar logic as the examination of differences in reading in the previous section but this time the underachievers are considered first. Children whose standardised mathematics scores were more than 1½ standard deviations <u>below</u> their standardised non-verbal intelligence scores were identified and the distribution of their raw mathematics scores was plotted in Figure 3.14. This time the distribution of scores is fairly normal but the number of children involved was 342.

The distribution of raw mathematics scores for children whose standardised mathematics score was 1½ standard deviations <u>below</u> their <u>verbal</u> intelligence scores was also normal but the number of children involved was less, 287 (Figure 3.15). There was very little difference in the means of the two distributions, Figure 3.14 mean = 32.5, standard deviation 11.0; Figure 3.15 mean = 32.3, standard deviation = 11.9.

Children whose standardised mathematics scores were more than 1½ standard deviations <u>above</u> their standardised non-verbal intelligence scores were also identified. The distribution of their raw mathematics scores is given in Figure 3.16. As with the overachievers in reading, we expected to argue that overachievers in mathematics have a normal distribution of raw mathematics scores. The distribution given in Figure 3.16 however is not normal. It has a mean of 56.4, standard deviation 9.4 compared with a mean of 43.4, standard deviation 12.6 for the whole sample. These over achievers in mathematics therefore are very good mathematicians and appear to contain an excess of very high scorers. There are 283 children in this group.

Figure 3.17 shows the distribution of raw mathematics scores for children whose standardised mathematics score were more than 1½ standard deviations <u>above</u> their standardised <u>verbal</u> intelligence scores. This distribution is not normal either and has a mean of 55.9, standard deviation 9.4. There are 253 children in this group.

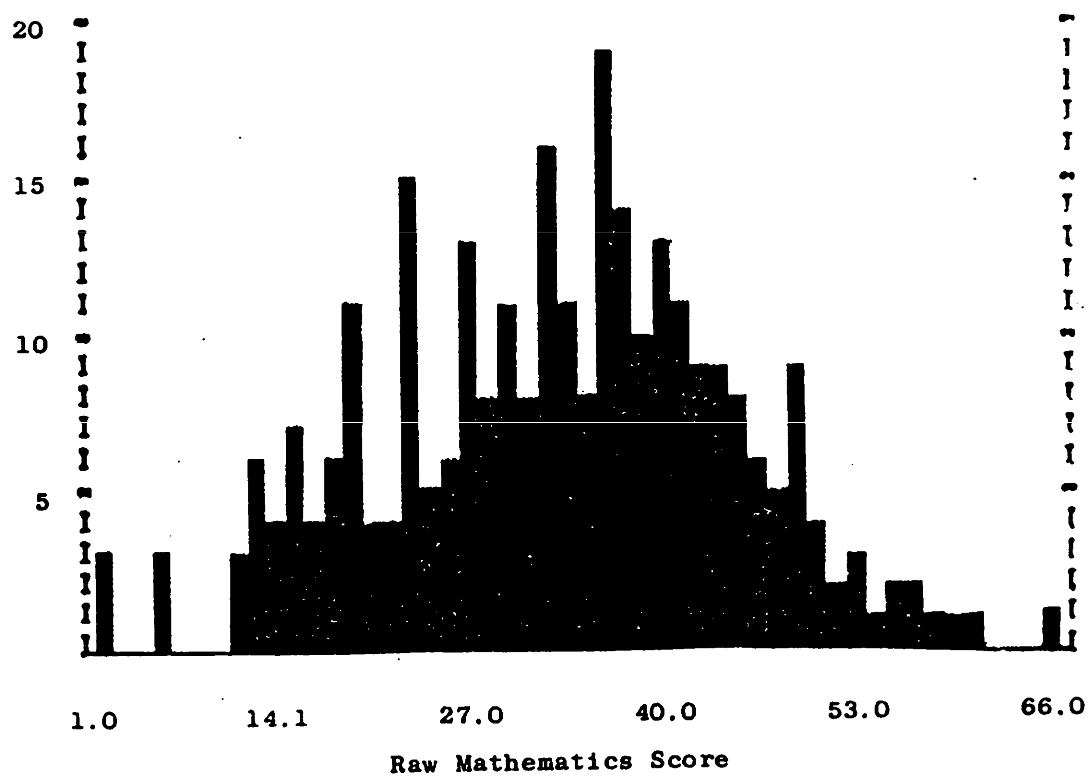
Figure 3.14 Distribution of raw mathematics scores of 342 children whose standard normal mathematics level is more than 1½ standard deviations below their standard non-verbal intelligence level



Mean = 32.5
SD = 11.0

Note: Discrete values are spread over equal 50-point scales and can be expected to show broken histograms. This will not affect results.

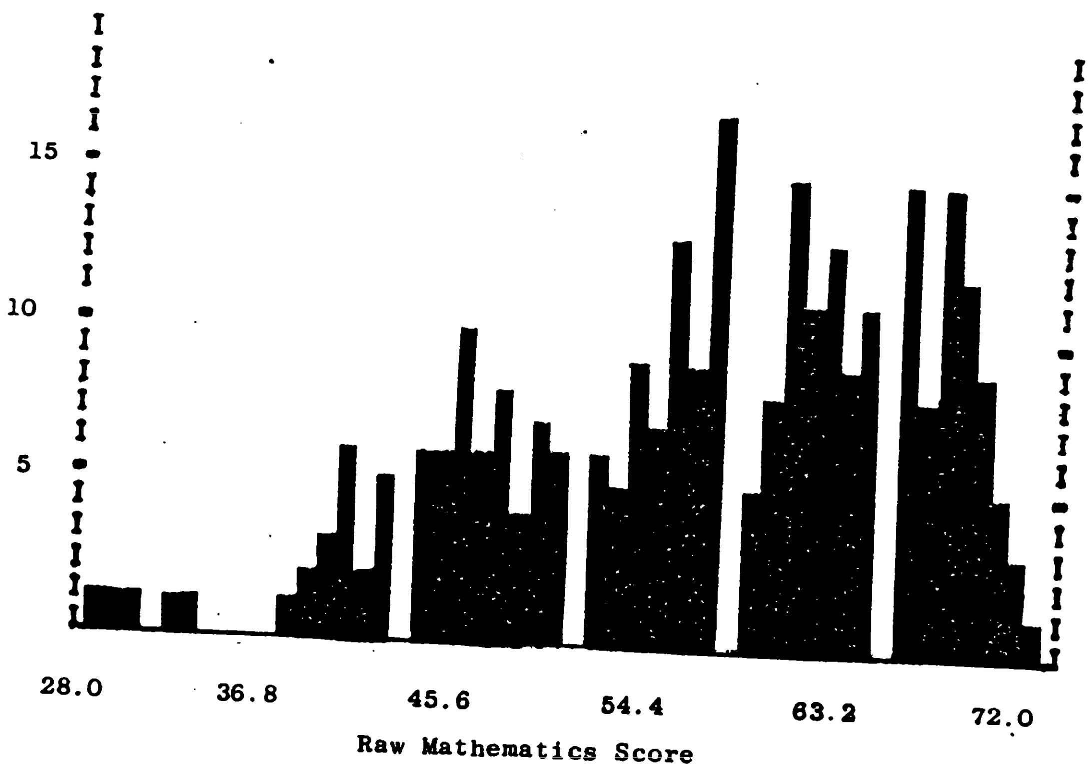
Figure 3.15 Distribution of raw mathematics score of 287 children whose standard normal mathematics score is more than 1½ standard deviations below their standard verbal intelligence level



Mean = 32.3
SD = 11.9

Note: Discrete values are spread over equal 50-point scales and can be expected to show broken histograms. This will not affect results.

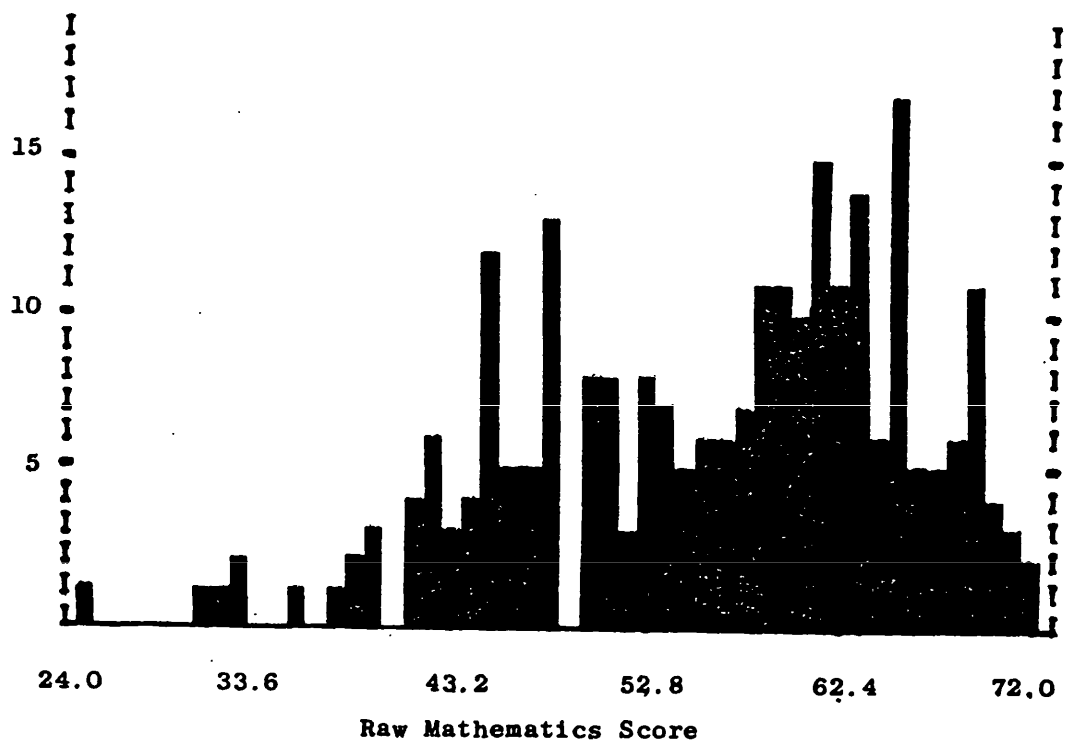
Figure 3.16 Distribution of raw mathematics score of 283 children whose standard normal mathematics score is more than 1½ standard deviations above their standard non-verbal intelligence level



Mean = 56.4
SD = 9.4

Note: Discrete values are spread over equal 50-point scales and can be expected to show broken histograms. This will not affect results.

Figure 3.17 Distribution of raw mathematics score of 253 children whose standard normal mathematics score is more than 1½ standard deviations above their standard verbal intelligence level



Mean = 56.0
SD = 9.4

Note: Discrete values are spread over equal 50-point scales and can be expected to show broken histograms. This will not affect results.

What then do these four distributions, Figures 3.14, 3.15, 3.16 and 3.17, appear to be showing us?

First, as with the reading, there is an excess of underachievers to over achievers; 342 underachievers predicted from the non-verbal intelligence score and 283 overachievers; an excess of 59 underachievers. If we look at mathematics scores predicted from verbal intelligence scores, we find 287 underachievers and 253 overachievers, an excess of 34 underachievers.

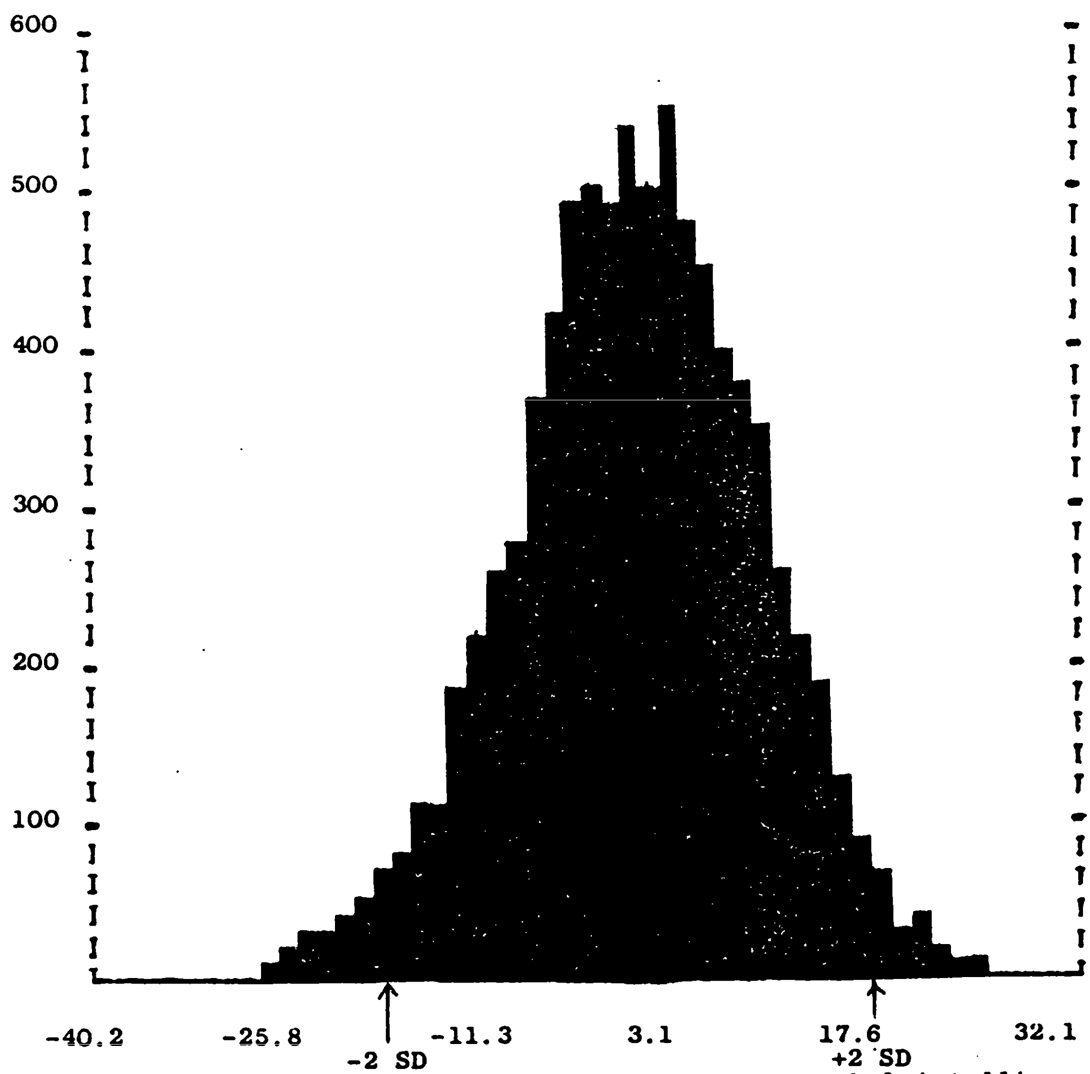
It should be remembered that it has already been argued (page 8) that the difference in sample sizes between the overachievers and underachievers, based on the criterion of absolute deviation of standardised scores of reading from those of non-verbal intelligence, is, as should be expected statistically, an under-estimate of the actual difference.

A regression of raw mathematics scores on the non verbal intelligence, therefore, will offer a more reliable indication of whatever differences there might be between over and under achievers. Since the presence of children whose mathematics and non-verbal intelligence scores differed greatly would attenuate the regression relationship, these children whose mathematics scores were more than 1½ standard deviations above or below their standardised non-verbal intelligence were excluded from the regression. The parameters from this regression were then used to give predicted mathematics scores for the whole sample including those children excluded from the regression itself.

The distribution of the residuals, the raw mathematics score minus the mathematics score predicted from non-verbal intelligence, is presented in Figure 3.18. The distribution is negatively skewed with a large number of cases in the left hand (negative tail). Following the practice of previous researchers we can focus on the children whose residual scores fall more than 2 standard deviations below the mean given a mean of -0.2 and a standard deviation of 9.6 there appear to be 330 children, 3.8 percent with residuals more than 2 standard deviations below the mean, and 180 children, 2.1 percent, with residuals more than 2 standard deviations above the mean. Statistically, we should expect 2.28 percent in each group.

<u>Figure 3.18</u> Residuals of regression of raw mathematics and non-verbal intelligence

(Note: regression parameters based on 8150 cases where standard normal mathematics levels were within 1½ standard deviations of standard normal non-verbal intelligence levels.)



Residuals of regression of raw mathematics on non-verbal intelligence

N = 8671

Note: Discrete values are spread over equal 50-point scales and can be expected to show broken histograms. This will not affect results.

The distributions of the residuals, from the raw mathematics score minus the score predicted from verbal intelligence is given in Figure 3.19. The distribution of residuals is slightly less negatively skewed than the distribution in Figure 3.18 and it has a mean -0.1 with a slightly smaller standard deviation. This gives 320 children, 3.2 percent with residuals more than 2 standard deviations below the mean and only 130, 1.5 percent, with residuals more than 2 standard deviations above the mean.

We must conclude therefore that whether mathematics is predicted from non-verbal or verbal intelligence an excess of severe under-achievers is apparent.

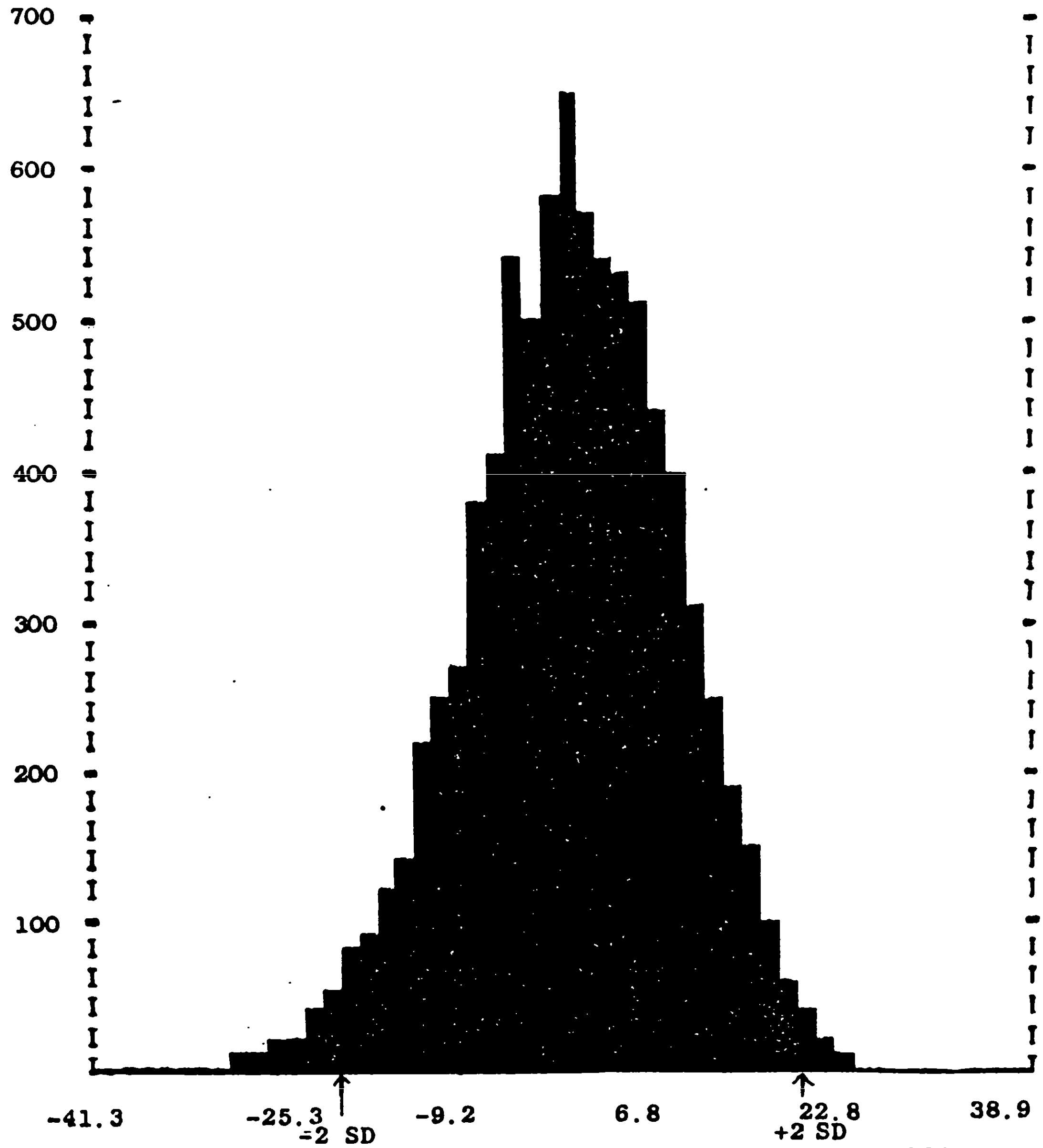
There is another interesting result within these analyses. This is apparent in Figures 3.16 and 3.17 which show the non-normal distributions of the raw mathematics scores of the over achievers. This lack of normality persists whether the overachievers are predicted from non-verbal or verbal intelligence. There appears to be an excess of high scoring mathematicians within this over-achieving group. It is not possible in this present report to carry this analysis further, but the possibility of a specific mathematics skill, as well as a difficulty, does seem to be suggested.

These analyses are the first in what we feel should be a series of investigations into the characteristics of under and overachievers. Much additional information including the results of tests which tap skills related to reading and mathematics are available within the data set of the 10 year follow-up of the CHES children.

We have presented evidence in this section which corroborates Yule and Rutter's assertion that there are more children who are underachieving in reading than would be predicted on a statistical basis. We have also found this is so for mathematics. The next section (Section 4) develops a general model of the way in which children's educational and personal characteristics interact with their educational environment to influence their attainment in reading and mathematics.

Figure 3.19 Residuals of regression of raw mathematics on verbal intelligence

(Note: regression parameters based on 8245 cases where standard normal mathematics levels were within 1½ standard deviations of standard normal verbal intelligence levels.)



Residuals of regression of raw mathematics on verbal intelligence

N = 8669

Note: Discrete values are spread over equal 50-point scales and can be expected to show broken histograms. This will not effect results.

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4.00 The Analyses of the Mainstream Educational Data

The sections covered under this heading describe the preliminary statistical analyses which have been carried out on what are termed the mainstream educational data from the 10-year survey of the CHES cohort.

Following a brief outline of the particular regression analysis technique used here, the predictors of the reading and mathematics scores of the 8,836 children in the first and major part of the cohort are examined and their relative strengths are presented graphically and discussed briefly. The final reading and mathematics models are then presented, together with subsidiary models pointing to differences across the upper and lower social groups in the cohort.

A detailed study is made of the information extracted from the principle components analysis of the Child Behaviour Scale, one of the major instruments in the educational assessment material. Particular attention is given to the hypothesised existence of a broad syndrome of 'hyper-activity'. The results of a 9-component analyses on 8,836 children suggest that some current theory on this issue needs reconsideration.

4.10 The Preliminary Analyses of the Educational Data

This section sets out the methods which are to be followed in the analyses described in succeeding sections.

The explanation for the choice of the regression method has been given in section 2.8. The method is seen as especially useful in enabling an overall study to be made of the very large number of variables assembled from the educational questionnaires and test instruments.

What is of particular interest to educationists is the question of which school and environmental variables are of most importance in predicting academic attainment. Beyond this stage is of course the even more important consideration of which of those variables are open to change and which are highly resistant to change. Thus the identification of large parts of the variance of reading or mathematics, for example, as related to the child's social environment and to its cognitive skills, merely indicates that a considerable proportion of the variance in these two basic skills is not easily open to change. On the other hand the identification of quite small predictions from particular school or parent behaviour variables may point to promising areas in which change may well be introduced. The same principles apply to the interpretation of relatively small differences in the academic models when divided according to the child's social group.

The method followed here has been to group most of the educational variables of 'mainstream' importance within conceptual areas of interest. Thus, for example, the variables reflecting the school reading environment are assembled for study within that group on its own. The reading score on the Shortened Edinburgh Reading Test is then regressed on to these 'school reading focus' variables. If only some of them make any credible contribution to the prediction the regression is re-run until only those variables are retained in the equation which make a contribution that is both highly significant and, of more importance, of some measurable size in terms of its unique variance contribution to the prediction. The same method is followed for identifying the important predictors within each of approximately 20 conceptual groups of variables.

What then follows is that the results from the final regression within each separate conceptual group are used to create what are known as latent variables. Thus for example those school reading environment variables which are found to contribute to the outcome of reading attainment are weighted to give a notional 'School Reading Focus' score for each child. In essence, the creation of a latent variable score is determined as follows for each child:

b_1.(Child A's score for class time spent on instructional reading) +
b_2.(Child A's score for class time spent on reading for pleasure) +
b_3.(Child A's score for class time spent on registration)
= Child A's score on the latent variable 'School Reading Focus'

The values of b_1, b_2 and b_3 are obtained from the final regression run referred to. When each of the 20 or more latent variables have been constructed for the reading model the reading score is regressed separately on to small groups of these latent variables, again with a view to identifying which are the more important predictor variables when they compete directly with each other. Again new and larger latent variables are assembled, based on the results of these regressions.

At the final stage some eight to ten major variables are entered into a regression equation as predictors of the reading score. This equation is reduced until a situation is reached in which all the remaining predictors have both meaningful and highly significant contributions to the variance in the reading score.

There are some limitations to note in regard to the conceptual bases of the above technique.

Firstly, the fact that a particular variable is not found to be an important predictor is not necessarily evidence that it is of no educational (or behavioural) value. It may be the case that the variable is only of value with certain sub-groups of children, but not with the majority. In such a situation the variable's contribution to the outcome score would not appear in a 'mainstream' analysis, but may well be shown as important when a sub-group is examined.

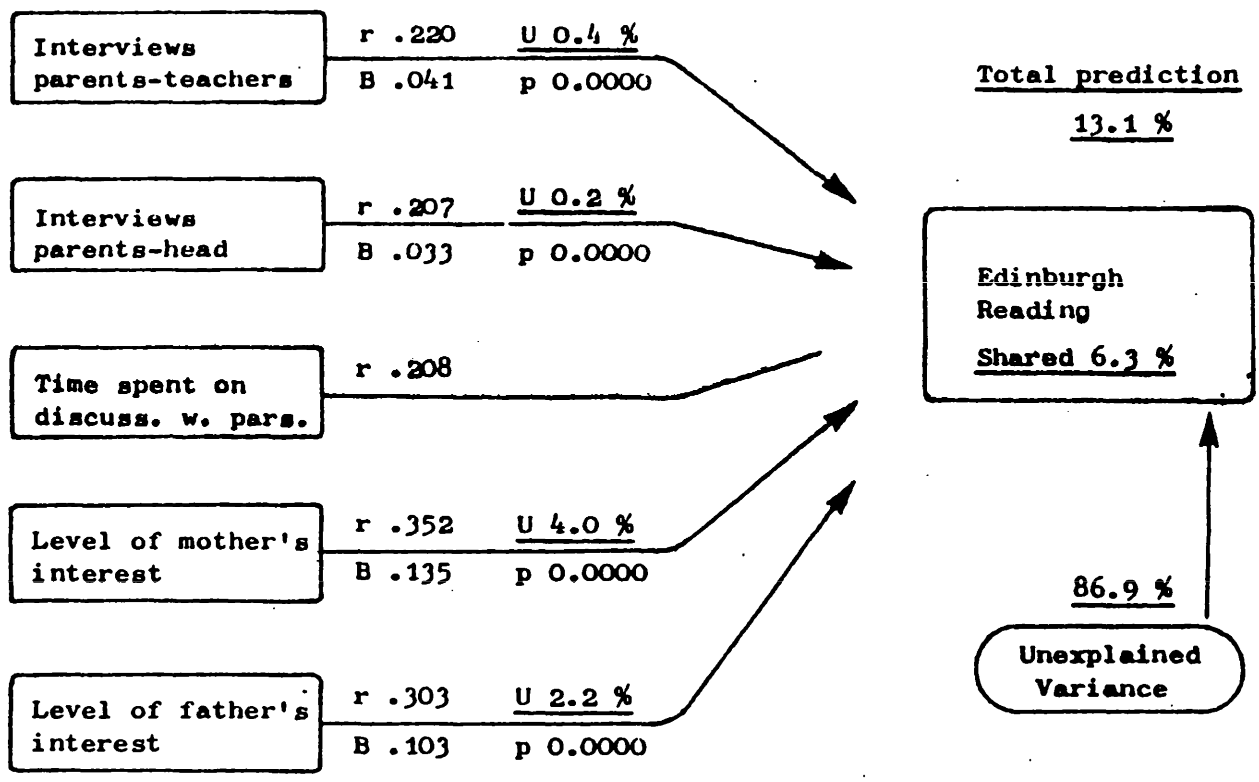
What is even more likely to be the case is that another variable in the equation may have duplicated the prediction of the variable in question; in such a case one or other of the two variables may not survive as a meaningful predictor. For example, parents' interest in their children's education may be closely bound up with the fathers' social class, since it is known that parents of a higher social class are likely to be more ambitious and to expect more of their children's education. The educational privileges which their children enjoy because of the parents' greater wealth may contribute to this greater degree of interest. Social class may thus become a surrogate for that interest, although equally the measured parental interest may be a surrogate for the social class variable.

It is therefore necessary to emphasise that the absence of a variable from a prediction is not in itself clear evidence that it is of less importance than some of the othervariables which do appear in the equation. At the same time the absence of the variable from an equation does raise the issue of whether it really has the importance which might normally have been attributed to it. Clearly when the importance of some variable is brought into doubt - or equally when its importance appears to be much greater than was thought initially - it suggests a more detailed examination of the particular variable in relation to its co-predictors. The importance of examining such variables within the context of other predictors should of course be apparent from what has already been discussed. The focus on single variables and their single relationships with attainment or other outcomes can be highly misleading.

A second limitation of the method used here is that it would be preferable to have available a set of longitudinal data in which parent and school variables drawn at several ages between 5 and 10 could be utilised to provide a more valid predictive model than is possible at present. The ultimate linking of the educational, social and health data from the birth, 5-year and 10-year surveys will naturally provide an excellent variety of material for creating longitudinal analytical models.

However many of the questions asked in 1980 have not been asked before. It has thus been necessary to build a model in which variables assessed at the same time as the outcome variables are used as predictors. In a number of conceptual areas this is legitimate. For example, parental interest and school reading environment as reported by teachers and heads is of its very nature referring to what has been the situation in the past. It would be most implausible to argue that it is the child's reading performance which leads to a particular school reading environment. It can also be considered that a child's cognitive skills are more likely to predict its reading performance than reading would be likely to predict cognitive performance. On the other hand motivational variables are closely linked with the level of success or failure experienced by a child, and thus the inclusion of motivational variables in the various models needs to be qualified by the consideration that there is probably a stong mutual influence of motivation and outcome on each other.

A third limitation is that it has not been possible to use age as a predictor variable. Although the range of three or four months within which most children underwent the educational assessment is not great, the contribution to variance from this source could well be noticeable, even if small. The reason for this omission is that it has not yet been possible to link the computer tapes containing the age and the large variety of other basic health data to the educational data. Subsequent analyses of the educational material will of course include age, once the links have been made. For ease of presentation, most of the analyses reported in the coming sections will be presented in graphical form. On each diagram are printed a variety of statistical details on the final regression equation. Below is a typical example.



Parent Educational Interest: prediction of Edinburgh Reading

In this diagram the 'r' refers to the simple correlation between the variable in question and the outcome or dependent variable. The 'U' statistic is a particularly valuable figure for an understanding of the variable's importance within the context of the associated variables, since U gives the percent unique variance of the outcome predicted by that variable. Thus the set of U figures within a diagram indicates the competing strengths of the different predictors. The 'p' figure is the well known probability statistic. Figures which read as p. 1.0000 or p 0.0000 are indicating that the probabilities of the regression coefficient are either greater than p 0.99995, or less than p 0.00005, respectively. The rounding to the four figures cited here is for ease of presentation. The B (beta) statistic is the size of the standardized regression coefficient or 'weighting' of the variable in question, within the particular model of prediction.

As a general rule a minimum of p 1.0000 or p 0.0000 is required for any variable to be retained in an equation for the largest samples. Unique variances of at least 0.15 per cent are required for retention in an equation. In situations where the total prediction is high, for example, in the region of 20 per cent upwards, these criteria are made more stringent. However in situations in which there is only a very small prediction by a subset of variables it seems reasonable to set these comparatively low limits so that variables are not eliminated before any assessment can be made of their relative strengths.

It has already been noted that the interpretation of relatively small amounts of variance can be a valid and important exercise in identifying contributors to attainment. This point needs to be emphasised in relation to the presentation of variance predictions as small as 0.15 per cent. Many analytical techniques do not quantify the size of particular contributions to variance, but simply offer probability data to emphasise the importance of a relationship. This is a procedure which can easily be abused, if there are sufficient sample numbers to provide a very high significance level for very small relationships. Thus the ultimate criterion in judging a relationship - particularly one based on regression where unique and total variance contributions are easily identified - should be a combination of both the size and significance of a relationship.

The point should also be made, in regard to the sample diagram presented on a previous page, that what is termed shared variance should be regarded as an important additional contribution to variance by each of the contributing variables in the model. Unfortunately it is difficult to assess the part played by each of a number of variables in a shared variance situation. When shared variance is large, however, it should be noted that this adds emphasis to the importance of those variables retained in the model.

It should also be apparent from the diagram that variables which make little or no contribution to the explained variance have been excluded from the model. Only the 'r' or correlation statistic is presented for them. This means that such variables have been eliminated in an earlier regression run with the same set of predictors.

Specific aspects of each model will be discussed alongside the presentation of the diagrams. As far as possible comparisons will be made between high and low social groupings, to emphasise the relative importance or unimportance of certain variables and how this changes or remains stable across the models.

4.20 The Predictors of Reading and Mathematics

The conceptual model followed in the analyses of the reading and mathematics attainments of Britain's 10-year-old children is set out in the following description of specific areas of educational interest.

Outcome Variables

Reading Model:	Shortened Edinburgh Reading Test
Mathematics Model:	CHES Friendly Maths Test

Major Predictor Variables

School Social and Academic Intake
School Educational Ethos
Class Teaching Ratio
Parent Educational Interest
Child Cognitive Assessment
Child Motivational Assessment
Child Behavioural Assessment
Child Language Assessment
School Reading Focus (for Reading Model)
School Mathematics Focus (for Mathematics Model)

Subsidiary Predictor Variables

NOTE: All the questions listed below can be found in the Appendices printed at the end of this document. The name of each predictor is also given in the regression diagrams which follow this description.

School Social and Academic Intake:

School social and Academic Intake (3 Variables):	D25b, weighted 4,3,2,1 respectively D26, weighted 5,4,3,2,1,3,0, respec. D25a, weighted +2,+1,0,-1,-2 respec.

School Educational Ethos:

School Streaming/Setting (3V):	A8a(i), A8b(i), D19 (coded 3,2,1)
Homework (1V):	D7a (coded 6,5,4,3,2,1)
Classroom Ethos (7V):	D9 (a,b,c,d,e as sep. predics.), D11 (a,b as sep.)
School Philosophy (3V):	D20 (a,b,c as separate predictors)
Incentives, Encouragement (5V):	D8a (i+ii, coded 1,2), D8c (i+ii+iii coded 1,2,2), D8d (i, coded 1), D10 (coded 1,2,2,2,3,3,1,1,1,0), D24e
Incentives, Competitive (2V)	D8b(i+ii, coded 1,2), D8e(i+ii, coded 1,1)

Class Teaching Ratio:

Class Teaching Ratio (3V): Equation= $\dfrac{\text{(Weighted Total Teaching Time) X 100.}}{\text{(Total Weekly Class Time)(Class Pupil Tota}}$

where: Weighted Total Teaching Time is the cumulation of D5:

4a(i+ii+iii) + 4b(i+ii) + 4c(i+ii) + 2d + e(ii) + 4g
(note differences in weights of sub-items)

Total Weekly Class Time is D4

Class Pupil Total is D2

Parent Educational Interest:

Parent Educational Interest (5V): A30a (coded 4,3,2,1,1) X A31b
A30b (coded ditto) X A31b
A31a (coded 1,2,3,4,5,6) X A31b
A32a (coded 5,4,3,3,3,2)
A32b (coded 5,4,3,3,3,2)

Child Cognitive Assessment:

Non-verbal B.A.S. (2V): Digit Recall and Matrices as sep. predictors

Verbal B.A.S. (2V) Similarities and Word Definition as sep. predictors

Sex of child (1V)

Child Motivational Assessment:

Locus of Control (16V) (in Pupil Questionnaire) : 16 items as separate predictors (excl. distractors)

Self-Esteem Questionnaire (12V) (in Pupil Questionnaire) : 12 items as separate predictors (excl. distractors)

Child Behavioural Assessment

Concentration and Perseverance(3V):A25, A26a, A28

School Absence (8V): B1b (items 1 to vii as sep. predictors

Behavioural Components (9V): The nine principal components from the Developmental Behaviour Scale, as separate predictors

Child Language Assessment:

Expressive Language Assessment (13V) :	A9 to A21 as separate predictors
Language Comprehension Assessment (3V) :	The three sub-totals from the CHES Pictorial Language Compr. Test

School Reading Focus (for Reading Model):

School Reading Activities (6V) :	A3, using a,c,d,e,f,p as separate predictors

School Mathematics Focus (for Mathematics Model):

School Maths and Scientific Activities (5V):	A3, using a,g,h,i and p as separate predictors
Breadth of Maths Curriculum (1V) :	D6 (add all eight items, coding each as 1)

In the pages which follow, the individual regressions as set out in the conceptual model will be portrayed in diagrammatic form, with brief discussions where relevant.

4.21 Comparison of Predictions within Conceptual Groups

The children's reading and mathematics scores were regressed separately on to subsets of variables derived from the educational survey data. The results are described below.

4.21.i The school's social and academic intake

The extent to which the social and academic intake of a school influence the performance of the children has long been a matter of concern. Coleman 1966[1] showed from the data collected in a large American schools survey that even after taking account of children's social class, the social composition of the schools attended by those children had a beneficial effect if the children were from a low socio-economic group and the schools' social make-up was relatively high; however children from a high socio-economic group were not subject to a downward pull in schools with a relatively low social intake.

1. Coleman, J.S., Cambell, E.Q. et al (1966) Equality of Educational Opportunity. U.S. Government Printing Office (H.E.W., Office of Education)

The planned linking of the CHES educational data with the survey children's social class data will enable a detailed examination of this question within the British context. Figures 4.211 and 4.212 show the overall influence of the schools' social and academic intake on reading and mathematics scores in the survey; however, as explained, the data cannot as yet take account of the social class of the survey children, so that the strength of the variables portrayed here is higher than might be expected.

The reading and maths models do not differ much, although it appears that the schools' academic intake is somewhat more important for progress in mathematics than it is for progress in reading.

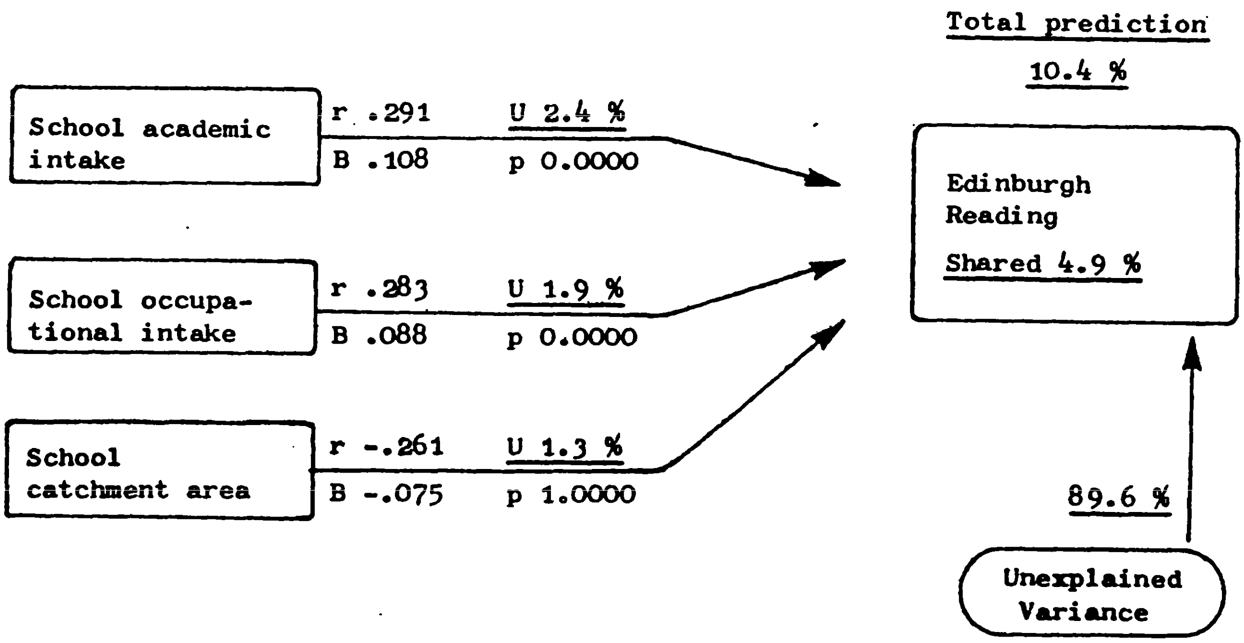


Fig. 4.211: School Social/Academic Intake: prediction of Edinburgh Reading

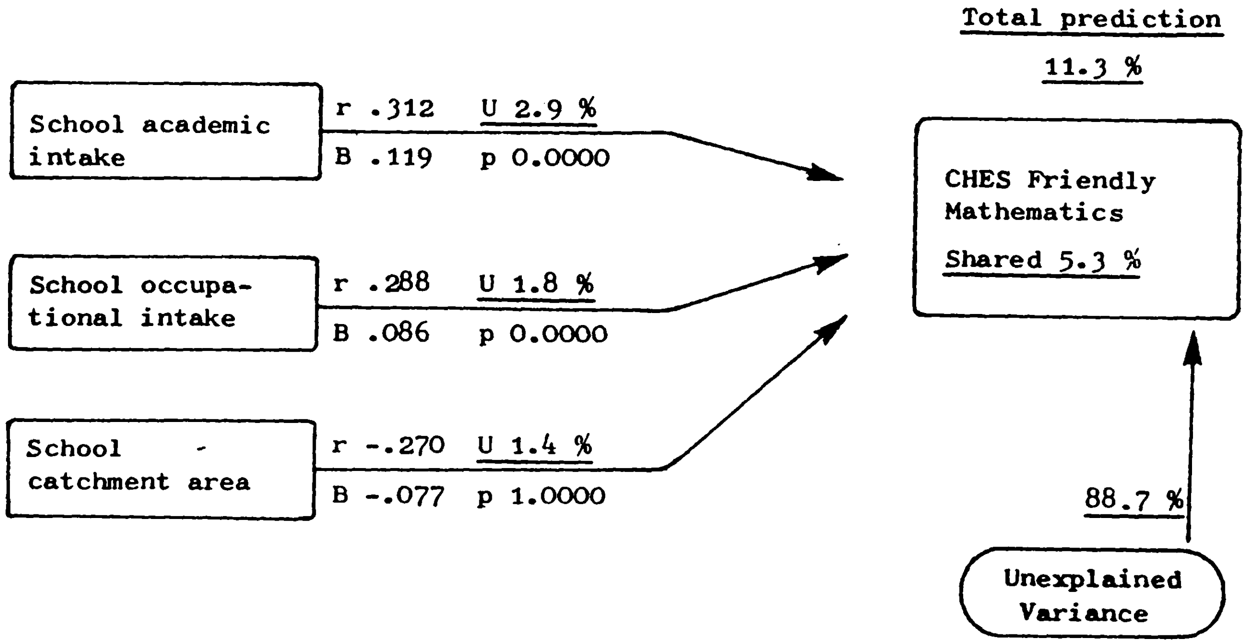


Fig. 4.212: School Social/Academic Intake: prediction of CHES Friendly Mathematics

1.21.ii **School streaming and setting**

The merits or demerits of streaming children or dividing them into set groups (according to attainment level) for different subjects has been an issue of some debate in recent years. The evidence from this survey offers little support for either proponents or opponents of the practices. There is a very small negative correlation ranging from -.014 to -.039 between the use of streaming or set groups and the children's scores in reading and mathematics.

Without information on whether more use is made of streaming and setting in schools with an academically higher or an academically lower intake, it is impossible to conclude that these slightly negative relationships (in both reading and maths) are anything more than a surrogate for school intake. What is clear, however, is that there is no real support in this analysis for claims that streaming and setting have any positive effect on children.

.21.iii **Classroom ethos**

The study by Rutter et al 1979[2] suggested that observational judgements of the school ethos were an important predictor of later behavioural

2. Rutter, M., Maughan, B., Mortimore, P. and Ouston, J. (1979) Fifteen Thousand Hours. Open Books

and academic outcomes, within a number of secondary schools in an inner city area. The resources of the CHES survey team did not permit observational studies to be undertaken within the 10,000 schools where the survey children were traced. It was therefore decided to rely on an alternative method of asking both the survey child's teacher and the school head to mark a series of analogue scale items on questions about the ethos pervading the classroom and school respectively.

The evidence shown in figures 4.213 and 4.214 does not indicate support for the view that the ethos, as interpreted and described by teachers and heads themselves, is highly predictive of attainment.

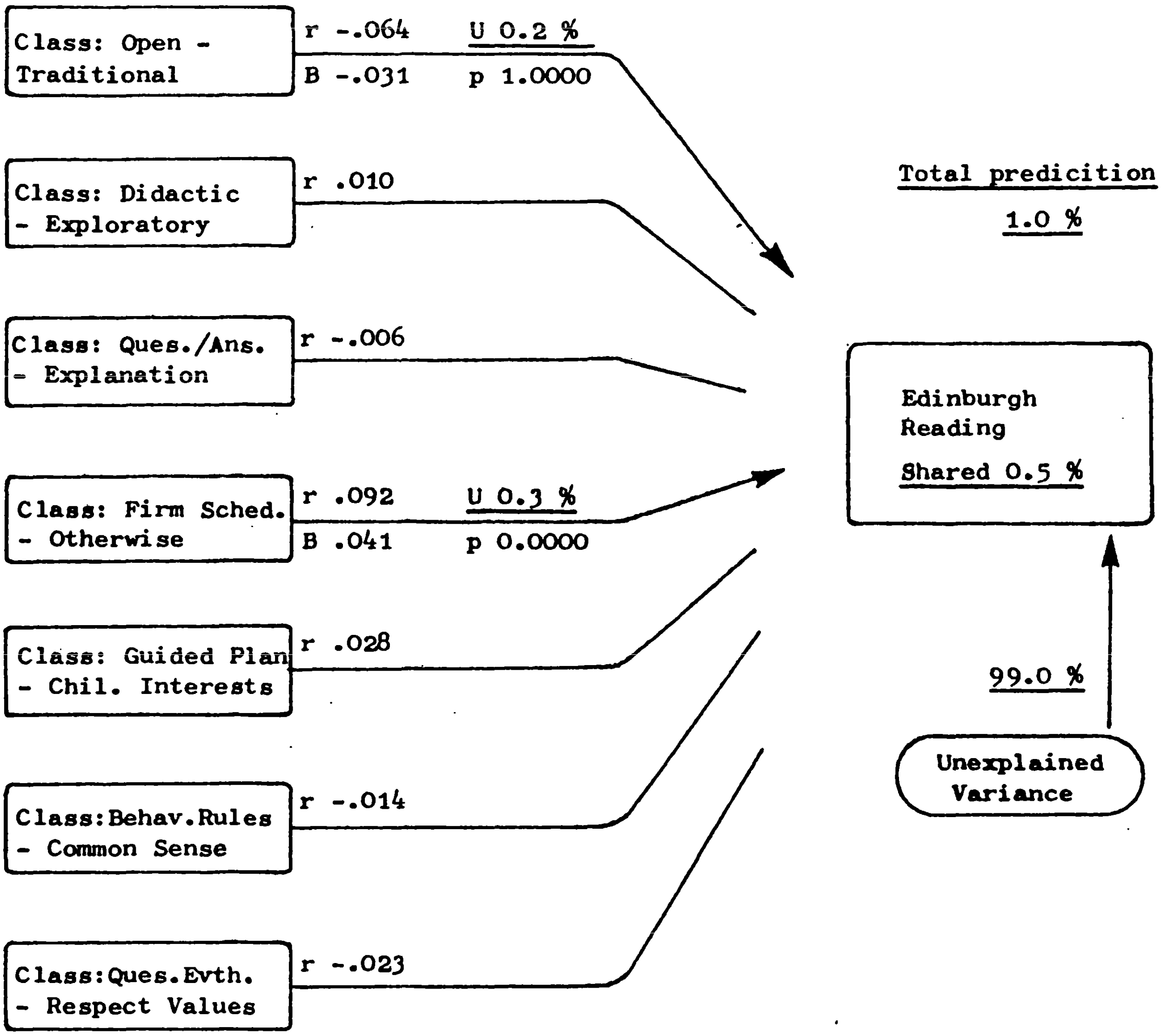


Fig. 4.213: Classroom Ethos: prediction of Edinburgh Reading

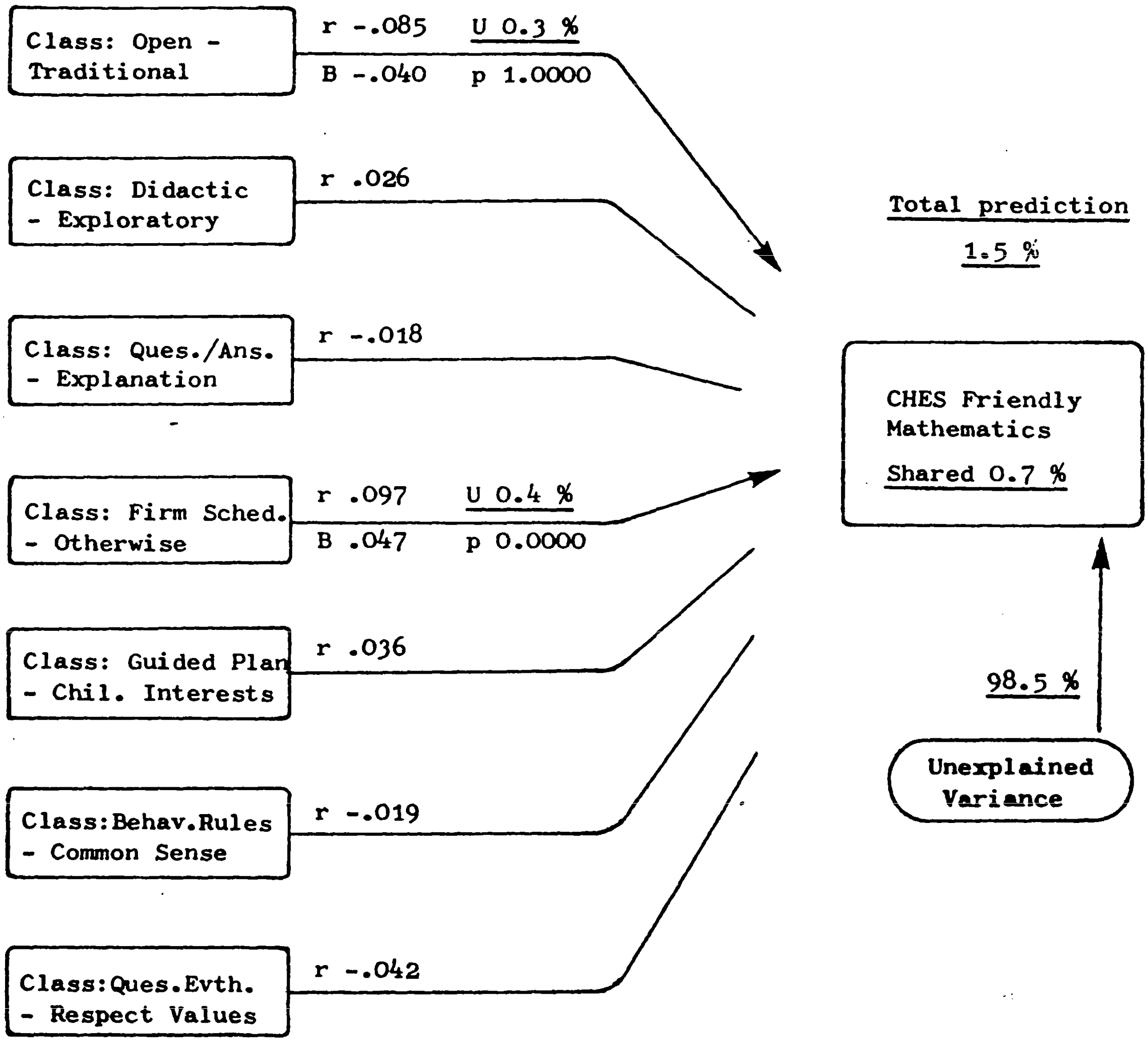


Fig. 4.214: Classroom Ethos: prediction of CHES Friendly Mathematics

The distributions of scores on these analogue scales showed curves close to normal, so that it has to be recognised that both teachers and heads did make use of the full range of possible scores. The only clear evidence from the CHES data at this stage is that there is a slight contribution from teachers' descriptions of their classrooms on the open/traditional continuum, with the data favouring, though only slightly, the more traditional environments. The data also indicate that the claim by teachers to be adhering more to a firm teaching schedule than to a looser schedule appears to point to a slight positive influence on attainment.

What should be noted here is that conventional forms of analysis of methods of examining differences between samples would have indicated a highly significant difference across the firm/loose schedule continuum, when relying on probability levels. However the total predictive power of the classroom ethos is only 1 per cent for reading and 1.5 per cent for mathematics, when viewed in isolation from other influences. It is interesting that this influence is stronger for mathematics, suggesting that a more traditional approach is slightly more important for the latter subject than it is for reading.

4.21.iv School philosophy

The three variables assessed under this heading all refer to the school ethos as expressed by the head's marking of those variables. Here the combined power of the variables is too low to make any meaningful contribution to the variance in reading or mathematics, although correlational evidence suggests a slight contribution from the school's general policy favouring structured classes rather than a blend of individual and structured teaching.

4.21.v Use of incentives

A number of questions refer to the kinds of incentives given to encourage academic attainment. None of them predict strongly enough to make a meaningful contribution to variance (in terms of the criteria set for inclusion). However the bivariate relationships are of some interest in view of the large number of cases involved. The use of praise, mentioning special goals to the children, and the encouragement of competition all show positive though very small and almost meaningless correlations with attainment (mostly in the region of .04). On the other hand methods such as the display of work, the awarding of free time, the naming of individual achievers in Assembly and the naming of class achievements in Assembly all show negative (though again very small) correlations with attainment. Naming of class achievements in the Assembly has the highest of all these correlations, reaching -.079 and -.083 in the reading and mathematics models respectively.

4.21.vi Parent educational interest

The Plowden Report 1967[3] re-emphasised the known importance of parental interest for the educational progress of their children. This matter has long been a matter of great concern to education authorities in this country. The recent development of special programmes in which parents of junior school children listen to their children's reading every night and try to overcome motivational and similar non-specialist reading problems in association with the class teachers, was in large measure the result of work initiated by Hewison and Tizard 1974[4]

Figures 4.215 and 4.216 show the sizable contribution of the group of 'parent interest' variables on their own. The prediciton is stronger in the case of reading than it is in mathematics. This could be expected. When it is possible to link the educational data to the CHES social data on the home environment and practices the strength of this prediction may be even higher.

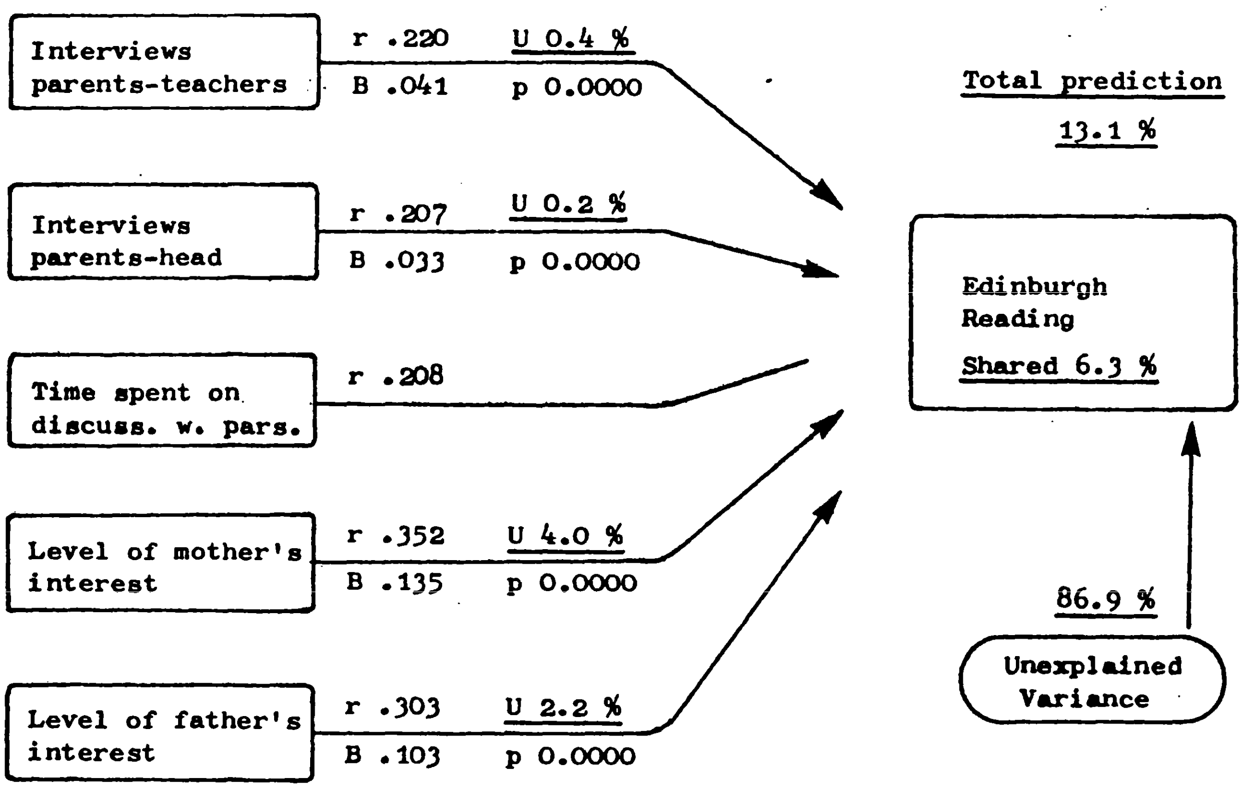


Fig. 4.215: Parent Educational Interest: prediction of Edinburgh Reading

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3. Plowden Report (1967). Children and their Primary Schools. Central Advisory Council for Education (England) H.M.S.O.

4. Hewison, J. and Tizard, J. (1979). Parental involvement and reading attainment. Research Paper, Thomas Coram Research Institute.

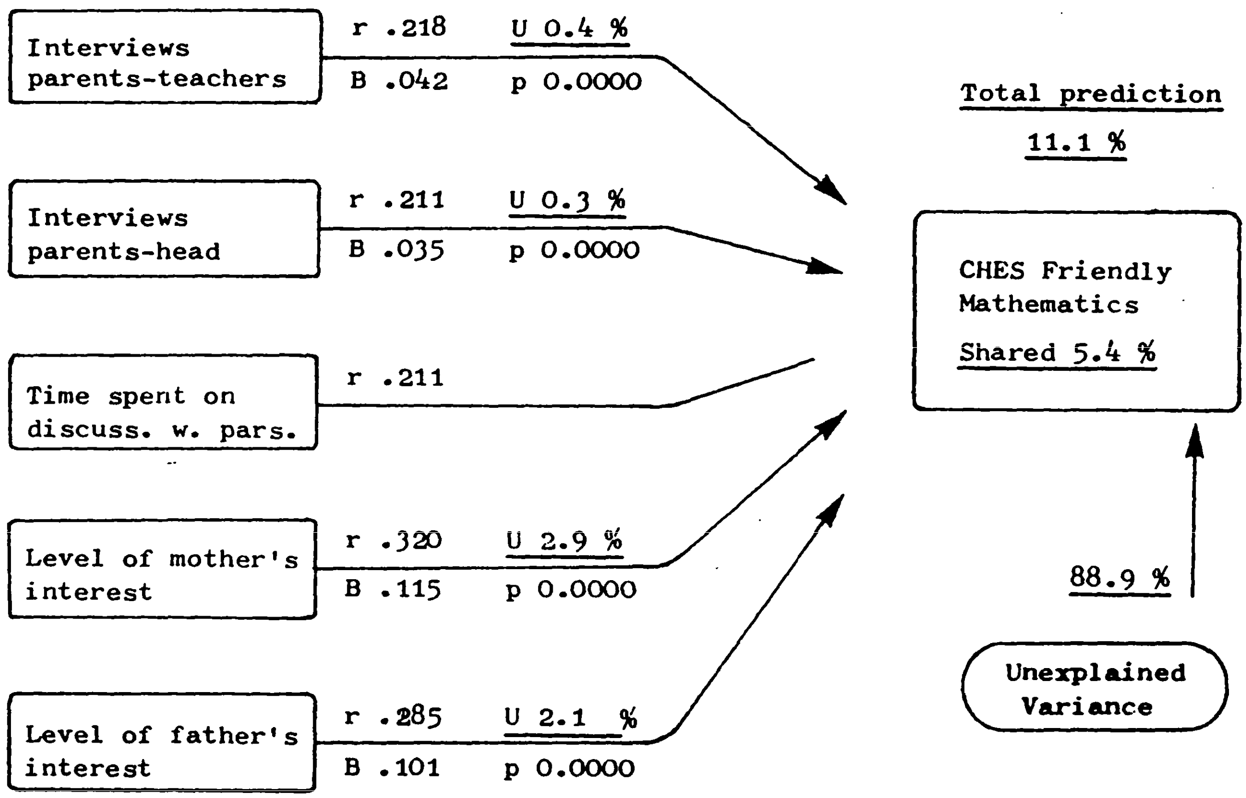

Fig. 4.216: Parental Educational Interest: prediction of CHES Friendly Mathematics

While measures of the number of times parents came to the school to meet the teachers and heads show a modest contribution to variance, the powerful predictors are seen to be the levels of parental interest, as judged by the teachers. It is noteworthy that the level of mother's interest has a considerably stronger predictive value than that of the father's interest, for both reading and mathematics. However the father's interest is undoubtedly also a strong contributor. A point of minor note is that the time the school spent discussing the children with the parents makes no independent contribution, despite the correlation being nearly the same as that of the variables indicating the number of interviews. It would appear that it is the frequency of visits rather than their duration which contributes more meaningfully to the children's progress.

4.21.vii Non-verbal and verbal cognitive abilities

The misuse and misunderstanding of the concept of intelligence quotients led to an early decision that I.Q. figures would not be produced nor employed within this study. However the tremendous importance of children's cognitive abilities is fully recognised as being among the most powerful contributors to educational attainment.

The administration by teachers of two verbal and two non-verbal measures, selected from the British Ability Scales for the CHES survey, has provided data confirming the power of the predictions from this source, both for reading and mathematical attainment.

Figures 4.217 and 4.218 show the contribution of the verbal ability measures to the two outcomes. As can be expected, the contribution of the verbal measures to reading is higher than it is to mathematics.

In both models the word definitions test is more powerful than the similarities test.

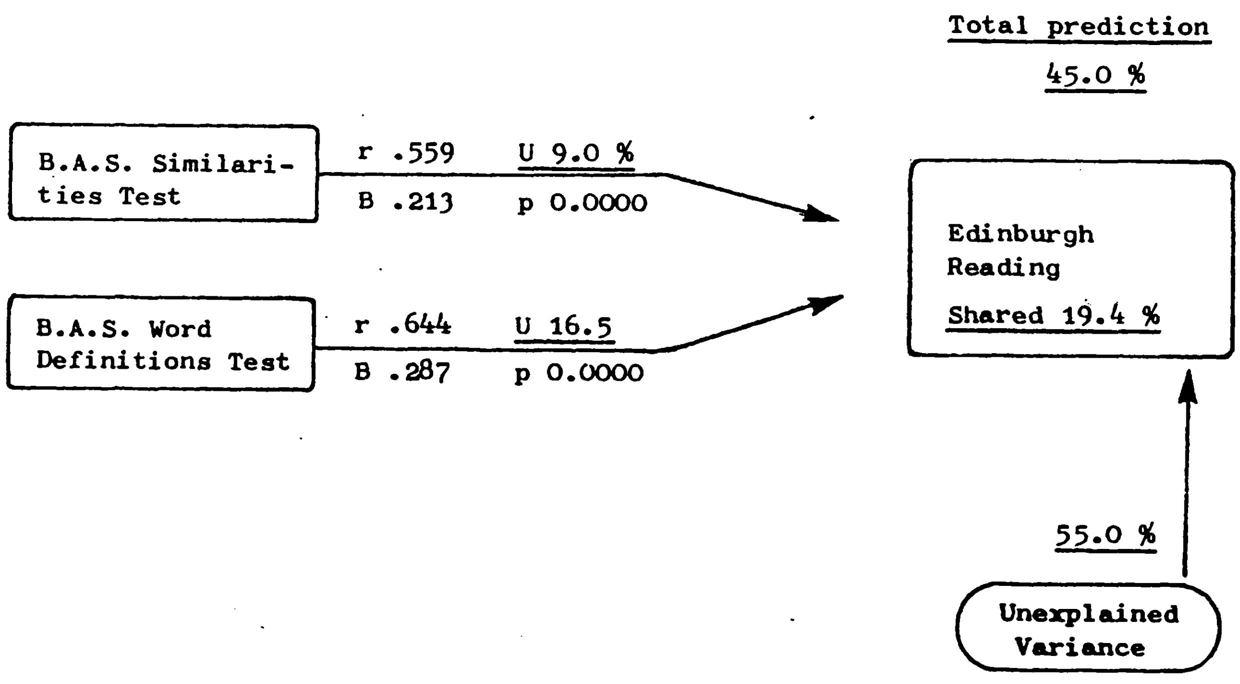

Fig. 4.217: Cognitive Ability (Verbal): prediction of Edinburgh Reading

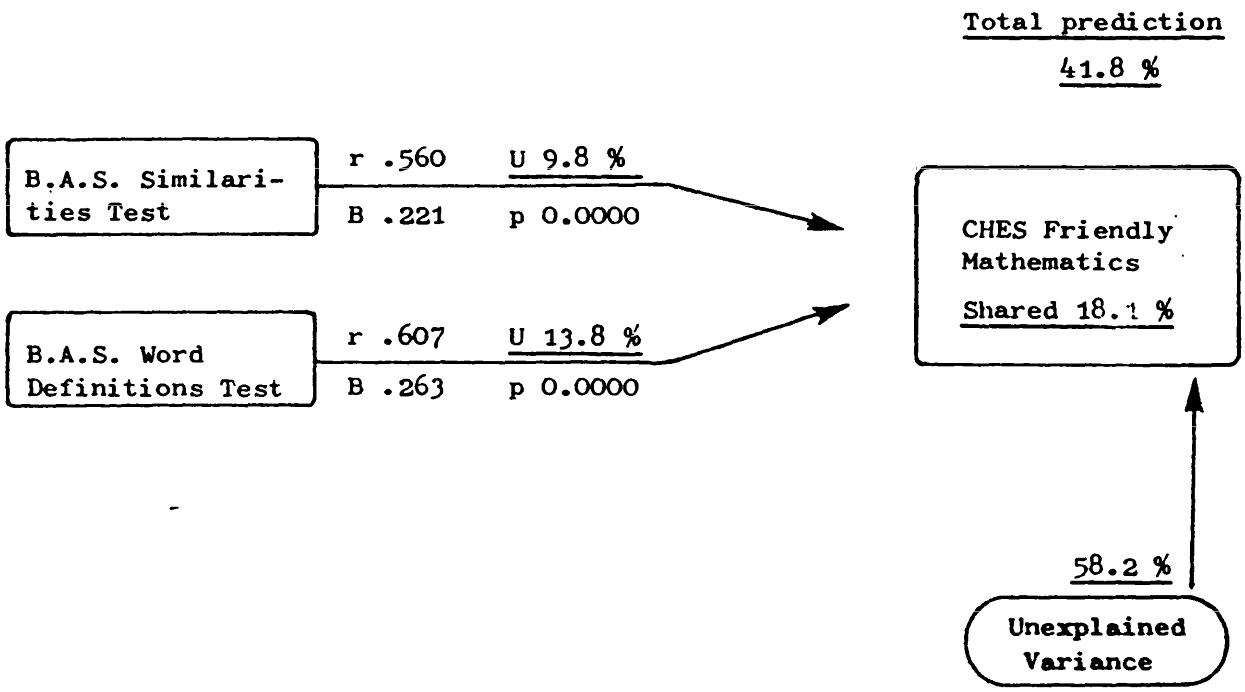

Fig. 4.218: Cognitive Ability (Verbal): prediction of CHES Friendly Mathematics

The next two illustrations, figures 4.219 and 4.220, show the contribution on non-verbal ability. Here it is mathematics which is more strongly predicted than is reading. In both cases the Matrices Test has a unique variance contribution several times greater than that of the Digit Recall Test. However it is expected and was indeed envisaged that the Digit Recall Test will prove particularly useful for assessing children at the lower end of the ability range.

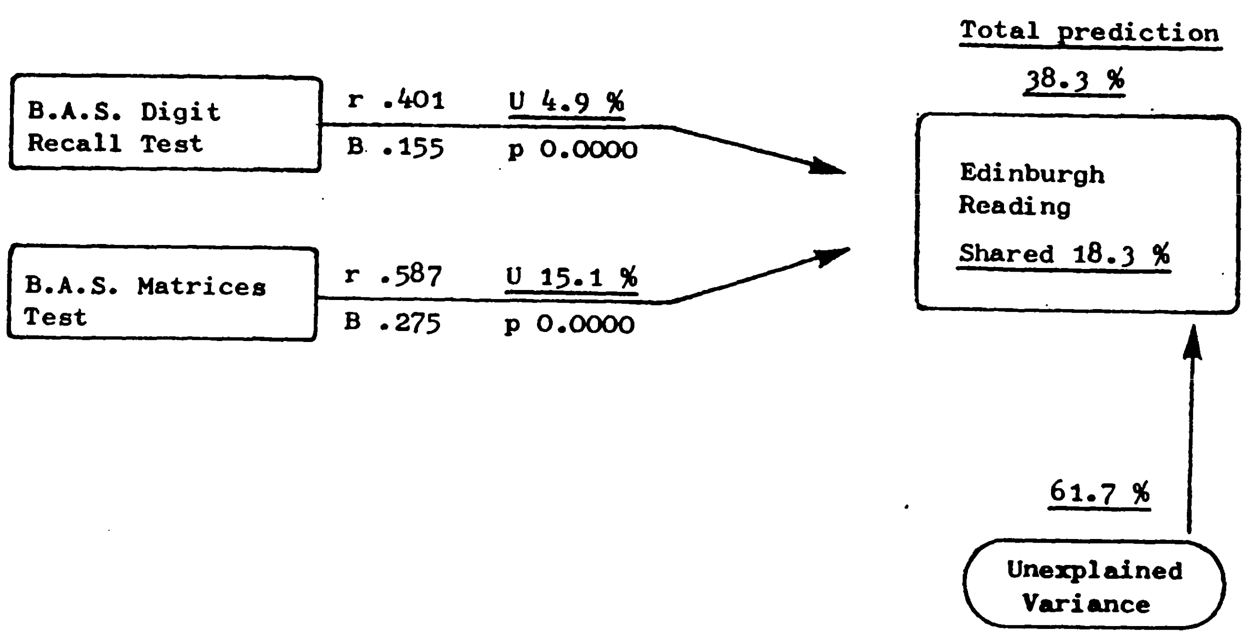

Fig. 4.219: Cognitive Ability (Non-Verbal): prediction of Edinburgh Reading

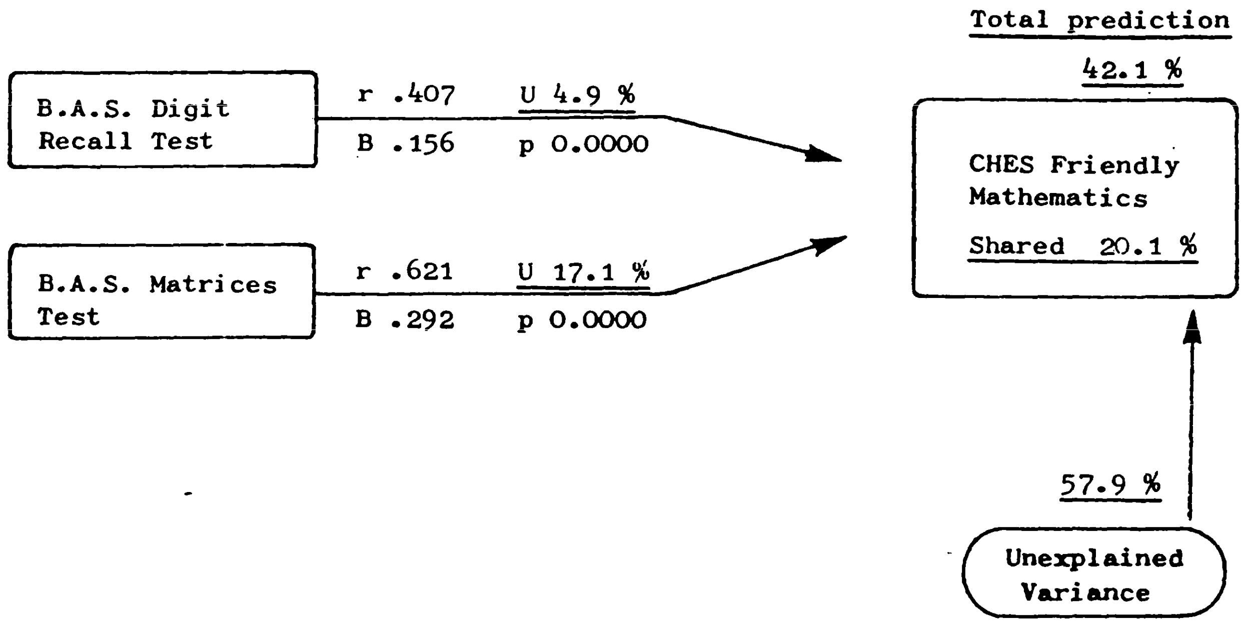

Fig. 4.220: Cognitive Ability (Non-Verbal): prediction of CHES Friendly Mathematics

The fair degree of similarity between the predictions of reading and mathematics in these and many other parts of the model is interesting. There is of course a fair measure of agreement between high performance in reading and high performance in mathematics, but the differences between the predictions in each model are not as great as might have been expected. A study of pre-school and infant school performance undertaken by one of the authors of this report has shown far greater differences between the predictors of early reading and those of early mathematics. It was hypothesised there, and the present study appears to confirm this hypothesis, that there is an increasing degree of integration of skills with increasing levels of attainment, a process which can be expected to occur as a result of the formative influence of the school within all areas of curriculum and overall development.

4.21.viii Locus of control measure

Because of the large number of items in the Caraloc Pupil Questionnaire (16 in all) it was decided to run separate regressions on each half of the items, combining the best items in an overall regression prior to creating a locus of control variable. Figures 4.221-2 and 4.223-4 present the final equations.

The unexpected power of this measure in predicting academic attainment has a number of potential implications, if subsequent fine-grained analyses support these findings.

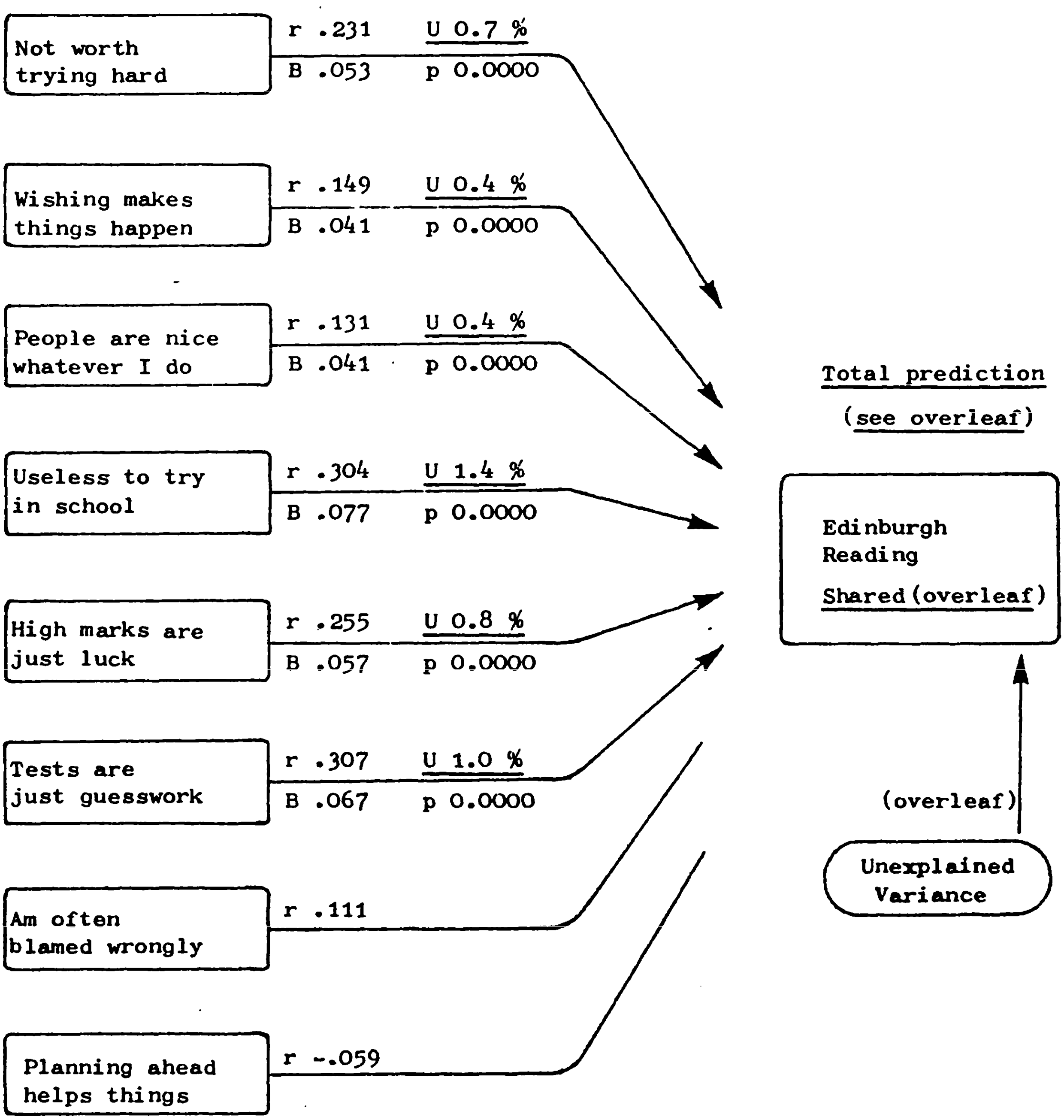

Fig. 4.221: Locus of Control (First Half): prediction of Edinburgh Reading

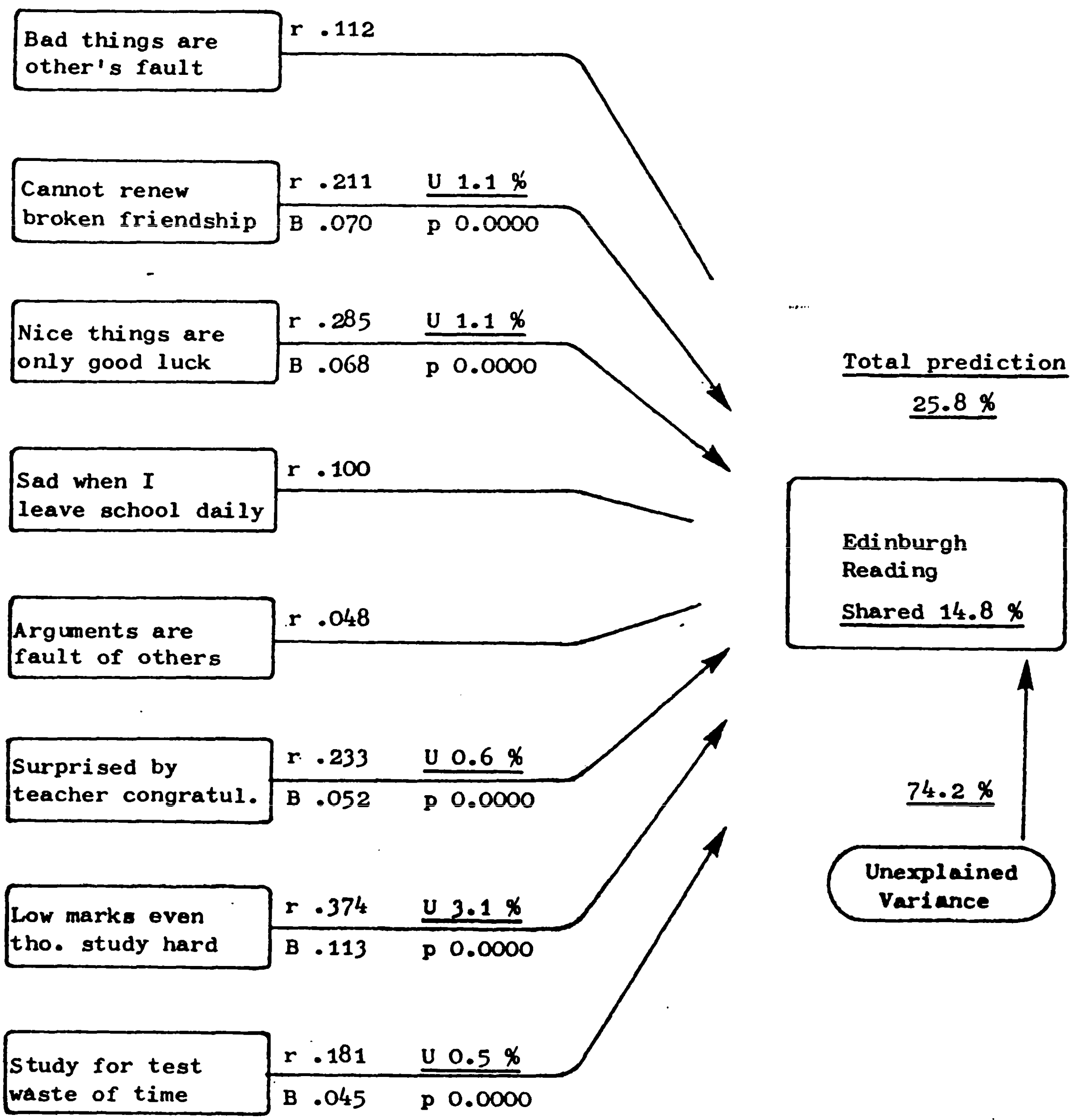

Fig. 4.222:Locus of Control (Second Half): prediction of Edinburgh Reading

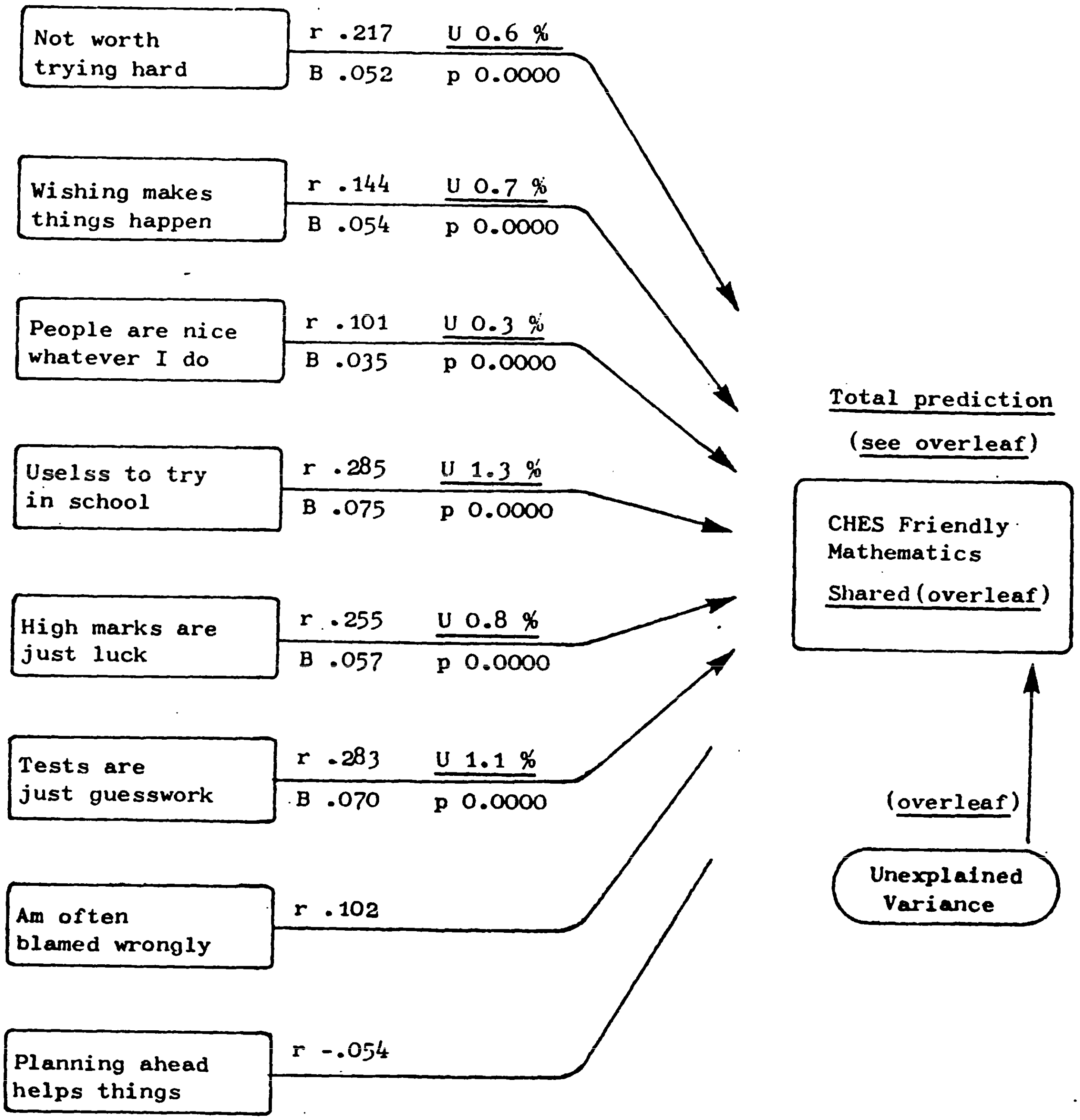

Fig. 4.223:Locus of Control (First Half): prediction of CHES Friendly Mathematics

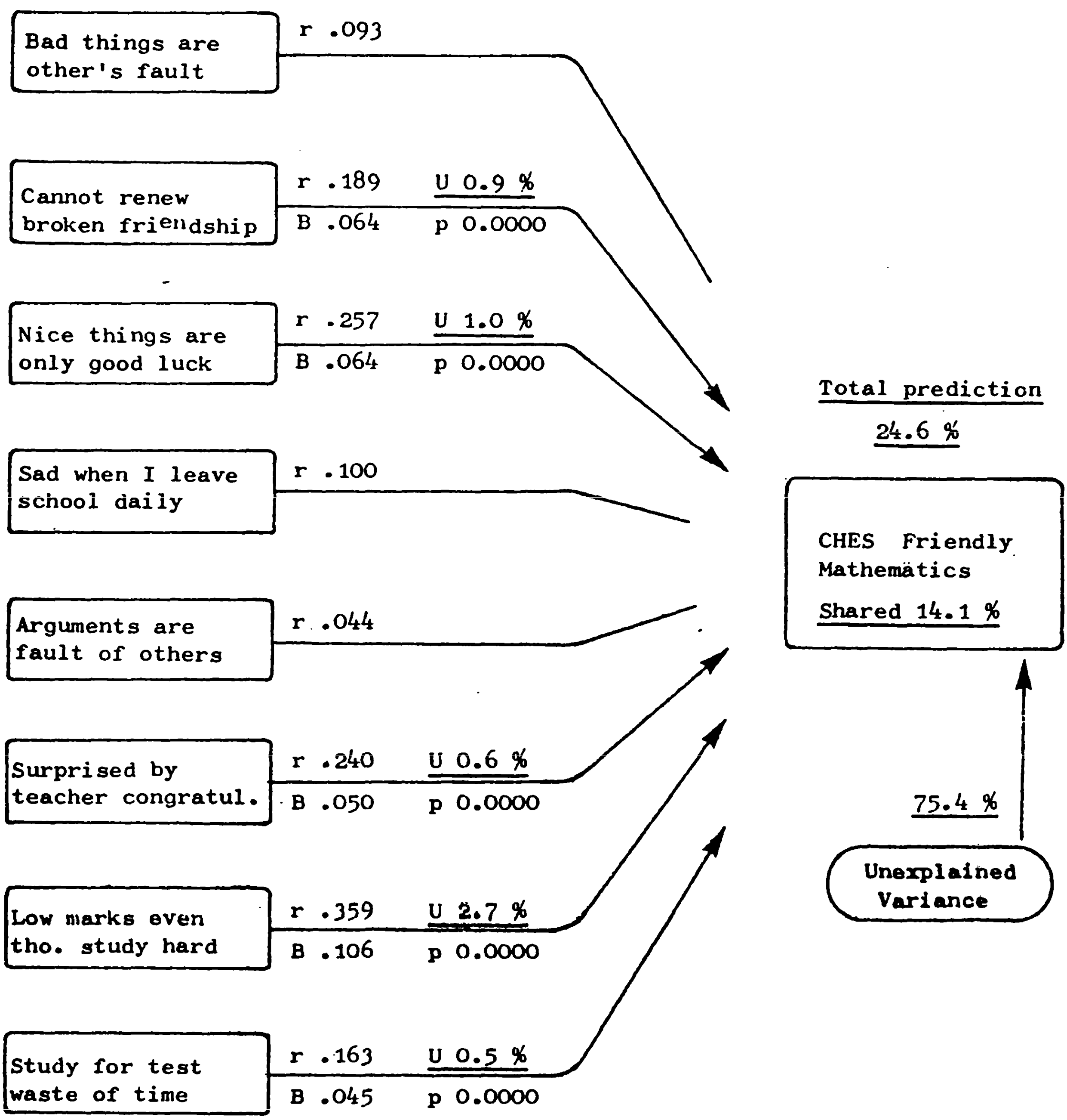

Fig. 4.224: Locus of Control (Second Half): prediction of CHES Friendly Mathematics

Firstly, the relative contributions of the children's temperaments and home and school experiences to their current level of locus of control is a matter needing further study, although some work has already been carried out in this area, as reported in research cited earlier in this document.

Secondly, depending on the findings of such a study, there may be grounds for considering whether schools have a particular responsibility for encouraging children to become more aware of their own control over what they achieve at school. This is related not only to the encouragement given to children to 'achieve' in the areas defined as important by the school, but equally to the question of what are the criteria for success at British schools, and how much scope is there for setting attainable and praiseworthy goals for low-attaining children, particularly those who are not destined for academically-oriented examinations.

There is very little difference between the predictive strengths of these variables across the reading and mathematics models, suggesting that academic attainment in general is highly related to the questions being asked in this measure. While some of the individual items are omitted in the comprehensive regression, they all predict in the expected direction. It is worth noting that the item with the strongest individual or unique variance contribution to both reading and mathematics is the item in which the child is asked to respond to the question: Do you usually get low marks, even when you study hard? It may be too simple an explanation to argue that the item merely reflects some natural tendency to blame ones bad luck rather than one's lack of effort; it may, alternatively, represent an inability of the children concerned to see any meaningful results from their attempts to master the subjects in question.

4.21.ix Self-Esteem Questionnaire

Another aspect of the child's emotional state which has become of interest in recent years is self-esteem. Figures 4.225 and 4.226 illustrate the performance of this questionnaire in the prediction of academic attainment. The models differ slightly in the items included or excluded, but the total prediction does not differ much.

It is clear that a child's locus of control is on its own a far stronger predictor of reading and maths than is self-esteem. This may be a

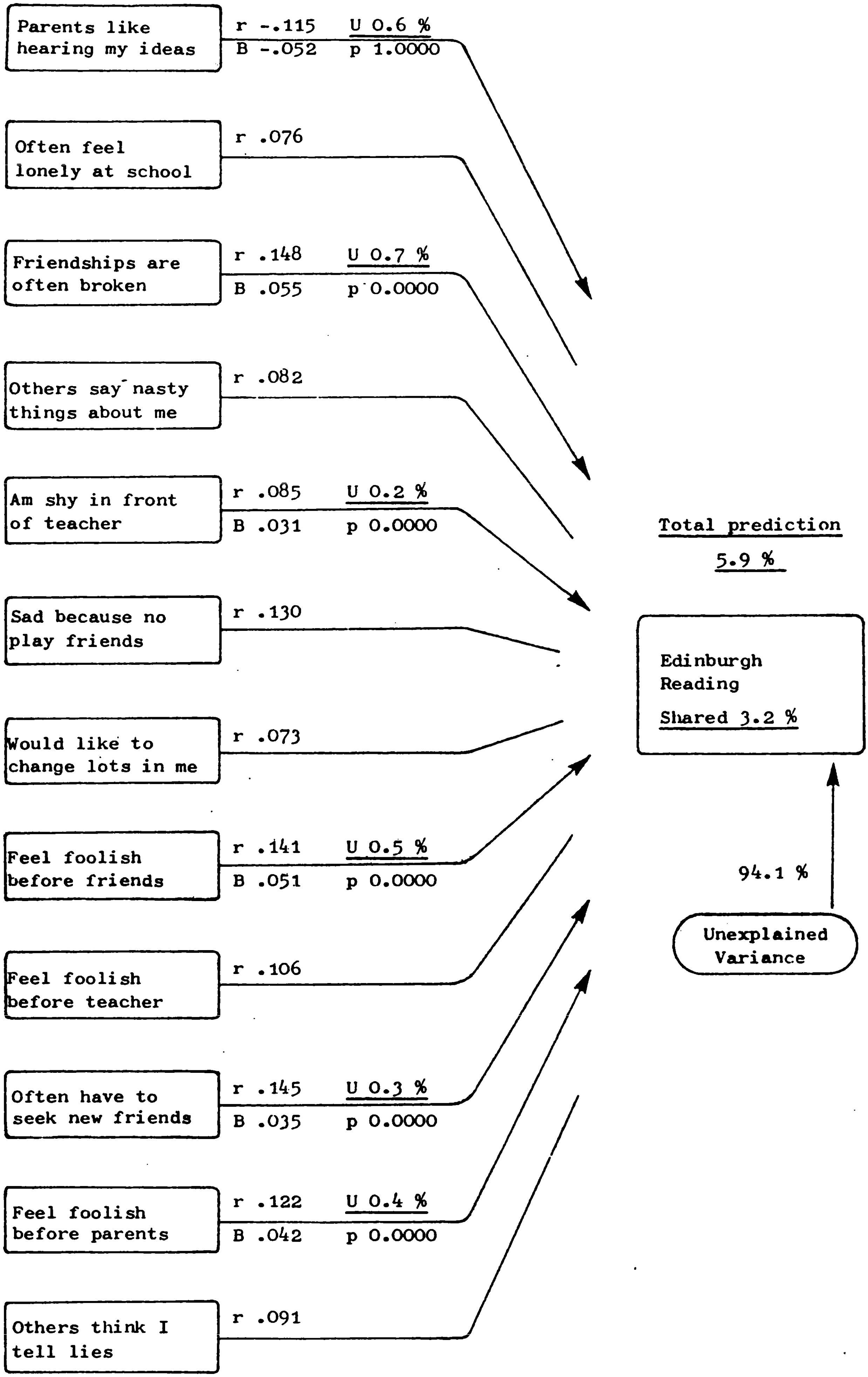

Fig. 4.225:Self-Esteem Questionnaire: prediction of Edinburgh Reading

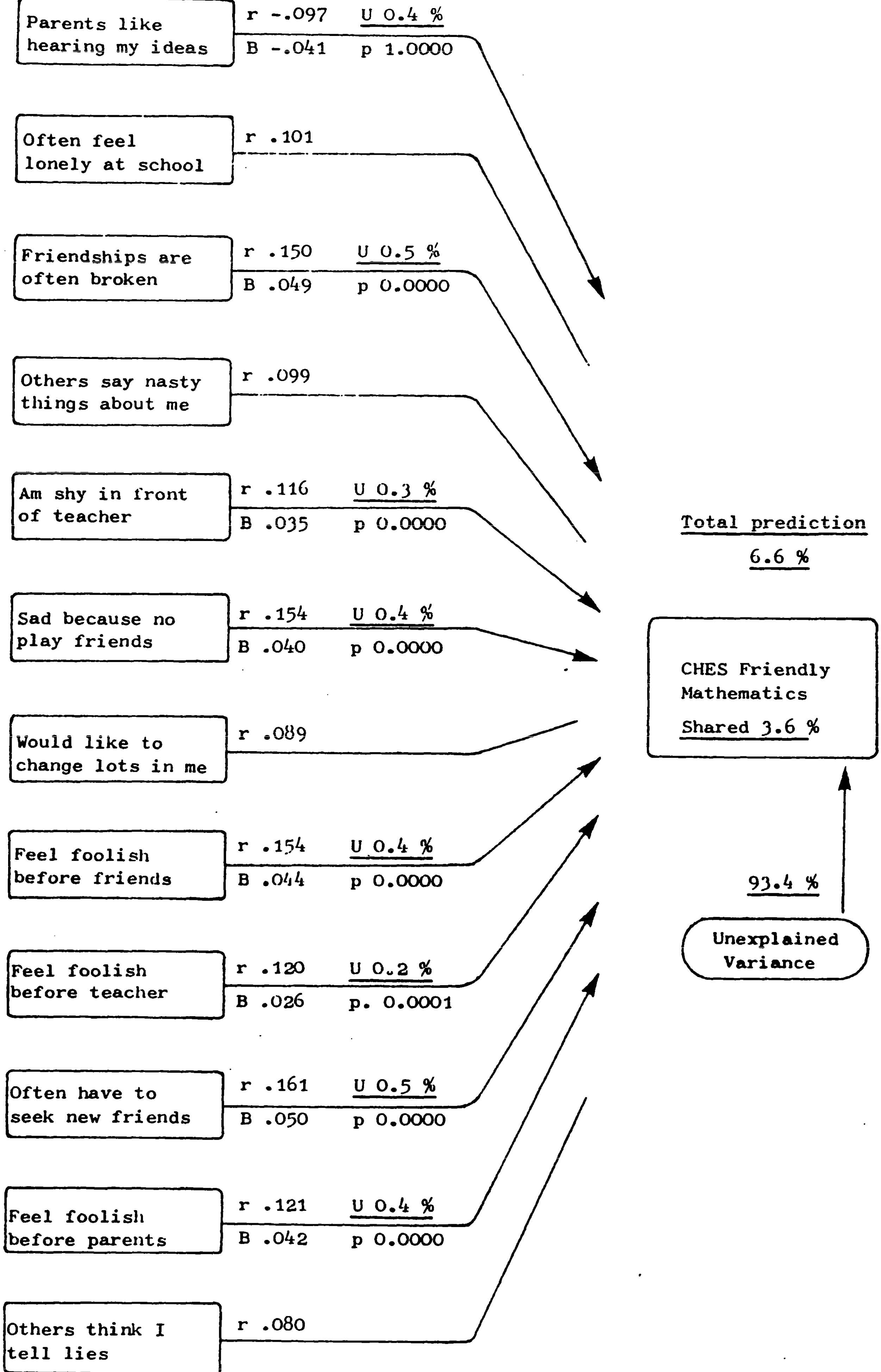

Fig. 4.226: Self-Esteem Questionnaire: prediction of CHES Friendly Mathematics

reasonable expectation in relation to the nature of these characteristics. A child's low self-esteem may certainly depress her or his enthusiasm for tackling the work necessary for reading and mathematical competence, and may also affect performance when these skills are assessed by means of tests. However an actual conviction that one is not fully in control of ones successes or failures, and that the locus of this control resides in other people or other situations, may be far more destructive of effort than is a lack of self-esteem.

4.21.x Concentration and perseverance

While the three items contained within this conceptual grouping may seem to have much in common, in fact both models show that each of the items make a unique contribution to outcome variance. The total prediction, as noted in figures 4.227 and 4.228, is quite high. Teachers and psychologists are well aware of the importance of both concentration and perseverance - the first defining an overall characteristic approach to any task and the second a particular willingness to continue working at the task in the face of difficulty.

The extent to which these are learned characteristics or innate qualities is an issue that requires a fuller study of longitudinal data.

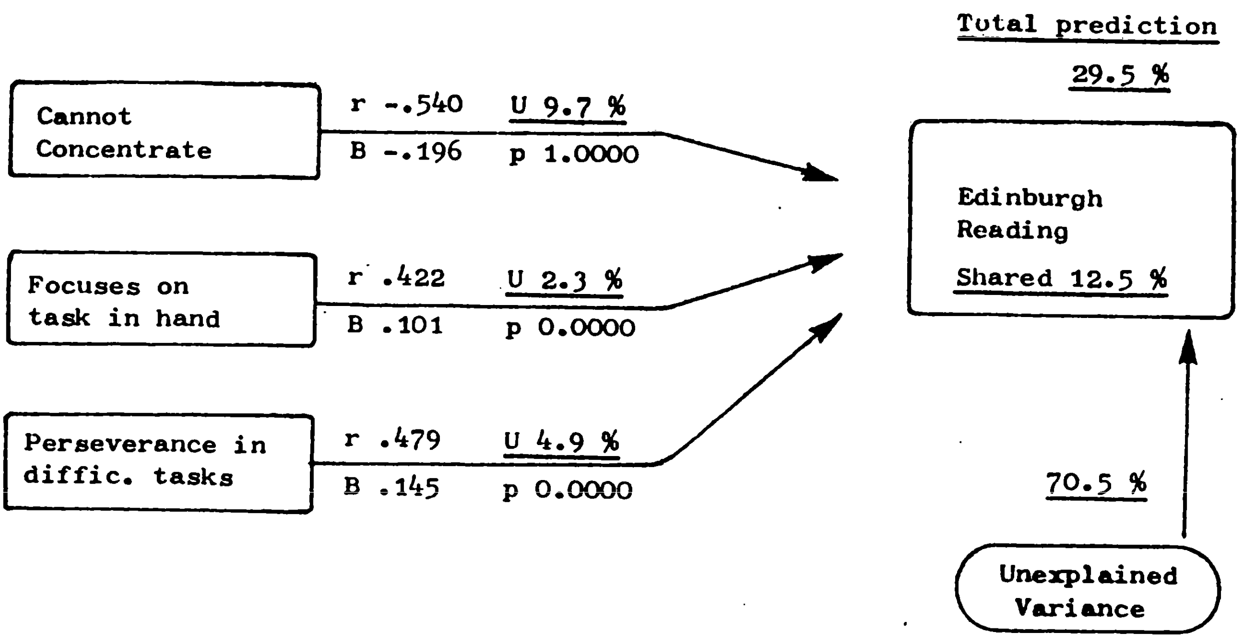

Fig. 4.227: Concentration and Perseverance: prediction of Edinburgh Reading

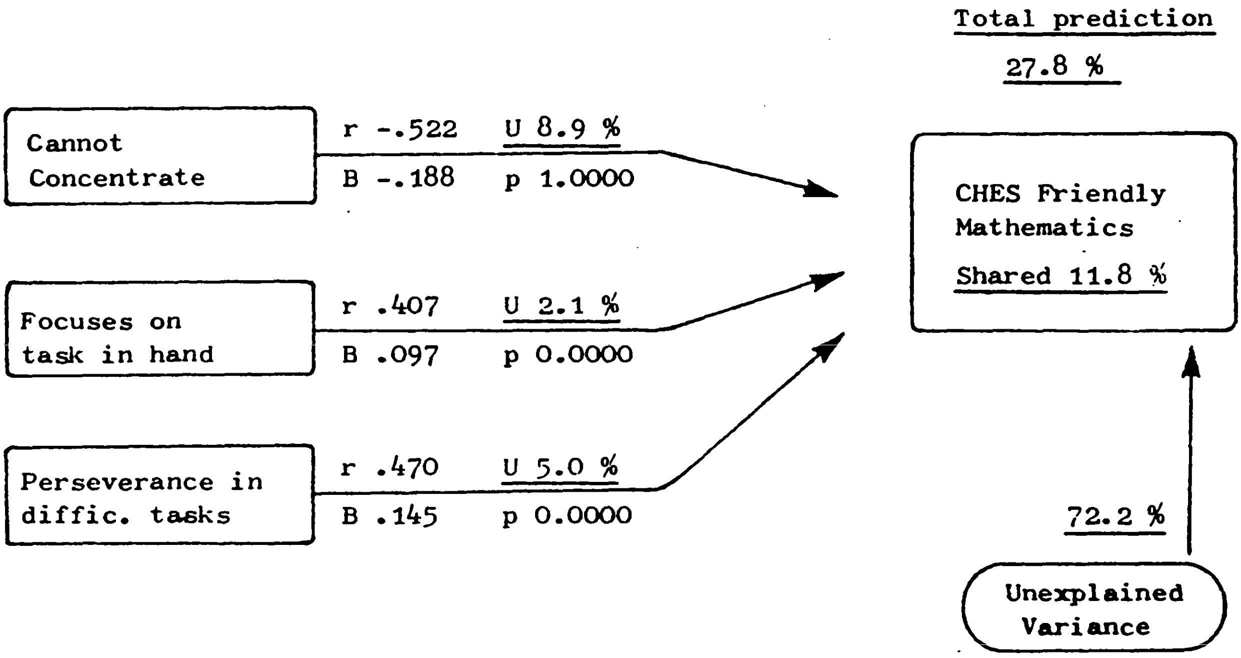

Fig. 4.228: Concentration and Perseverance: prediction of CHES Friendly Mathematics

4.21.xi School absence

The interest shown in the effects of school absence prompted the inclusion of a number of items related to this theme. Figures 4.229 and 4.230 suggest that at the age of 10 school absence is not, for the cohort as a whole, an important predictor of mathematical attainment, and is only a marginally important predictor of reading attainment.

Only one item appears in both regressions, the number of days absent for 'reasons unknown'. It is only possible to speculate why this item should be a predictor, compared to all the other items referring to the explicable reasons for absence; perhaps these are the children with whom the teacher has least communication in regard to their daily lives, and possibly also the least contact with the child's parents - something which would be necessary if the reasons for absence were to be explained.

The fact that item 'days due to truancy' appears in the reading model but not in the mathematics model is simply an artefact of the regression and the criteria used for inclusion or exclusion, since a unique prediction of 0.2 per cent is at or close to the limit for inclusion. The correlations between the item and the two attainment scores are virtually the same.

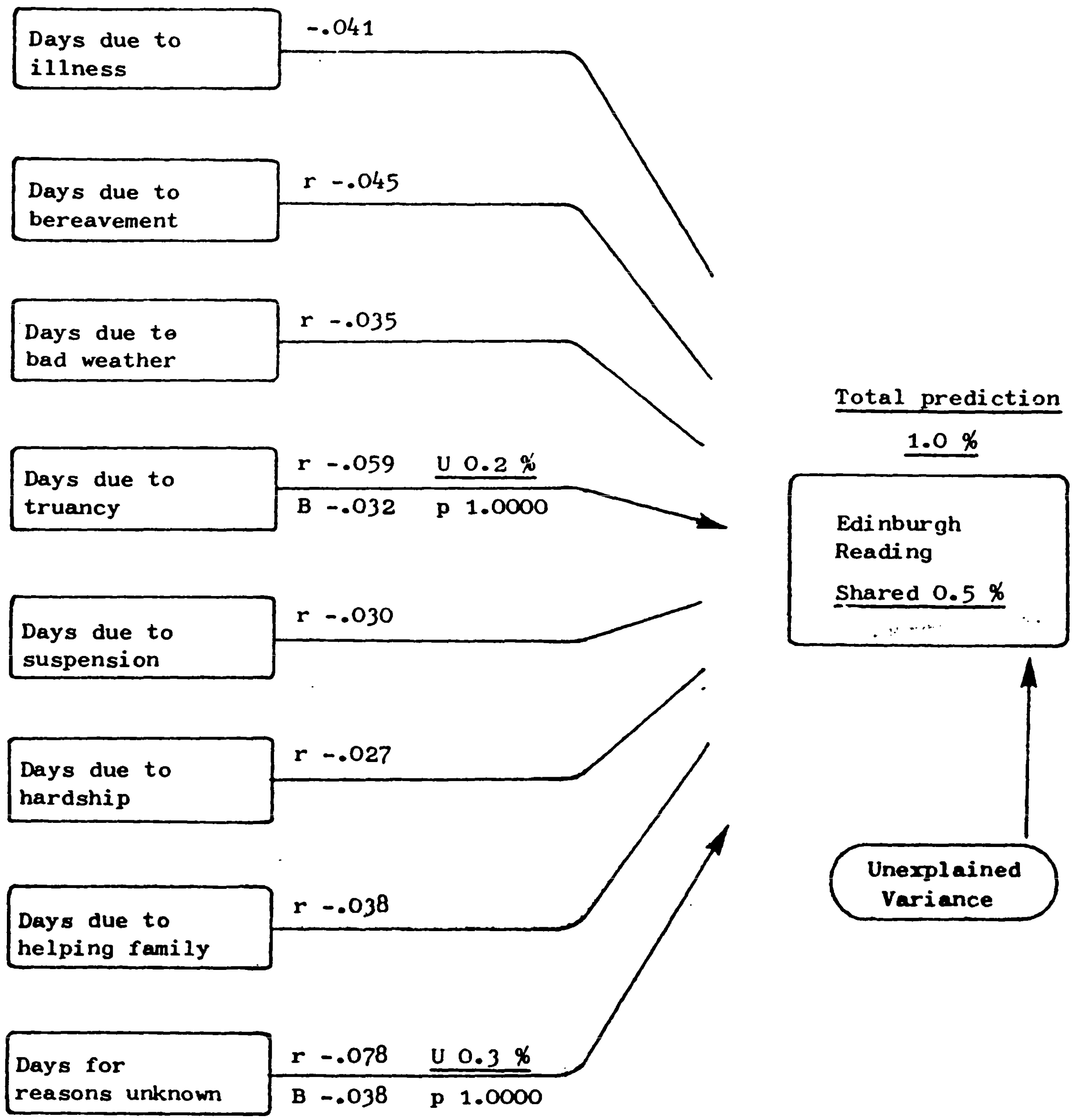

Fig. 4.229: School Absence: prediction of Edinburgh Reading

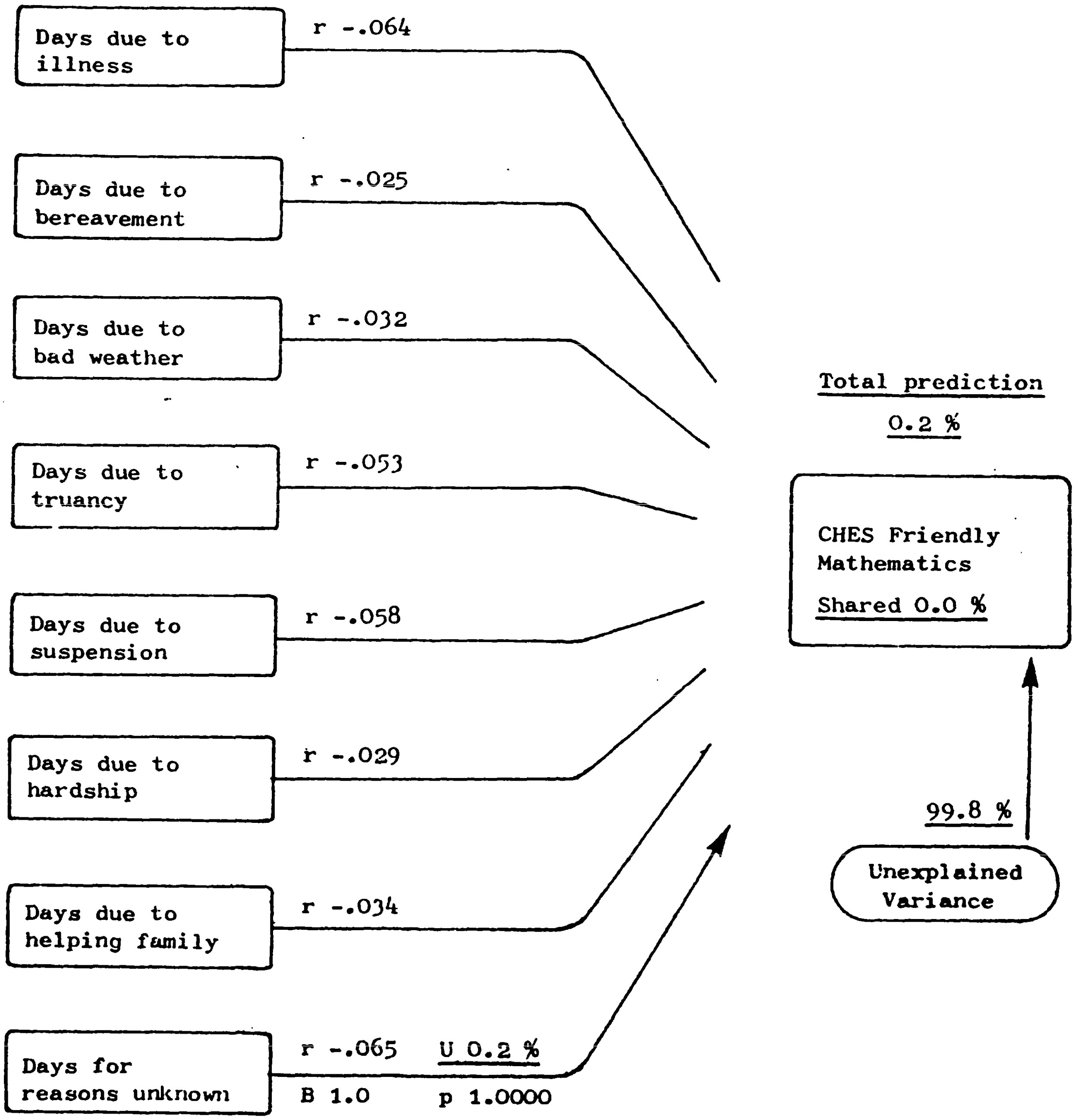

Fig. 4.230: School Absence: prediction of CHES Friendly Mathematics

4.21.xii **Behavioural Components**

The predictive power of the nine components derived from the Child Behaviour Scale - they are described in detail in section 4.4 - was of particular interest in this study, in terms of both the educatonal and health aspects of the survey.

Section 4.4 sets out the nature of the analysis and the justification for the decisions on the number of individual components; it is interesting that the present regressions appear to offer some support for the hypotheses put forward in that section.

Figures 4.231 and 4.232 show the predictions for these components, in relation to academic attainment. The first point to note is that although anti-social behaviour has correlations of between -0.21 and -0.24 with reading and mathematics scores, the unique contribution from this source is minimal. It is disorganised activity and the

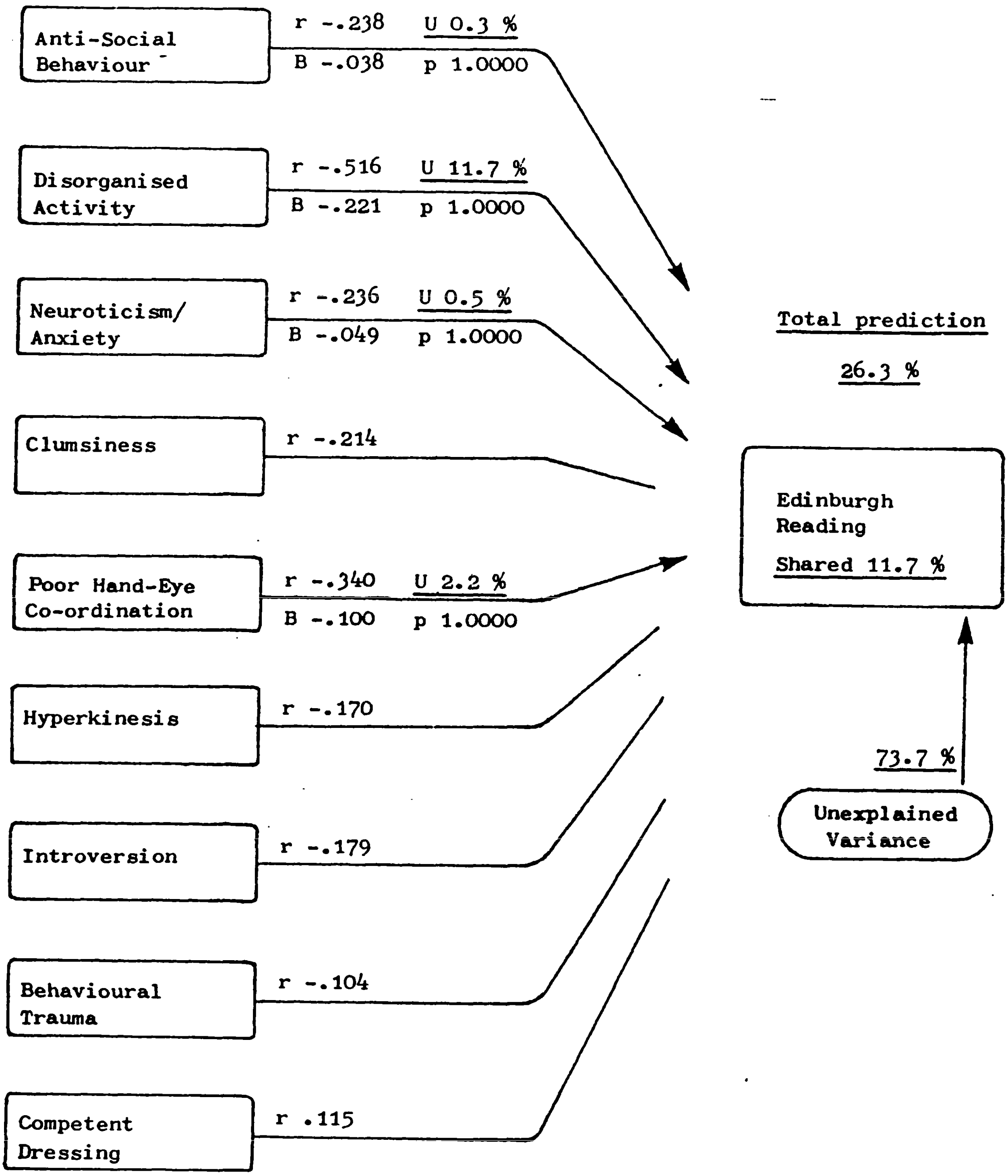

Fig. 4.231: Behavioural Components: prediction of Edinburgh Reading

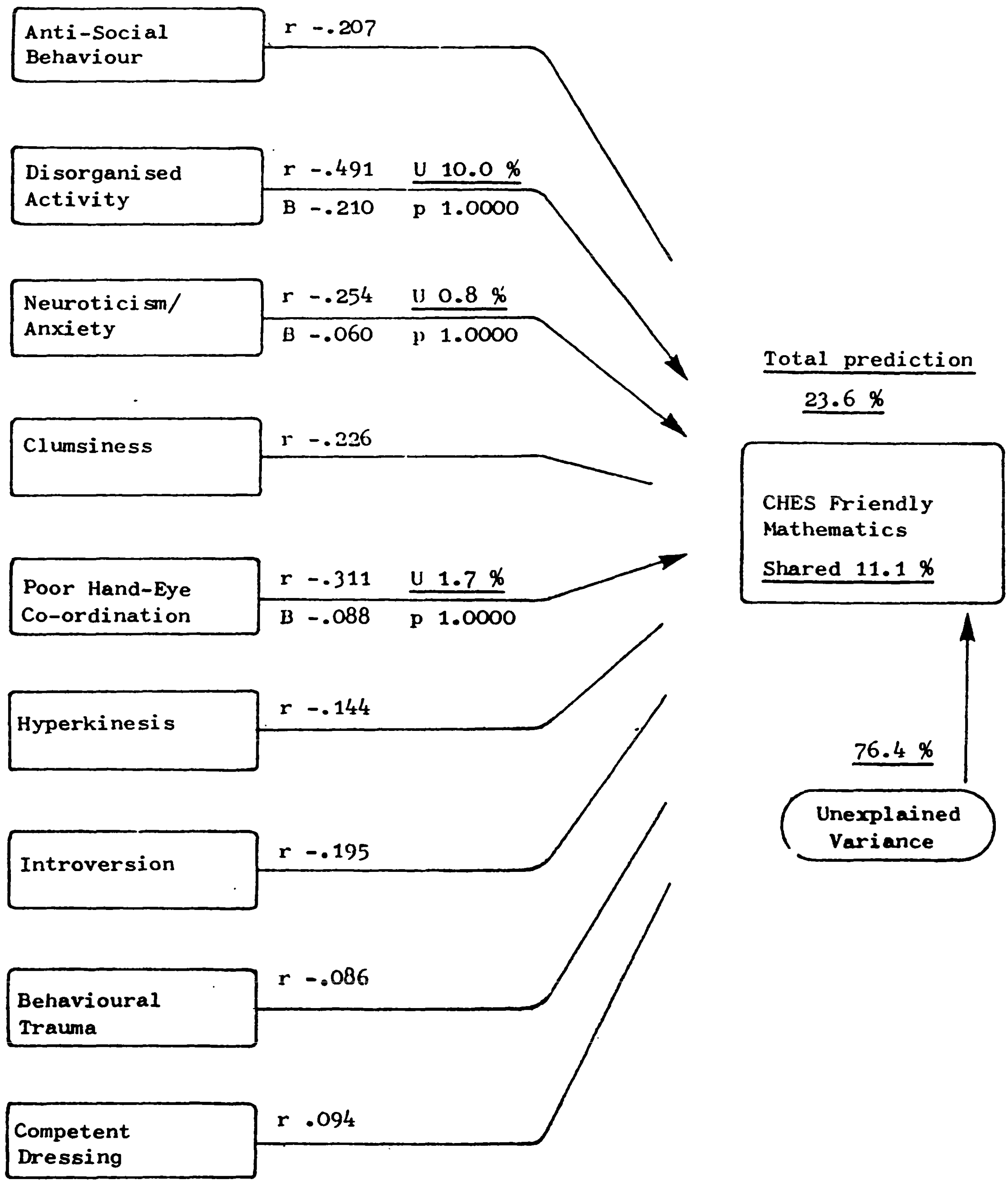

Fig. 4.232: Behavioural Components: prediction of CHES Friendly Mathematics

eleven individual items that go to make up that component - for example day-dreaming, poor concentration, boredom, confusion, distractibility, forgetfulness, lethargy and inability to complete tasks - which make an overwhelming unique contribution of 10 per cent to the total prediction of around 25 per cent.

Neuroticism/anxiety makes a minimal contribution, while components such as clumsiness, hyperkinesis, introversion, behavioural trauma and competent dressing all fail to predict independently, despite their moderate correlations with the two outcomes (ranging from -.09 to -.23).

Hand-eye coordination makes a surprising appearance as a moderate unique contributor, suggesting that competence in fine motor skills is linked to academic attainment. It may be argued however that hand-eye coordination simply reflects social class and learned rather than maturational skills, and that the relationship with reading and mathematics is indirect rather than direct.

The finding that the hyperkinesis component - made up of the three items rhythmic tapping, hums/odd noises and twitching - has too small a contribution to be significant, is interesting. As pointed out in section 4.4, many of the items described in the literature as evidence of hyperactivity were found in this study to be linked to disorganised activity or anti-social behaviour rather than to any unique hyperactivity component. Whether disorganised activity has some physiological or unlearned component is naturally a matter for speculation at this stage, although it should be possible to puzzle out some of the relationships once the health data has been linked.

4.21.xiii Language comprehension

Customarily a child's 'language competence' is assessed by a test of language comprehension, since this is easily carried out and provides a useful indicator of potential academic attainment.

As already explained, a new English pictorial language test was devised for use with 10-year-old children in this country. The results of the regressions appear in figures 4.233 and 4.234, for the two models. It is evident that in each case all three sub-scales of language comprehension make useful contributions to outcome variance. What is particularly interesting is that the pictorial sentences score makes a higher unique contribution to each model than does the pictorial vocabulary score. The sentences items require the child to choose the correct picture - from among sets of four pictures - to match the sentences spoken by the teacher.

The closeness and similarities of the predictions in both models - 42.4 and 40.6 per cent - add support to the finding of others that

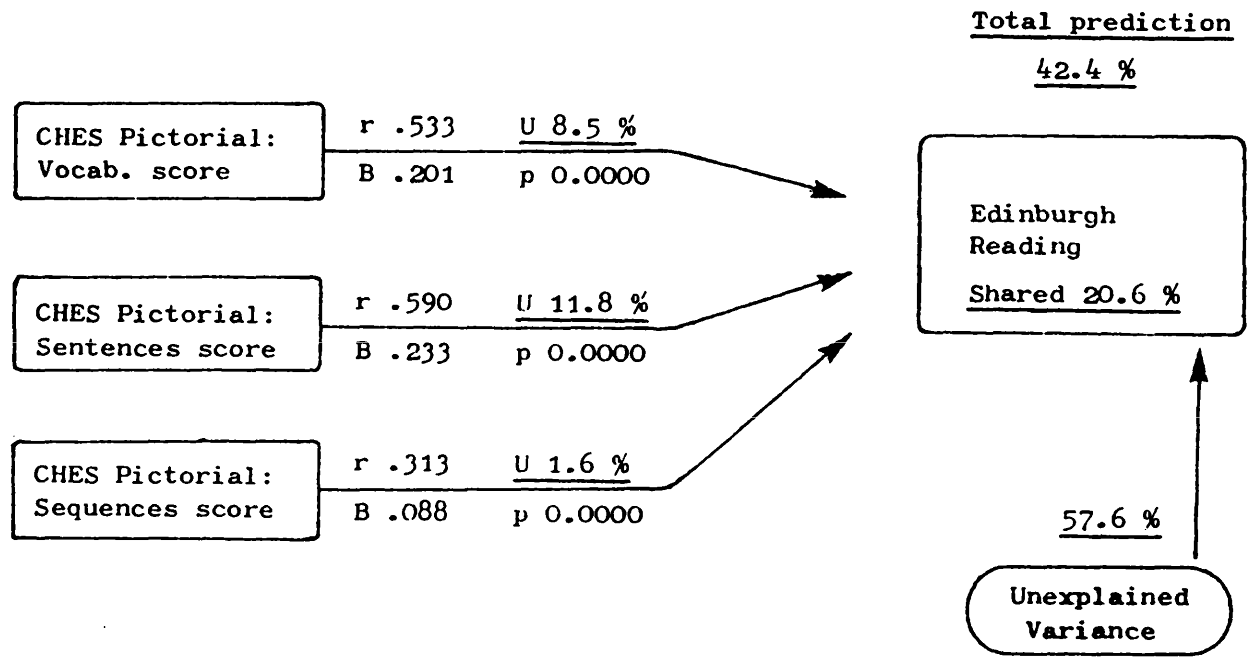

Fig. 4.233: Language Comprehension: prediction of Edinburgh Reading

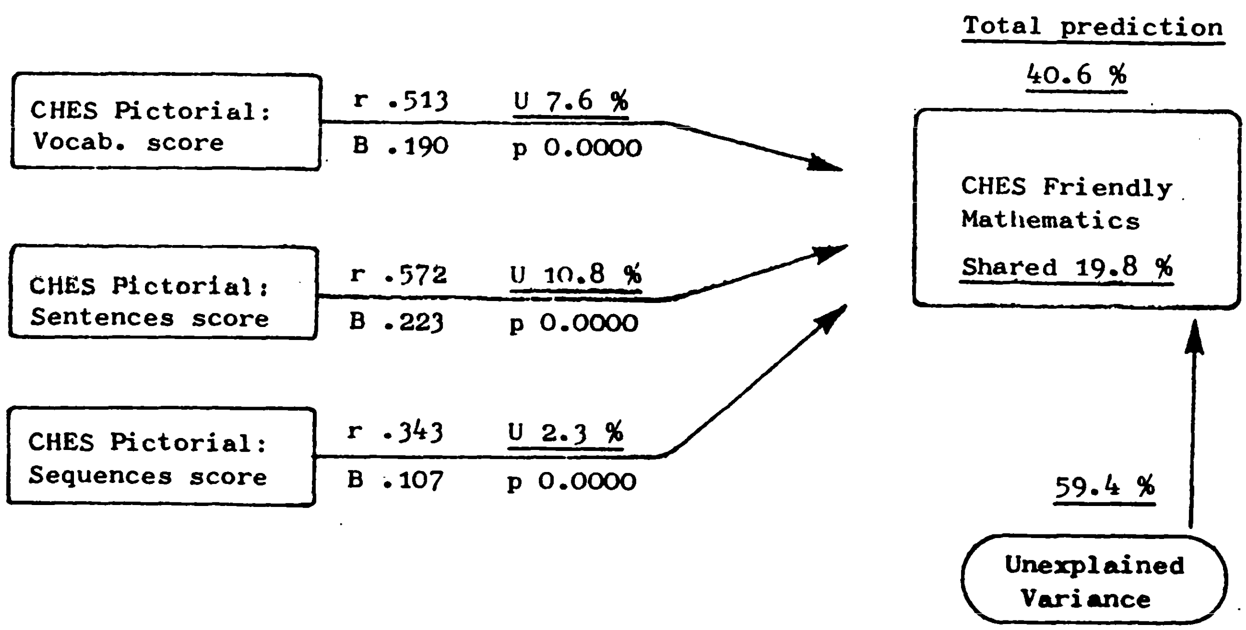

Fig. 4.234: Language Comprehension: prediction of CHES Friendly Mathematics

there is an unusually high component of intelligence in vocabulary scores (and indeed vocabulary comprehension is sometimes used, wrongly, as a substitute for a cognitive abilities test.)

4.21.xiv **Expressive language**

Given the customary emphasis on language comprehension as the criterion of language competence, certainly at infant and junior level, it was felt necessary to broaden the compass of language assessment within the CHES survey. The language specialist at the Institute of Education, London, previously referred to as the author of the new pictorial language test, devised a set of questions requiring teachers to make a series of judgements, using analogue scales, on the survey children's expressive language. Because of the number of items used it was again necessary to carry out regressions on half the number of items, and then combine the stronger predictors within a single regression.
The results of the regressions of reading and mathematics on to the set of items, as seen in figures 4.235 to 4.238, showed an unexpectedly high prediction in both models, with a higher prediction for reading. All the items correlated in expected direction. The three most powerful items were the simplicity of the vocabulary, the simplicity

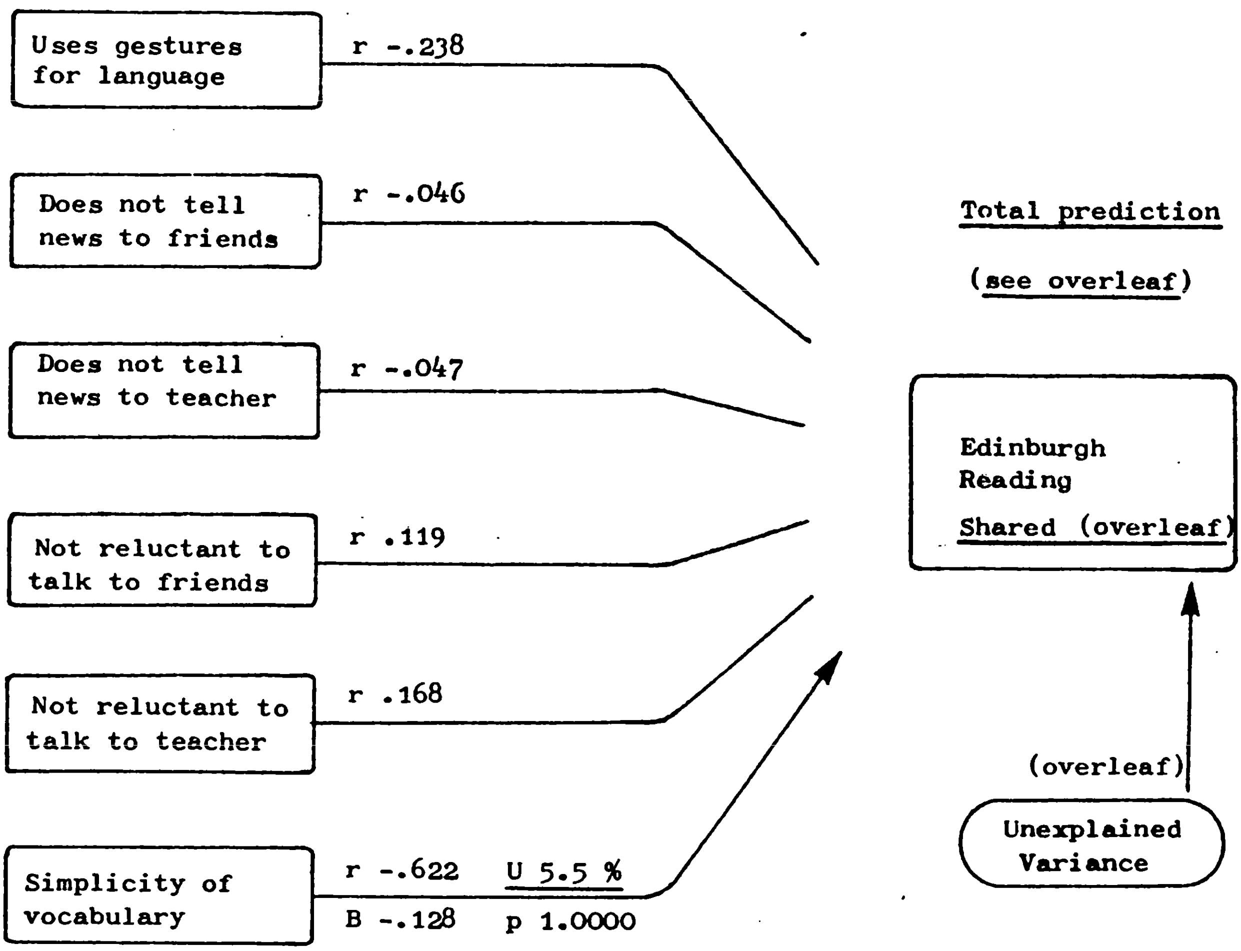

Fig. 4.235: Expressive Language (First Half): prediction of Edinburgh Reading

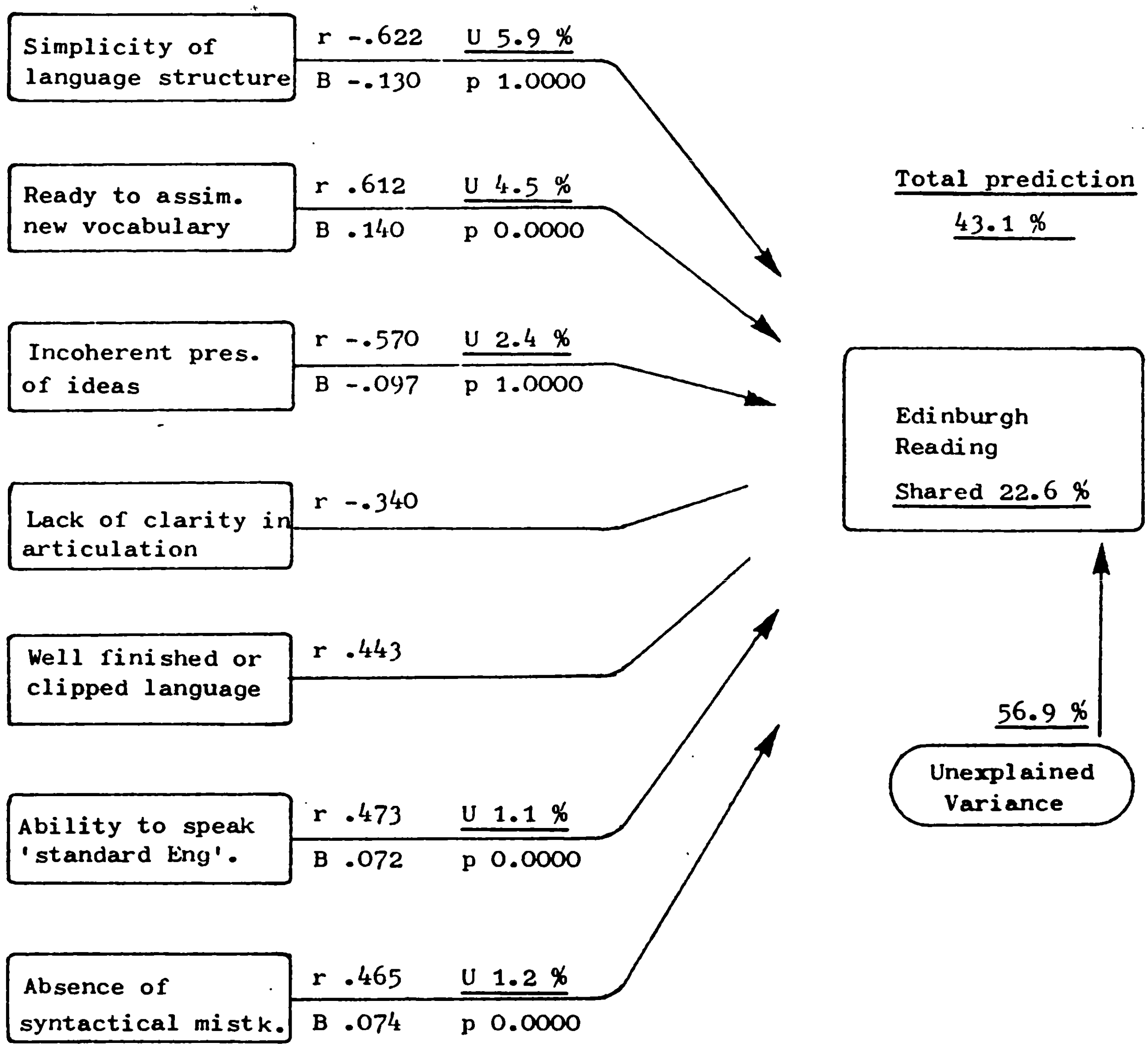

Fig. 4.236: Expressive Language (Second Half); prediction of Edinburgh Reading

of the language structure, and the child's readiness to assimilate new vocabulary, each of which made relatively strong unique contributions to variance. The coherence of the presentation of ideas was shown to be another moderate predictor. The total predictions of 43 per cent in the reading model and 37 per cent in the mathematics model were unusually high, although it has to be recognised that, as with all the predictions by individual groups of variables, the unique contribution within an overall model could be considerably reduced due to competition from other predictors.

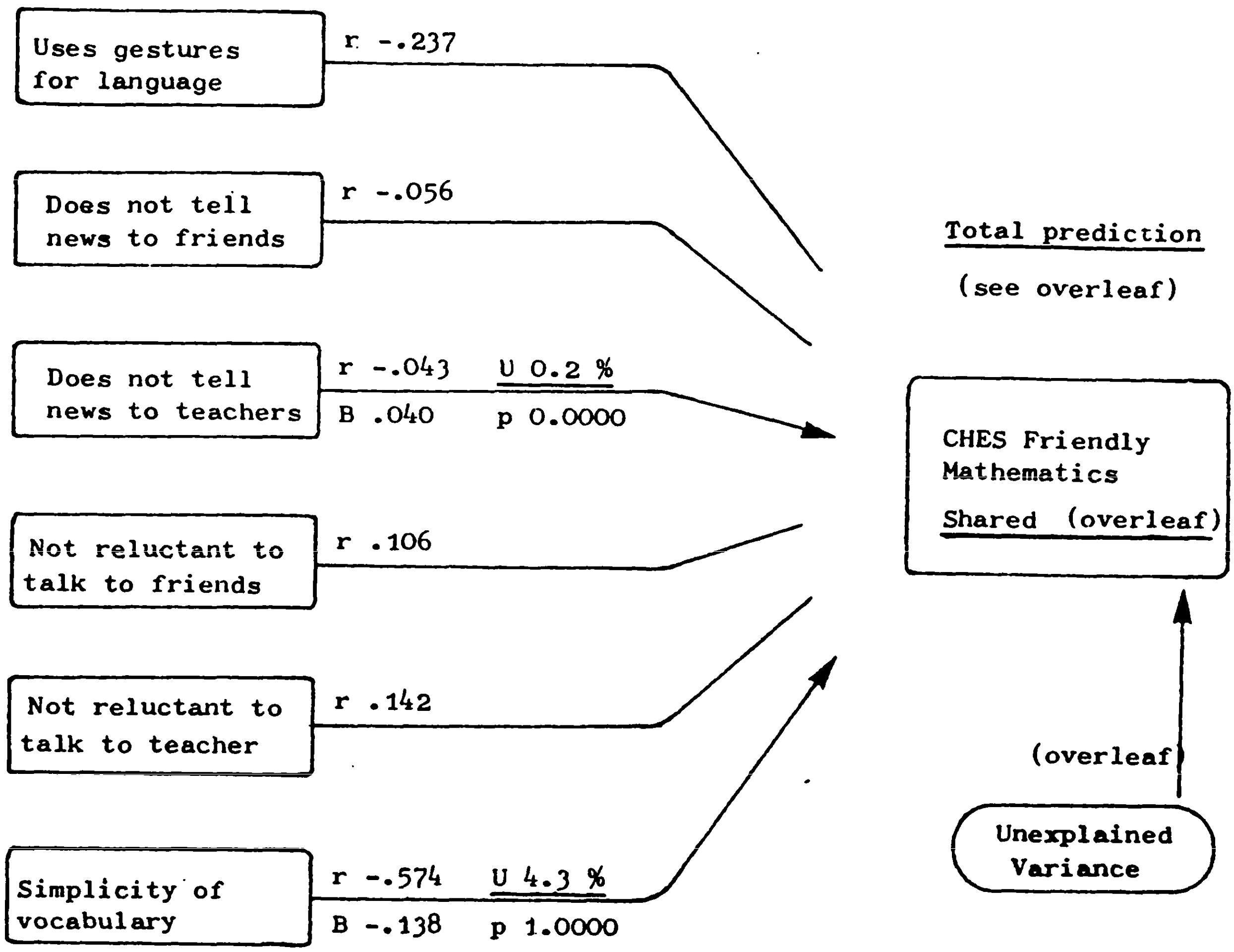

Fig. 4.237: Expressive Language (First Half): prediction of CHES Friendly Mathematics

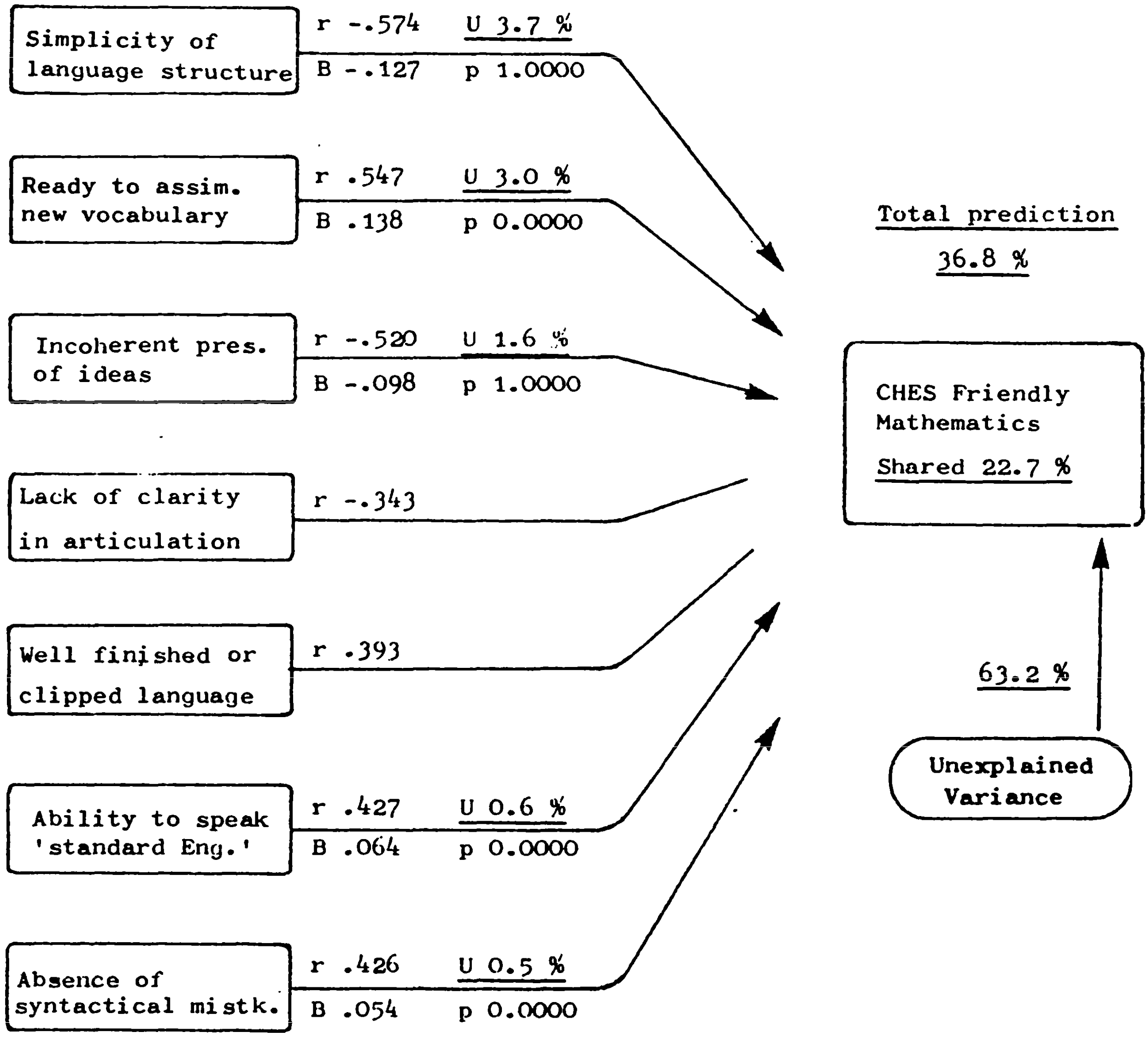

Fig. 4.238:Expressive Language (Second Half): prediction of CHES Friendly Mathematics

4.21.xv School Academic Focus

A number of questions were inserted into the educational instruments with the aim of assessing the degree to which the school's activities were specifically focused on reading and mathematics (or science), as opposed to other curriculum or outside activities.

Figure 4.239 shows that, as could be expected, the time allocated to reading for pleasure and information made a small but useful contribution to reading attainment. The hours spent on other reading-related activities all correlated positively with attainment, but not strongly enough to predict beyond the minimal inclusion level.

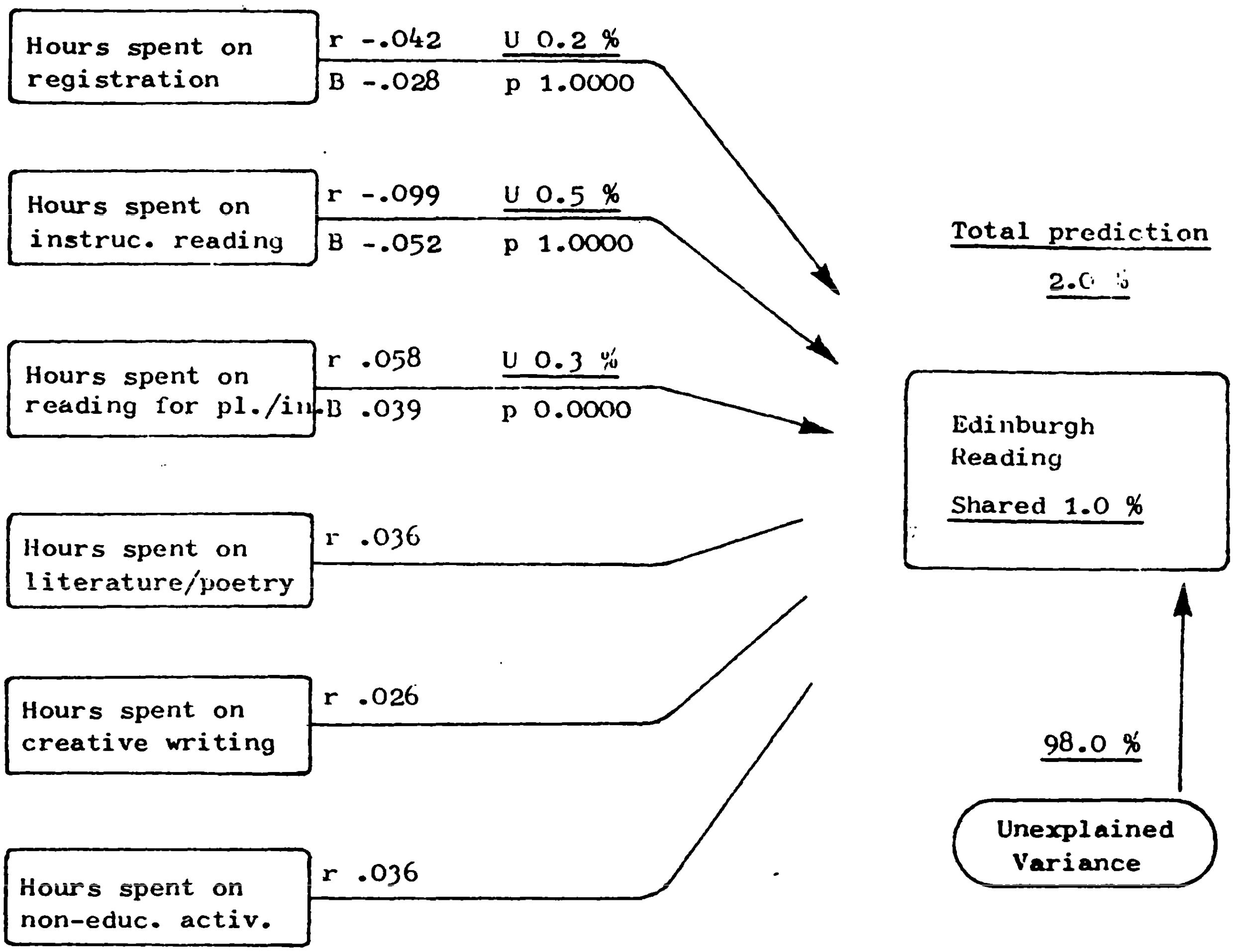

Fig. 4.239: School Reading Focus: prediction of Edinburgh Reading

However it is also noteworthy that two variables predicted negatively to reading attainment. The time spent on registration activities predicted negatively in both models. Although the predictions are not high, they are of a meaningful size. What is rather unexpected is the finding that the time spent on instructional reading, as compared with the other more interesting forms of reading, also predicted negatively.

It is possible to argue that this finding simply represents the likelihood that poor readers would require more instructional reading, and that this may account for the negative relationship. On the other hand it may also indicate that a surfeit of rote-like instructional reading could be counter-productive even for poor readers. The issue is one that will merit fuller study on sub-sets of the data.

Two figures, 4.240 and 4.241, describe the contribution of school mathematics and science activities to attainment in mathematics. The first figure shows the expected positive relationship between the hours spent on maths and the hours spent on science, and mathematics attainment.

A more interesting picture is given by the second figure, 4.241, where the latent variable derived from the regression portrayed in figure 4.240 is combined with another predictor, breadth of mathematics curriculum, in a further regression equation. In combination the two predictors account for nearly 8 per cent of the variance in mathematics attainment. Judging by the results portrayed in figure 4.420, most of the additional contribution to variance comes from the item which quantifies the breadth of the mathematics curriculum. It may be claimed that this result could be expected in view of the wide ranging nature of the CHES Friendly Maths test. But equally it could be said that the test is a reflection of the curriculum areas which should be covered at the age of 10, and to that extent it is highly satisfying to note the implication that schools with a broad sweep of mathematics curriculum do better on this test than do schools with a more limited view of what is required of junior schools mathematics in the 1980s.

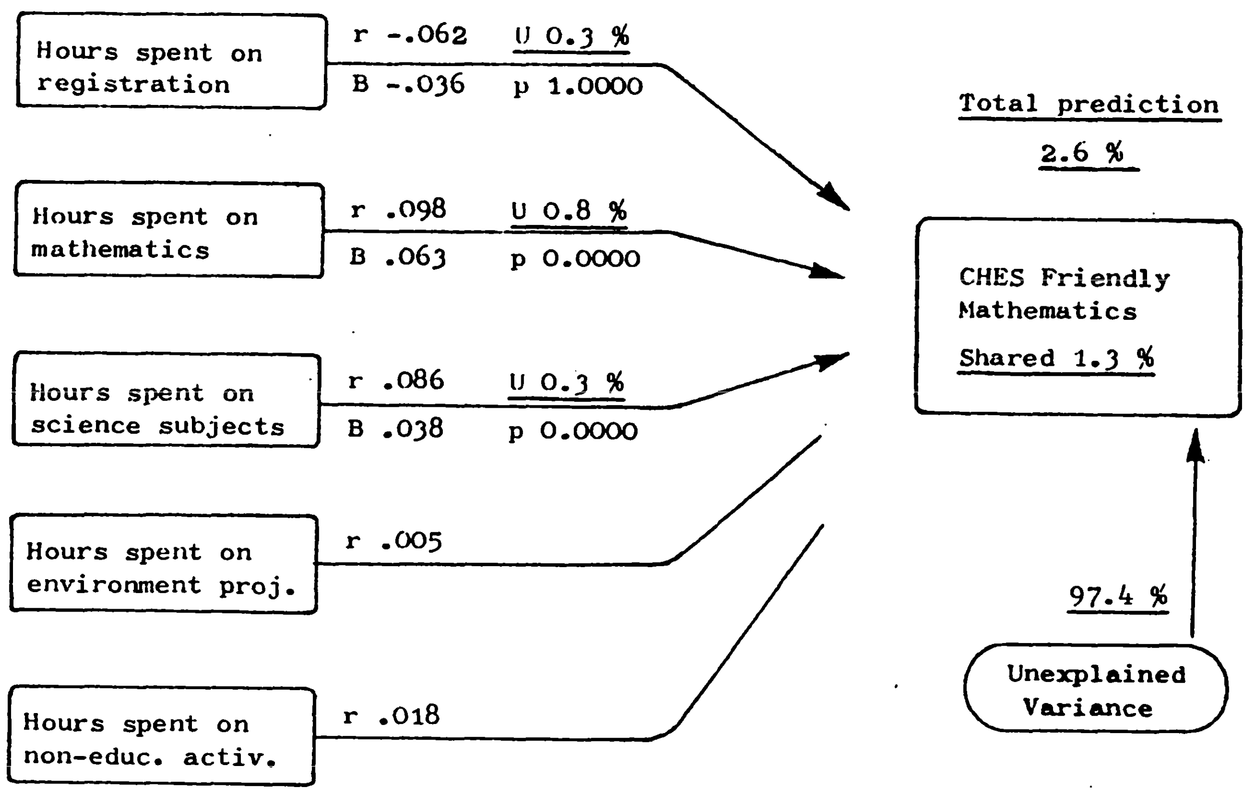

Fig. 4.240: School Maths/Science Activities: prediction of CHES Friendly Mathematics

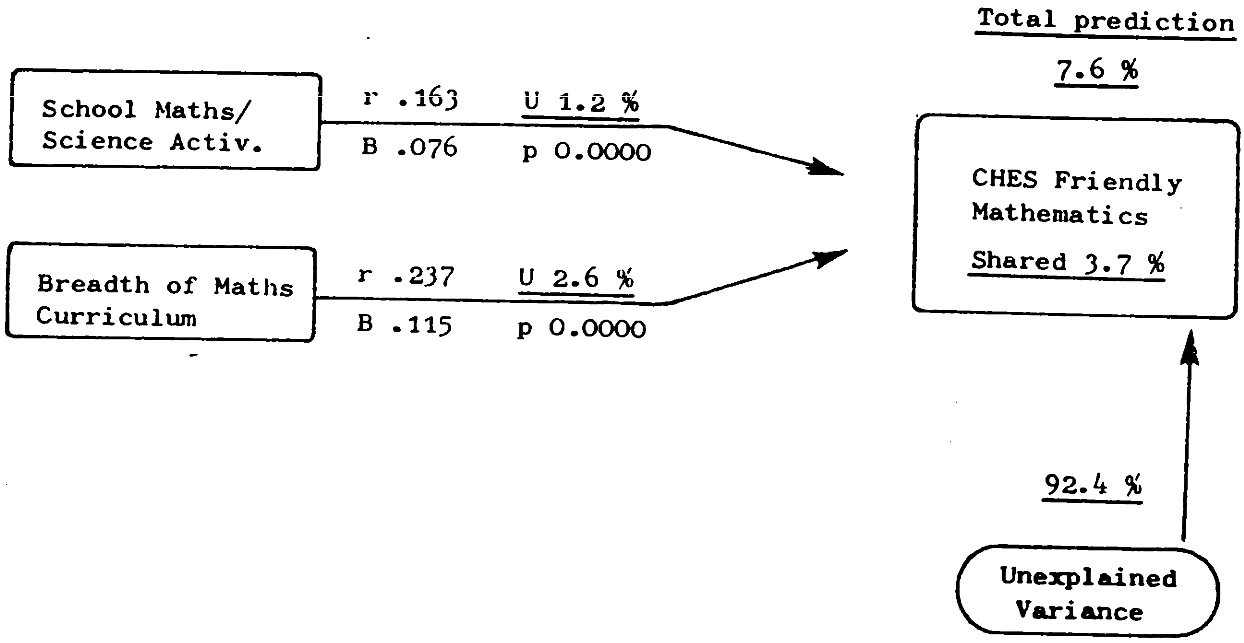

Fig. 4.241: School Mathematics Focus: prediction of CHES Friendly Mathematics

4.30 The Final Reading and Mathematics Models

The competing strengths of many of the predictors of reading and mathematics attainment have been set out in the previous section.

Below the final models are assembled and discussed in relation to their educational and social importance.

Following those analyses a further limited set of regression analyses are presented in which an initial look is taken at the possible social dimensions of the data. While the variables relating to the schools' catchment areas - occupational levels of parents and housing levels in the surrounding community - are to some extent a surrogate for social class, they clearly do not identify the social class of the individual child, although it can be assumed that in many cases these variables will reflect the social origins of the survey child. Pending the complex and difficult task of linking the educational, health and social data, and removing anomalies in regard to names and identification numbers to ensure that the same children are matched across the scores of computer tapes on the cohort, an attempt was made to sort out the sample of 8,836 children into high social class (1 and 2) and low social class (4 and 5) sub-samples. The operation required a good deal of manual handling of data, including the exclusion of those children whose identification problems are at present being resolved. Thus the particular analyses on the two social groups will have to be seen as provisional, merely pointing to some interesting possibilities for future analyses.

It should also be emphasised that until it is possible to match the data properly, fully separate models for the low and high social groups cannot be derived. The present analyses have only been carried out on the final sets of latent variables prepared for the whole sample. It is possible that later regression analyses of individual predictors may show more basic differences between the groups. This in turn will mean that different weightings will be used in creating the latent variables for each social group, and that may well lead to a much larger basic difference between the models.

4.31 Assembly of final variables for main models

4.31.i School educational ethos

Three variables were combined within this regression. Homework was a single variable which did not need entry into a prior regression. The creation of the latent variables of classroom ethos and incentives has been described in the previous section.

Figures 4.242 and 4.243 portray the predictions of these groups of

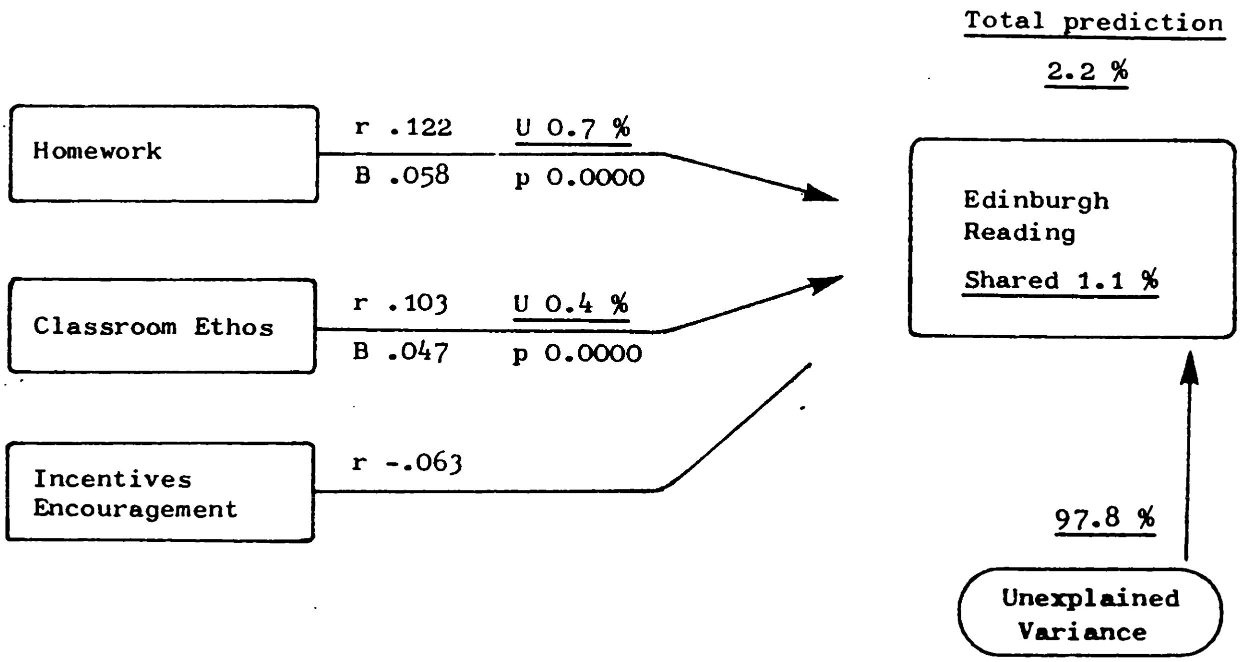

Fig. 4.242: School Educational Ethos: prediction of Edinburgh Reading

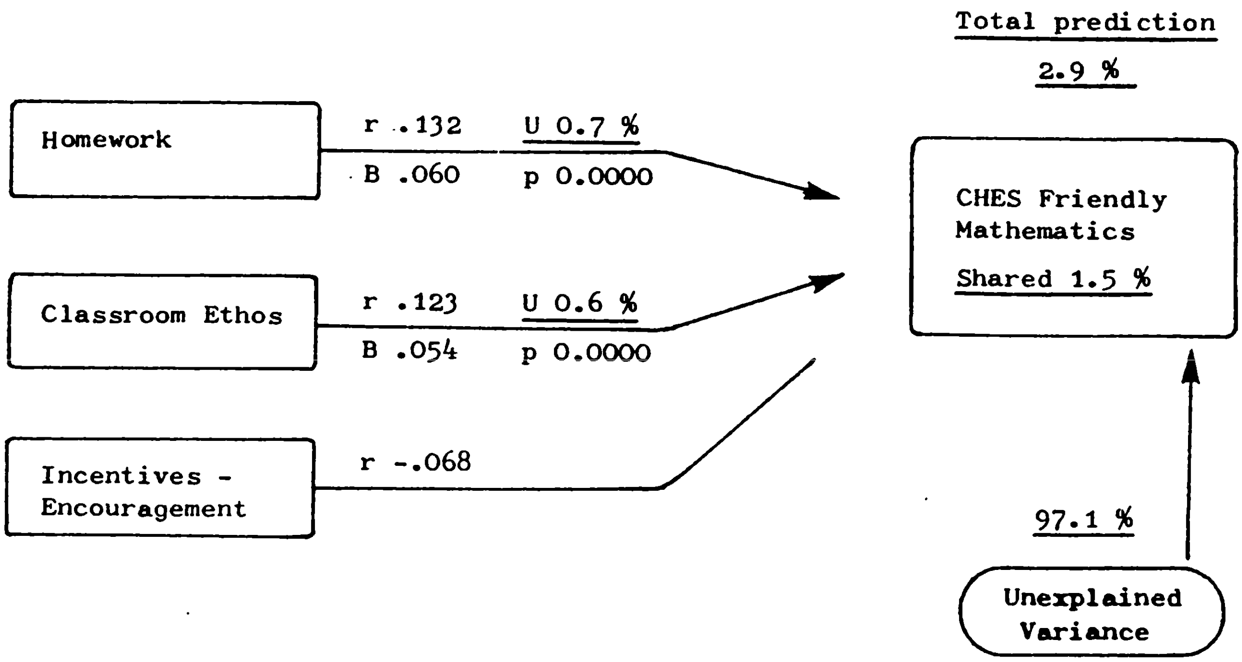

Fig. 4.243: School Educational Ethos:prediction of CHES Friendly Mathematics

variables within the two models. Homework is seen to be a small but sturdy predictor while classroom ethos also remains as a co-predictor. It is seen to have a stronger relationship with mathematics than with reading. The total variance explained is, however, relatively small.

4.31.ii **Child cognitive assessment**

In these regressions, shown in figures 4.244 and 4.245, the latent variables of verbal and non-verbal ability measures are presented, together with the sex variable, within a single regression. As could be expected, verbal ability is a stronger predictor of reading than is non-verbal ability, while the sex of the child makes a minor contribution - one which points to the slightly higher attainment levels of girls at this age. (A recent report of the Assessment of Performance Unit confirms this finding.)

Within the mathematical model non-verbal ability is seen to be a more powerful predictor than is verbal, although the difference is not great. The sex variable does not make a unique contribution within this model, but the correlation is in the direction often reported, suggesting that even at this age the attainment of girls is slightly below that of boys.

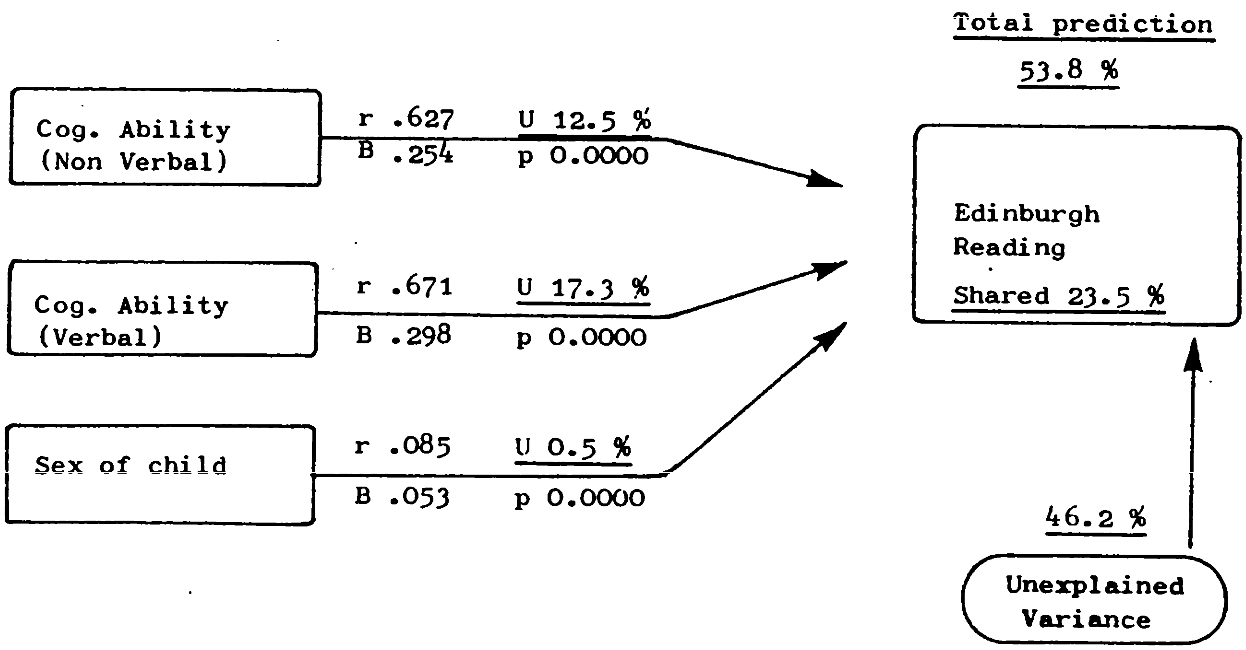

Fig. 4.244: Child Cognitive Assessment: prediction of Edinburgh Reading

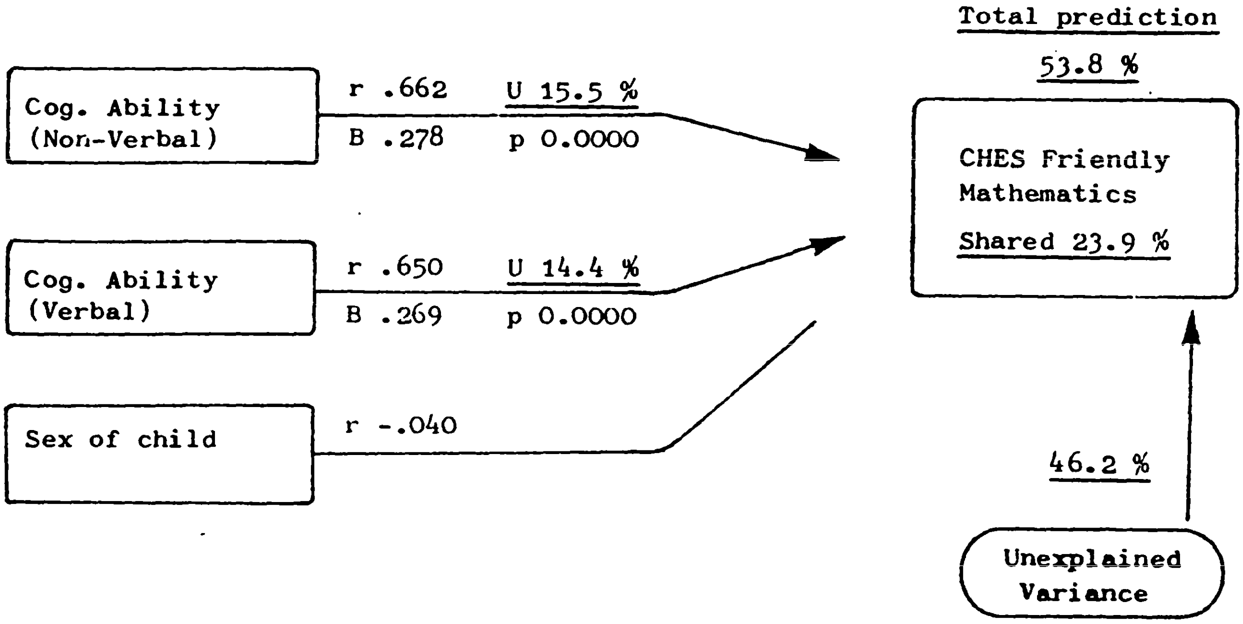

Fig. 4.245: Child Cognitive Assessment: prediction of CHES Friendly Mathematics

4.31.iii **Child motivational assessment**

Figures 4.246 and 4.247 combine the latent variables derived from the locus of control and self-esteem measures, within regression equations for each model. As expected from the earlier results with these two variables, locus of control is considerably more powerful than is self-esteem. It is worth noting that the total prediction from the two variables in combination is not much higher than that of locus of control on its own. The implication is that the two measures overlap to a considerable extent in relation to their impact on reading and mathematical attainment. At the same time this is not to deny their separate importance, as pointing to different characteristics of the 10-year-old child.

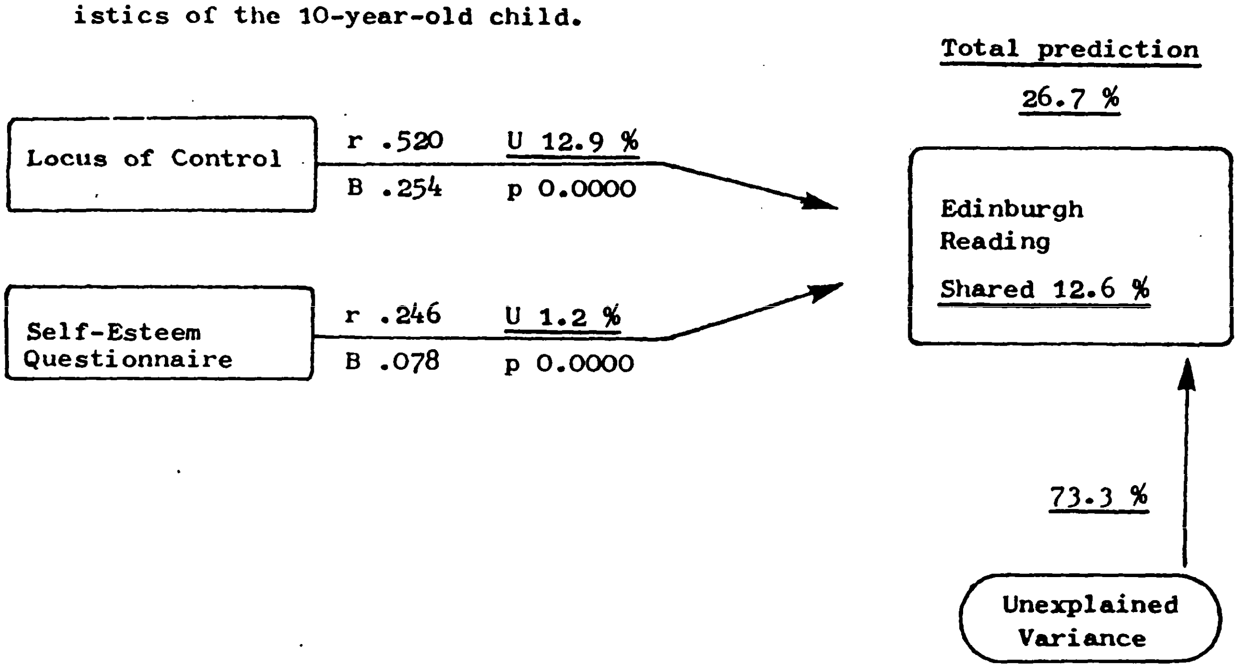

Fig. 4.246: Child Motivational Assessment: prediction of Edinburgh Reading

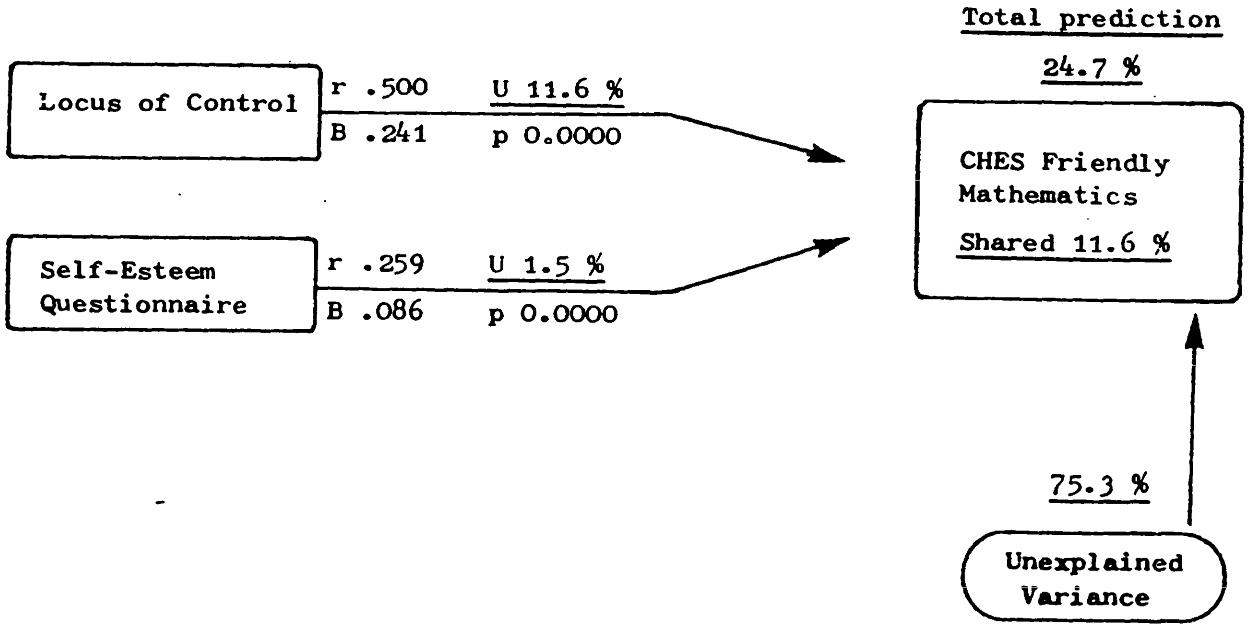

Fig. 4.247: Child Motivational Assessment: prediction of CHES Friendly Mathematics

4.31.iv Child behavioural assessment

The combination of the 'concentration' latent variable with those of the behavioural components and school absence shows the considerable strength of the latent variable representing the three simple variables of concentration, perseverance and percentage of time concentrating, even in the presence of the behavioural componets, when predicting academic attainment. Figures 4.248 and 4.249 set out the parameters

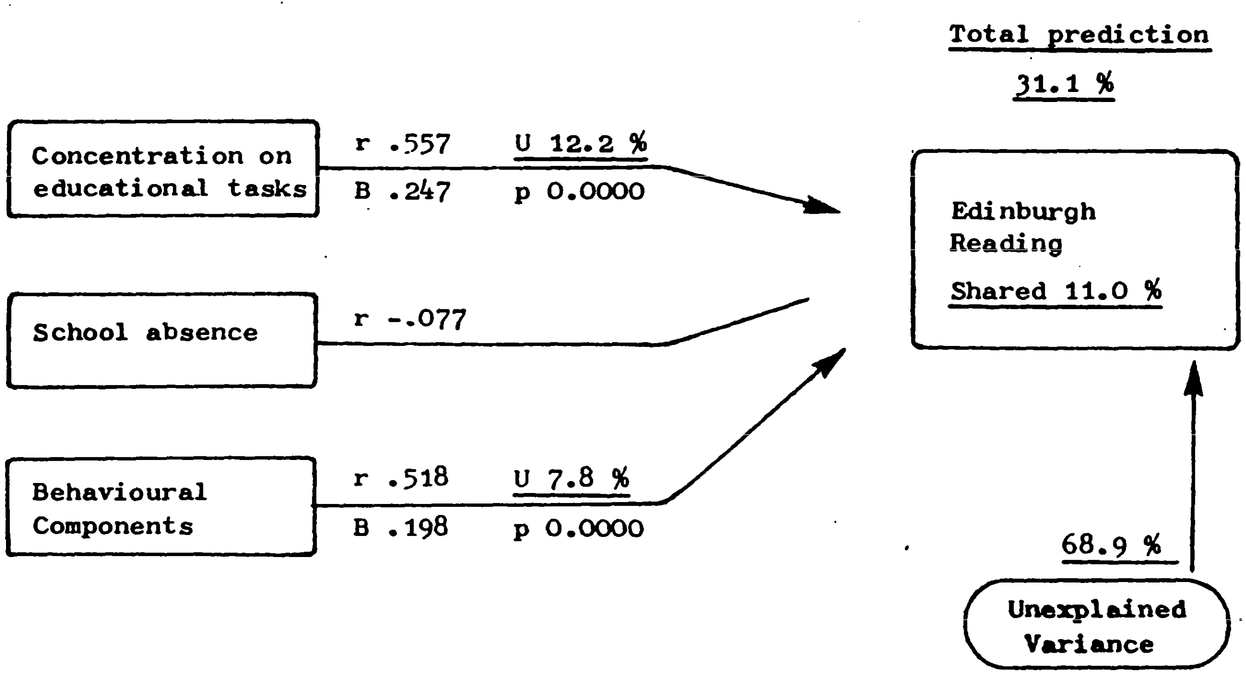

Fig. 4.248: Child Behavioural Assessment: prediction of Edinburgh Reading

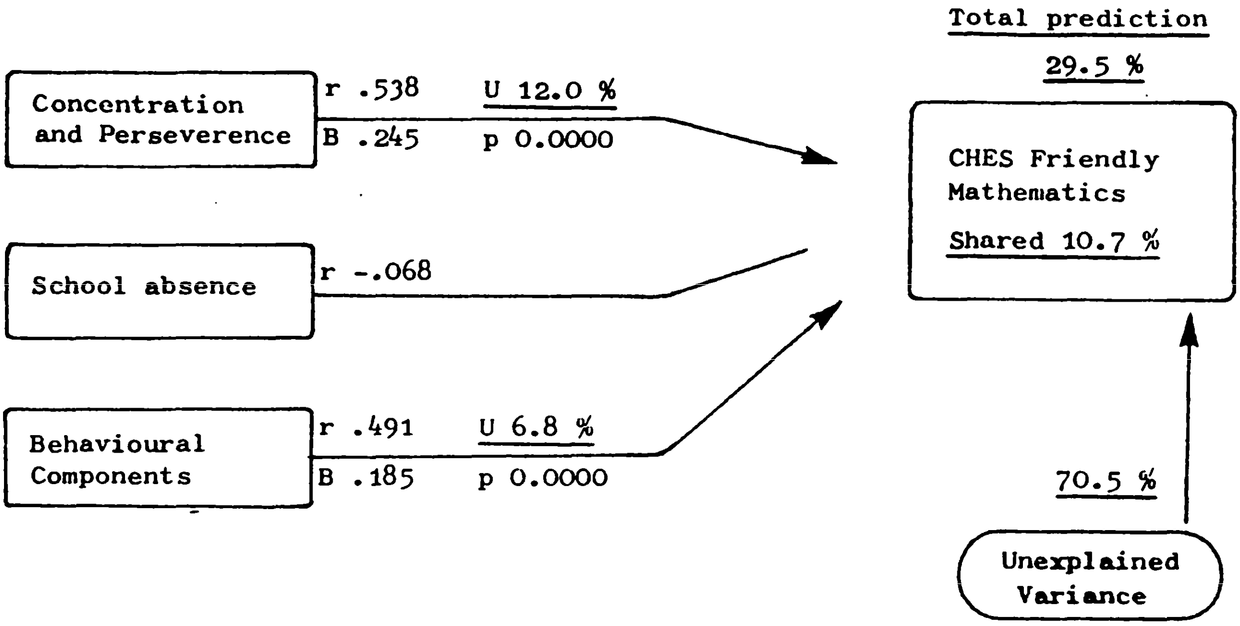

Fig. 4.249: Child Behavioural Assessment: prediction of CHES Friendly Mathematics

of the two equations. While school absence predicts negatively to outcome, as expected, it is so dwarfed by the two major predictors that it makes no independent contribution.

4.31.v Child language assessment

Figures 4.250 and 4.251 show the combination of the two latent variables formed from the expressive language and language comprehension items respectively. In the reading model expressive language proves to be a more powerful predictor than language comprehension, with a total prediction of nearly 57 per cent. The mathematics model points to a stronger prediction for language comprehension, perhaps because of the latter's closer links with cognitive ability - as already suggested

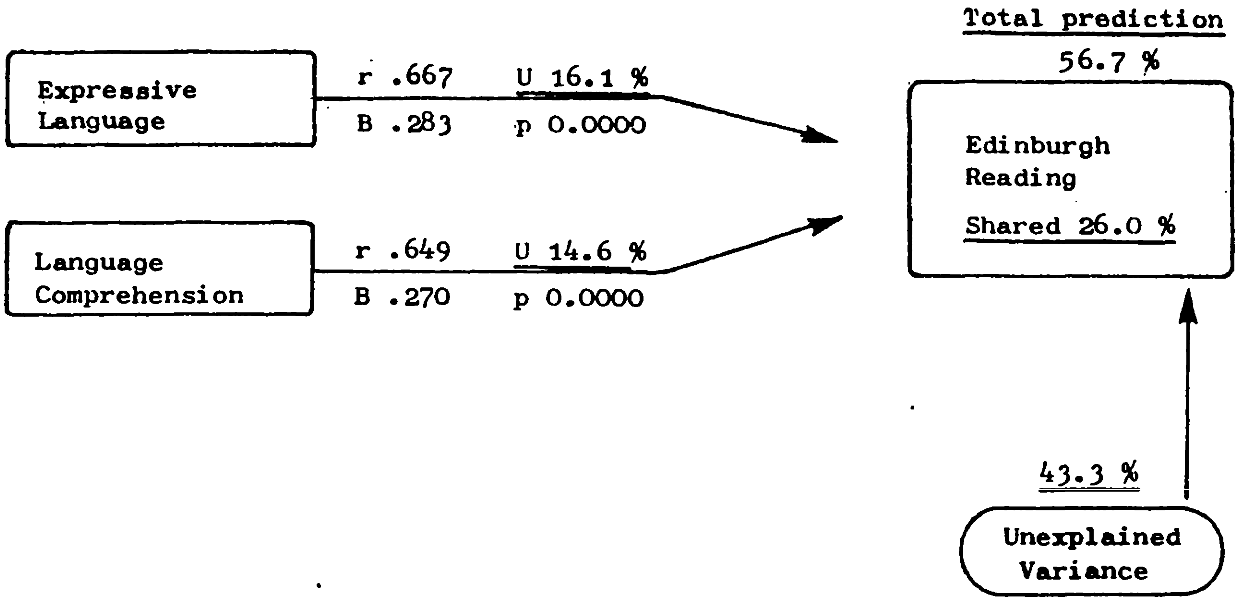

Fig. 4.250: Child Language Assessment : prediction of Edinburgh Reading

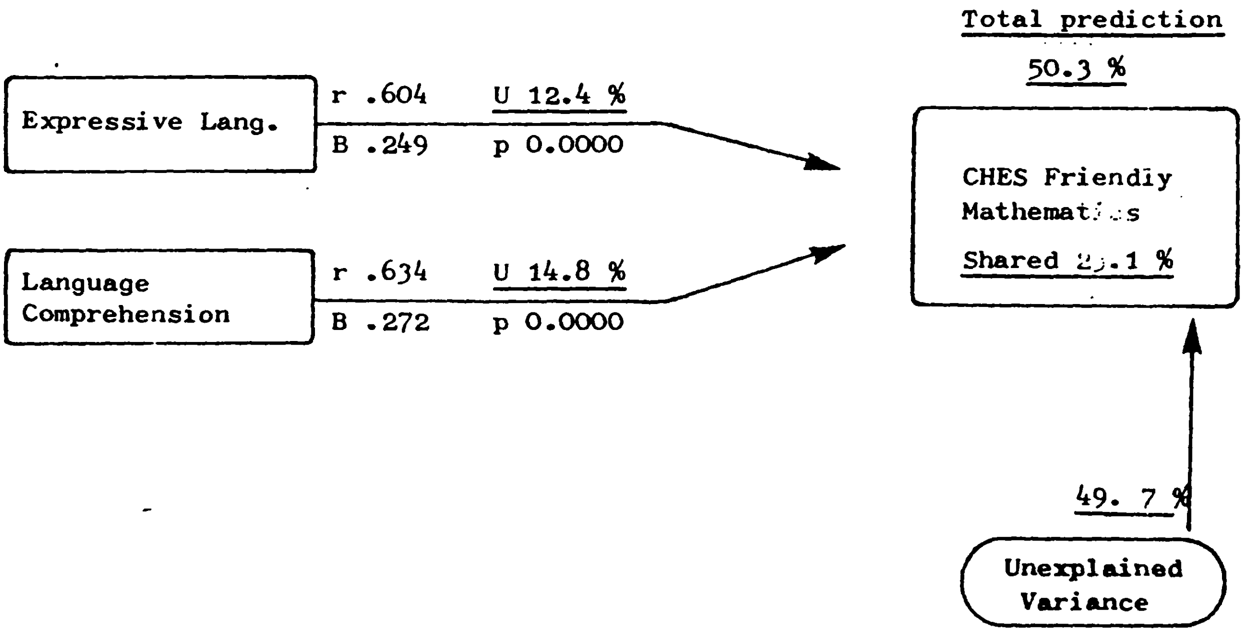

Fig. 4.251: Child Language Assessment: prediction of CHES Friendly Mathematics

in the previous section. The total prediction of the variance in mathematics (compared to reading) is also lower for the language variables - although still surprisingly large for that subject.

1.32 Full reading and mathematics models

Nine major latent variables are assembled as predictors for full reading and mathematics models. Because of their similarity, both models will be discussed and compared directly. Figures 4.252 and 4.253 present the two models.

Overall prediction is slightly higher in the case of the reading model, reaching 64 per cent, compared with 62 per cent for the mathematics model.

It is at once apparent that a child's language skills and cognitive abilities are the strongest predictors of attainment. While it is possible to see cognitive attainment as in some measure a product of innate and environmental characteristics, the language measure, despite its contamination with cognitive ability, does reflect a greater degree of learning and experience. Both the child's motivation and its behavioural characteristics, each of which were seen to be so important on their own, make only small though modest contributions to attainment in the presence of the language and cognitive variables. The parent educational interest and the school's social and academic intake each make very small independent contributions.

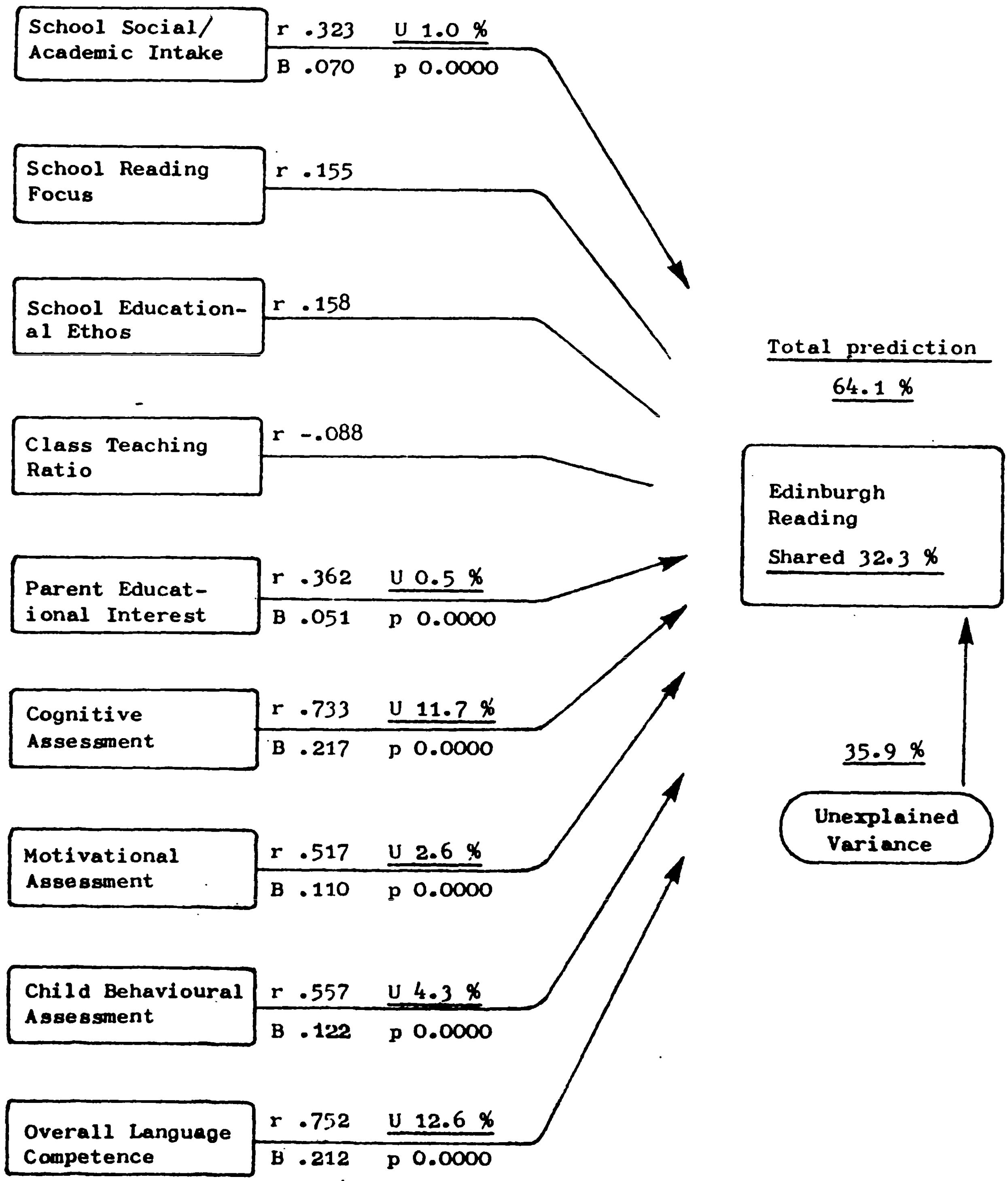

Fig. 4.252: Full Reading Model: prediction of Edinburgh Reading

It is surprising that none of the other school-related variables make a direct and independent contribution to reading. The school reading focus offers a small though reasonable correlation of .155 with reading, while the school educational ethos also correlates at approximately the same level. What can of course be suggested here is that all schools have a fairly common commitment to and awareness of the importance of reading. Thus failure to obtain an independent

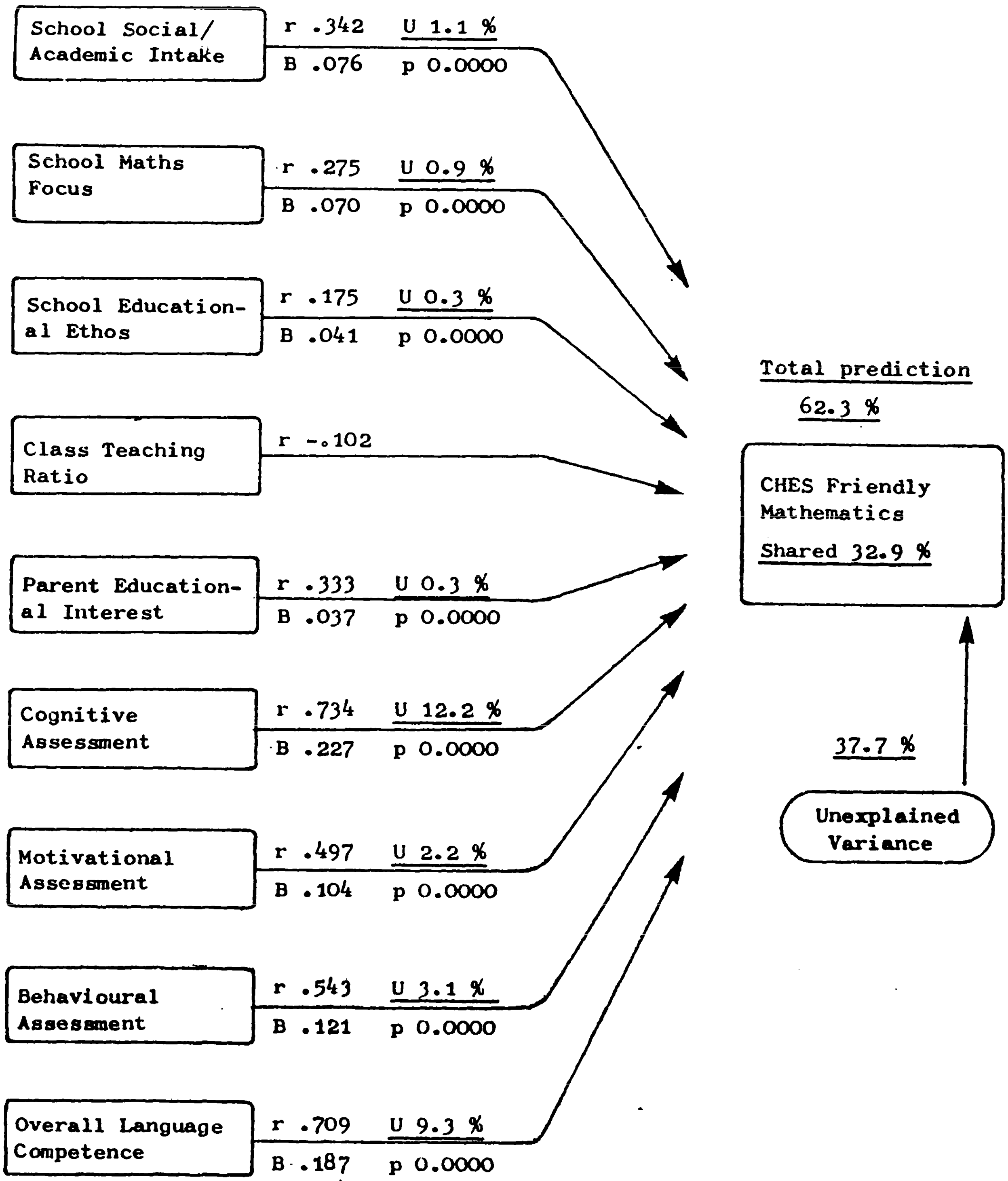

Fig. 4.253: Full Mathematics Model: prediction of CHES Friendly Mathematics

prediction in the overall model may simply suggest that the variation in the ethos and reading focus across schools is not wide enough to have any independent predictive power in the presence of powerful contributors such as those already described.

It is equally interesting to note that two of the three school-related latent variables do make a direct and independent contribution to mathematics. The school maths focus, which predicts 8 per cent of variance on its own, still makes a small but useful addition to variance within the overall model. The school educational ethos also survives as an independent predictor, suggesting again that structured teaching methods are helpful within the curriculum area.

The importance of this contrast between the two models needs some emphasis. While it is possible to argue that standards of reading - particularly for the disadvantaged - can always be improved, the real implication of the comparison between the models is that the extent of a school's commitment to mathematics and the breadth of its mathematics curriculum is what differentiates British schools today rather than any difference in the focus on reading.

The long-term implications of this finding for Britain's future in the electronic and technological age of tomorrow can hardly be exaggerated.

The behaviour of a variable not previously entered into any regression, class teaching ratio, merits brief discussion. A very considerable amount of attention has been given to assessing whether the teacher/child ratio contributes positively or negatively to achievement, in other words whether in comparable circumstances smaller classes produce higher attainment. At this preliminary stage all that it is possible to assert is that the evidence for the cohort as a whole indicates that larger classes are linked to higher attainment. However, this is an extremely partial picture of the situation, since it is well known that children with disabilities, slow learners and remedial class children are frequently found placed in small classes to enable them to get additional attention from the teacher. It will require extensive and detailed analysis of the data to determine whether this first finding persists after taking account of special class situations and other situations where extra teachers have been used in an effort to overcome poor attainment.

What can be emphasised here is that the measure by which class size has been contructed is extremely comprehensive, taking into account the hours of help received from second and third teachers, the help of assistants and even of parents, with a differential weighting of the contributions of the professionals, aides and non-professionals.

In conclusion, the results of the analyses reported here point to the overwhelming importance of the child's language and cognitive abilities, in relation to attainment in reading and mathematics. While the relationships with school and parent measures are much lower, and are often at a point where they no longer make a unique contribution, their potential importance cannot be ignored. The unique contribution of the school's mathematics focus is of particular importance.

There is a great deal of additional analysis to be carried out in which the interaction between school variables and the children's cognitive and language skills is assessed in depth and across sample groups, within regression and other statistical models.

What this study has shown is how the totality of variables weigh up against each other within a composite model. Following this work, more detailed analyses need to be undertaken on each aspect of the data referred to briefly in the preceding pages.

4.33 High and low social groups: models of attainment

The limitations of the initial examination of high and low social groups have been stressed in the introduction to this section. It was possible to match a total of 1297 children as belonging to social classes 1 and 2, and a further matching yielded a total of 740 children in the two lowest social groups.

4.33.1 Cognitive assessment: reading model

The differences between the high and low socio-economic groups in the power of the cognitive ability variables to predict reading attainment are fairly marked, with 50 per cent of variance being explained for the low group compared to 44 per cent for the high group. Figures 4.254 and 4.255 illustrate these differences. They are in accord with other research suggesting that among working class children, measures of their ability predicted a higher percentage of the variance in early reading in infant school than such measures predict for highly advantaged children.

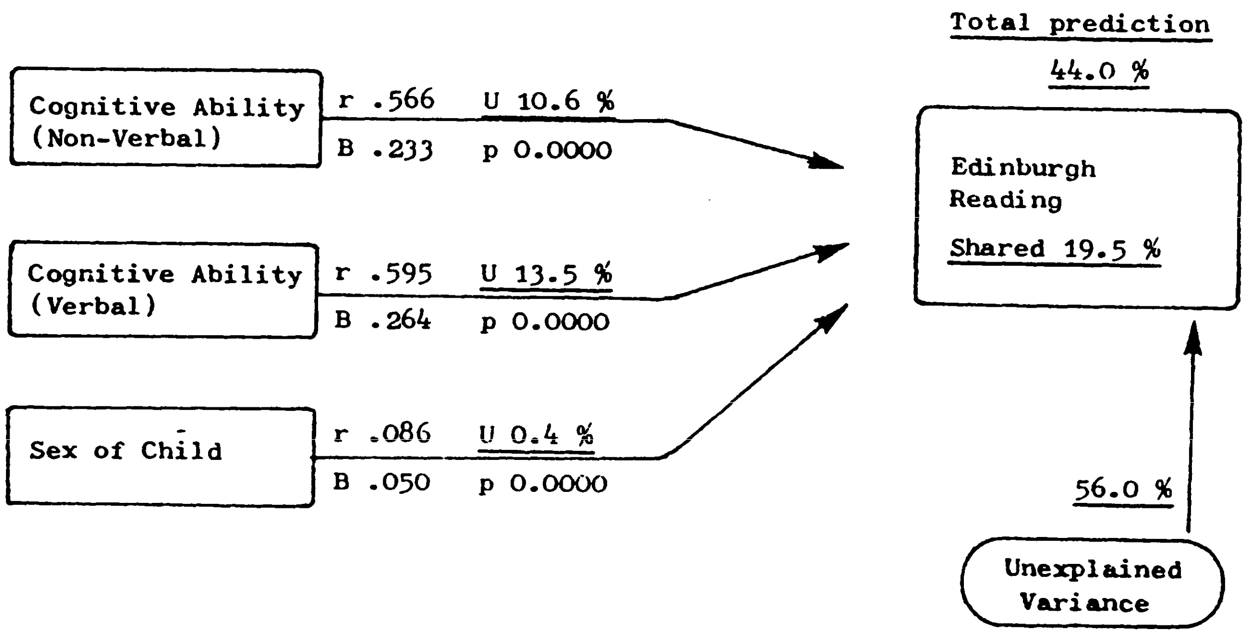

Fig. 4.254: High Social Group, Child Cognitive Assessment: prediction of Edinburgh Reading

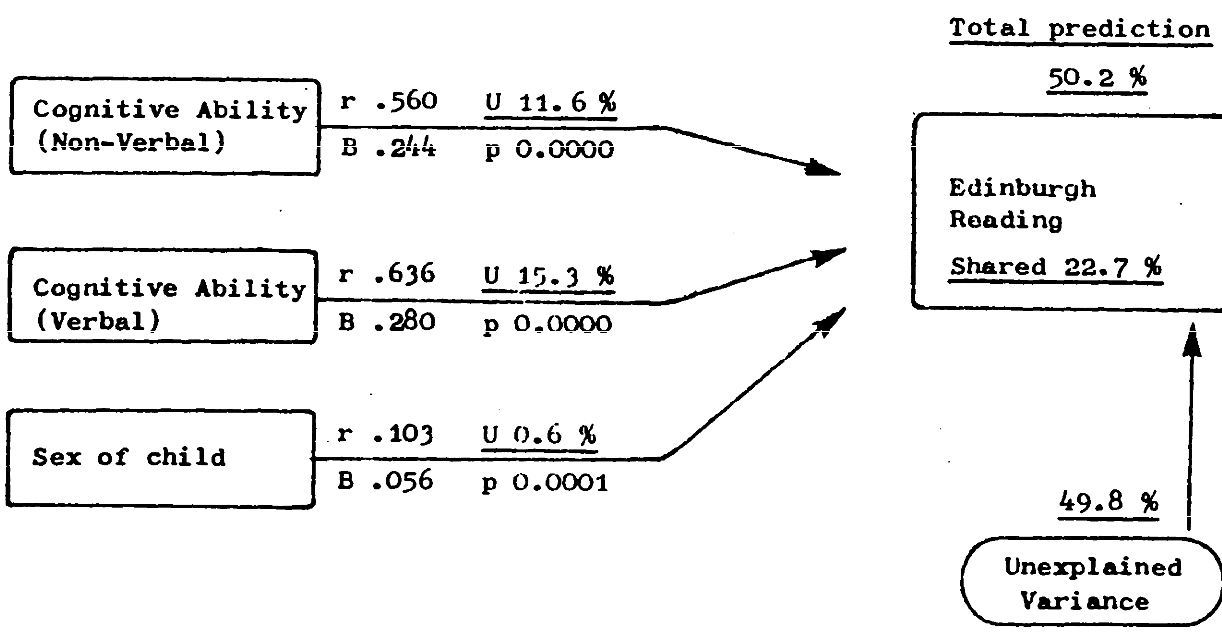

Fig. 4.255: Low Social Group, Child Cognitive Assessment: prediction of Edinburgh Reading

4.33.ii Full reading models for high and low social groups

It needs to be remembered that the correlations and unique predictions in these two models have been derived from the minority upper and lower socio-economic groups of the population, excluding the two middle groups (usually described as class 3 manual and 3 non-manual) which comprise the majority of the population.

Figures 4.256 and 4.257 show that a higher percentage of the variance

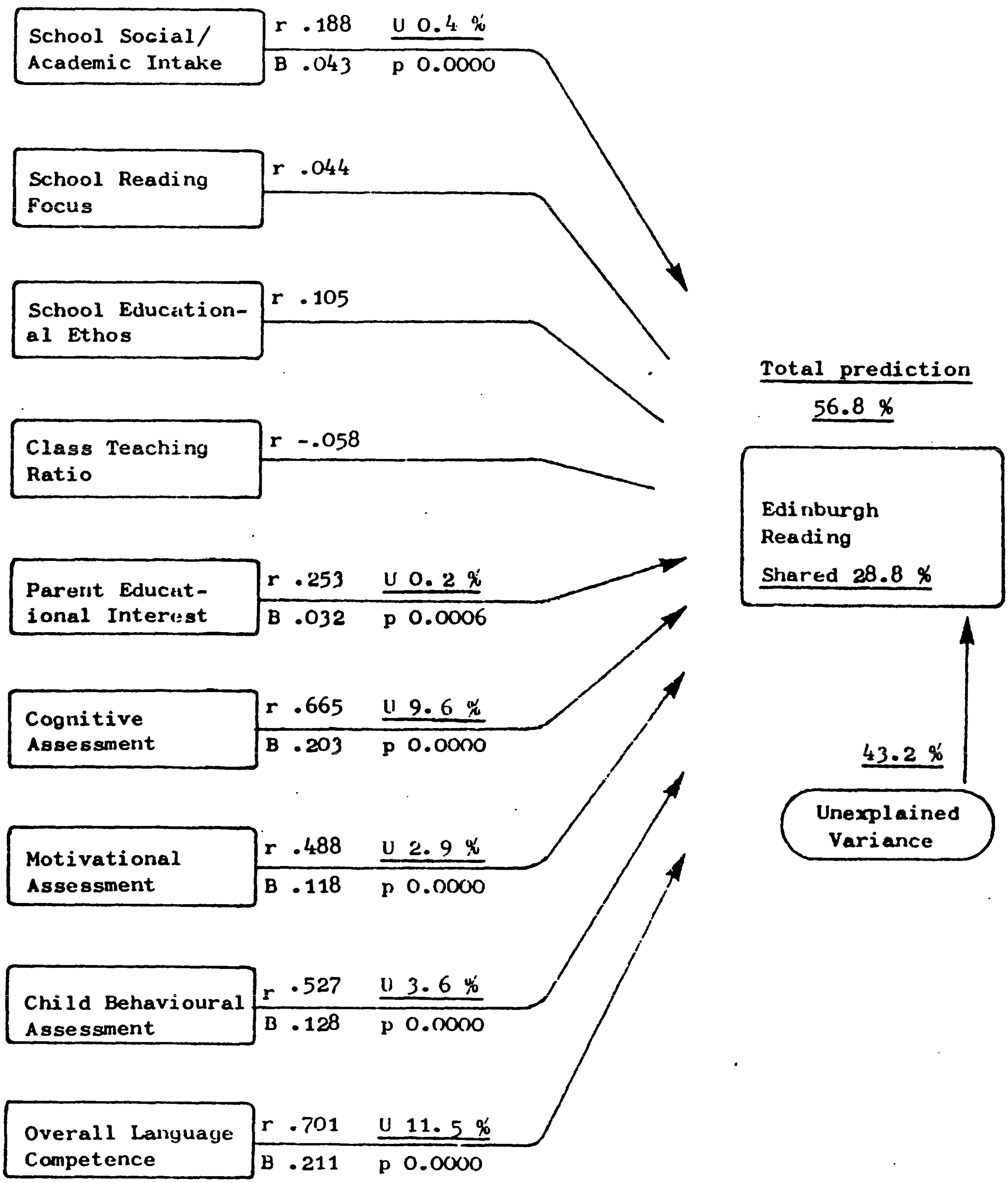

Fig. 4. 256: High Social Group Reading Model: prediction of Edinburgh Reading

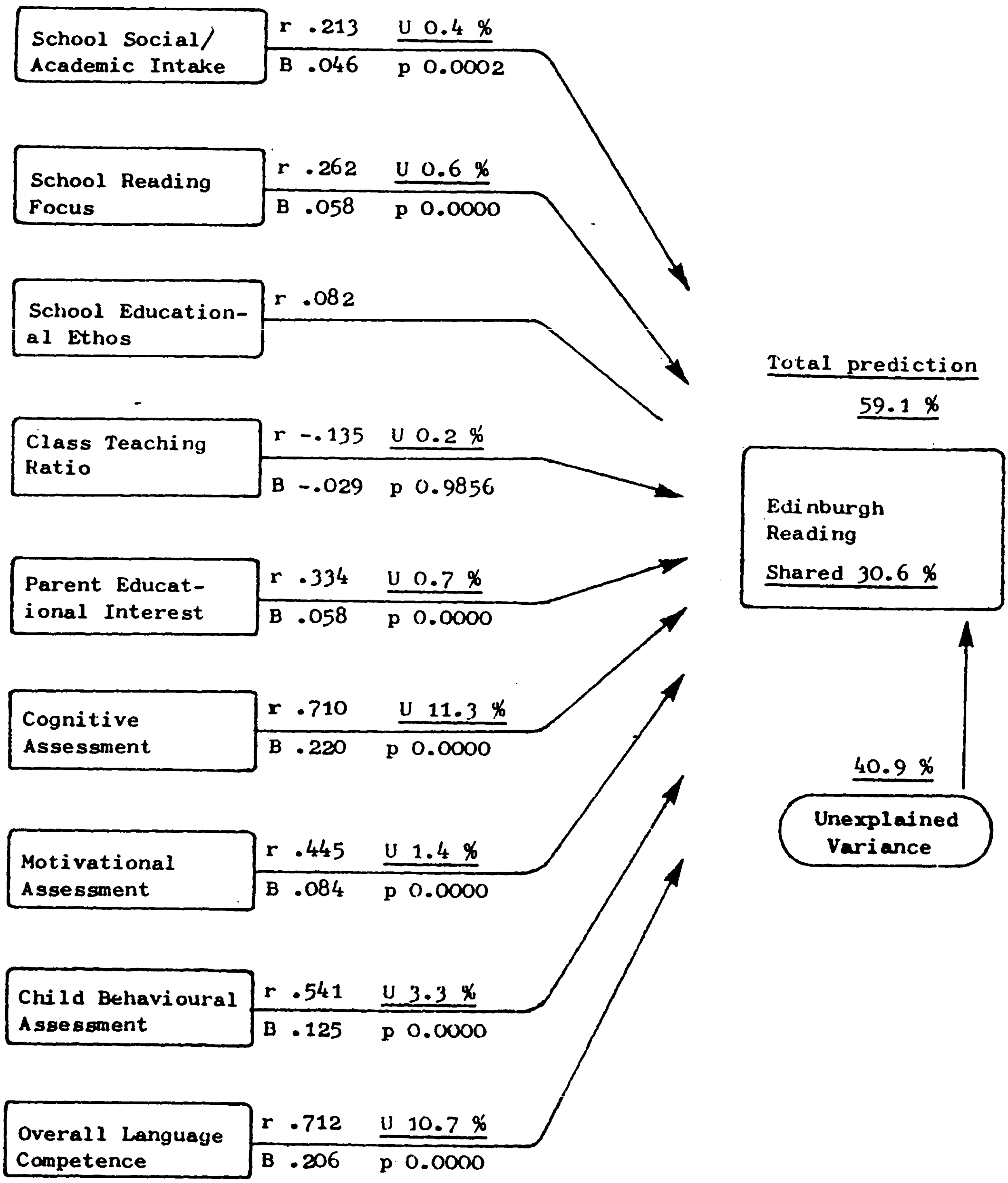

Fig. 4. 257: Low Social Group Reading Model: prediction of Edinburgh Reading

in reading outcome can be predicted in the low socio-economic model. The expected decline has taken place in the importance of the school's social and academic intake, as a result of the division of these latent variables according to the social grouping of the children. On the other hand two of the three school variables have been shown to be important for the low social group, but not so for the high group. It appears that the school reading focus is moderately important, suggesting thus that there is a degree of variation in the extent to which schools attended by low social group children emphasise constructive reading activities. On the other hand the class teaching ratio has a negative (and unique) relationship with reading attainment. Again this may be due to the fact that small remedial groups and other special teaching situations are, understandably, more likely to be found in schools teaching disadvantaged children.

The fact that parent educational interest has a much higher unique contribution to reading for low social group children than it does for the high group children is possibly related to the fact that most high group parents are likely to take a considerable interest in their children's schooling, with relatively little variation in this group; on the other hand the variation in interest among the low group parents may be relatively large, leading to a higher prediction of reading variance (if the assumption is justified that parental interest leads to higher attainment in reading).

Cognitive ability continues to predict more strongly for the low social group than it does for the high group, whereas the reverse situation occurs with the motivational assessment. It is not clear why the latter predictive relationship (as well as the bivariate correlation) should be higher for the high social group children. It can be noted however that the two correlation coefficients do not differ greatly.

4.33.iii School maths focus: mathematics model

The importance of the two variables comprising the school maths focus is particularly apparent in this comparison of the low and high social groups. It is seen from figures 4.258 and 4.259 that the time given to school maths and science activities and even more the breadth of the mathematics curriculum is a highly important predictor of mathematics attainment for the low group children, compared to the high group children. Again the explanation may well be that for the high group children the relative uniformity of focus on this area leaves a more limited contribution to the variance of mathematics attainment than is the case in the low social group, where the variation in the emphasis and breadth of the schools' mathematics curriculum may be a major contributor to ultimate performance.

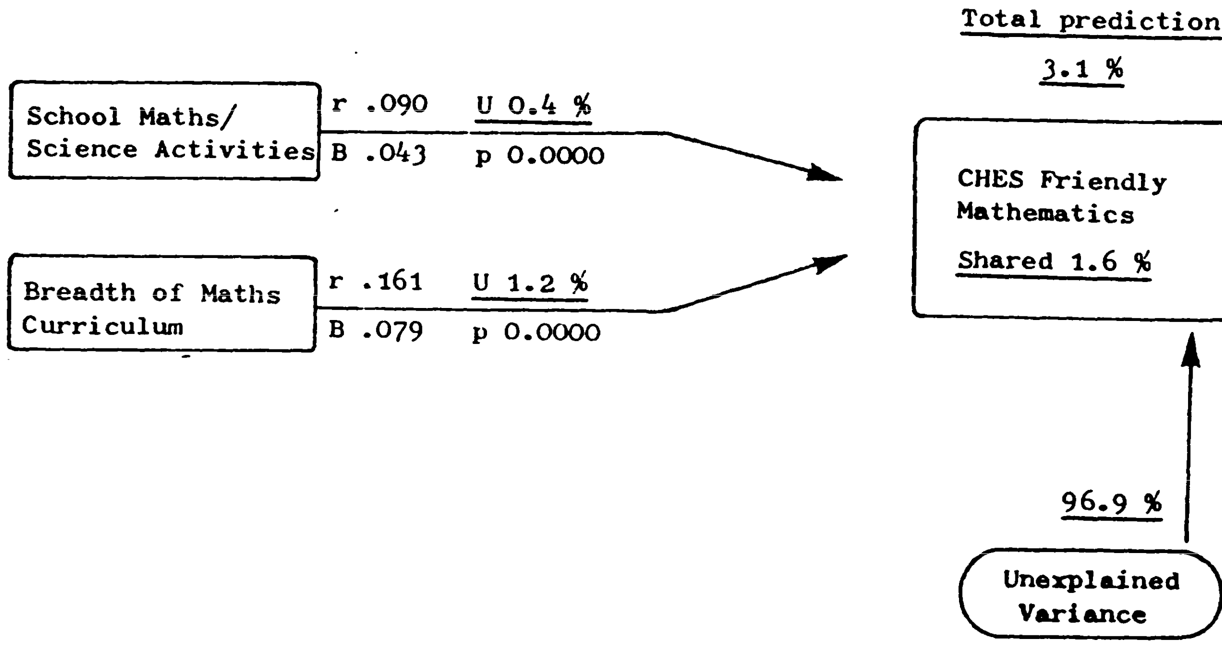

Fig. 4.258: High Social Group, School Maths Focus: prediction of CHES Friendly Mathematics

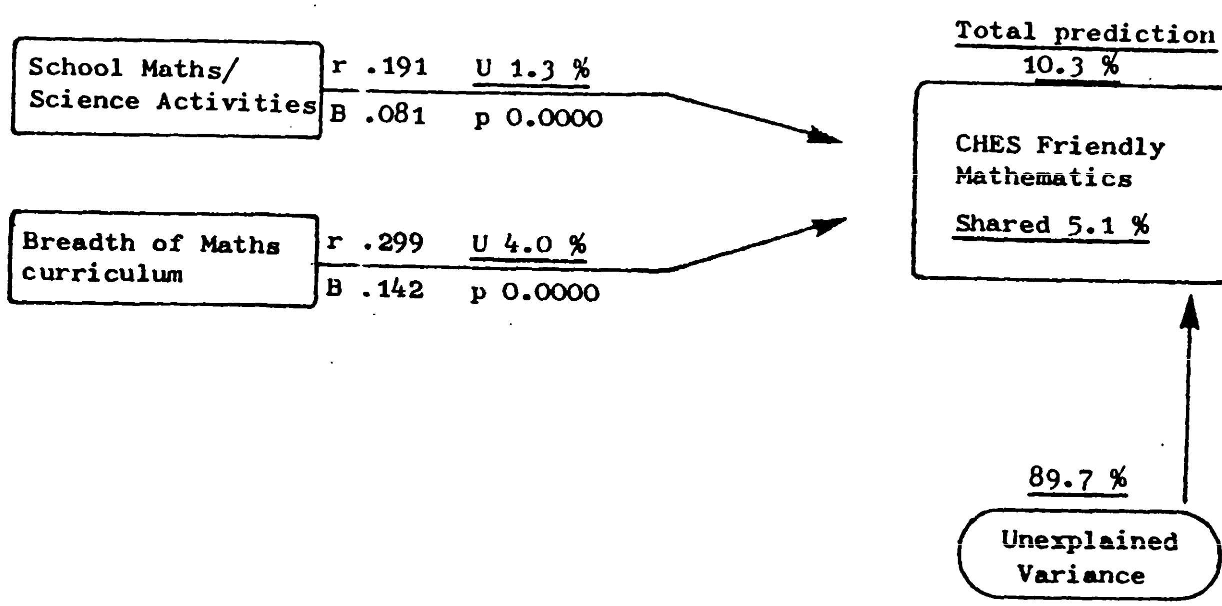

Fig. 4.259: Low Social Group, School Maths Focus: prediction of CHES Friendly Mathematics

4.33.iv **Cognitive assessment: mathematics model**

Figures 4.260 and 4.261 suggest that the differences between the models are not large enough to justify stong conclusions about the findings. It is interesting to note that verbal ability appears to contribute slightly more to variance in mathematics than does non-verbal ability for the low social group children, whereas the reverse situation occurs with the high social group children.

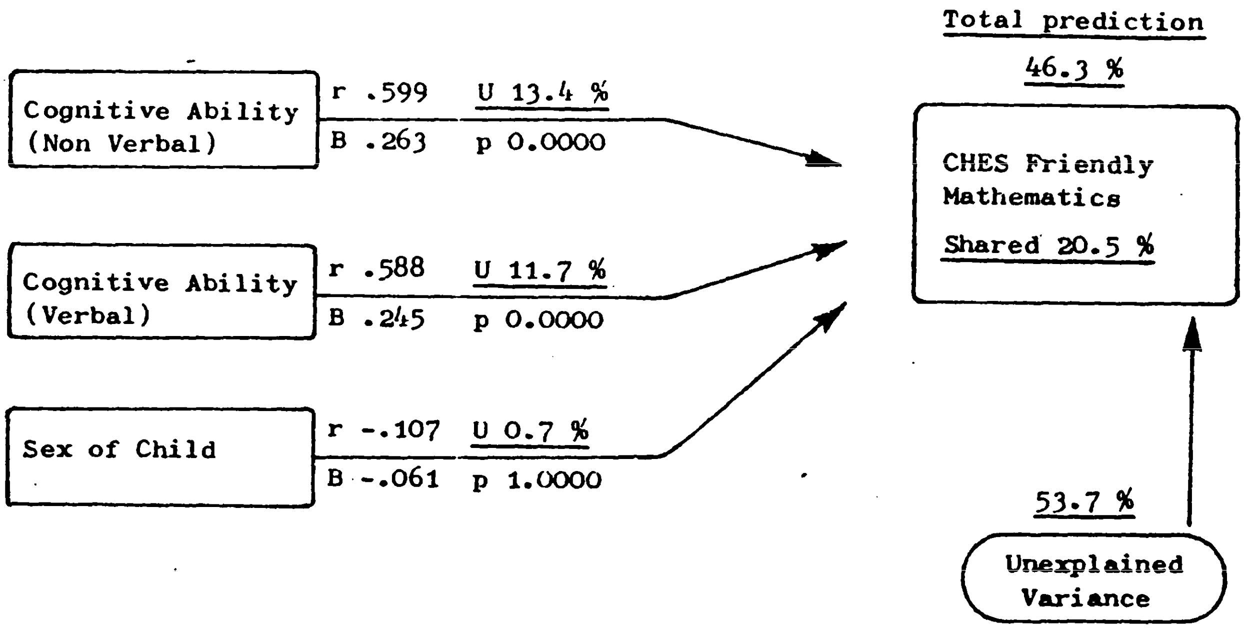

Fig. 4.260: High Social Group, Child Cognitive Assessment: prediction of CHES Friendly Mathematics

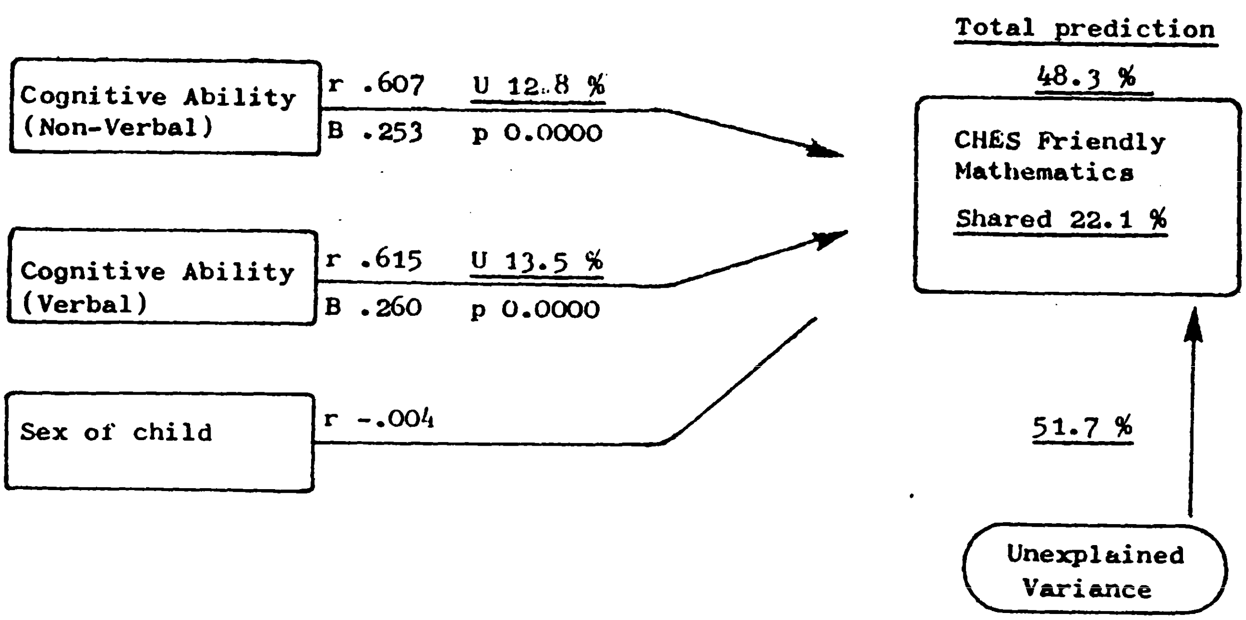

Fig. 4.261:

Low Social Group, Child Cognitive Assessment: prediction of CHES Friendly Mathematics

The sex difference previously noted over the whole cohort (with a negative correlation indicating poorer mathematics performance by girls) is particularly marked in the high social group model, and is almost non-existent in the low group model. The difference is quite marked and unlikely to be artefactual. It is difficult to understand why there should be a relatively strong sex prediction for the high group, unless this may be related to a tendancy to start differentiating earlier in the curricula pursued by boys and girls at some of the schools attended by high group pupils. This is one of many findings which merit more detailed examination, possibly within sub-groups of children.

.33.v Full mathematics models for high and low social groups

The comparable situations in the full mathematics models for the high and low social groups are portrayed in figures 4.262 and 4.263.

In many respects the models are fairly similar to each other. The big difference already noted in the importance of the school mathematics focus is again reflected in the moderate unique variance contribution of this variable in the low group, well above that for the high group.

An interesting finding is that the school's social and academic intake also appears more strongly as a unique predictor in the low group model. While the social composition of the school was not seen to have a differential effect on reading across high and low social groups, as found in the Coleman study previously referred to, the reported difference does appear for mathematics attainment, suggesting that low social group children benefit more from the social and academic composition of their schools than do high social group children. (Even for reading the correlation with social/academic intake is higher for the low social group, although the unique prediction is the same in both models.)

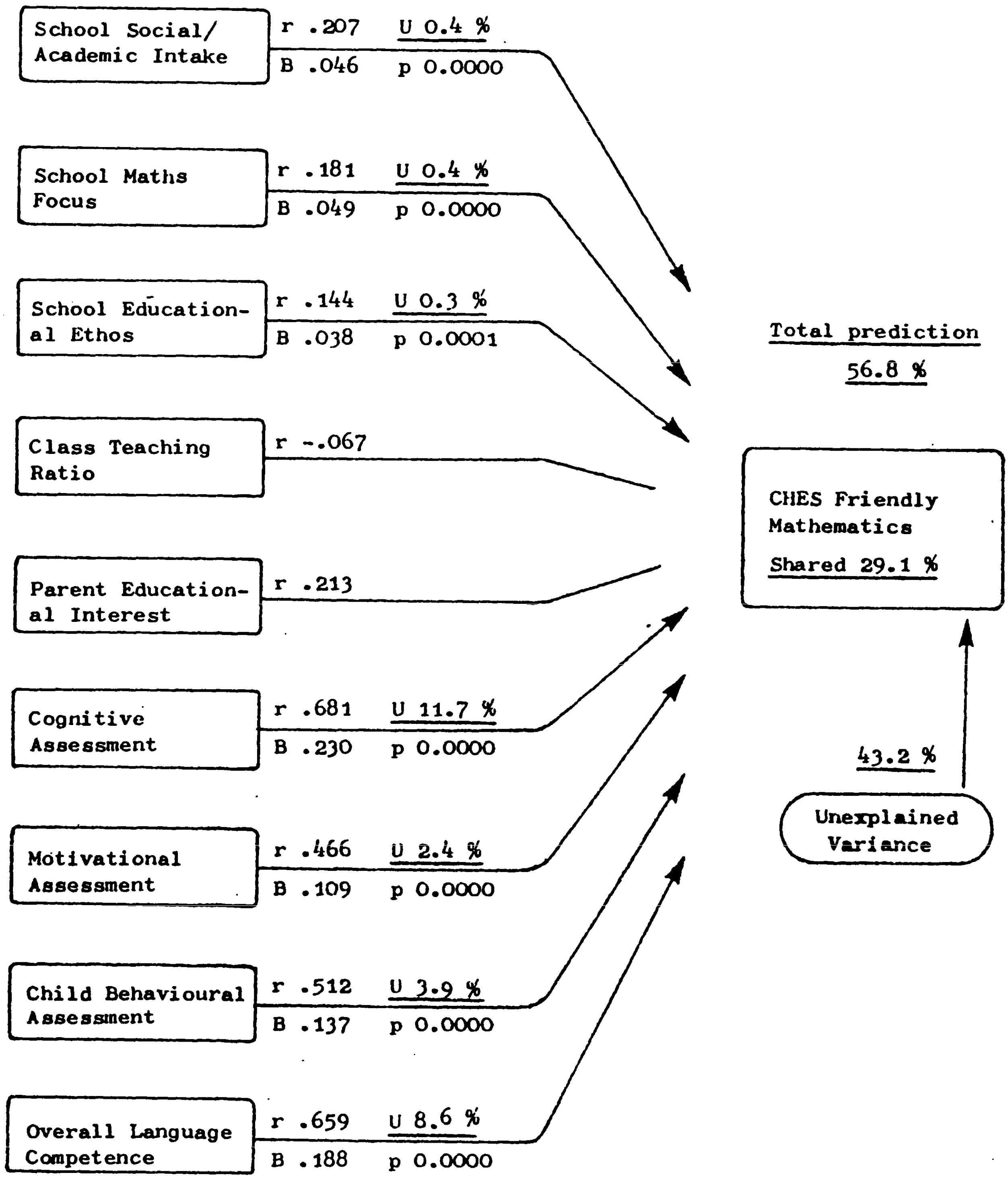

Fig. 4.262: High Social Group Mathematics Model: prediction of CHES Friendly Mathematics

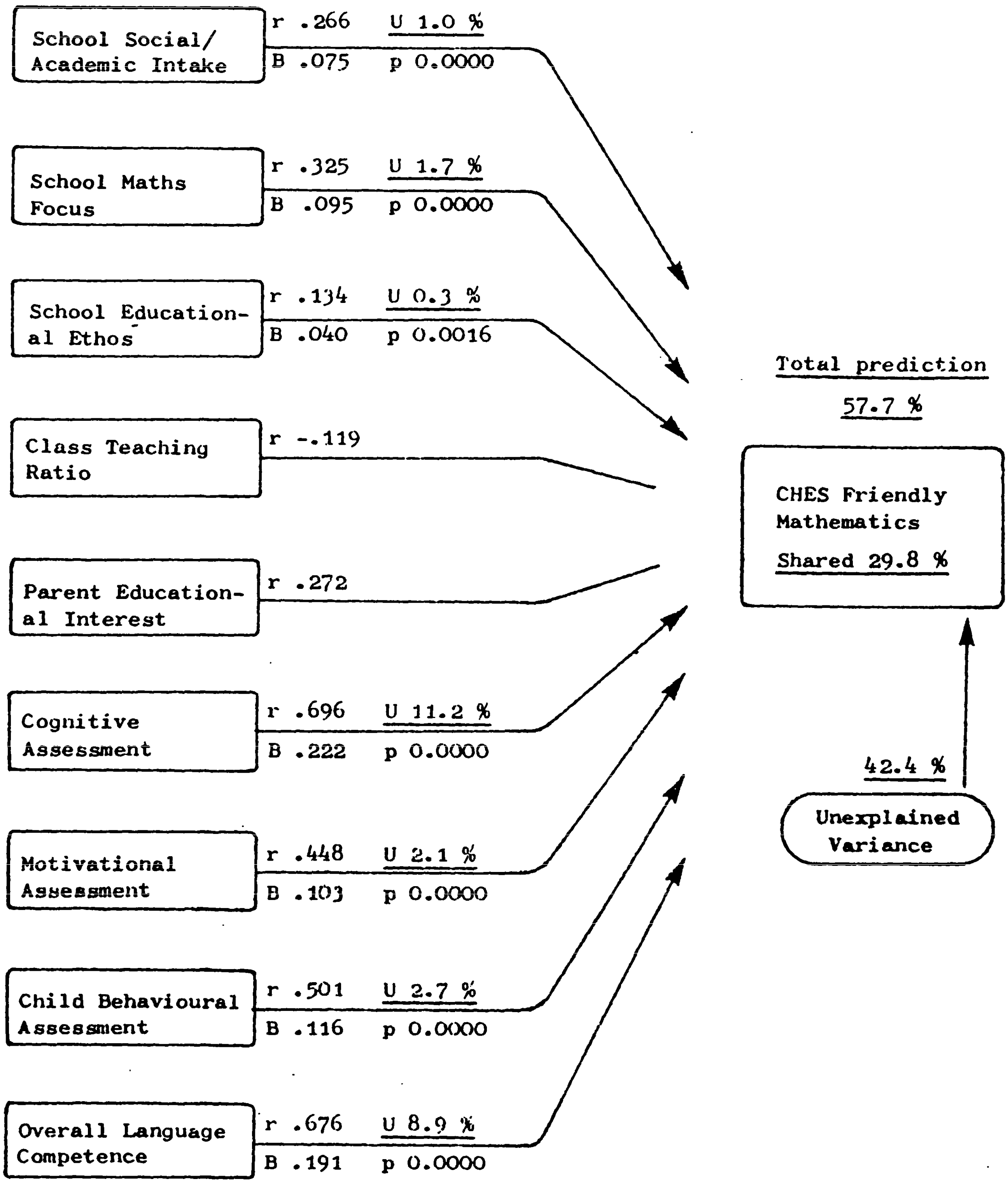

Fig. 4.263: Low Social Group Mathematics Model: prediction of CHES Friendly Mathematics

4.34 TECHNICAL NOTE: Comparisons between V-ridge and Least Squares interpretations

As previously explained, all major analyses were dependent on agreement between the least squares and V-ridge solutions of the regression equations. In view of the fact that the coefficients (and unique variance) published on these pages were taken from the V-ridge solutions, it is instructive to examine a few comparisons.

Table 4.31 sets out the series of regression coefficients derived from the regression of reading attainment on the final set of latent variables. By dividing the sample, first into odd and even numbered cases (sequence numbers rather than identification numbers), and then re-dividing these half samples into the top and bottom halves of the data set, it was possible to examine the results from what are in effect six fairly similar and fairly representative samples from the cohort.

While a critical examination of the statistical comparison requires a much fuller account than can be given in these pages, the table focuses attention on the sizable variation in the coefficients derived by the least squares algorithm from what are essentially similar samples; in contrast the V-ridge coefficients vary much less.

The last two columns of the table present the mean value of the six coefficients in each row of the table and the largest individual deviation from the mean within that row. Thus each pair of least squares values can be compared with an equivalent pair of V-ridge values, enabling a summary comparison for each of the nine latent variable predictors.

Omitting the one situation where a mean coefficient value of zero is noted, an overall statistic based on the last two columns of figures, giving the average value of the statistic.

$$\frac{\text{Largest deviation from mean}}{\text{Mean value of coefficient}}$$

for all nine predictors, showed that whereas this average ratio was only 0.213 for the V-ridge coefficients, it reached 1.168 for the least squares coefficients. The implication is that even with samples consisting of thousands of cases there is a serious instability in the derived coefficients when using least squares regression.

Table 4.31 Comparison of least squares (LS) and V-ridge (VR) coefficients

Regression Predictor	Methods	Odd Cohort Cases All N=4418	Odd Cohort Cases First half N=2209	Odd Cohort Cases Sec. half N=2209	Even Cohort Cases All N=4418	Even Cohort Cases First half N=2209	Even Cohort Cases Sec. half N=2209	Coeff. mean value	Largest dev. fm. mean
School Intake	LS VR	.081 .072	.089 .080	.073 .065	.047 .061	.033 .053	.065 .070	.065 .067	.032 .014
Reading Focus	LS VR	-.003 .014	-.003 .013	-.003 .015	.031 .032	.025 .029	.039 .036	.014 .023	.025 .013
Educational Ethos	LS VR	.024 .026	.012 .021	.036 .031	.035 .030	.048 .034	.020 .026	.029 .028	.019 .007
Class Tch. Ratio	LS VR	-.001 -.012	-.005 -.018	.004 -.006	.000 -.013	-.005 -.019	.005 -.007	.000 -.013	.003 .007
Parent Interest	LS VR	-.005 .048	-.004 .049	-.007 .047	.009 .049	.003 .042	.016 .057	.002 .049	.014 .008
Cognitive Assess.	LS VR	.340 .220	.347 .220	.332 .220	.351 .225	.373 .235	.328 .215	.345 .222	.028 .013
Motivat. Assess.	LS VR	.115 .118	.118 .121	.113 .115	.080 .105	.071 .103	.088 .106	.098 .111	.027 .010
Behav. Assess.	LS VR	.108 .121	.117 .123	.099 .120	.096 .122	.093 .123	.097 .121	.102 .122	.015 .001
Language Assess.	LS VR	.322 .215	.323 .211	.361 .218	.361 .221	.361 .225	.362 .217	.348 .218	.026 .007

Least squares does of course score by virtue of its higher predictive power as measured by variance explained. This is because of the nature of the least squares algorithm, which minimises the squared distance between all the points in variable space and the regression line. But this definitional strength of the algorithm is also its weakness, since it capitalises considerably on error variance. V-ridge and other shrinkage methods such as the use of Stein estimators do not overcome all the faults of least squares but they do tend to minimise them.

Cross-validation tests in a number of the regressions carried out for this study showed that in most, though not all of the tests, the cross-validation prediction when measured as variance explained is still slightly higher for the least squares solution, compared to that of V-ridge. On the other hand in every case examined here the stability of the V-ridge coefficients is better, according to two different criteria. This means that although least squares, in large samples of this size, can still offer slightly higher figures for total variance predicted in cross-validation exercises, the coefficients themselves remain less stable and are therefore less reliable across similar samples than is the case with the V-ridge coefficients.

It is thus a matter of what one seeks in the analysis of data, as to which algorithm is used. If the aim is to maximise the prediction of variance in a model, including capitalisation on error, least squares is likely to be the algorithm of choice. If however the aim is to obtain the most reliable set of coefficients, particularly if these coefficients are intended for application to other situations, then V-ridge or some of the other ridge or Stein method may be preferable. In the present study it would appear that the stability of the coefficients is of more long term importance than the maximisation of the variance prediction.

4.4 Components of the Child Behaviour Scale

The interpretation of a child's social and neuro-development behaviours is a matter of intense professional debate. It is known that various behaviour patterns are stongly predictive of school performance; an ability to concentrate on a task in hand is clearly of crucial importance, for example, whether or not this characteristic is situational, innate, learned or a combination of all three.

The importance of the innate features in behaviour was highlighted by the classic studies of Thomas, Chess and Birch, 1968 et seq., who were present at the birth of each of a moderately large sample of middle class New York children. The made assessments of each infant's temperamental characteristics shortly after birth and followed the children longitudinally. The team were able to show that behavioural characteristics noticeable at birth were often of major importance in the subsequent development of the children. But they also showed that it was the way the children were reared - in other words, the parental environment - which was equally a major determinant of how the children's characteristics contributed to their later personalities and life experiences.

The wealth of information available to CHES on the birth, the subsequent health and social environment and the education of the children, has meant that it will be possible to link many of these variables in a wider interpretation of the children's behaviour patterns at the age of 10.

Normally it is difficult to identify any single behaviour as expressing a characteristic or more broadly defined behaviour, and most non-clinical methods of assessment rely on the scoring of an extended check list of behaviours, followed by a summation of certain groups of scores to yield overall values for particular characteristics. Alternatively, more advanced analyses of the individual scores can be used to produce the sought after characteristic scores.

Two widely known instruments are the Rutter Behaviour Scales A and B (1967, 1970) - for teachers and parents respectively - and the Conners teacher and parent Rating Scales (1969, 1973). While the Rutter scales have undergone only minor changes since their development and piloting, various amendments and new forms of Conners have appeared since the original versions were published. Both sets of scales have their strong points and theoretically it would be desirable to administer both of them, adhering to the norms provided for characteristics such as hyperactivity and anti-social behaviour in order to assess whether a child could be defined as scoring above certain ad hoc cut-off points on the behaviours in question.

However, as already pointed out in section 2.2, the decision was taken that as there would be too much work involved for the teachers in scoring both scales, and since the cultural influences in the wording of each would make a direct comparison of scores across the two scales difficult and problematical, it would be preferable to create a completely new and more up to date Child Behaviour Scale for the teachers.

There were also more serious conceptual reasons. Both the exisitng scales contain questions asking the teachers to score the extent to which a child lies or steals. In today's world it seem inappropriate that teachers should be asked to note what is effectively a very severe criticism of children in their classes, even given the total confidentiality of the CHES questionnaires. (It is not quite the same when a parent is asked to make these judgements, since she is more free to decide on whether or not to report on the behaviours in question.) For the teachers, moreover, there are other types of question which can be used to indicate whether a child is displaying aberrant behaviours, without the labelling process which occurs when they score a child on items such as lying and stealing.

A further problem is that there are a number of behavioural issues which were of particular interest to CHES, but which were not included in either the Rutter or Conners instruments. These include questions relating to anxiety and neurosis and to a range of gross and fine motor coordination behaviours which help to define a child's physical interactions with the environment and may indirectly contribute to social adjustment.

It was accordingly decided to select for the Child Behaviour Scale the best and most appropriate items from the Rutter and Conners scales, avoiding duplication and amending the wording to relate it as far as possible to present-day usage in Britain. A variety of questions on other topics of interest were added to form what appears to be a highly comprehensive instrument.

Because of the very considerable concern about the question of hyperactivity - whether or not it exists as an identifiable characteristic and what sort of behaviours may define it - a total of 14 questions thought to relate to this topic were incorporated in the new scale. Half of this number were taken from the previously cited British and American scales. The topic is discussed at greater length in the review of the behavioural scale components later in this section.

4.41 Principle Components Analysis

It was decided to adhere to the use of principal component analysis for reducing the dimensions of the 53 questions within the Child Behaviour Scale, rather than relying on factor analysis with its highly problematical techniques. As is well known, principal components offer a consistent solution provided the scales of measurement are themselves uniform or standardised.

It was interesting to note that although the loadings of scale items on the different components varied somewhat between the original pilot analysis on 1,000 children and the present analysis on 8,836 children, the same items loaded strongly on the same components.

The question arose however of whether to follow the customary method of creating component scores from the 53 items. Normally the loadings of items on the different components are used to determine whether the components are credible conceptual entities in relation to the goals of the study. Items with high loadings are then flagged as the defining items for each particular component, and are described as such in reports on the study, together with the relevant loadings. However the actual component scores, which are equivalent to new variables created to represent the reduced dimensions of the item array, are not based simply on these loadings but rather on component score coefficients equivalent to (though not the same as) regression coefficients; component scores are in fact a product of the loadings and the inverse of the eigenvalues of the particular component solutions.

For the unrotated principal components solution there is thus no real difference between the loadings on the components and the component score coefficients, apart from the inclusion of the inverse eigenvalue (which acts as a constant within any one component).

Once the original component solution has been rotated, however, the relation between the item loadings on the rotated components and the component score coefficients changes fairly considerably. The mathematics of the transformation is rather complex and need not be discussed here other than to emphasise that the effect of the rotation is to move away from a basic principle components solution in which the variance associated with the first component is maximised, followed by an orthogonal second component maximising its share of the remaining variance, and so on. The rotation procedure effectively spreads the variance more widely among the retained components, although there is still a sequential order on the amount of variance represented by each successive component.

The behaviour of three particular items within the rotated loading matrix and in the rotated transformation matrix (from which the component score coefficients are obtained) is an example of what happens. The table below refers to the first component, anti-social behaviour.

Table 4.41. Selected loadings and component score coefficients, First behavioural component

Item	Loading on First Component	Component Score Coefficient
5. Complains about things	.68	.131
8. Displays temper	.80	.163
9. Teases to excess	.77	.146
16. Interferes with others	.72	.109
21. Changes mood quickly	.74	.134
22. Excitable	.59	.050 **
24. Restless	.58	.024 **
25. Squirmy, fidgety	.47	-.012 **
34. Quarrels with others	.81	.169
37. Destroys belongings	.60	.084
43. Bullies	.77	.162
44. Sullen, sulky	.70	.158
49. Easily frustrated	.61	.088

It is clear that the component score coefficients do not bear a simple relationship to the item loadings. What is even more interesting is that there are three items whose loadings appear satisfactory (according to the criterion set of .40 as a minimum loading), but which perform so poorly within the component score vector that it was decided to omit them from consideration.

It is possible to argue that there are good reasons why these three items chould in fact be omitted from an anti-social component. Excitability is not of itself an anti-social form of behaviour, even though many anti-social children may be excitable. Likewise the behaviours loosely defined as restless or as squirmy and fidgety may be regarded as only marginally anti-social.

There are three other items which appear with moderately strong loadings in the loading matrix but which fail to meet the qualifying criteria (to be discussed shortly) in the component score matrix. Squirmy and fidgety appears again in disorganised activity, with a loading of .52, but has too low a component score coefficient. Two other items, miserable/unhappy and obsessional, each appear with moderate loadings in the neuroticism/anxiety component, but fail to qualify in the component score matrix.

Again it is possible to argue that squirmy and fidgety do not necessarily indicate disorganised activity (compared with items such as day-dreaming, poor concentration, boredom, confusion, distractibility, forgetfulness, failure to complete tasks, and other items which do feature within this component.) A teacher's assessment that a child is miserable and unhappy may apply as much or as little to an anti-social child as it does to a neurotic/anxious child. Obsessional likewise is not a clearly defined characterisitc, although it has been used widely in other behavioural instruments. For a ten-year-old child the definition of obsessional may apply more to his or her passionate interest in a few activities than it does to any clinical definitiion such as might be applied to an adult.

There is a second and even more basic issue involved in the decision to define components in terms of the score coefficients rather than the original loadings. While a component is defined, in written reports, in terms of the items which load highly on it, in fact the customary procedure for generating component scores takes every item in the battery, whatever the loading, and uses it in weighted form to help create each component score. Thus one can in effect almost swamp the small number of defined high loading items by the much larger number of unnamed items with lower loadings (and lower coefficients). There is no particular statistical reasons for doing so and there may well be conceptual arguments against this practice. This is not to say that a component created from the weighting of all the items in a large battery is necessarily very different from a component based only on the weights of the strong loading items, though it may well be. However it does seem rather inappropriate to define a component in terms of the high loading items, but then construct it in terms of weighted values of all the items in a battery. The procedure followed in the present study was therefore as follows:

a. The 53 items in the Child Behaviour Scale were entered into an S.P.S.S. Principal Components programme (PA1), followed by a Kaiser Varimax rotation.

b. A series of solutions ranging from four to twelve components were examined in detail.

c. The item loadings on the various components were examined, using a cut off point of .40.

d. The conceptual justification for the different components was studied in relation to the theoretical assumptions underlying the educational survey, taking into further consideration the theoretical stances of Rutter, Conners and others whose theories and behaviour scales contributed in part to the formulation of the Child Behaviour Scale.

e. These various considerations led to a decision to rely on a nine-component solution, set out in full in the accompanying Table 4.42. (The rationale for these components will be discussed shortly.)

f. The component score coefficient matrix was then used as the final arbiter as to which items should be incorporated in each component. The criterion was that within any one component the smallest coefficient should be at least half the size of the largest coefficient.

g. Only the selected items and their relevant coefficients were then used to generate component scores.

h. For the small number of individual missing item values within any particular group of component items, the individual means of the remaining item values were substituted. In cases where all the item values within a group were missing for a child, the sample means were substituted for those items.

i. Eigenvalues for the nine components in the unrotated solution ranged from 16.3 to 0.9, with the matching percentages of the total variance ranging from 30.8 to 1.7.

4.42 Definition of Behavioural Components

The components themselves appear to form a credible set of behavioural characteristics for a population of 10-year-old school children. The items, the weights used in the construction of each component, and details of omitted items, appear in table 4.42.

The items in the first component, anti-social behaviour, clearly have a great deal in common. Although anti-social and disorganised activity items are often put into a single component within other behavioural studies, there appears to be no sound reason for assuming that disorganised activity is a necessary concomitant of anti-social behaviour. A disorganised child may have a high social awareness, or may not.

The set of disorganised activity items forming the second component likewise have a clear rationale of their own and have little in common with any of the other components.

The third component, neuroticism/anxiety, also has a valid independent existence. Although it is a small component in terms of the number of items used, they are related to each other. The presence of two separate items referring to anxiety is seen as a minor shortcoming of this scale. Question 53, asking for a judgement of temperament on the continuum between anxious and unworried, is clearly too close to Q.23, asking for a score on the extent to which the child is worried and anxious. In a revised scale Q.53 would probably disappear, as Q.23 has a slightly higher coefficient on this component.

It is interesting that the nine component solution offers separate components for clumsiness and poor hand-eye coordination. With the exception of Q.18 (difficulty in picking up small objects), all the clumsiness items relate to gross motor skills and sudden failures in motor control. Even Q.18, on picking up objects, could be thought related to the accompanying gross motor movements of reaching. In contrast all the poor hand-eye coordination items refer to fine motor control and, one assumes, to the patience and dexterity needed to acquire fine motor skills. Thus the separation into these two groupings appears highly satisfactory and again offers a more sensitive interpretation of the data than would a presentation of a single 'clumsiness' component.

The sixth component, hyperkinesis, will be dealt with separately at the end of this section.

A comparison of the seventh component, introversion/extraversion, with the third component, neuroticism/ anxiety, indicates that their differences are quite strong. This is, in fact, in line with personality theories advanced by workers such as Eysenck and Eysenck 1969, who see introversion/extraversion as a separate dimension from that revolving around neuroticism. The principal components solution certainly lends weight to this theoretical assumption.

The existence of the eighth component, here termed behavioural trauma, may be thought problematical. Yet the component appeared as identifiably separate even when solutions were considered with fewer than nine components. It appears that truancy is at a level of seriousness - and difference - that does not qualify it to be included within the anti-social component, where its loading is very low. Its only major loading in the nine-component solution appears on the eighth component, alongside the two items of enuresis and encopresis, both of which can also be described as indicative of serious behavioural trauma. Thus, the surprising grouping of these three items may well point to a considerable degree of similarity in their nature and origins, particularly at the age of ten when truancy is not yet the mark of the alienated teeneger but rather an indication of the child's serious problems either within him or herself, or at home (or even possibly at school).

The ninth component is composed of only one item, namely the child's ability to dress and undress competently. It is an unusual item, and it may be asked why this item should not appear within clumsiness or poor hand-eye coordination, where it would seem to belong. The fact is, as nursery and infant school teachers know only too well, that with the exception of the very small minority of children suffering from poor motor coordination, the skill in dressing and undressing competently is highly associated with the parental pressure on the pre-school child to learn how to dress and undress her or himself. The parent who does the dressing and undressing for the child and has neither the patience nor determination to teach the child will leave that child as the butt of jokes by its peer group and critical comments from teachers trying to cope with a large class of children getting ready for physical education or sports. Failure to learn this skill at an early age may have long term consequences. The appearance of competent dressing and undressing as an isolated component has thus adequate justification if it is seen mainly as a learned skill rather than simply as a maturational ability linked to muscular control.

4.43 The Hyperactivity Debate

In view of the importance of the debate over the existence and definition of the hyperactivity syndrome, considerable attention has been paid to this issue, both in the Child Behaviour Scale an in the analyses of that scale. It is clearly of much importance both in health terms - for example, how justified is the prescribing of stimulant drugs to reduce the appearance of the phenomenon in children thought to be seriously hyperactive? - and in educational terms, where it is often contended that the hyperactive child is a serious problem because he (less frequently she) disturbs other children in the class and cannot concentrate sufficiently to keep pace with the rest of the class.

The scale contains 14 items which have been described in the literature, specifically or in more general terms, as indicative of hyperactive behaviour. The items in question were the following:

Q. 3 Cannot concentrate on any particular task, even though the child may return to it frequently

Q. 9 Teases other children to excess

Q.16 Interferes with the activities of other children

Q.22 Is excitable, impulsive

Q.24 Shows restless or over-active behaviour

Q.25 Squirmy and fidgety

Q.26 Is easily distracted

Q.29 (Negatively scored) Pays attention to what is being explained in class

Q.36 (Negatively scored) Shows lethargic and listless behaviour

Q.38 Hums or makes other odd vocal noises at inappropriate times

Q.39 Given to rhythmic tapping or rhythmic kicking during class

Q.48 (Negatively scored) Child completes tasks which are started

Q.49 Request must be satisfied immediately - is easily frustrated

Q.51 Fails to finish things he starts

Items 9, 16, 22, 24, 25 and 38 are fairly similar to Conners' hyperactivity items, while items 24 and 25 are cited by Rutter as strong hyperactivity items.

The term hyperactivity is used very widely in the literature. It has been reported to be associated with minimal brain dysfunction, with learning difficulties, lead pollution, consumption of too much sugar and food additives, and with a variety of anti-social and disorganised behaviours. Only a very small selection from a vast number of articles on this topic will be referred to here.

Trites 1978 is typical of the massive and comprehensive reviews presented on the subject, discussing the origins, measurement and treatment of hyperactivity. Elsewhere, Trites 1979 reviews the reliability of the Conners Teacher Rating Scale. Among his findings he notes that fewer than half of a large sample of children who were identified by two teachers as hyperactive (above a defined cut-off point on the Conners scale) were identified as hyperactive a year later. However Trites also notes that children who scored at the cut-off point or above were likely to differ from their classmates in a number of ways, to be below average in achievement, not working to capacity, having a below average learning capacity and behaving much more poorly than their classmates. The author felt that the findings of his and other research supported the use of the Conners Teacher Rating Scale.

Conners himself, in a normative study (Goyette, Conners and Ulrich 1978) identifies seven teacher scale items in a varimax principle factor analysis (equivalent to rotated principal components) as contributing to a hyperactivity factor. He cites these as:

1. Restless in the "squirmy" sense
2. Makes inappropriate noises when he shouldn't
3. Demands must be met immediately
8. Disturbs other children
14. Restless, always up and on the go
15. Excitable, impulsive
16. Excessive demands for teacher's attention

The study was based on 570 children. The researchers also found that a hyperactive-impulsive factor (component) on a parent scale correlated 0.36 (equivalent to about 13 per cent of shared variance) with the hyperactive factor on the teacher scale. Age and sex effects were seen to be significant determinants of children's scores, but social class effects were non-significant.

In turn, Schachar, Rutter and Smith 1981 have presented an analysis of the data from the Isle of Wight sample which was assessed in the late 1960s. Over 70 per cent of the relevant age group on the island were in the sample. The team found that almost 10 per cent of over 1500 children scored three or more on the hyperactivity factor on the parent scale, while 8 per cent of the sample scored 3 or more on the teacher scale. However only 2.2 per cent of the sample, 3 children, were identified as hyperactive on both parent and teacher scales. These children were defined as pervasively hyperactive, while children who were only hyperactive in one or other situation were termed situationally hyperactive. The authors noted that children with pervasive hyperactivity also showed general behavioural disturbance, persistence of overall disorder and marked cognitive impairment, whereas these associations were not shown with the situationally hyperactive children.

At another level, that of health, Black 1982 reviewed the evidence on what she termed the hyperkinetic child. One examination of 110 drug treatment studies showed that three-quarters of children assessed as hyperkinetic improved when they were given stimulant drugs, while the remaining quarter did not change or became worse. The article also concluded that the prognosis for hyperkinetic children is poor in adolescence.

In contrast to these and many other supportive articles there have been some strong criticisms of the generally accepted criteria for identifying hyperactivity. Stewart et al 1980 undertook research to test the results of family studies which suggested that alcoholism, anti-social personality and hysteria are unusually prevalent among the adult relatives of hyperactive children. Their evidence, from a sample of 126 boys attending a child psychiatric clinic, showed that anti-social personality and alcoholism were common in the natural fathers of aggressive, anti-social boys, but no association was found between parental disorder and those children identified as hyperactive on the basis of a structured interview.

Sandberg, Wieselberg and Shaffer 1980 examined over 200 primary school boys where hyperactivity or conduct disturbance had been identified. The authors did not find it possible to distinguish clearly between the two syndromes when measured by teacher questionnaires. Parent questionnaires distinguished the two characteristics somewhat better. In general the authors doubted whether the characteristics had independent causal factors. Overall social disturbance in the boys' background was associated with both kinds of disturbance on the teacher measures, whereas it was possible to show a relation between mother's mental distress and both hyperactivity and conduct problems as measured by the parent questionnaire. On the other hand both teachers and parents largely identified separate children as disturbed. In contrast to the move by the American Psychiatric Association to change the diagnosis of hyperkinetic disorder into that of attention deficit disorder, the authors found little overlap between children scoring high on Conners' hyperactivity and inattention-passive factor scores.

The strongest criticism is presented by Shaffer and Greenhill 1979 who examine the literature and conclude that the lack of consistency in results weakens the validity or clinical usefulness of this diagnostic concept. Likewise the usefulness of the hyperactivity syndrome in predicitng response to drug or other treatment has yet to be demonstrated. The authors criticise in particular the non-specific nature of the syndrome, the lack of any clear antecedent influences, and the looseness of the common inclusion criteria of restlessness and inattention.

It is at this point that the preliminary evidence on the the components of the Child Behaviour Scale can be examined in relation to the syndrome under study. It should be noted that the principal components analysis has been carried out on a sample of nearly 9,000 children, all within a few months of their tenth birthday.

The most important finding is that many of the behaviours described as hyperactive by Conners and Rutter do not crystallise out into a separate hyperactivity component when a nine-component solution is used. In fact, several of the Conners items fit clearly into the Child Behaviour Scale's anti-social component, as judged by the grouping of items within this component on the full table 4.42.

Subject to the limitations of the choice of items and the statistical algorithm used to identify components, what remains of the hyperactivity syndrome in this analysis is a much simpler and more credible array of three items reflecting hyperkinesis; the child who hums and makes odd noises at inappropriate times, who kicks or taps against a desk or other object with an annoying rhythmic persistence, and whose face or body twitches beyond the customary

Table 4.42. Final Component Score Coefficients for rotated solution of 9 principal components of Child Behaviour Scale

Component 1 Anti-Social Behaviour	Component 2 Disorganised Activity	Component 3 Neuroticism/ Anxiety	Component 4 Clumsiness	Component 5 Poor Hand-Eye Co-ordination	Component 6 Hyper-kinesis	Component 7 Introversion/ Extraversion	Component 8 Behavioural Trauma	Component 9 Competent Dressing
Q. 5 Complains about things .131	Q. 1 Daydreaming .167	Q. 2 Afraid of new things .194	Q. 6 Trips easily or bumps into things .291	Q. 7 Deft with hands -.306	Q.38 Hums, odd noises .410	Q.22 Excitable, impulsive -.224	Q. 4 Wets pants .466	Q.15 Competent Dressing .724
Q. 8 Displays temper .163	Q. 3 Cannot concentrate .148	Q.19 Behaves nervously .220	Q.10 Clumsy in games .310	Q.27 Manipulates small objects easily -.308	Q.39 Rhythmic tapping .415	Q.33 Solitary child .350	Q.41 Soils pants .470	
Q. 9 Teases to excess .146	Q.12 Bored in class .145	Q.20 Fussy .162	Q.14 Difficulty kicking ball .320	Q.35 Uses scissors competently -.336	Q.45 Face or body twitches .361	Q.36 Lethargic, listless .197	Q.46 Truants .433	
Q.16 Interferes with others .109	Q.13 Perseveres -.163	Q.23 Worried, Anxious .269	Q.18 Difficulty picking up small objects .180	Q.40 Inadequate control pencil, brush .256		Q.44 Sullen and sulky .182		
Q.21 Changes mood quickly .134	Q.17 Confused with diffic. task .102	Q53* Anxious/ Unworried scale .244	Q.28 Drops things .196	Q.50 Holds writing instruments well -.313		Q.52 Extravert/ Introvert scale -.342		
Q.34 Quarrels with others .169	Q.26 Easily distracted .162		Q.42 Has classroom or play ground accidents .172					
Q.37 Destroys Belongings .084	Q.29 Pays attention -.158		Q.47 Fearful in movement .232					
Q.43 Bullies .162	Q.32 Forgetful with complex task .131							
Q.44 Sullen, sulky .158	Q.36 Lethargic, listless .101							
Q.49 Easily frustrated .088	Q.48* Completes tasks -.148							
	Q.51 Fails to finish tasks .156							

Items which do not feature strongly in any component score:

- Q.11 Cries easily
- Q.24 Restless, overactive
- Q.25 Squirmy, fidgety
- Q.30 Miserable, unhappy
- Q.31 Obsessional

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*Qs. 48 and 53 are possibly superfluous

N = 8836

Notes:
1. Table reports component score coefficients.
2. Item loadings of .40 or over are used originally to define a component.
3. Within any one component, items are chosen whose coefficient values are ≥ half the value of the highest coefficient in that component.
4. For missing item values, individual means substituted within each component. If all items absent, sample mean is inserted.

grimaces of the ten-year-old acting out in front of teachers or peers, can indeed be considered to suffer some degree of hyperkinesis.

Two items which might well have appeared in this component are restlessness and squirmy/fidgety. However both their loadings and component score coefficients are just below the levels set for inclusion within hyperkinesis. Again one is forced to accept that the statistical solution has shown up what is probably a looseness in the interpretation of terms such as restless, squirmy and fidgety. These terms can apply equally to the child who is bored or uninterested in school work - and as pointed out earlier, the two items concerned were in fact eliminated from anti-social behaviour because they failed to meet the criteria for inclusion in that component. Thus the long tradition of using 'restless' and 'squirmy, fidgety' as potent descriptors of hyperactive school children may need to be replaced by the more specific wording of those other items which have been taken up within the components defined in this exercise.

One needs to ask why there should be such a disparity between the solutions offered by Conners and Rutter, and that presented here on the new scale.

It is true that three of the components derived from the new scale have only arisen because of the fair number of clumsiness and fine-motor coordination items put into this scale. (As already reported, competent dressing crystallised out into an additional component.)

It may well be that the remaining six components in the Child Behaviour Scale offer sufficient 'breadth' for the statistical process to clarify their separate relationships within these components rather than forcing them to become uneasy bedfellows in the more limited types of solutions which have been consistently presented by Rutter and Conners. As with any statistical technique when solutions are 'forced' into narrow confines, the results are likely to prove more confusing than helpful to the analyst.

The existence of six components within the Child Behaviour Scale, in addition to the three already cited, has thus enabled the clear separation of anti-social items from disorganised behaviour items, in the first two components; the third component has a fairly clear existence as a neurotic-anxiety component, although Eysenck has objected to coupling the two characteristics. The remaining three components derived from the Child Behaviour Scale are an interesting Introversion/Extraversion component, a small but persistent behavioural trauma component - including the very special distress indicated by a truanting ten-year-old, as compared with an alienated teenage truant - and finally a clearly identifiable hyperkinesis component in which humming and other inappropriate noises, rhythmic tapping and kicking, and twitches and other mannerisms appears to identify a distinct and possibly clinically definable hyperkinetic behaviour, leaving both anti-social and disorganised behaviour as components in their own right.

As pointed out earlier, two of the hyperactive behaviours identified by both Rutter and Conners, restless and over-active, and squirmy and fidgety, each failed to appear at an acceptable level within the hyperkinesis component of the Child Behaviour Scale, although loading moderately on that component. The overlapping and loose definitions of these two behaviours probably make them unsuitable for specifying any distinct behavioural abnormality.

While the evidence presented here does not imply the rejection of the whole corpus of theory in regard to hyperactivity, it does appear as though much of what is termed hyperactive behaviour is simply a situational response or the outcome of a long process of learned behaviour in environments which only prove interesitng when they react to excessive or unexpected behaviours on the part of the child. It could well be argued that the 'uncontrollable' behaviours with which some children arrive for their first school day are in fact behaviours developed over years of poor and inappropriate stimulation in the homes.

4.44 Conclusions

It is worth taking a brief look at the two solutions closest to that of a 9 component model. With an 8 component solution, competent dressing disappears as a separate component and becomes part of the fine motor (hand-eye coordination) component. In other ways the solution does not differ much from that of 9 components. While it would have been reasonable to rely on the smaller solution, following the parsimonious principles of Occam's Razor, the fact that competent dressing becomes increasingly strong and isolated in larger solutions does point to its separate identity, apart from the reasons discussed earlier.

The possibility of using a 10 component solution was considered seriously. Again most of the loadings remain much the same, but the added component comprises and is defined by the two 'accident proneness' items, namely trips and bumps, and playground accidents, both of which were previously part of clumsiness. There may be good grounds for a 10-component solution when notor control disabilities are being examined in depth. In the present analysis, however, it seemed reasonable to limit the behavioural model to 9 components.

Of the 53 items in this scale, the principal components analysis described here indicate that five items already referred to have not justified their inclusion in the scale, when measured against the performance of the remaining 48 items within the nine-component solution. If these items cannot contribute meaninfully to a solution as sensitive as nine components, there may well be reason for omitting them from future versions of this scale. One further item, Q.53, the assessment on the continuum of anxiety/unworried, may possibly be omitted as superfluous since it overlaps the highly similar item Q.23; the same applies to Q.48, where the wording is not sufficiently different from Q.51 to justify its separate inclusion. This would leave a scale consisting of 46 items.

If the conclusions set out in this section are supported in further examination of the Child Behaviour Scale data drawn from the final sample of over 13,000 10-year-olds, there are some educational implications.

Firstly, anti-social behaviour needs to be recognised for its clearly defined manifestations in the first component of this scale. Whatever the environmental or other causes of the anti-social behaviour pattern, it must now seem far-fetched to ascribe any considerable part of it to a theoretical hyperactivity syndrome which requires drugs or other heroic medical intervention to block it.

Secondly, if disorganised behaviour can be recognised for what it is, rather than as a manifestation of hyperactivity, it may be possible to undertake more research into what is possibly the most serious of all learning problems, namely the child who because of early upbringing or because of the interaction between temperament and parent environment is unable to benefit more than minimally from school, and who in consequence becomes increasingly alienated from the learning process, with a concomitant increase in disorganised and inappropriate behaviour.

What remains of the concept of hyperactivity may well be the minimal one presented in this analysis, as something of limited but clearly defined importance, and to that extent requiring particular treatment. Further study of the CHES data on this issue can be undertaken once it is possible to compare the teachers' and parent scores of child behaviour and to link this to a special analysis of all the data from the samll sample of hyperkinetic children defined by the Child Behaviour Scale. Such children may show some resemblance to the sample defined by Schachar, Rutter and Smith (ibid) as 'pervasively hyperactive', a minority of perhaps 2 per cent of all children who may well need specialised treatment for their behavioural difficulties.

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5.0 Future Work

This First Report has been an initial exploration of the wide range of information collected on the educational characteristics of the 10 year old children in the Child Health and Education Study.

Descriptive data has been presented for children with speech and language problems and preliminary studies have been made of children with reading and mathematics difficulties and children with behaviour problems. It has been shown, for example, that the number of underachievers in the study, predicted on the basis of statistical regression techniques, exceeds prediction.

Using the First Report sample of 8,836 children, models have been constructed to assess how the characteristics of children and their educational environment influence attainment at the age of 10 in reading and mathematics.

Future work should expand the terms of reference of these models to include factors in the medical histories of the children and their families, such as longstanding illness of a child or parent, or parental difficulty in learning to read, as well as the many home and family variables such as parental education, age of parents, the interest parents say they take in the child's education, parental aspirations for their children's future, the size of the family and parental occupation. Consideration of such variables is important as they may diminish or modify the influence of the characteristics of the school environment in relation to attainment.

Further work should also be concerned with groups of children likely to have particular educational needs. To this end the identification of under achievers in reading and mathematics will be repeated on the full national sample of thirteen thousand children. The total number of children on whom educational information has been collected, including children who completed the special educational assessment for lower achievers, was 13,091.

Considering the length of testing involved for each child this represents a remarkable achievement by the primary school teachers of this country.

Attention will be focussed particularly on children with reading difficulties, be they backward readers, or underachievers. The under achievers will be examined in relation to the characteristics attributed to specific developmental dyslexia.

Since language development is so crucial to reading attainment, the study children found to have speech and language difficulties will be investigated in much greater depth. The health data has much more information to contribute to investigations with these children.

The extensive descriptions of children's behaviour difficulties from the health data are being classified and should be used in combination with the information from the behaviour scales in the health and educational studies to investigate the range of behaviour problems reported in the cohort. The special provisions made for children with severe behaviour difficulties and their educational attainment will also be examined.

Extensive work has already been carried out on children with epilepsy from the data collected nationally when they were five years old. This will be extended to the 10 year study. Further study of children identified as having hearing difficulties from the sweep audiometry used on the entire cohort and of children with vision difficulties using the comprehensive vision screening carried out in the 10 year follow-up is also planned.

The children with physical disabilities form another important group of children with special educational needs. Using information from the health and the educational sides of the study it will be possible to examine the use made by these children of health, educational and specialist services and the relationship between the use made of these services and the children's educational attainment.

Future work will also develop models of the influence of the educational, familial and personal characteristics of the child on attainment. These models will be applied separately to each of the groups of children with special educational needs, to see which characteristics are of crucial importance for particular groups of children, and whether some school or home characteristics are important for children with one special educational need, while other characteristics may only be relevant for children with other special needs. Such findings may have considerable value in the provision of certain services for these children.

There is clearly a great deal of policy-related information which has yet to be assessed from the unusually comprehensive data gathered in the 10 year follow-up of the Child Health and Education Study. The foregoing paragraphs have set out the principal themes of investigation currently planned for the immediate future.

Butler, N.R., Haslum, M.N., Barker, W. and Morris, A.C. (1982) ***Child Health and Education Study. First Report to the Department of Education and Science on the 10-Year Follow-up.*** **Department of Child Health, University of Bristol.**

Introduction

A1.1 This *Report* is being included as an Appendix to the documentation specially prepared to accompany the deposited with Data Archive of data for the BCS70 Ten-year Foloow-up for the following reasons:

(a) *Sections 1 and 2* of this *Report* present a more detailed account of the planning, piloting and fieldwork associated with both the Educational and Health Packs. In particular, the coding and editing of the social, medical and educational information is described on pages 1-67 in more detail than in Section 1 of the main document.

(b) *Sections 3 and 4* are included to illustrate some of the potentially valuable uses of the educational data. However, it should be stressed that this report was written at a time when data were only available for 8,826 Educational Packs. No analysis based on data from the Health Pack is reported.

Section 3 deals with difficulties in speech, and language expression and comprehension (pages 76-112); reading and mathematics difficulties (pages 113-131); and specfic learning problems (pages 132-164).

Section 4 (pages 165-244) demonstrates how the extensive data in the Educational Pack can be used for modelling various effects on the study childs reading and mathematical performance. These effects include: the schools academic focus and philosophy; its social and educational intake; the classroom ethos; the schools use of incentives; the parents' interest in the study child's education; the child's verbal/non-verbal cognitive performance; the child's motivational level, as evidenced by results of locus of control and self-esteem scales; and the child's behavioural patterns, oncentration and perserverence, language comprehension and expression. Section 4 ends by describing a 52-item Child Behaviour Scale which was specially assembled for completion in the Educational Questionnaire by the childs Class Teacher. Analysis identified nine behavioural dimensions: antisocial behaviour; disorganised activity; neuroticism/anxiety; clumsiness; poor hand-eye co-ordination; hyperkenesis; introversion/extroversion; behavioural trauma; and competent dressing.

Corrigenda

A1.2 There are a small number of errors in the report:

(a) Page 8, line 4: the figure 15,000 is incorrect and should be ignored.

(b) Page 24, last sentence: this is incomplete. The following should be added '...The social level of the school neighnourhood and the closeness to major traffic arteries and thus to sources of pollution were also the subject of enquiry...'.

(c) Page 32: the returns quoted for the Medical Examination Form, Parental Interview Form and the Maternal Self-completion Questionnaire are provisonal.

(d) Page 39, line 9: the figure of 16,015 children in the birth survey refers to provisional figures for those surviving to the end of the first week of life in England, Scotland and Wales.

(e) Page 59, paragraphs 1 and 2: these are misplaced. They belong at the bottom of page 55.

(f) Missing data labels: where quoted, are different to those included on the BCS70 10-year data deposited with the Data Archive.

NB: Page numbers shown in the remainder of Appendix 1 are those of the original documents.

APPENDIX 2

Summary of Information Collected at Birth, 5, 10, 16 and 26 years

BCS70: Summary of Information Collected at Birth, 5, 10, 16 and 26 years.

A2.1 This Appendix provides a brief summary of the wide range of information that has been collected from and about BCS70 cohort members during the birth survey and subsequent follow-ups.

British Birth Survey: 1970

Parents

Father's occupation
Mother's occupation
Marital status
Child care
Mother's smoking during pregnancy
Contraception
Antenatal care

Medical

Abnormalities during pregnancy
Length & abnormalities of labour
Analgesia & Anaesthesia
Sex, weight, progress, management & outcome of infant
Obstetric history

1970 British Cohort Study, First Follow-up (Child Health and Education Study): 1975

Parents

Social and family background
Environmental background
Assessment of the child's behaviour

Medical

Height and head circumference
Use of health services
Screening and assessment procedure
High risk factors

Subject

Human figure drawing test
Copying designs test
English picture vocabulary test
Schonell graded reading test
Complete-a-profile test

1970 British Cohort Study, Second Follow-up (Child Health and Education Study): 1980

Parents

Medical history
Accidents
Use of health services
Father's occupation
Mother's occupation
Type of accommodation
Parent's level of education
household amenities
Neighbourhood
Hospital admissions
Clinic attendance
The child at school
Child's skills
Child's behaviour: Maudsley Parental Behaviour Inventory
Mother's health: Cornell Health Inventory

Medical

Medical examination
Disability and chronic illness
Height and weight
Head circumference
Blood pressure
Pulse
Near and distant vision
Audiometry
Laterality
Co-ordination

School

School composition
Curriculum
Discipline and ethos
Teacher's assessment of child's ability
Maudsley Behaviour Inventory
Conners Hyperactivity Scale

Subject

Academic success
Smoking
Attitudes to school
Food and drink consumed
Caraloc scale (ability to 'control' destiny)
Lawseq Self-esteem scale
Eysenck Personality Inventory
English Picture Vocabulary Test
Writing, copying and spelling tests
Social judgement scale
British ability scales
Mathematics test
Shortened Edinburgh Reading Test

1970 British Cohort Study, Third Follow-up (YOUTHSCAN): 1986

Parents

Health status
Family health
Chronic illness and disability
Medication
Accidents and injuries
Use of health services
Social experience
Father's occupation
Mother's occupation
Parental situation
Family finances
Household amenities
Accommodation type
Number of rooms
Neighbourhood
Alcohol consumption
Smoking
Performance at school
Life skills
Behaviour

Medical

Special requirements
Chronic illness and disability
Psychological/psychiatric problems
Medical examination
Blood pressure
Distant and near vision tests
Motor co-ordination tests
Audiometry
Height and weight
Head circumference

School

Curriculum
Teaching methods
Special education
Teacher's assessment of behaviour
Academic achievement
Academic potential
Absences from school

Subject

Exercise and sporting activities
Hygiene
Diet (including a four day diary)
Diary of all activities over four days
Leisure activities
Family life
Religion
Leaving home
Money
Smoking
Alcohol
Laterality
Television, video and radio
Friends and social behaviour
Law and order
Sexual behaviour
Self-esteem
Health status
Medical history
Attitudes to health and emotions
Drug use
School
Occupational interests
Reading, spelling and vocabulary tests
Mathematics tests
Life-skills test (education, training and employment)

1970 British Cohort Study, Fourth Follow-up (BCS70): 1996

Subject

Views on:
- politics
- sex equality
- law and order
- traditional marital values
- work
- standard of living
- life satisfaction
- feels in control of life

Training, qualifications, skills:
- date left school
- date left full-time education
- nature and number of training courses
- nature and number of academic and vocational qualifications gained
- self-perceived skills

Employment history:
- number of jobs
- number of periods unemployed
- length of longest period of unemployment
- number/nature of periods out of the labour force
- current economic status
- details of any current job:
  - year job started
  - job title
  - work done
  - nature of employers business
  - number of employees
  - number supervised
  - average weekly hours
  - usual take home pay

Relationships marriage and children:
- current relationships
- marital status
- date of (most recent) marriage
- when started living with any partner
- economic status of spouse/partner
- has spouse/partner children from a previous relationship
- number of children
- current spouse/partner the other parent of some/all children
- do all children live with CM
- household composition
- year began living at current address
- tenure
- number of rooms in accommodation

Health:
- self-assessment of general health
- self-reported height
- self-reported weight
- experience of c20 medical conditions/symptoms since 16
- eyesight problems
- details of accidents/injuries/assaults since 16
- disability
- drinking and smoking habits
- Malaise Inventory - depression

Other:
- voting intentions
- religious affiliation

APPENDIX 3

Publications and Reports.

BOOKS AND MONOGRAPHS

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APPENDIX 4

Coding of Accident Aetiology

Coding of Accident Aetiology

Introduction

A4.1 Existing coding frames had the disadvantage that only one aetiological factor was permitted per accident. If, for example a child on a bicycle collided with a car, the accident had to be classified as a road traffic accident and the bicycle would be lost as an aetiological factor. This would have 'wasted' information gathered in the ***Parental Interview Form*** (see question B18 in the annotated questionnaire in ***Section 4*** above).

A4.2 To avoid such waste, an *ad hoc* coding system was designed. The actual accident codes were assembled from a list of accidents taken from the first 1,000 ***Health Packs***. In this system up to six aetiological categories could be allocated to any one accident, as indicated below.

Accidents and What happened?- variables

Information was gathered on a maximum of four accidents, and a maximum of six aetiological ('What happened?') codes were allocated to each. The variables are:

Accident	*What happened?-variables*
1	B18.10 B18.11 B18.12 B18.13 B18.14 B18.15
2	B18.24 B18.25 B18.26 B18.27 B18.28 B18.29
3	B18.38 B18.39 B18.40 B18.41 B18.42 B18.43
4	B18.52 B18.53 B18.54 B18.55 B18.56 B18.57

Coding frame

There are five aspects of an episode involving injury which may be identified:

		Codes:
1.	Persons involved	0 - 7
2.	Motivation	8
3.	Agent	9-51
4.	Mechanism	61-70
5.	Activity	74-98

Coding is as follows:

Persons involved

1 Self
2 Parent
3 Sib
4 Other adult
5 Other child
6 Other person implied
7 Person n.o.s.

Motivation

8 Intentional/self inflicted not accidental

Agent

9 Agent n.o.s. or implied
10 Inanimate object:n.o.s. or unable to classify
11 Inanimate object: blunt
12 Inanimate object: sharp
13 Firearm
14 Knife
15 Dart or arrow
16 Broken Glass
17 Ice skates
18 Skate Board
19 Roller Skates
20 Other non motorised vehicle
21 Household
22 Toy/game/recreational machine/sports equip
23 Play park/ground:equipment n.o.s
24 Play park/ground:roundabout
25 Play park/ground:swings
26 Play park/ground:see saw
27 Play park/ground:slides
28 Play park/ground:climbing frame/monkey bars
29 Play park/ground:rocking horse/hobby horse
30 Play park/ground:others
31 Animal n.o.s.
32 Domestic pet
33 Other domestic animal
34 Wild animal
35 Other animal
36 Insect
37 Liquid n.o.s.
38 Liquid Water
39 Liquid Other
40 Fire
41 Fire purposefully lit & in control
42 Fire accidentally lit & out of control
43 Fireworks
44 Heat
45 Cold
46 Electricity
47 Therapeutic agents
48 Chemical agent
49 Other agent
50 Agent not classifiable
51 Glass which breaks during the accident

Mechanism

61 Fall n.o.s.
62 Falling downwards
63 Falling on level ground
64 Injury involing motion of part of the body only
65 Trapping injury
66 Attacked/fell on/dropped on/hit with/bitten/kicked

67 Spillage
68 Ingestion
69 Mechanism other or unclassifiable
70 Mechanism unspecified

Activity
74 Pedestrian n.o.s.
75 Pedestrian and cycle
76 Pedestrian and motorbike
77 Pedestrian and car
78 Pedestrian and other
79 Cyclist n.o.s.
80 Cyclist in collision
81 Cyclist and pedestrian
82 Cyclist and cycle
83 Cyclist and car
84 Cyclist and other vehicle
85 Passenger on cycle
86 Driver of moped/motor bike
87 Passenger on motor bike
88 Driver of car
89 Passenger on/in car
90 Driver of other vehicle
91 Passenger of other vehicle
92 RTA n.o.s.
93 Vehicular accident unclassifiable
94 Vehicular accident other
97 Road accident unclassifiable
98 Other accident unclassifiable

99 Non specified, illegible or no info