2.25 TECHNICAL NOTE : The uni-directionality of the scales

The rationale for the use of uni-directional items in the CHES Developmental Scale and in the Lawseq and Caraloc (motivational) questionnaires can be described in the following terms.

Research on sets of attitudinal items whose answers require the choice of one or other pole, or an intermediate alternative, has shown that an undesirable 'halo effect' can arise if the trend of the items is such that every answer at one pole would offer an unproven 'validation' of every other answer at the same pole. While the multi-behavioural Developmental Scale is not an attitudinal instrument, and the two motivational questionnaires deal with the child's beliefs or impressions - which are only marginally attitudinal - it is important to examine the reason why the uni-directional nature of the instruments has been allowed to remain largely unchanged.

(a) The original validated scales from which a number of items were selected for the final Developmental Scale were themselves uni-directional (see for example the various Rutter and Conners scales).

(b) Attempts to alter the wording of some of the items so as to evoke answers (on the relevant issue) in a direction counter to the general 'trend' of a particular behavioural description, resulted in ungainly and confusing wording. For example, it seemed reasonable to ask whether a child tends to drop things which are being carried - either a 'great deal', 'not at all', or somethere in between. On the other hand it required awkward wording to ask whether a child does not drop things which are being carried, while it proved almost impossible to create adequate poles for the answer to that question.

(c) In general the developmental scale items tend to ask whether the child deviates from the normal, the normal being the pole 'not at all', while the pole 'a great deal' refers to a deviant, maladaptive or even a praiseworthy behaviour. In these circumstances it was expected - and confirmed in pilot trials - that teachers tend to score non-normal behaviours at or close to the 'not at all' pole, using other points on the scale to indicate some degree of a particular abnormal behaviour There was little evidence of halo effects in the scales completed by teachers at a number of pilot schools.

(d) The possibility of switching the poles themselves was considered, but this would have hampered the efficient completion of the questionnaires

A teacher who knew that one pole represented the item 'not at all' in each item would find it easy to adjust her judgement of where to mark any particular item. If the poles of some items were randomly reversed this would have made the task of completion more confusing. This argument is even more pertinent in the case of children completing the Lawseq and Caraloc questionnaires.

(e) The two motivational questionnaires originally contained a number of positively worded items on the same themes as those dealt with by the negatively worded items. The item analysis and the validation of the individual items against both reading and mathematics criteria (in large scale pilot studies on the original instruments) showed that most of the negatively worded items made a reasonable contribution to the variance of academic test scores, while none of the positively worded items made any significant contribution to variance within the multiple regression model in which these contributions were assessed. (A small number of distractor items, where the polarities of the 'expected answers' to easy items were in opposing directions, were however interspersed among the motivational items to make up the final versions of these two questionnaires).

For the above reasons it was felt that the questionnaires could with some confidence be left in the form in which they now appear.

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2.30 Design and Piloting of Health Survey Material

Early in 1979 we started to design the questions for the survey forms. The first pilot study using health forms was carried out by the Cheshire and Gloucestershire Area Health Authorities in June 1979 and a second pilot study was carried out by the Lancashire, Derbyshire and Devon Area Health Authorities in September 1979. Ten year old children not born during the study week, 5th to 11th April, 1970, were medically examined, their parents were interviewed and the mothers completed a form about their children's skills, behaviour and their own health. The final versions of the forms were subsequently vetted by and copies lodged with the Survey Control Unit at the Cabinet Office.

The pilot studies examined not only responses difficulties with the questions and the forms but also the response medium itself. We were keen to use a very fast form of data processing, Optical Mark Reading, which involves the rapid scanning of horizontal pencil marks in 5 mm lozenges. The forms are printed in non-carbon containing ink, the scanner responds to the carbon in the pencil marks. This method of data processing was adopted for forms filled in by teachers in the educational side of the study but we could not adopt it for the health side as the examining medical officers in the pilot studies ticked the lozenges, crossed them out, and wrote in ink or biro but not in pencil. We therefore adopted a more conventional data input system.

2.40 Fieldwork

2.41 Dispatch of the Survey Material

Packaging and dispatch of the material was carried out by Remploy, a firm established for the re-employment of disabled people, who offered the most competitive service with the most safeguards.

Remploy workers labelled all polythene envelopes and packed 6 inserts into each of 16,500 envelopes for the health survey and 9 inserts into another 16,500 for the educational part of the survey. Remploy packed and despatched over 15 tons of survey material in less than three weeks. A special service contract was taken up with the GPO to use their direct bag service for delivery of the material which was fully insured in transit. A reply-paid postcard was also inserted to be sent to us on receipt of the survey material by the Study Co-ordinator. This allowed us to see whether in fact all the material had reached its proper destination. A few early problems were encountered by Local Education Authorities being quicker sending the survey material out to schools than the Area Health Authorities in recontacting the parents. A few children were tested before health visitors had the chance to explain about the study in detail to their parents.

2.42 Return of the Survey Material

The first Health Study packs were returned to CHES in May 1980 and by July 2,500 were received back in contrast to approximately 8,000 educational packs. This apparently slow rate of return from the health side of the study was attributable to three main difficulties. First the actual study took time to carry out. An appointment had to be kept by the parent at the school or a clinic for the child's Medical Examination. Often another appointment had to be kept between the health visitor and the parent for the Parental Interview and the mother had to complete and return the Self-Completion Form. These three forms had then to be collected and checked at the Area Health Authority before returning to CHES.

In spite of requests not to hoard study packs, a large number of Educatic and Area Health Authorities were still holding on to the completed forms hoping to return them all in one batch. Many were concerned about the cost of postage for the return of the packs. Letters were sent to every Area Health Authority asking for the return of the packs as we were ready to start coding the medical data. This produced an avalanche of post in the CHES office. At that time seven Area Health Authorities had not yet started the study in their areas. We knew of a few authorities who had opted to carry out thē medicals and interviews during the summer holiday but the recent letter which was sent from CHES to the authorities brought responses from authorities suffering such severe staff shortages that they had not yet been able to start the Study. All these authorities were contacted by telephone and the state of the Study discussed with them. Similar approaches were made to the Education Author

2.43 Logging in and Identifying completed Survey Forms

Completed survey forms were returned to CHES by the health and education authority study co-ordinators. The forms were logged in by checking the name of the child on the front of each form against the alphabetical index and stamping the entry in the index with the data of the arrival of a set of forms. The appropriate Central Survey Number and its associated check digit were entered on each form together with a singleton/twin code, a health district code and a Local Education Authority code.

The health forms were allocated the health district and Local Education Authority codes appropriate to the address at which the child was resident at the time of the Parental Interview. The educational forms for the same child was allocated the health district and Local Education Authority codes appropriate to the address at which the child was resident when the teacher completed the Educational Questionnaire. It is possible therefore that for some children health district and Local Education Authority codes will not correspond across the health and educational parts of the study. If we wish to examine the regional distributions of reading difficulty therefore we shall use health district codes allocated to the educational data, but if we want to examine the regional distributions of hearing difficulty we shall use health district codes allocated to the health data.

All sets of forms were checked to make sure that the child's name was spelt the same on each form and the Central Survey Number, check digit and singleton/twin codes corresponded. The manual alphabetical index was updated with the child's most recent address.

Each Parental Interview Form was examined at the logging in stage for children who were not living with both their natural parents. The forms for these children were marked and set aside for careful coding of the relationship of the male and female heads of the household to the study child.

The problems encountered in the logging-in and identification process centred mainly on children who had changed their surnames since the birth or 5 year study. In anticipation of this problem we had included questions in the Parental Interview Form which asked if the child had the same surname at birth and when he or she was five years old. We also asked for the child's home address at the time of birth, at the age of five years. This additional information permitted us to check both our five year and our birth information in our efforts to identify the Central Survey Number allocated when the child took part in the birth survey. Children who could not be identified as having taken part in the Child Health and Education Study previously were allocated new Central Survey Numbers.

The completed sets of survey forms were also logged into the Area Health Authority and Local Education Authority lists. This permitted us to know at any time which sets of forms were outstanding in each

Authority. Refusals were also logged into these lists as were partially completed sets of forms. This permitted us to carry out exercises later to make sure all possible medical examinations had been completed.

2.44 Assessing the Survey Returns

The returns for the health side of the study are very high; 13,823 children have taken part, Medical Examination Forms have been returned for 13,760 and audiogram forms for 13,627; Maternal Self-Completion Forms have been received for 13,709 children.

We shall not know the total number of children who have taken part in the study until we match and link the health and educational data. We believe it is in excess of 14,000 children.

In order to make an estimate of the non-response rate we have compared the reasons for non-response in a ten percent sample of children with surnames in the first half of the alphabet with a ten percent sample of children with surnames in the second half of the alphabet. The children in the First Report sample have surnames mainly beginning A to G.

There was no difference in the reasons for non-response given between the two groups of children, Table 2.3 lines i and iii, and lines ii and iv. The overall parental refusal rate was 6.1 percent for the Health Study and 4.9 percent for the Education Study. This is attributable to the fact that some Local Education Authorities sent the educational test material out very quickly and some children received their lengthy educational testing before contact had been made by the Area Health Authority and the parents interviewed by a health visitor. Some of the parents of these children wrote to us and withdrew their children from the study before the health part of the study had been carried out.

We lost 2.7 percent of the children from the education study because their teachers or head teachers refused to co-operate with the study. We knew that we were asking for their help at a time of severe staff shortages and received much correspondence about this. We are in fact gratified that the children lost to the educational study through teacher refusal was so low.

Table 2.3

Reasons for non-response

	Parental refusal	Parental absolute refusal - no further contact to be made	Area Health Authority refusal	Teacher refusal	Emigrated	Died	Packs lost in the post
1st half of alphabet							
i Health Study	3.7%	2.7%	-	-	1.0%	-	0.7%
ii Education Study	3.0%	2.0%	-	3.0%	0.7%	-	-
2nd half of alphabet							
iii Health Study	3.3%	2.5%	0.2%	-	0.6%	0.1%	0.1%
iv Education Study	2.5%	2.3%	-	2.4%	0.6%	0.1%	0.1%

Packs were lost for a number of reasons, the main one being that they disappeared in the post, in one case the headmaster's study burned down and our study pack went with it.

The figures in Table 2.3 cannot be used to estimate the overall success rate of the survey. We tried to trace any child currently resident in England, Scotland and Wales who had been born during 5th to 11th April, 1970. We shall obviously have picked up children who were born between these dates who were not born in this country. The birth survey covered 16,015 children and this was believed to represent 98% of live births during that period. This time we have picked up children who did not take part in the 5 year study and we have some evidence that we may have picked up children who did not take part in the birth survey. In order to complete the survey accounts properly we first need to know the total number of children who have taken part and this is dependent on linking the data sets. We then have to check the emigrants and identify the immigrants and make allowance for the children who have died or been adopted and changed their surnames since the birth survey. Only then will we be in a position to see how the number of children with reasons for refusal fits in with the number of children who have taken part in the survey.

2.45 <u>The York Screen to identify children for the York Study</u>

The aim of the York study, carried out by our colleagues at the Social Policy Research Unit at the University of York was to investigate the knowledge and use of services of the families of handicapped children.

In order to make the York study possible, handicapped children had first to be identified from the information collected during the national survey. The purpose of the screening procedure was to identify from the children in the cohort any child who was suffering from a longstanding illness of impairment which was likely to result in some interference with their daily life at home or at school.

It had been hoped originally to provide a computer screen of the health study data to identify these children but it quickly became clear that this would impose impossible delays in the York timetable.

Two clerical assistants directed by York but working at Bristol examined manually every health form which was returned for children with potentially handicapping conditions. The criteria they used for this identifications process were agreed with York and the DHSS and are set out in the York Report.[4] They are summarised here:

i Asthma: Any child suffering from asthma who had been off school for more than one week in the past year for asthma alone, or for more than a month for asthma and some other condition.

ii Epilepsy: Any child who had had one episode of unconsciousness since the age of five due to epilepsy or to febrile convulsions, or any child who had had two or more symptomatic convulsions since the age of five.

iii Enuresis: Any child wetting in the daytime most of the week or always, or any child wetting the bed always.

iv Encopresis: Any child soiling most of the week or always.

v Partial sight/blindness:

(a) Distant vision: All children who scored 6/36 or worse on the Snellen test with their better eye (uncorrected) were included except where their corrected vision (ie. wearing glasses or contact lenses) was 6/12 or better in their better eye.

(b) Near vision: All children who scored 24 on the Sheridan-Gardiner test with their better eye (uncorrected), except where their corrected vision was 9 or better in their better eye.

Some of the children who normally wore glasses or contact lenses did not have them available at the time of the screen for this study. For this reason relatively stringent criteria were adopted for uncorrected vision. If children with such poor uncorrected visual acuity had their glasses or contact lenses available and their corrected vision was good they were excluded.

vi Poor hearing/deafness: All children who had 35 db or more hearing loss at at least two frequencies in their better ear.

vii Cardiovascular abnormalities: The general criterion for inclusion was that these should be such as to limit to exercise tolerance of the children. Effectively this meant cyanotic congenital heart disease, congestive cardiac failure and pulmonary hypertension. Asymptomatic or corrected congenital heart disease was not cause for inclusion in the study.

viii Musculoskeletal disorders: All children with marked limb deformities, chronic arthopathies and muscular dystrophies.

xi Neurological abnormalities: These included cerebral palsies, spina bifida, hydrocephalus, microcephalus and paraplegias.

x Cancers: All children who had had a malignant neoplasm and were still under treatment or still under observation because of the likelihood of a relapse.

xi Educational difficulties: Any children ascertained on Form SE2 or 4HP as requiring special education for intellectual or emotional reasons (regardless of the type of school they attended).

xii School absence: Any children who had missed more than three months of school in the past year for any medical reason.

xiii Speech difficulties: All children whose speech was assessed as containing 'many unintelligible words' in a particular test. Children who stammered or stuttered moderately or severely were also included.

xiv Facial disfigurement: All children with disfiguring facial conditions were included.

xv Other specific conditions: These were diabetes, coeliac disease and cystic fibrosis.

Most of these criteria for inclusion in the sample for this study were clinical based on medically diagnosed conditions (asthma, epilepsy, etc). Of the remainder one (ascertainment for special educational treatment by the Local Education Authority) was a purely administrative categorisation and three (enuresis, encopresis and loss of schooling) were behavioural or factual criteria.

From Interim Report, DHSS, 108, 16, 82, K.C., Pages 11-13

The clerical assistants examined forms ahead of our medical and social coders. They noted the children who appeared to fulfil the 'York criteria' and these were subsequently vetted by the Medical Research Officer or the CHES Director, Prof Butler. Some difficulty was experienced in Bristol in deciding which of the potentially handicapped children should be sent to York even after the 'York criteria' were followed.

It was agreed by Bristol and York that York interviewers should not carry out their knowledge and use of service interviews with families who were unlikely to think the study child had anything wrong with him/her. Whilst the children were selected on the 'York criteria' they were sent to York at the discretion of the Director. The details of children sent to York included the children's names and addresses, medical diagnoses and any social information of which it was thought the interviewer should be forewarned. It is likely that the major morbidity groups we have derived to describe children with current impairments in this report will not tally with children covered by the York research. This does not imply that either study has incomplete data but rather that the approach used to screen the children for the York interviews is not the approach used to analyse the data for this report. The York screen, of necessity, was based on a medical model of handicap where the diagnosis was used to infer the severity of the accompanying handicap. We, at Bristol, are concerned with identifying children with current impairments and using the data we have collected in the survey to describe the accompanying disability and handicap to examine how disablement is affected by family and social influences.

2.46 The 'Screen' for the Special Pack Children

One of the particular concerns of the educational side of the 10 year study has been to gather information on educational attainment for children who were unlikely to be able to complete the attainment tests of the national follow-up study. Teachers were given the option of electing to ask for a special pack of easier tests for any child for whom they considered our standard testing too hard.

The criteria for selecting children for the receipt of special packs also included children with scores in the bottom 5 percent on the reading or the maths test of the standard educational tests and all children receiving special educational treatment.

The special pack testing took place between February and July, 1981, Directors of Local Education Authorities and Principal Educational Psychologists and Local Education Authority Study

Co-ordinators were informed that the special pack testing was taking place. Packs were dispatched directly to the schools accompanied by a reply paid gusset envelope and were returned directly to CHES.

Each special pack contained the standard educational test material and teachers were asked to try this with the children as we needed to know where the children fitted in to the low end distributions of the standard pack test scores at the time the special pack tests were carried out.

The special packs also contained the Thackray Reading Readiness Profile[(5)] of which the visual discrimination and auditory discrimination tests were used, and the Young Maths Test,[(6)] a special test booklet combined tests of conservation, matching classification, seriation, and was accompanied by balls of plasticine, red and blue plastic counters and small strips of cardboard of varying lengths. It also contained the Human Figure Drawing test[(7)] and a copying designs test which had been completed by all the children in the 5 year follow-up. A Special Teacher Questionnaire contained check lists on the children's vision, hearing, dexterity and discrimination.

It was hoped in this way to collect some educational attainment information on every child in the survey no matter how severe their educational difficulties appeared to be. The questionnaire also asked teachers to describe the study child and contained questions on the provision of remedial services.

The special pack information has been data processed and part of the data has been edited. The analysis of this information will form a part of future work on the 10 year follow-up.

2.50 Coding the Forms

The method of data processing used for the health survey forms involved keying information directly from the forms to magnetic tape. Before this operation was carried out we imposed careful and stringent checking procedures on the raw data, medically coded all diagnoses, drugs and accidents and allocated Occupation

Unit Group codes to mothers' and fathers' employment using the OPCS Classification of Occupations.[8] The checking and coding of the health forms was divided between medical and social coders. Medical coders examined all the health information in the Medical Examination Form (MEF) and the Parental Interview Form (PIF). Social coders checked all other information in the PIF and the Maternal Self-Completion Form (MScF).

2.51 Medical Coding

The medical coding was developed and supervised by the Study Medical Research Officer. From June to September, 1980, the diagnosis, operation and accident coding systems were developed and the editing instructions designed. The first medical coders were trained from September to November, 1980, with the assistance of the Oxford Regional Health Authority. Medical coding took eleven months to complete and during this time a new set of medical coders financed by the Manpower Services Commission Community Enterprise Programme were trained and took over the coding. Stringent checks were carried out during the period to check and assess intra and inter coder reliability.

The survey packs were arranged in strict alphabetical order in fire-resistant cabinets. All packs received by March 1981 were coded in complete letter blocks. Packs arising after this date were kept separate until the Zs had been completed. Each coder put her own coder number on each form she checked and coded.

Coding System

(a) Diagnosis Codes

Four different systems for coding the diagnoses recorded in the health data were considered; the International Classification of Diseases IXth revision[9] the Cardiff/BPA Supplement to the ICD IX, SNOMED[10] and the coding system used in the previous CHES follow-up when the children were five years old.

None of these systems was wholly appropriate for coding lay terminology of mid-childhood illness. We decided to use ICD IX with BPA fifth digits where appropriate.

Modifications to ICD IX

The offered data ranged from non-specific to very detailed and in order to deal with this without losing useful information we had to modify the ICD IX.

Throughout the coding procedure the coders had access to a Medical Research Officer to assist in selecting appropriate codes for unusual or poorly developed diagnoses.

(b) Procedure codes

Four systems were considered; the OPCS classification of surgical operations; the WHO classification of procedures, the five-year CHES operation codes, and SNOMED. The OPCS system was selected but has required some modification for use in our data. Minor procedures (blood tests, X rays) are poorly represented and a series of codes starting with the letter P were adopted to code such procedures.

(c) Drug Codes

The Oxford record linkage group have created a drug coding system which they kindly offered to us for use in this Study. The system comprises an alphabetical list of mixed proprietary and real drug names, with appropriate codes, a numerical listing of codes with translations and a programme which will convert proprietary drug codes to real drug codes. The system is excellent and has saved us much time, but it lacks codes for useful for non-specific responses, eg 'antibiotic', 'vitamins'. In addition inhaled preparations for asthma and rectal preparations for constipation are not included. These codes have been added for our purposes. The codes are all alpha-numeric and five characters in length.

(d) Codes designed for the ten-year Study

(i) Accident Codes

Three systems were considered for coding the 'what happened' section of the accidents question (PIB18): the five year codes, the accident coding system currently used by the 1946 cohort, and the external cause codes in the ICD. The latter proved inappropriate for coding the common causes of accidents among five - ten year olds and all three systems suffered from the disadvantage that only one aetiology was permitted per accident; so that, for example, if a child on a bicycle collided with a car the accident must be classified as a road traffic accident and the bicycle would be lost as an aetiological factor.

A coding system was designed therefore in which up to six aetiological categories could be specified for any one accident, each aetiological factor having a two digit code.

The codes were designed from a summary of accidents amongst the first 1,000 packs taking the five-year codes and the 1946 cohort codes as a starting point; they include a detailed section on vehicular accidents: (these need to be combined with the 'Road' code in the 'where section' to identify RTAs); a section on playground equipment, one on pets, and one on other likely causes of accidents, eg skate-boards, roller skates, guns, darts, etc; plus a section which can code the people involved if these are specified. For example, if the child was hit by his brother the brother will be specified; if the child and his brother were fighting together both the child and his brother will be specified.

The system includes many non-specific codes and therefore does not force soft data into set categories. However, it does afford the advantage of retaining detail where this is offered.

(ii) Other CHES Codes

Throughout the questionnaires there are many questions to which useful responses are limited and which have the option 'other, please specify ...'. These 'please specify/describe' sections have been coded with single digit codes designed from an examination of the responses on the first 500 children. In designing these codes an attempt was made to group responses and not to force non-specific answers into specific categories.

Training the Coders

The first two coders to join the study were involved from the start in the creation and selection of the coding systems and editing instructions and by the start of coding were very familiar with the questionnaires. All coders attended a short course in Oxford run by members of the Record Linkage Study to train clerical staff in the use of the ICD and OPCS operation codes. In addition they practiced coding on an extensive series of diagnoses extracted from the first 500 questionnaires. Accident coding was also taught on extracts from the ten-year questionnaires. Editing of the forms was initially on photocopies of packs and subsequently in pencil on actual questionnaires. Training took between four and six weeks for each coder and three separate training sessions had to be undertaken during the coding period as the coding staff changed.

2.52 Reliability of Medical Coding

During training and the initial medical coding period considerable informal checking of the allocation of medical codes and text editing was undertaken by the Medical Research Officer to ensure that the coding instructions were understood by the coders and that coding standards were maintained. Formal reliability checks were introduced in April 1981 and were carried out on a 5 percent randomly selected sample.

The checks recorded errors of omission and mistakes. Every coder action, for example, assigning a code or editing a passage of text, was listed and a coder's reliability was estimated as the:

$$\frac{\text{Number of actions accomplished}}{\text{Number of actions which should have been accomplished}}$$

The mean error rate was calculated for each coder and each question after each check to identify weak areas in the coding and coders in difficulty. Three hours of each week were spent by each coder on the reliability checks.

Individual coder reliabilities ranged from 0.8 percent to 3.8 percent with an average reliability of 2.0 percent. The accuracy of assigning medical codes was checked from a printout of ICD codes assigned and theiraccompanying text on a 10 percent sample. The overall error rate was 2.6 percent.

2.53 Social and Social Class Coding

Social coders checked and coded information in the Parental Interview Form except Section B on which contained the child's medical history and Section E which contained information on the family's health. In the Maternal Self-Completion Form they checked all the questions except those on the mother's health in Section E. The precise measurement of responses on the analog scales was carried out by the data processors. Nine social coders were employed altogether. Four of them worked on all the social questions from the start of coding until August 1981. They were then replaced by 5 people funded under the Manpower Services Commission Community Enterprise Programme. Two of these worked solely on Section C of the Parental Form which contains the information on the occupation and occupational status of the parents. The others coded the remaining social data.

It took between 4 to 6 weeks to train a coder to the required accuracy and speech. Coders kept a record of the number of forms they processed and their weekly totals were monitored and reviewed with each of them individually. The time taken to code each form varied considerably; we estimate that on average a coder took 6 minutes for the occupations Section (C) of the Parental and 10 minutes for the remaining social questions.

Parental Interview Form

The first task was for the social coders to check and code the front page of the Parental Interview Form. This included missing health and education authority codes, rewriting badly written text and specifying text for inclusion on computer files. Checks were also made to ensure that the child's name and identification number was consistent between all three and health forms and audiogram. Section A covered questions on the composition of the household and the family, separations, change in parental figures and ethnicity.

Questions A1 and A2 cover the child's name and place of birth. Any change in the child's name and address from birth to 5 years and to 10 years was coded. If the child currently lived in a residential institution (A3) the coder entered details about the child and the type of institution in a separate 'institution/in care referral file'.

Family composition was described by questions A4 to A8. The relationships specified in A4 on the number of people in the household were coded and checked to make sure that they were consistent with the sex and dates of birth for these people also given in A4, and with the status of the parent figures given in questions A5 and A6. The total number of people and children resident in the household were calculated and recorded on the form. Reasons for temporary absence from the household were also coded. Codes were assigned to the reasons given for changes in parent figures A5b, A6b).

The statutory care of children is investigated by question A9. Reasons for being in care were coded and details of the agencies concerned were entered in the 'institution/in care referral file'.

Finally, in Section A, questions A11 on the number of addresses at which the child has lived and the reasons for moves and A12 on ethnicity both provided the opportunity for unstructured responses which were also coded.

Section C covers the education and occupation of the parents, receipt of benefits and income. The education of the parents was described in question C. Where 'other educational qualifications' were specified a directory of qualifications(11) was used to assign them to the appropriate preceding categories in the question.

Question C2 examined the parents' current employment status. Coders were required to assign values to 'other reasons for not being in paid work' for example, retired, in prison, ill health, and to edit multiple responses. This involved examining other sections of the form to check, for example, that a parental figure was present or absent. The 'other employment situation' category in this question was reserved for foster parents all other responses being edited back into the main body of the question.

The occupation and type of industry coding encountered in C3 on parental occupation was the most complex encountered in the survey. Codes were assigned to the job description for both parents using a composite index of 1970 and 1980 occupational titles. This index was derived by the Social Research Officer from the 1970 and 1980 OPCS Classification of Occupations.[8] If this failed an insufficient data code was awarded. Some groups of jobs, however, share the same social class value and for some cases it was possible to derive social class values from the fact that the job belonged to a group, even though there was insufficient information to allocate an OUG code. Coders also assigned social class values to British Service personnel using a classification developed for the 1975 CHES project which was based on the Hall-Jones Scale of Occupational Prestige.[12]

The 'Standard Industrial Classification[13] was used to assign codes to the type of industry in which the parents worked. This proved to be very difficult at the time the social coding was going on as no index to it had been published.

The coders also edited the text which described the parental occupations and the industry text. This was later punched and used to check the assignment of occupation, social class and type of industry codes.

Question C4 examined the parents employment status, where information on this was missing the coders edited in information on parental occupation from C3.

In C6 the parents were asked about unsocial hours, eg worked 3 hours on a Sunday, or before 8.00 am or after 5.00 pm. Overtime patterns described in the 'please specify section' were edited back into the question. C7 asked if the mother was working regularly outside the home during the child's summer holiday from school last year and if yes, who looked after the child. Codes were allocated to the caring agent mentioned in C7.

C8 asked if the family had received any benefits in the past 12 months and provided a check list of these. C9 asked what was the family's total gross weekly income. The 'other' replies in both C8 and C9 were coded. Where more than one income level was given in C9 a predefined adding scheme allowed coders to calculate the actual income level.

Section D covered questions on housing and amenities. Question D1 asked what accommodation was occupied by the household and D2 asked if the accommodation was owned or rented. Neither question allowed for multiple responses and so these questions were edited to give the family's main residence and primary form of tenure.

The question on heating the home (D6) permitted up to three 'other' methods of heating to be recorded. Information on the main method of heating (part b) was edited into methods of heating regularly used in the home (part a). Where more than one main form of heating was listed priority was given to the first item specified, but if central heating was mentioned it was taken as the main method of heating.

Finally in Section D coders dealt with question D8 on the dampness of buildings. Again multiple responses were not permissable and so where they did occur they were deleted to leave the most severe level specified. 'Other' damp rooms mentioned were edited back into the preceding three main groups of rooms, namely kitchen, or bathroom, living rooms, bedrooms.

The last coding operation on the Parental Form was the coding of the parents permission for access to the child's medical records.

Maternal Self-Completion Form

There was initially some concern that the responses line (analogue) scales showed particular response patterns. Some people, for example, appeared to use only the extreme ends of the scale, some use the ends and the middle, some appear to drift gently in their responses on successive lines, for the majority, however, there was no particular response pattern. We decided to take the precaution of asking the coders to identify these apparently different response patterns and so for each of the three analogue scales in the MScF a 'pattern code' was assigned.

In Section D which lists children's skill items, the opportunity was provided to comment about each item as well as responding to it on the analogue scale. The social coders coded the comments, where offered, for each item.

The remaining parts of the MScF required relatively little coding. Some questions contained 'other, pelase specify' categories which were either coded or edited back into the main questions. The coders also checked the names and identifiers on the front page of the MScF with the PIF and MEF. Coders also added their own identifier to each form they checked and coded so that later on we could check individual coders for bias.

2. 54 Reliability of Social and Social Class Coding

Three different methods have been used to assess reliability of the social coding. Two of these were used to monitor coder reliability throughout the seven months of social coding. The object of these two tests was to assess coder errors and to provide the coders with feedback about their performance. The methods used were a Checklist of all coding operations and an assessment of the reliability of occupational coding. The Checklist method was carried out on a 5 percent sample throughout the seven months of social coding and the reliability assessment of occupational coding was carried out on a 2 percent sample. The Checklist itemised all the coding operations and recorded if these had been completed. Rates of coder error were based on the number of errors vis a vis the number of coding operations actually required in the particular forms; rather than on a theoretically possible maximum number of coding operations.

Every two weeks each coder checked six of his/her own recently coded forms and four recently coded by another coder. The forms to be checked were chosen at random. In 8,698 necessary coding operations the checklists indicated there were 89 errors giving an error rate of 1.0 percent.

Occupational coding was included in the checklist, but becuase of the complex nature of occupational coding a separate reliability check was made of it. This occupational coding check examined whether occupational codes had been assigned but it also investigated the quality of the coders' decisions involved in allocating occupation and industry codes to the mother and father figures.

This check was carried out every two weeks. Between 10 and 20 recently processed forms were selected at random for each coder and checked by the Social Research Officer. Any errors identified were fed back to the coder. The error rate identified by this method of checking was 5.0 percent. This is higher than the rate indicated by the checklist but the checklist examined relatively mechanical coding procedures unlike those involved in the occupational coding which were far more complex and required much more thought.

The most important use of the occupational codes is in the assignment of social class values to the parents. When the social coding was complete therefore a further and more extensive check of the reliability of occupational coding was undertaken. This was done by examining the extent to which coder errors lead to the assignment of incorrect social class categories in 1,300 forms. Occupation codes were checked and where an occupation code was found to be incorrect social class values leading from the incorrect and correct occupation codes were derived and compared. Slightly higher error rates were obtained from the fathers than the mothers. This may be due to the fact that a far greater variety of occupations requiring more varied coding were reported for the fathers. The mother's occupation tended to be more restricted in range.

Each coder was assigned an identifier which was added to the data and so it will be possible, for example, to compare the distributions of social class codes allocated by each coder, and to check that the social variables are not influenced by the coder who coded them.

2.55 Educational Coding

There were two main parts to the educational coding. The first involved work on the optically mark read (OMR) forms and the second involved coding a major part of the test material.

The first operation carried out on the OMR forms involved the translation of the numeric identifiers, child's central survey number, singleton/twin code, sex, local education authority code, school code and area health authority code to lozenge form for OMR processing. The forms were checked to make sure they were completed in pencil. Any which were not were overwritten in pencil.

The second part of the coding work involved the scoring of the reading test, maths test, the four tests of the British Ability Scales, the social awareness test, the serial recall test, the handwriting and spelling in the dictation test, and the handwriting in the copying test.

Four coders were trained initially to do the work and were eventually replaced by seven coders on the Manpower Services Commission Community Enterprise.

Coding was carried out in pencil on specially designed coding sheets. The coders were instructed that in virtually all tests it was important that the content of the response and not its form should be scored. In verbal tests a response should not be scored zero because of grammatical or pronunciation error, similarly, in a test requiring a child to draw a response, as in matrices, the child should not be penalised for clumsy or crude drawing providing that the essential features of the response are present.

Coders were given detailed written instructions on every aspect of scoring and coding the test material. For the word definitions and similarities tests from the British Ability Scales for example, tests of acceptable responses were provided together with rules to be applied for coding 'borderline' responses. The coders received considerable training in coding the tests and coder reliability was monitored carefully through the training period and results fed back to the coders.

The first part of the coding and data preparation work was concerned with the OMR forms and was completed far ahead of the manual test coding.

The OMR forms were dispatched to the data processors in Milton Keynes by courier. On their receipt at Milton Keynes the numeric data was keyed to disc, the spines of the forms were then guillotined and the forms were then passed through the optical mark reader and a second data tape created.

We received at Bristol two data tapes for each batch of forms, one of OMR data and one of keyed data. These were merged and checked. We also received hundreds of boxes of loose pages all of which had to be restapled and returned to the appropriate survey pack so that they could be found when needed in the subsequent editing procedures.

The checking and editing of these data were begun before the educational test coding was completed and was dovetailed with it in order to give the coders an occasional rest from coding and scoring.

2.56 Reliability of Educational Coding

The assessment of educational coding reliability had two purposes. The first was to provide feedback to the education coders and to minimise the errors and the second was to provide estimates of coder reliability which could be reported.

Initially, during the training period, attention was concentrated on the former and efforts were made to tell the coders about discrepancies between themselves (coding consistency) and differences over time (coding stability). Some parts of the educational coding required considerable qualitative judgments. These included the scoring of the Word Definitions and the Similarities Tests of the British Ability Scales which required decisions about acceptable responses, the scoring of the samples of handwriting for form and slope and the scoring of the Social Judgment Scale items. Considerable efforts were made with these tests to ensure coder consistency and stability.

Regular checks of a 5 percent random sample of the educational tests which the coders scored were carried out. Seventy two packs of educational tests were completed and recoded. The disagreement between the two versions of coding are given as percentages in Table 2.4.

Table 2.4

Test - Retest Disagreement on the Tests Scored by Coders

i	Edinburgh Reading Test	1.44%
ii	Friendly Maths Test	0.80%
iii	Recall of Digits	0.83%
iv	Word Definitions	4.76%
v	Word Similarities	1.97%
vi	Matrices	2.37%

In the tests which involved straightforward scoring, Table 2.4, i to iii, the reliability is very good indeed. The higher disagreement values for Word Definition, Similarities and Matrices, reflect the difficulty the coders had making subjective judgments about the 'appropriateness' of a response.

2.60 Data Preparation and Production of Analysis Files

2.61 Educational Information

(a) Creation of Data Files

Educational data exists on six questionnaires. Three of these questionnaires, the Educational Score Form, the Educational Questionnaire and the Pupil Question Form were prepared so as to be optically mark read (for the majority of the information) by an external commercial organisation, namely DRS Limited of Milton Keynes. Each dispatch of questionnaires to this organisation resulted in three separate data files corresponding to each of the three questionnaires. The three raw data files were used to create three SPSS system files which were given the labels EDSCORE, EDQ and PUPIL (corresponding to the order of mention given above).

Residual information, coming mainly from the Educational Questionnaire, which could not be mark read, was keyed directly to disc and then stored on tape. This enabled the production of a fourth SPSS system file, which was given the label KEY.

Questionnaires were sent off in batches ranging from 400 cases to 2,000 cases, but irrespective of the size of the data batch involved the same procedures were carried out. These procedures are described in (b) below; namely checking central survey numbers, range checks and logic checks. On completion of these procedures for each of the four data sets, a particular batch of data was added to the cases already so processed. Each of the four SPSS files therefore gradually grew larger and larger (casewise) as more batches were returned and processed.

The addition of particular data batches produced problems of case duplication which were resolved by examination of the complete response set for such cases and comparisons with the questionnaire.

The remaining three questionnaires, the Edinburgh Reading Test, the Friendly Maths Test and the BAS tests were not designed to be optically mark read. They were in fact coded up on coding sheets and sent to a local commerical organisation to be keyed to disc. Information was coded onto a single coding frame resulting in only one raw data tape per batch being produced but with far more information than each of the OMR tapes. Checks on Central Survey numbers were carried out together with range checks and on completion of the satisfactory editing of each data batch data was added to an SPSS system file called TESTS, in a similar fashion to the build up the other four SPSS files previously mentioned.

(b) Data Editing

Each batch of data returned from either source was subject to the following procedures:

(i) Central Survey numbers were compared with check codes placed on the questionnaires by coding assistants. This applied to both keyed and optically mark read data. A complex mathematical operation on the Central Survey number should have produced the same value as given by the check code. Any instances where this was not found to be the case were listed and examined. In some cases this enabled us to spotlight incorrect Central Survey numbers given to children. In other instances it turned out that the check code was given incorrectly. Sometimes the keying or optical mark reader was at fault.

(ii) A check was made for any duplication of Central Survey number. This was done both within each batch as it arrived and also after the addition of a particular data set to the main body of the data.

(iii) For files KEY, EDQ, EDSCORE and PUPIL inconsistencies in the coded value for the child's sex were thrown up and examined. Corrected sex codings were edited in where appropriate. On other occasions, it was discovered particular questionnaires had been placed in wrong packs and Central Survey modifications were implemented.

Similar operations were performed after comparison of Local Education Authority codes, Health District codes and School codes between files EDQ and KEY.

(iv) Range checks were carried out. This involved searching entire data sets for values which did not fall within the range of the particular variables involved. For the EDQ, EDSCORE, PUPIL and TESTS data this generally involved simply editing in the correct value when discovered. However for file KEY very often extreme values actually existed on the questionnaire (eg greater than the number of hours in a week when the question concerned number of hours per week for a particular activity). These were left unaltered. A record exists of the acceptable range involved in the checks on file KEY. Given these stated ranges the researcher is thus free to exclude values falling outside these bounds if he feels it appropriate.

(v) Logic checks were carried out both within files and between files. For instance, on the Educational Questionnaire, Question B1(b) there are a number of lozenges which the teacher is asked to tick to indicate reason for absence. Opposite the lozenge the teacher should have written the number of days absence for this reason. These corresponding items of information end up on file EDQ and KEY respectively. Where any lack of correspondence between the files was found to exist, eg number of days given but no lozenge was ticked or vice-versa; this was investigated and the files were edited in line with the information on the questionnaire.

A particularly important edit took place on file KEY. For questions such as QD24 on the Educational Questionnaire which concerns the percentage of Assembly time devoted in one term to a set number of activities it was found to be the case that when no time was spent on any activity the teacher, naturally enough, did not write anything in the box. However, the same situation for any particular box occurred if the teacher simply had not answered the questions. To overcome this problem therefore we looked at the responses to all the boxes pertaining to one question. If all were blank the teacher was considered not to have attempted to answer the question and all the blanks were recoded into the missing value code (-3).

If one or more boxes had been answered the blanks were considered as zero responses. Questions treated this way were Questions A3, A26, A31 (part 2), D12, D24, D25a, D25b, D25c and D26 on the Educational Questionnaire and Q14 on the Pupil Question Forms.

For the material on file TESTS variables were derived which recoded the original responses on a particular item to a CORRECT v INCORRECT form.

2.62 Health Information

For each child in the study the Health information was derived from four separate questionnaires - Parental Interview, Maternal Self-Completion, Medical Examination and Audiology Examination. However, it was intended to treat this data as a single entity in the initial stages of setting up the computer files. The questionnaires had been designed for punching documents so that the Beaufort Computer Services key-punch operators punched directly from the forms as they used the Redifon Key-to-Disc system.

From our past experience with large scale data derived from survey Questionnaires it was realised that the amount of work necessary at the analysis stage could be reduced by having validity checks performed at the time of data input. To this end, it was decided that a method involving the use of 'error diagnostic flags' would be adopted. Since each question could give rise to a number of predefined errors, for example, illegal multiple answers, numberical values out-of-range and inconsistent answers both within and between questions, these errors would be flagged and stored with the data for that question. It would be

possible subsequently to provide an easy way of checking how well the individual questions were answered. In order to minimise the space required to store all these error flags, use was made of the 24 bit word architecture of the ICL 2900 series computer that was holding the data. Each bit was associated with a particular error and thus up to 24 different errors could be stored per computer word. Consequently one or more words containing these error flags were used for each of the questions.

Also, with the view to saving space, a system of 'text pool' was used to hold text from the Parental and Medical Questionnaires. This text pool was a pre-designated area of storage that could hold text strings together with the necessary printers set to enable the text to be linked with the originating question.

Beaufort Computer Services wrote a COBOL program (BU25) which took the original Redifon Disk data, performed the error checks that we had specified, built up the error flag words and rewrote the data together with the associated error flag words and output this onto disk on the computer mainframe. This aspect of the study involved considerable work both by BCS and ourselves. All the potential errors had to be identified and the specification for the checking program had to be produced. After designing the layout of the mainframe output and writing the first version of the BU25 program, various sets of test data were provided and these were processed through the program and the output checked carefully to ensure that all possible errors were being recognised and flagged. This process of checking and refining the program was continued until we were sure that it was working satisfactorily.

As well as this BU25 program, a number of the programs were also produced to provide progress reports and summaries of the data that were being processed and stored on the mainframe. Other programs screened the data to provide reports on those children with certain specific medical conditions or those who had been admitted to hospital.

The complete sequence of operations in moving from the original documents to the computer record was as follows: a batch of questionnaires, separated into the four types were sent from Bristol to Gloucester. These were keyed in on the Redifon machine and transferred via the BU25 program onto the mainframe. A listing was generated of all the questionnaires that had been transferred together with any questionnaire with a duplicate serial number of one already on the file. At the same time, where a complete set of questionnaires existed, the identifying information from the front page of each document (eg sex, date of birth, area authority code) was checked for consistency and any mismatches were listed. For each of these mismatches a 'query flag' was set to prevent that set of data being pulled off until the query had been resolved.

These reports and the corresponding questionnaires were then returned to Bristol where the forms would be refiled after being checked against the lists. Any queries, about the serial number (Central Survey Number) mismatches or duplicates were resolved and Beaufort was provided with updating information for use with program BU70. This program had been designed to make the necessary modifications to the data stored on the mainframe.

Each child is uniquely identified by a serial number and one of the main problems in setting up the data correctly was in making sure that these serial numbers were correct. To assist with this each serial number had an associated two digit check number computed from the individual digits of the serial number. By this means it was possible to reassign incorrectly allocated numbers and complete as many sets of questionnaires as possible. The process of checking these serial numbers is continuing and at present some of the data still contains an incorrect number. This is of no consequence at present although it will be important when the health/education matching is undertaken.

When the first 1,000 (approximately) sets of questionnaires were ready on the mainframe, a magnetic tape copy was made and supplied to Bristol. The analysis of the data was to be undertaken on the University of London Computer Centre's computer (CDC 7600) and since the tape had, by necessity, to be written in ICL 1900 code it could not be read directly on the CDC machine. We enlisted the aid of the Computer Centre staff at Queen Mary College, London, who have an ICL 2980 machine and they were able to read and rewrite the Beaufort supplied tape in a CDC compatible format.

At this stage the main data (ie excluding the Audiogram data) consisted of a 8,500 character record per child. The first step at ULCC was to create three separate tapes of the Parental, Maternal and Medical data using a FORTRAN program. From there it was possible to create smaller data files as well as producing SPSS (Statistical Package for the Social Sciences) Save Files for use by the various members of the CHES research team.

Preliminary analyses were performed on these first 1,057 cases and by then the next 6,000 cases became available. After conversion via QMC these were added to the existing data set to give a total sample of 7,464 children. In the same way the remaining data will be added to create the full national data.

(vi) Other editing took place which made reference to existing data, consulting the questionnaires and creating new variables from the information found. For instance, if 'other type of school' was ticked on Question A6, we went back to the questionnaire in order to decide why the child went to this other school. This information was then coded into a new variable.

(vii) Finally edits were carried out on the basis of comparisons between the TESTS file and the other four files. Where discrepancies on sex, date of birth, school code, LEA code or health district code were found to exist these were investigated and the data sets altered accordingly.

2.70 Work involved in linking the Health and Educational Data

As indicated, considerable effort has gone into the checking of the serial numbers which are used as unique identifiers of the children. Although not all of the corrections have been made, the present data remains internally consistent, ie Parental, Maternal and Medical questionnaires are matched correctly for the same child. However, some of the children do not have their correct serial number, that is the number that they carry in the previous surveys on the CHES children.

Before we attempt to link the data of the Health and Education studies, it will be necessary to spend a considerable amount of time in completing this checking of serial numbers in each part of the survey separately at first. Then the two parts will be linked and this linkage carefully checked by reference to the other identifying information on the various questionnaires. This will inevitably produce 'mismatches' which will need to be resolved by reference back to the original documents as well as the various computer listings of children that we have produced. Until this has been satisfactorily performed, there will be no possibility of using any data from both parts of the study.

:. 71 The current State of the Data

Two further magnetic tapes of the Health data have been supplied by Beaufort Computer Services comprising 3,763 and 2,329 cases. These tapes have been rewritten using the Queen Mary College, London, ICL computer in the same way as the previous files. This brings the total number of children on the file to 13,556 at present. There still remain 267 more cases that have to be checked at Beaufort since we suspect that these may contain a few more children that will have to be included. However, this is a very small job and the remaining children will be added shortly to the existing data set. As already outlined, this complete file will have to be checked finally to ensure that there are no errors in the serial numbers that uniquely identify the children and this will be done by reference back to our other data sets on the Birth and 5 year studies. When this checking has been completed we will then be in a position to create data files that will be used in the subsequent analyses since it is essential that the very large amount of data available for each child is reduced to a manageable size for analysis. Computer processing of a large file is very expensive in terms of the computer resources it consumes, and whilst we cannot reduce the number of cases in the file it is possible to work with small subsets of the data.

At the same time as the final checking of the health files is being carried out a similar exercise will be undertaken on the educational data so that the two parts of the 10 year study can be 'linked'. The information from the two data sets for each child can then be made available for analysis. We shall ensure that the linkage is correct by checking the identifiers on the two parts of the study very carefully. Queries will be resolved by reference back to the original questionnaires. When this is done it will be possible not only to 'link' both parts of the 10 year study, but also to 'link' the 10 year data to the 5 year and birth studies.

2.72 **Validation of Medical Diagnoses**

The health part of the study employed the forms, one of which was completed at an interview with the parent(s) by the health visitor, one by the clinical medical officer who examined the study child and one by the mother herself. Each of these forms in their various ways enquired whether the child had any impairment or disabling condition. Moreover, the first part of the Medical Examination Form, pages 2 to 5, were completed either from the School Medical Records or from the Medical Records held at the Area Health Authority on the children. These forms are to a large degree therefore self-validating.

We are, nevertheless, taking the additional precaution of writing to any hospitals attended by a child identified as having a current impairment and who contributes to the prevalence figures given in Chapter 2.

Letters are sent to the Medical Records Officer in each hospital attended by these children which explain the aims of the validation study and ask the consultant concerned for permission to examine the relevant hospital notes.

Notes or photocopies of relevant entries are sent to us. Their contents are summarised and they are returned within one week of receipt.

Validation of medical diagnoses of children in the 5 year study[14] has been carried out over the past few months. Many of the children with impairments at age 10 have already featured in the recent validation of the 5 year information.

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Statistical Analyses employed in this Report

As explained earlier, in the development of the educational questionnaires and the accompnaying educational tests it was decided to relate the survey material and the tests themselves to current educational theory, rather than attempt to conform to earlier survey models which, though highly effective when created in previous decades, were no longer appropriate to the educational situation of the 10-year-old in 1980.

The same broad principles have been applied to the preliminary statistical analyses of the data themselves. These principles are set out below.

1. Analogue scales have been used very widely in the CHES educational questionnaire and to a more limited extent in the health and social questionnaires. Although often used in market research they do not appear much in scientific research. Aitken 1969 and Remington et al 1979 offer some of the limited number of published studies on this technique.

In essence analogue scales offer the person marking them a wide choice of positions on the particular question. Thus, for example, instead of asking a teacher to decide whether a child is highly restless, moderately restless, minimally so or not at all restless - as is customary in a variety of instruments - she has the freedom to mark at some point along a 10 cm. line her estimate of the child's restlessness, ranging from not at all to very much so. This method avoids the confusion which can arise when the person completing a questionnaire is faced with the interpretation of dimensions such as 'moderately restless', or choosing between two defined labels when neither judgement seems quite appropriate. Of wider importance in statistical terms, analogue scales enable a more sensitive interpretation of the variance of the variable in question, in view of the greater range of possible scores - compared with the 3 to 5-point range of most labelled or numbered ratings.

The pioneering work done by the CHES team with analogue scales has shown that while they have been generally successful, there are two difficulties which need to be guarded against; one of them arises if the method of marking these scales is not explained clearly to naïve persons who are asked to complete a questionnaire. The second difficulty is more fundamental; it appears that some people can only interpret a question as having a dichotomous (or occasionally trichotomous) answer, and their completed forms show a series of marks fairly close to or adjoining either extreme, with a smaller group using the extremes as well as the centre in three-way answers.

Although a relatively small proportion of parents marked the analogue scales incorrectly, it was possible to incorporate their answers into the data for the whole cohort since the two and three-way markings did not cause any serious distributional problems. The very considerable number of analogue scales marked by teachers and heads offered little or no difficulty and in fact many of the distributions were close to normal.

2. Frequency distributions on their own are interesting and useful as an initial guide to how the analyses of the individual variables might be tackled. The distributions are particularly useful as summary statistics on the prevalence of certain educational handicaps or other deviations from the normal or the expected. However they are of more limited value in reporting on the range of 'normality', the numbers of cohort children in different types of schools, the housing quality in the catchment areas served by the children's schools, the size of the school classes and other educational indices whose ranges are more fully explored in national statistics. To date some four volumes of frequency distributions have been produced on the raw educational data; further distributions will be available in the course of time on composite or derived variables.

3. Correlations and cross-tabulations are well known techniques for presenting bivariate relationships. Contingency tables (cross-tabulations) can also involve a larger number of variables, enabling bivariate relationships to be examined within different categories of one or more controlling variables.

While such techniques have an important function in the early stages of data analysis, Tukey 1954 warned of the danger of reliance on this type of relationship, pointing out that it is tangential to data analysis and can never rise to be a functional measure. Blalock 1964 in turn pointed to a particular flaw in correlational methodology - and this is even more pertinent for cross-tabulations - namely that the ways in which cases are grouped can lead to considerable fluctuations in the size of the relationships.

These and other warnings are highly relevant to all survey analysis. It could be seriously misleading to come to any major conclusions on the basis of simple bivariate relationships; even the use of two or three controlling variables within such relationships can be problematical, unless there is reasonable certainty that all other variables have little or no share in those relationships.

4. Log linear, analysis of variance and multiple regression are among the wide range of important statistical techniques available for assessing the relationships among a number of variables. Each method has its strengths and its limitations. Authors such as Bishop et al 1975, Namboordiri et al 1975, and Cohen and Cohen 1975, offer useful descriptions of the wide range of possibilities which exist within these three approaches to multi-dimensional and multivariate analysis, while O'Muircheartaigh and Payne 1977 offer a comprehensive statistical treatise on the analysis of survey data. The choice among techniques is largely determined by the particular questions being asked and the form of the data.

The log linear approach is especially useful for examing the relationships among categorical variables when some of these variables have a J-shaped or U-shaped distribution, with only a small number of cases in particular categories of interest. Thus, once the educational, health and social data have been linked it will be possible to examine a number of important questions in regard to very small groups of children, such as the E.S.N.(S) sample, using this technique.

Analysis of variance is a widely used method for assessing the importance or significance of certain relationships, in particular the difference in mean values of certain variables across sub-samples, when controlling for a number of other variables, and in the interactions between those variables.

Multiple regression is of value for developing predictive and other linear models where the competing sizes and significance of all the variables in the model are of interest; it also has the virtue of presenting their predictive relationships more clearly and 'visibly' than is usually possible within analysis of variance.

Both the latter tehniques have been used in the present study, with analysis of variance answering some important questions in regard to the handicapped children. On the other hand multiple regression has been able to offer a relatively straightforward interpretation of the competing strengths of the large number of predictors in the 10-year mainstream educational data, particularly at this early exploratory stage in the analyses.

5. Stepwise, hierarchical and simultaneous multiple regression are variants in the methods of entering variables into a regression equation.

There are strong reasons for rejecting stepwise methods. Kendall 1975 points out that forward and backward stepwise methods may yield different answers and that the answers themselves may not be optimal. Perhaps an equally serious criticism of stepwise techniques - which are unfortunately widely used within multivariate models - is that the analytical parameters generated by the stepwise algorithm give a highly misleading impression of 'importance'. The algorithms identify variables as predictors in a sequence of importance, starting with the 'most important' and relying on variance added as the criterion for decision on this sequence. In consequence the completed model, in which there may have been some rearrangement in the order of precedence as new variables are added, gives the totally erroneous impression that the first variable is responsible for a very high proportion of the variance, with all subsequent variables making increasingly small contribution. A great deal of educational and psychological theorising is based on the somewhat dubious assumptions underlying the use of this ordering technique.

Even the hierarchical technique can be criticised, though more because of how it is applied than because of the method itself. In essence this technique enables the analyst to specify the order of entry of variables into an equation. When there is an absolute time sequence among a number of predictive influences or some overwhelming reason for forcing an order among contemporaneous predictors it is legitimate to treat variables as hierarchically based within an equation - although path models may offer a more advanced method of handling such a predictive sequence over time. However the hierarchical method is often used to justify the preconceptions of the researcher rather than any sequence over time. For example social class and sex may be forced into an equation as prior predictors in an hierarchical model in which cognitive function and motivation are entered last. Yet in a model of reading for example, there is little justification for considering that social class and sex are truly prior in their prediction of this academic skill. Only in exceptional situations in educational analysis can forced prior entry (or forced last entry) be justified conceptually.

Given the limitations of both stepwise and hierarchical regression, the use of simultaneous entry seems the obvious alternative for the mainstream analyses which are at this stage based entirely on multiple regression. Each equation, starting always with the fullest possible assembly of variables within a conceptual grouping, is examined in relation to two criteria - the size of the unique contribution of each variable to the outcome variance, and the significance of the regression coefficient for that variable. Variables which fail to meet the stringent criteria set out for the different equations are removed from those equations and the regressions are then re-run until all the variables remaining in the model have satisfactory parameters. The simultaneous entry method does of course lead to a form of backward stepwise elimination of variables. However it is under the firm control of the analyst and the misconceptions which can arise with automatic stepwise procedures can usually be avoided.

6. The choice of regression algorithm has raised some interesting questions. A non-stochastic ridge regression technique developed earlier by one of the authors of this study has been shown to exhibit a more satisfactory performance than ordinary least squares regression. The work of Goldstein, M. and Smith, A.F.M. 1974, Gunst and Mason 1977 and others have shown the potential importance and limitations of the ridge algorithm. The main objection to the algorithms developed so far has been that they do not offer consistently better results - as assessed by the mean square error (MSE) of the resulting coefficients since the ridge applications depend on a variety of ad hoc stochastic techniques.

This basic objection has been overcome by the development of a method which offers consistent and repeatable ridge ridge results under all conditions. The question remains of course whether this particular parameter does in fact yield lower MSE figures than do the corresponding least squares regression coefficients. While simulated data have established the superiority of the new technique - referred to here as V-ridge regression - in moderately sized samples with moderate to high multicollinearity, with larger samples and reduced multicollinearity the difference in MSE figures is reduced and even reversed on occasion. However it is of importance to note that in terms of another criterion, that of cross-validation - advocated by Stone 1974 as an important means of assessing the validity of obtained solutions - V-ridge coefficients have in general shown greater stability, compared to least squares coefficients. (In essence, cross-validation is a method whereby parameters - in this case regression coefficients - are developed for each of two parallel or similar samples so that the validity of the parameters can be assessed.) In nearly all the situations where cross-validation has been undertaken, the V-ridge coefficients show greater stability across the two samples.

Given the understandable caution that is necessary when applying a relatively new technique, it was decided to rely on a joint agreement between least squares and V-ridge solutions before accepting any equation in the present study. With the relatively large size of the samples employed, nearly all the V-ridge and least squares solutions were in agreement.

However one particular feature of the ridge algorithm was used extensively in the graphical presentations which appear in section 4 of this report. The unique variance parameters of the V-ridge solutions are generally larger than those of the least squares solutions, with less of the outcome variance being treated as shared and more of that variance being divided out among the predictor variables. This is to be expected from the nature of the two algorithms, with least squares maximising the total predicition within the variable space (and capitalising highly on error) at the expense of precision, while V-ridge adds precision to the individual components of prediction at the expense of maximising the total and shared predictions. The choice here was thus in favour of greater accuracy in pinpointing the individual predictors, rather than maximising the total and shared predictions and thereby blurring the detailed picture.

It should again be emphasised that the least squares and V-ridge solutions of virtually all the published equations are in agreement. A few minor differences occur in the subsidiary equations, where better V-ridge probability figures have in a handful of cases compelled a choice to be made in favour of that algorithm. The two algorithms are in total agreement however in regard to the retention or exclusion of each of the variables noted in the final diagrams for each model.

At selected points some of the competing parameters of least squares and V-ridge solutions will be set out, to illustrate the comparisons which have been described above.

7. Principal components analysis has been used on a number of occasions to reduce the dimensions of large numbers of items within a particular conceptual framework. The work of authors such as Harman 1967 is of course well known in the field of factor analysis in general and because of the variety of solutions offered by this technique it is widely employed when interpreting variable sets. However it is also recognised that such analyses do not offer unique solutions and indeed are open to some misuse because of this fact. In contrast principal components offers a more straightforward solution, less open to the individualised interpretations and choices such as occur among the variety of rotated factor solutions.

Although the components solution has its own problems - in particular the choice of scale can influence the results in data sets with varying scales - it offers a powerful method for data reduction. While rotation of the component solution is a concession to the desire for interpretation and identification of a number of strong components rather than relying on one or a few major components, the use of the widely known Kaiser Varimax rotation offers a consistent solution for all users, subject of course to the problem of scale mentioned earlier. A particular modification of the conventional principal components solution to the data set is reported in the section on behavioural components (section 4.4).

8. Reliability of the data. The question of the reliability of a set of data is always problematical. Every research team hopes to achieve the highest possible level of reliability in the data which is gathered. Yet the reality of the assessment of reliability is an immensely complex issue. Brown 1976 hints at some of the problems which arise. A great many other authors could be cited on this same topic, within the fields of both education and psychology. Tests, interviews and questionnaires all have their particular difficulties. The size of the sample or cohort on which reliability coefficients are derived is also relevant to the values obtained. The definition of reliability itself becomes particularly confusing in relation to non-test measures, where the reliability of the reporting and recording of the information proferred may be separate from the reliability of the information itself. Cannell and Kahn 1968 and others have examined this particular problem.

While test-retest reliability checks will naturally be undertaken on all the main test measures once the bulk of the cohort material is available, the assessment of the reliability of the great number of other variables gathered in this study would involve a major research operation; it is not certain whether resources should be diverted to that work, given the other more pressing demands for analysis of the data themselves. It should be stressed moreover that both the general piloting of all the instruments and questionnaires as well as the major item analyses carried out on samples of 400 and 800 when the new tests were being piloted has already provided a fairly useful indication of how well individual items correlate with the tests as a whole.

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3.00 Children with Special Educational Needs

3.10 Introduction

Under the provision of the 1981 Education Act, when the special educational resources which are normally available appear to be insufficient to help a child, the Local Education Authority is required to decide whether or not to make additional provision for him and to formalise this provision by maintaining a statement on him. The statement will effectively provide a justification for making special educational provision for a particular child. The first parts of the 'statement' involve the formulation of the child's special educational needs.

Wedell, Welton and Vorkhaus carried out a survey of SE forms to examine the way in which the needs of children were conceptualised in carrying out the existing special education procedure. Descriptions usually consisted of diagnosed pathological conditions (eg epilepsy); descriptions of impairments (eg hearing loss); specifications for provision: requires physiotherapy or even only placement recommendations: "should go to an ESN(M) school".[1]

The degree of special need was described in a variety of ways. It could, for example, be formulated in relation to the degree of pathology for a child with a physical impairment. Often children's current level of functioning was stated in terms of difference from an apparently expected 'normal' level, or presupposed age norm. The extent of difficulty in coping with the child's needs was also used as a measure of degree of need. Wedell concludes that 'there is no doubt that the concept of special educational need put forward in the Act and the implications for special educational provision, constitute a formidable challenge to the professional competencies of teachers, psychologists and doctors and the many others involved.

The concept of special educational need has some obvious parallels with the model of handicap put forward by Nagi[2] and Wood and Badley.[3] In its simplest form this model defines an impairment as:

'In the context of health experience an impairment is any loss or abnormality of psychological, physiological or anatomical structure or function. Such losses or abnormalities may be temporary or permanent. Impairment is characterised by the existence or occurrence of an anomaly, defect or loss in a limb, organ, tissue or other structure of the body, or a defect in a functional system or mechanism of the body, including the systems of mental function. Impairment thus represents deviation from the norm in the individual's biomedical status which may or may not lead to a disability:'(3)

Disability: 'In the context of health experience a disability is any restriction or lack (resulting from impairment) of ability to perform an activity in the manner or within the range considered normal for a human being. The concept of disability represents a departure from the norm in terms of performance of the individual and it is characterised by excesses or deficiencies of customarily expected behaviour or activity. Such may be temporary or permanent, reversible or irreversible, and progressive or regressive. By concentrating on activities disability is concerned with what happens - the practical - in a relatively neutral way, rather than with the absolute or ideal and any judgments that attach thereto which may or may not lead to a handicap:'(3)

Handicap: 'In the context of health experience, a handicap is a disadvantage for a given individual, resulting from an impairment or disability, that limits or prevents the fulfilment of a role that is normal (depending on age, sex and social and cultural factors) for that individual. Three important features of this concept should be borne in mind.

- Some value is attached to departure from a structural, functional or performance norm, either by the individual or by peers in a group to which he relates.

- The valuation is dependant on cultural norms so that a person may be handicapped in one group and not in another - time, place, status and role are all contributory.

- In the first instance, the valuation is usually to the advantage of the affected individual.

Thus the state of being handicapped is relative to other people, and depends on existing societal values and institutional arrangements. The attitudes and responses of the non-handicapped play a central role in ... defining the possibilities for a person who is potentially handicapped.'(3)

A handicap may also result directly from an impairment. These relationships may be expressed diagrammatically thus:

Impairment ———————— Disability ———————— Handicap

Impairment can be observed and described and in some cases quantified. Disability can also be described and to some extent quantified. Handicap is immeasurable directly. It is implied by the preceding impairment and disability and is modified by the child's environment and characteristics of the child himself.

The concept of special educational need is being introduced into a society which operates on something akin to the above model in its understanding of children's difficulties. Much as we may try to emulate the Warnock Report in the formulation of special needs in terms of the additional provision required, it seems inevitable that, for example, children who require 'modifications of the curriculum in connection with physical activities may be still referred to as physically disabled or having motor locomotor impairments.

A major difficulty with the concept of special educational need is that it encompasses not only children with known impairments who have associated learning difficulties and therefore special educational needs, eg ESN(S) children, but also children with impairments with no apparent learning difficulty in terms of educational attainment but nevertheless for whom special educational provision is required, eg a child with spastic diplegia and above average intelligence, and also children for whom learning difficulty is apparent but the impairment in doubt, eg a child with specific reading retardation.

In this survey we have no alternative but to start with children whose impairments and disabilities are known. We shall examine their educational attainment and leave the reader to infer their special educational need.

In this section and the next three sections, we begin with a consideration of children with speech and language impairments (3.20), then examine children with reading and mathematics difficulties (3.30, 3.40) and conclude with an examination of under achievers in reading and mathematics (3.50).

3.20 Children with Speech and Language Difficulties

Children with speech and language difficulties form a very heterogeneous group. The group includes children whose language development is delayed, those who have severe problems with articulation, those who are dysphasic and those who have other communication difficulties.

Ingram (1965)[4] classified speech and language disorders into six categories:

1 Disorder of voicing (Dysphonia)

2 Disorders of respiratory co-ordination, hesitation, stammer (Dysrhythmia)

3 Disorders of speech production associated with neurological dysfunction or structural abnormalities of the tongue, lips, teeth or palate (Dysarthria)

4 Disorders of speech production not associated with neurological dysfunction or structural abnormality. (Secondary speech disorder.) These Secondary speech disorders were associated with mental defect, hearing defect, true dysphasia, psychiatric disorders, adverse environmental factors or combinations of these.

5 Specific developmental speech disorders in which the speech abnormality is not attributed to associated disease or adverse environmental factors. Diagnoses such as dysphasia and word deafness can be included in this category. However, as Mittler[5] points out true or acquired dysphasia, where a speech or language function is acquired and then lost or reduced by a neurological lesion, should be distinguished from specific developmental speech disorders.

In this present report although we have some information about the types of speech and language disorders we are concerned more with the severity of a disorder, its effect on the child's school life and educational attainment. We use a dichotomy of dysrhythmia (stammers or stutters) and 'other' speech defects.

Stammering and stuttering result from a neuromuscular dysfunction. Stuttering involves the repitition of a word or syllable sound whilst stammering involves hesitant utterance and lack of sound.

In the health part of the 10 year follow-up study, mothers reported that 2.3 percent of the children had stammers or stutters and 5.4 percent had other speech defects.

In the CHES 10 year follow-up the children's class teachers were asked, as well as the mothers and clinical medical officers, about the children's stammers and stutters and other speech defects. The sample of the educational data which we are using to examine speech and language difficulties at present covers 8,836 children from a total of 12,901.

It is essential to link the health and educational aspects of the study as soon as possible and this is scheduled to begin as soon as this Report is completed.

3.21 <u>Teachers' assessments of children's stammers or stutters and other speech defects</u>

In the follow up study of the 1958 National Child Development Study children at the age of 11, three different measures of speech problem were used: the teacher's rating of poor speech, clinical medical officers' assessment of the children's articulation during the medical examination and the number of words mispronounced in a speech test. Calnan and Richardson[6] found that the teachers' assessment was by far the most powerful of the three measures in predicting the depression in attainment scores associated with speech problems.

A higher proportion of children were reported as having stammers and stutters (7.6 percent) by the teachers in the CHES educational study sample than by the mothers in the health study (2.3 percent). The same was true for other speech defects (7.6 percent compared with 5.4 percent). The class teachers, however, were given a much wider scale with which to rate the severity of the speech problems and it included a 'not easily noticed' category (Table 3.1).

Table 3.1

Stammer/stutter and other speech defect reported by the children's class teachers (N = 8836)

Severity of speech problem	i) Stammer/stutter Number of Children	Percentage	(ii) Other speech defect Number of Children	Percentage
Severe	2	0.1%	10	0.1%
Quite serious	19	0.2%	41	0.5%
Moderate	141	1.6%	240	2.7%
Not easily noticed	509	5.8%	380	4.3%
No speech problem	8070	91.3%	8108	91.7%
Not stated	95	1.0%	57	0.6%
	N = 8836		N = 8836	

There was an overlap between the groups of 166 children (1.9 percent of the sample) who were described as having both stammers or stutters and other speech defects.

The prevalence of speech problems increases markedly with decrease in cognitive function. This can be observed in the educational data using the standardised total score of the British Ability Scale tests, grouped in standard deviation units (Table 3.2). The reported prevalence of stammers and stutters increases with decrease in BAS score whatever the severity of the stammer or stutter. The same is true for the 'other' speech defects (Table 3.3).

Table 3.2

Stammer/Stutter

British Ability Scales Standardised Total Score in Standard Deviation Units	Quite Serious	Moderate	Not easily noticed	No other defect	Number of Children
-4	4.3%	-	13.0%	82.6%	23
-3	1.4%	4.3%	10.6%	83.7%	208
-2	0.6%	2.5%	8.8%	88.1%	1183
-1	0.2%	1.5%	5.7%	92.6%	2877
1	0.1%	1.3%	5.3%	93.3%	3007
2	-	1.1%	3.3%	95.5%	1144
3	-	0.7%	3.7%	95.6%	136
4	-	-	-	100.0%	6
Number of children	21	135	494	7934	8584

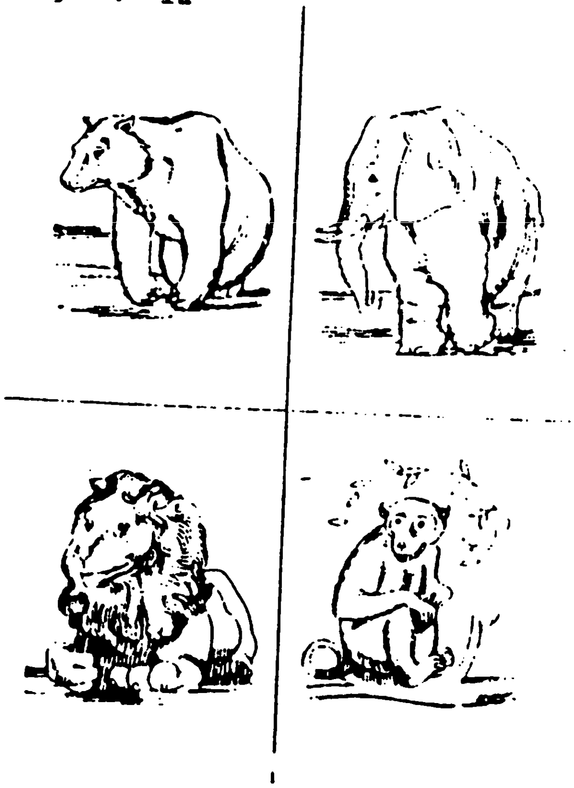
Missing data = 252

Any other Speech Defect

British Ability Scales Standardised Total Score in Standard Deviation Units	Quite Serious	Moderate	Not easily noticed	No other defect	Number of Children
-4	23.8%	23.8%	-	52.4%	21
-3	2.9%	8.3%	8.3%	80.6%	206
-2	1.0%	5.0%	4.9%	89.0%	1150
-1	0.4%	2.5%	4.4%	92.7%	2783
1	0.2%	2.2%	4.4%	93.2%	2931
2	0.3%	1.8%	3.7%	94.3%	1115
3	1.5%	0.8%	3.1%	94.7%	131
4	-	-	-	100.0%	6
Number of children	45	236	368	7694	8343

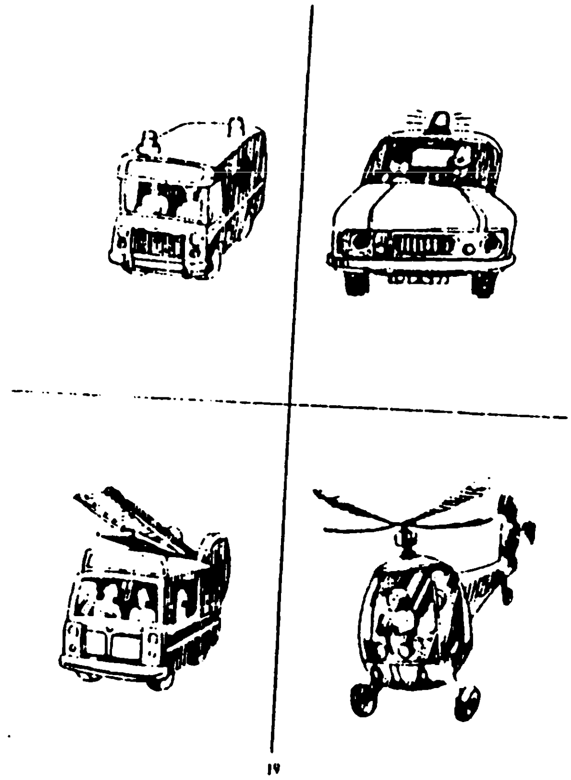
Missing data = 493

Fig 3. 1a



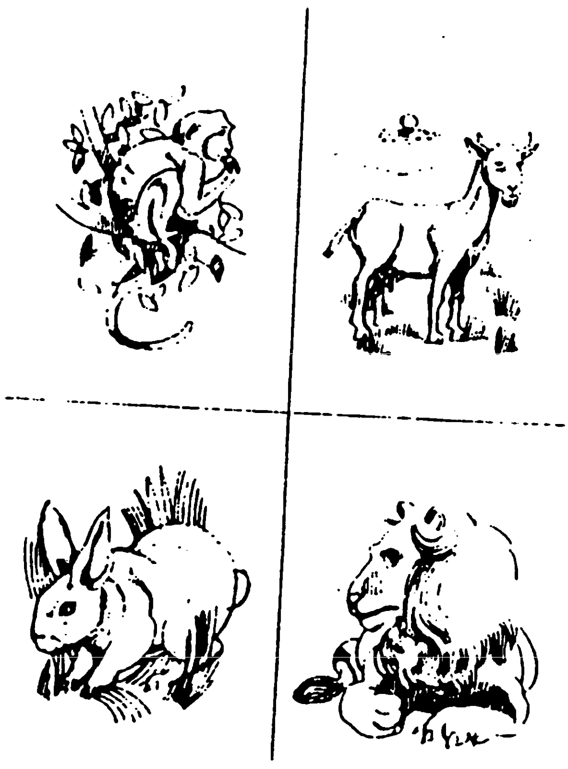
"point to the elephant"

Fig 3. 1b



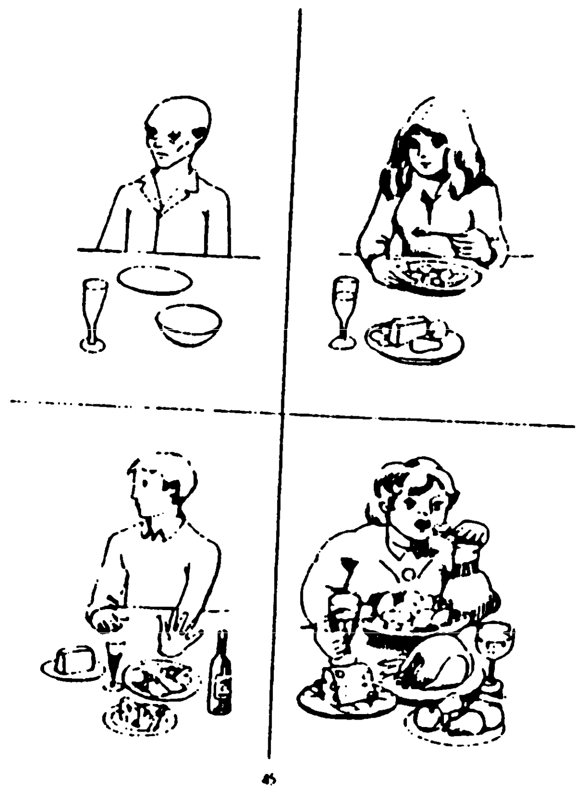
"point to the fire engine"

Fig 3. 1c



"point to the carnivore"

Fig 3. 1d



"point to abstinence"

3.22 Speech defects and language comprehension

All the children in the CHES 10 year follow up attempted a Pictorial Language Comprehension test, a shortened version of the Edinburgh Reading Test, a mathematics test, spelling tests, a dictation task and a copying test.

The main score of the language comprehension test was based on responses to items such as those shown in Figure 3.2.1a, b, c and d. The test increased in item difficulty and items developed from 'concrete' to 'abstract', eg 'fire engine', (Figure 3.1b), 'abstinence' (Figure 3.1d).

Children with stammers or stutters performed less well on this language comprehension test than other children and their level of performance was related to the severity of the stammer/stutter. This was also true of children with other speech defects and this relationship remained after general cognitive ability had been taken into account (Figure 3.2). For children with stammers or stutters the relationship disappeared once general cognitive ability was taken into account. For children with other speech defects the relationship remained after controlling for cognitive function but the relationship was no longer linear. Children with moderate or not easily noticed defects scored less well on the language comprehension test than children with more marked or not easily noticed defects. This requires further investigation which will include an examination of the types of speech problems involved.

Fig 3.2

Performance on the Pictorial Language Comprehension Test
of children with i) stammers/stutters, ii) other speech defects
Results of Analysis of Variance

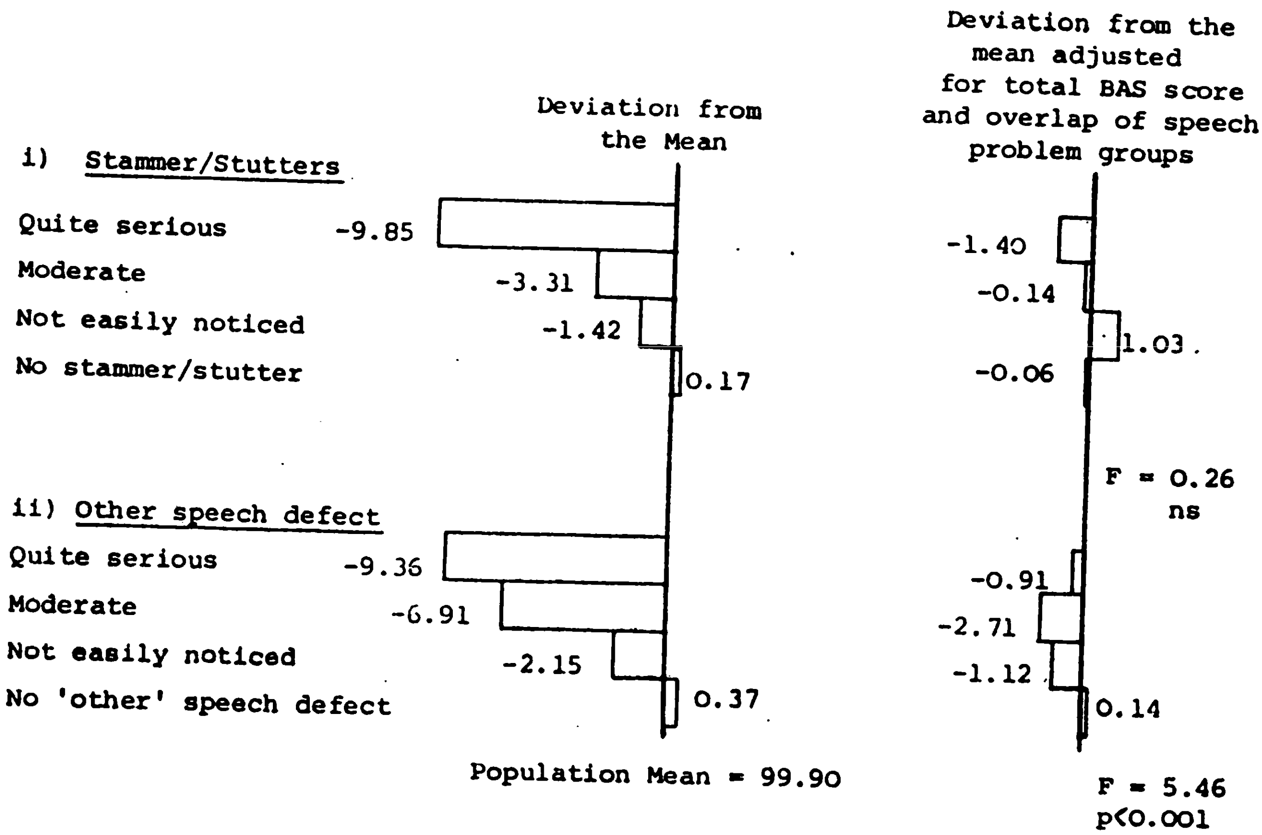
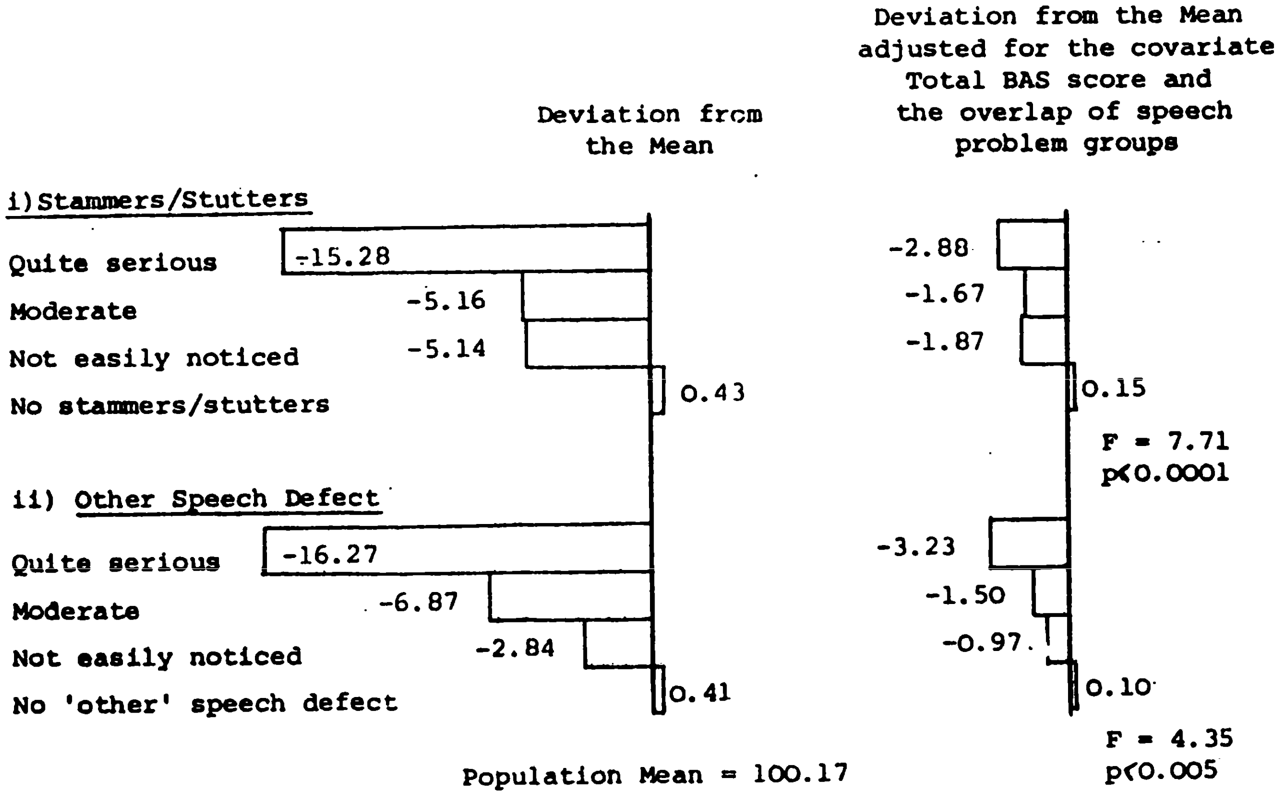


Fig 3.3

Performance on the Shortened Edinburgh Reading Test

of Children with i) stammers/stutters, ii) other speech defects

Results of Analysis of Variance



3.23 Speech defects and reading

The severity of the stammer or stutter and other speech defect is also related to attainment on the reading test. This relationship remains after adjusting for total BAS score and the overlap between the stammer/stutter and other speech defect groups (Fig 2.. 3).

3.24 Speech defects and writing

All the children were asked to copy 'The quick brown fox jumped over the lazy dog'. A copy was presented to them written in cursive form. Their copying was scored as good, fair and poor for 'impression' and 'form', ie roundness and completeness of letters, and coded as cursive, printing or mixed cursive and printing. More children with quite serious stammers or stutters produced poor copies than children with milder speech problems. The same effect was apparent for other speech defects (Table 3.4) and the quality of the writing form (Table 3.5).

Table 3.4

Severity of stammers/stutters and other speech defects and quality of copying

i) Impression

	Copying : Impression				
	Poor	Fair	Good	Missing	No
i Stammer/stutter					
Quite serious	4.8%	42.9%	52.4%	-	21
Moderate	1.4%	22.6%	73.8%	2.1%	141
Not easily noticed	1.8%	18.1%	78.8%	1.3%	509
No stammer/stutter	0.5%	13.4%	84.8%	1.1%	8070
Missing data	1.0%	16.8%	74.8%	8.4%	95
	0.6%	14.0%	84.1%	1.2%	8836
ii 'Other' Speech Defect					
Quite serious	2.0%	35.3%	49.0%	13.7%	51
Moderate	2.5%	25.8%	68.3%	3.3%	240
Not easily noticed	1.1%	16.8%	81.1%	1.1%	380
No stammer/stutter	0.6%	13.3%	85.2%	1.0%	7820
Missing data	0.3%	16.8%	83.8%	3.2%	345
	0.6%	14.0%	84.1%	1.2%	8836

Over half (55.5 percent) of the children in the sample were using cursive writing, 20.3 percent had mixed cursive and printing, 23.0 percent were still printing. More children with serious stammers and stutters were still printing or using mixed cursive and printing than children with milder or no stammers or stutters (Table 3.6).

Table 3. .5

Severity of stammers/stutters and other speech defects and quality of copying

ii) Form

	Copying : Form				
	Poor	Fair	Good	Missing	No
i Stammer/stutter					
Quite serious	4.7%	57.2%	38.1%	-	21
Moderate	1.4%	37.6%	58.9%	-	141
Not easily noticed	1.0%	34.2%	63.5%	1.3%	509
No stammer/stutter	0.4%	24.1%	74.3%	1.2%	8070
Missing data	1.1%	31.6%	60.0%	7.3%	95
	0.5%	25.0%	73.2%	1.3%	8836
ii 'Other' Speech Defect					
Quite serious	2.0%	41.1%	43.1%	3.8%	51
Moderate	2.9%	37.1%	56.7%	3.3%	240
Not easily noticed	0.8%	31.1%	67.1%	1.0%	380
No 'other' speech defect	0.4%	24.1%	74.4%	1.1%	7820
Missing data	0.2%	27.2%	69.3%	3.2%	345
	0.5%	25.0%	73.2%	1.3%	8836

Table 3. .6

Severity of stammers/stutters and other speech defects and printing, mixed or cursive writing

	Copying : Cursive				
	Printing	Mixed	Cursive	Missing	No
i Stammer/stutter					
Quite serious	33.3%	23.8%	42.9%	-	21
Moderate	29.8%	16.3%	51.8%	2.1%	141
Not easily noticed	27.5%	18.5%	52.7%	1.0%	509
No stammer/stutter	22.5%	20.4%	55.8%	7.8%	8070
Missing data	24.2%	21.0%	47.4%	7.3%	95
	23.0%	20.3%	55.5%	1.2%	8836
ii 'Other' Speech Defect					
Quite serious	25.5%	13.7%	47.1%	13.7%	51
Moderate	31.3%	15.4%	50.0%	3.3%	240
Not easily noticed	26.8%	18.4%	53.7%	1.1%	380
No stammer/stutter	22.5%	20.6%	55.8%	1.0%	7820
Missing data	23.8%	17.9%	55.5%	3.0%	345
	23.0%	20.3%	55.5%	1.2%	8836

3.25 Teachers' Assessments of Expressive Language

The children's class teachers completed a number of questions about the children's expressive language by marking line (analogue) scales. The response dimensions they used varied with the questions asked and these are shown in Table 3.6, 1 to 13, together with the mean scores for children with stammers or stutters and other speech defects.

For many of the questions about language the mean responses in the stammers and stutter group and the 'other' speech defect group showed a linear relationship with the severity of the problem.

Children with severe stammers or stutters and other speech problems were reported as using gesture and non verbal communication more than children with milder or no speech problems (Table 3.6.1). They tend to talk to their peers less (Table 3.2) and be less talkative compared with other children, (Table 3.6.4). This is in line with Lerea and Reed's[14] finding that children with speech defects exhibit speech avoidance and are reluctant to interact socially.

Their vocabulary is simpler (Table 3.6.6), so are the language structures they use (Table 3.6.7) and they are slower to assimilate new vocabulary (Table 3.6.8). They are significantly less good at expressing their ideas coherently (Table 3.6.9).

Their articulation, not surprisingly, is more slurred (Table 3.6.10, their words tend not to be well finished (Table 3.6.11) and their speech is less well understood (Table 3.6.12). They also tend to make syntatical mistakes more frequently than children without speech difficulties.

We have been looking at teachers' descriptions of expressive language in children whose severity of speech problems they assessed in the same document. It will be reassuring when we have the severity rating corroborated by information from the health data.

Table 3.6

Class teachers' descriptions of children's language

1 Does the child tend to use gestures and other non-verbal communication in preference to verbal language?

Score 47 Nearly all the time -- Score 1 Not more than is usual for age group

Stammer/stutter		Other speech defect	
Quite serious	19.33	Quite serious	16.10
Moderate	14.99	Moderate	12.64
Not easily noticed	12.20	Not easily noticed	10.30
No stammer/stutter	8.12	No 'other' defect	8.19
Between Groups F = 67.79 $p<0.00001$		Between groups F = 36.98 $p<0.00001$	
Linear component F = 202.03 $p<0.00001$		Linear component F = 110.71 $p<0.00001$	

2 When something important has happened, does the child endeavour to tell his or her friends about it?

Score 47 Not particularly ------------------------------------ Score 1 Very much indeed

Stammer/stutter		Other speech defect	
Quite serious	23.29	Quite serious	25.06
Moderate	20.15	Moderate	18.85
Not easily noticed	19.42	Not easily noticed	19.55
No stammer/stutter	18.01	No 'other' defect	17.96
Between Groups F = 4.76 $p<0.002$		Between Groups F = 7.96 $p<0.00001$	
Linear component F = 13.77 $p<0.0002$		Linear component F = 15.62 $p<0.0001$	

Table 3.6

3 When something important has happened does the child endeavour to tell his or her teacher about it?

Score 47 Not particularly ---------------------------------- Score 1 Very much indeed

Stammer/stutter		Other speech defect	
Quite serious	20.62	Quite serious	24.88
Moderate	21.19	Moderate	21.06
Not easily noticed	20.84	Not easily noticed	20.27
No stammer/stutter	19.50	No 'other' defect	19.98
Between Groups F = 1.16	ns	Between Groups F = 2.99	$p<0.03$
Linear component F = 3.09	ns	Linear component F = 6.07	$p<0.01$

4 When talking to friends, is the child (compared to the rest of the class):

Score 47 Very talkative -- Score 1 Reluctant to talk

Stammer/stutter		Other speech defect	
Quite serious	29.38	Quite serious	22.58
Moderate	26.20	Moderate	29.01
Not easily noticed	28.73	Not easily noticed	29.11
No stammer/stutter	30.49	No 'other' defect	30.50
Between Groups F = 11.85	$p<0.00001$	Between Groups F = 13.02	$p<0.00001$
Linear component F = 31.43	$p<0.00001$	Linear component F = 28.84	$p<0.00001$

Table 3.6

5 When talking to you, is the child normally (compared to the rest of the class):

Score 47 Very talkative -- Score 1 Recluctant to talk

Stammer/stutter		Other speech defect	
Quite serious	24.24	Quite serious	23.72
Moderate	25.24	Moderate	26.08
Not easily noticed	26.33	Not easily noticed	27.05
No stammer/stutter	28.12	No 'other' defect	28.09
Between Groups $F = 8.46$ $p < 0.0001$		Between Groups $F = 6.39$ $p < 0.0005$	
Linear component $F = 24.95$ $p < 0.00001$		Linear component $F = 18.58$ $p < 0.00001$	

6 When describing his or her own experiences, is the child's vocabulary:

Score 47 Very simple -- Score 1 Very advanced

Stammer/stutter		Other speech defect	
Quite serious	32.00	Quite serious	35.61
Moderate	32.08	Moderate	30.86
Not easily noticed	27.96	Not easily noticed	26.17
No stammer/stutter	24.01	No 'other' defect	23.98
Between Groups $F = 48.93$ $p < 0.0001$		Between Groups $F = 65.93$ $p < 0.00001$	
Linear component $F = 134.44$ $p < 0.00001$		Linear component $F = 191.29$ $p < 0.00001$	

Table 3.6

7	Are the language structures used by the child:	
	Score 47 Very simple --	Score 1 Very advanced

Stammer/stutter		Other speech defect	
Quite serious	32.71	Quite serious	35.54
Moderate	30.40	Moderate	31.17
Not easily noticed	28.82	Not easily noticed	27.07
No stammer/stutter	24.78	No 'other' defect	24.75
Between Groups F = 46.91 $p<0.0001$		Between Groups F = 61.54 $p<0.00001$	
Linear component F = 135.40 $p<0.00001$		Linear component F = 180.814 $p<0.00001$	

8	When the class is given new words and concepts, does the study child assimilate and use the new vocabulary:	
	Score 47 Readily --	Score 1 Reluctantly (or slowly)

Stammer/stutter		Other speech defect	
Quite serious	15.67	Quite serious	12.47
Moderate	17.94	Moderate	18.51
Not easily noticed	19.87	Not easily noticed	21.69
No stammer/stutter	24.30	No 'other' defect	24.31
Between Groups F = 38.67 $p<0.00001$		Between Groups F = 40.18 $p<0.00001$	
Linear component F = 112.10 $p<0.00001$		Linear component F = 117.36 $p<0.00001$	

Table 3.6

9 When describing his or her own experiences to you, do the ideas come out coherently in a sequence which makes sense for the listener? In other words, how are the child's thoughts organised:

Score 47 Very poorly -- Score 1 Very well

Stammer/stutter		Other speech defect	
Quite serious	35.67	Quite serious	34.02
Moderate	29.82	Moderate	27.95
Not easily noticed	26.62	Not easily noticed	23.79
No stammer/stutter	19.68	No 'other' defect	19.76
Between Groups F = 119.20 $p < 0.00001$		Between Groups F = 87.4 $p < 0.00001$	
Linear component F = 349.02 $p < 0.00001$		Linear component F = 261.17 $p < 0.00001$	

10 Is the articulation of the child's speech:

Score 47 Heavily slurred -- Score 1 Very clear

Stammer/stutter		Other speech defect	
Quite serious	38.38	Quite serious	39.48
Moderate	29.59	Moderate	31.92
Not easily noticed	24.34	Not easily noticed	24.12
No stammer/stutter	15.40	No 'other' defect	15.18
Between Groups F = 263.59 $p < 0.00001$		Between Groups F = 444.25 $p < 0.00001$	
Linear component F = 781.07 $p < 0.00001$		Linear component F = 1331.08 $p < 0.00001$	

Table 3.6

11 In ordinary conversation, do the child's words tend to be:

Score 47 Well finished -- Score 1 Very clipped

Stammer/stutter		Other speech defect	
Quite serious	15.67	Quite serious	13.73
Moderate	18.09	Moderate	18.79
Not easily noticed	22.42	Not easily noticed	24.14
No stammer/stutter	29.44	No 'other' defect	29.49
Between Groups $F = 147.48$	$p < 0.00001$	Between Groups $F = 159.64$	$p < 0.00001$
Linear component $F = 432.74$	$p < 0.00001$	Linear component $F = 478.88$	$p < 0.00001$

12 Given that most children's spoken language understandably reflects the importance of regional accents and dialects, can this child, in the appropriate situation, speak in such a way that he or she is clearly understood within the language context of 'standard English'?

Score 47 Very well -- Score 1 Very poorly

Stammer/stutter		Other speech defect	
Quite serious	17.86	Quite serious	13.55
Moderate	23.49	Moderate	23.20
Not easily noticed	27.47	Not easily noticed	28.51
No stammer/stutter	33.12	No 'other' defect	33.26
Between Groups $F = 105.26$	$p < 0.00001$	Between Groups $F = 165.66$	$p < 0.00001$
Linear component $F = 313.90$	$p < 0.00001$	Linear component $F = 487.78$	$p < 0.00001$

Table 3.6

13 When talking to the teacher, does the child make syntatical mistakes which make it difficult to understand him or her?

Score 47 Not at all -- Score 1 Very frequently

Stammer/stutter		Other speech defect	
Quite serious	19.62	Quite serious	19.60
Moderate	26.33	Moderate	25.69
Not easily noticed	28.08	Not easily noticed	30.53
No stammer/stutter	34.76	No 'other' defect	34.76
Between Groups F = 110.46 $p < 0.00001$		Between Groups F = 112.11 $p < 0.00001$	
Linear component F = 315.84 $p < 0.00001$		Linear component F = 334.96 $p < 0.00001$	

Although the responses to the thirteen items are interesting and each deserves consideration, the multidimensionality involved is a little hard to grasp conceptually. We subjected these items to principal components analysis to reduce their multidimensionality to three factors which we called language development, articulation and communication (Fig 3.4). The factor score means for the children with stammers or stutters or other speech defects are given in Table 3.7. The more severe the speech problem the more negative the mean score.

3.26 Expressive Language, Language Comprehension, Reading and Mathematics

Multiple regression analyses were carried out to see what these descriptions of children's expressive language predicted scores on the language comprehension, Edinburgh Reading and Friendly Maths Tests (Table 3.8). 'Language Development' had the greatest Beta coefficient and was the most powerful predictor of the three expressive language factor scores. It accounted for 19 percent of the variance in the language comprehension test, 37 percent of the variance in the Reading Test and 31 percent of the variance in the Maths Test.

The analysis was then repeated including the children's total score on the BAS (Table 3.9). The BAS explained 34.3 percent of the variance in the language comprehension test leaving 1.2 percent explained by language development and 0.3 percent by articulation. It accounted for 57.0 percent of the variance in the Edinburgh Reading Test, language development then accounted for 4.2 percent and articulation for 1.7 percent. The BAS accounted for 56.1 percent of the variance in the Maths test. Language development accounted for 2.2 percent and articulation for 0.6 percent.

This analysis serves to remind us of the very strong relationship between cognitive ability and attainment. It does also show however that Language Development accounted for 4 percent of the test variance in the Reading Test, 2 percent in the Mathematics Test and 1 percent in the language comprehension test after cognitive ability had been taken into account. It is interesting to note that whereas articulation accounted for 0.3 percent of the variance in the language comprehension test it accounted for five times as much variance, 1.7 percent, in the reading test.

Fig 3.4

Language Development

When describing his or her experiences is the child's vocabulary:

Score 47	Score 1
Very simple	Very advanced

Are the language structures used by the child:

Score 47	Score 1
Very simple	Very advanced

When the class is given new words and concepts, does the study child assimilate and use new vocabulary:

Score 47	Score 1
Readily	Reluctantly (or slowly)

When describing his or her own experiences to you, do the ideas come out coherently in a sequence which makes sense for the listener?, In other words, how are the child's thoughts organised:

Score 47	Score 1
Very well	Very poorly

Articulation

Does the child tend to use gestures and other non-verbal communication in preference to verbal language,

Score 47	Score 1
Nearly all the time	Not more than usual for age group

Is the articulation of the child's speech:

Score 47	Score 1
Heavily slurred	Very clear

In ordinary conversation do the child's words tend to be:

Score 47	Score 1
Well finished	Very clipped

Given that most children's spoken language understandably reflects the importance of regional accents and dialects, can this child, in the appropriate situation, speak in such a way that he or she is clearly understood within the language context of 'standard English'?

Score 47	Score 1
Very well	Very poorly

When talking to the teacher, does the child make syntatical mistakes which make it difficult to understand him or her?

Score 47	Score 1
Not at all	Very frequently

Communication

When something important has happened, does the child endeavour to tell his or her friends about it,

Score 47	Score 1
Not particularly	Very much indeed

When something important has happened, does the child endeavour to tell his or her teacher about it,

Score 47	Score 1
Not particularly	Very much indeed

When talking to friends, is the child (compared to the rest of the class):

Score 47	Score 1
Very talkative	Reluctant to talk

When talking to you, is the child normally (compared to the rest of the class):

Score 47	Score 1
Very talkative	Reluctant to talk

Table 3.7

Teacher ratings of expressive language:- factor scores

Stammer/stutter	1 Language Development Mean Score	2 Articulation Mean Score	3 Communication Mean Score
Quite serious	.3564	2.0420	0.1591
Moderate	.3163	1.2032	0.1923
Not easily noticed	.2471	0.7264	0.0911
No defect	-.0060	-0.0759	-0.0018
	F = 15.4837 $p < .0001$	F = 217.79 $p < 0.0001$	F = 3.19 $p < .03$
Any speech defect			
Quite serious	.6726	1.8032	0.4916
Moderate	.3876	1.1499	0.0630
Not easily noticed	.0923	0.5785	0.0870
No defect	-.0066	-0.0832	-0.0024
	F = 20.6554 $p < .0001$	F = 242.26 $p < 0.001$	F = 5.30 $p < 0.001$

Table 3.8

Multiple Regression Analysis

Independents	Beta	R Square	RSQ Change	F
Dependant: Pictorial Language Comprehension				
Language Development	0.430	0.18645	0.18645	1965.258
Articulation	0.167	0.21450	0.02805	306.152
Communication	0.032	0.21554	0.00104	11.375
Dependant: Standardised Reading Score				
Language Development	0.606	0.36967	0.36967	5029.078
Articulation	0.261	0.43805	0.06838	1043.280
Communication	0.013	0.43821	0.00016	2.458
Dependant: Standardised Friendly Maths				
Language Development	0.559	0.31390	0.31390	3923.251
Articulation	0.216	0.36044	0.04653	623.805
Communication	0.003	0.36045	0.00001	0.200

Note:

The form of regression presented here in Table 3.8 and in Table 3.9 yields results in terms of variance added to the model. Future regressions will present more detailed results in which shared variance can be shown as absorbing a considerable part of the variance taken by the first predictor in each of these models.

Table 3.9

Multiple regression analyses of standardised total BAS, Language Development, Articulation and Communication Scores on (i) Pictorial Language Comprehension Score, (ii) Edinburgh Reading Test score and Mathematics score

Multiple Regression Analyses

Independants	Beta Standardised Regression Coefficient	R Square	R Square Change	F
Dependant Variable: Standardised Pictorial Comprehension Test				
General Cognitive Ability (Standardised total BAS)	0.486	0.343	0.343	4475.44
Language Development	0.147	0.355	0.012	160.67
Articulation	0.058	0.358	0.003	41.58
Communication	0.018	0.359	0.001	4.52
Dependant Variable: Shortened Edinburgh Reading Test Standardised Total Score				
General Cognitive Ability (Stnadardised total BAS)	0.561	0.570	0.570	4475.44
Language Development	0.279	0.612	0.042	160.67
Articulation	0.135	0.629	0.017	41.58
Communication	0.003	0.629	0.000	4.52
Dependant Variable: Standardised Total Maths Score				
General Cognitive Ability (Standardised Total BAS)	0.614	0.561	0.561	10933.72
Language Development	0.201	0.583	0.022	467.34
Articulation	0.078	0.589	0.006	116.42
Communication	0.014	0.589	0.000	3.89

Table 3.10 Behaviour in the classroom of children with stammers and stutters

When the child is expected to be working, what percentage of time would you describe the child's behaviour as:

	Concentrating	Interested in other tasks	Talking to other children	Moving around class	Fidgeting	Serious behaviour aberrations	Day dreaming
a Stammer/stutter	%	%	%	%	%	%	%
Quite serious	47.75	7.56	18.75	4.20	11.15	0.35	10.25
Moderate	55.39	8.37	12.70	3.34	8.26	0.62	13.31
Not easily noticed	60.39	7.94	12.23	3.11	6.39	0.64	9.16
No defect	68.60	5.99	11.38	2.62	5.05	0.27	6.59
Between Groups F	42.6934	13.8021	5.5948	3.0567	16.3498	4.9343	27.5867
	$p<0.00001$	$p<0.00001$	$p<0.0008$	$p<0.03$	$p<0.0001$	$p<0.0021$	$p<0.00001$

Table 3.11 Behaviour in the classroom of children with 'other' speech defects

When the child is expected to be working what percentage of time would you describe the child's behaviour as:

	Concentrating	Interested in other tasks	Talking to other children	Moving around class	Fidgeting	Serious behaviour aberrations	Day dreaming
b <u>Other speech defect</u>	%	%	%	%	%	%	%
Quite serious	51.52	8.83	11.35	6.75	13.63	2.24	11.65
Moderate	60.03	7.78	11.91	3.31	7.56	0.68	10.90
Not easily noticed	64.40	7.55	11.44	2.51	5.65	0.47	8.00
No defect	68.38	5.97	11.45	2.63	5.05	0.22	6.65
Between Groups F	23.08	10.85	0.1661	12.84	27.8378	12.3864	12.8783
	$p<0.00001$	$p<0.00001$	ns	$p<0.00001$	$p<0.00001$	$p<0.00001$	$p<0.00001$

Table 3.12

Children's Behaviour

Stammer/Stutter	Anti-social score	Inattentive score	Clumsy	Hand-eye co-ordination	Neurotic -anxious
Quite serious	1.02	0.89	0.48	-0.67	0.96
Moderate	0.57	0.75	0.90	-0.84	0.84
Not easily noticed	0.43	0.49	0.62	-0.60	0.59
No defect	-0.04	-0.04	-0.06	0.05	-0.05
Between Groups F	57.86	80.57	127.23	112.14	115.26
	$p<0.00001$	$p<0.00001$	$p<0.00001$	$p<0.00001$	$p<0.00001$
Deviation from Linearity F	3.34	0.12	19.27	14.23	9.02
	p 0.05	ns	p 0.00001	p 0.00001	p 0.00001

Any speech defect	Anti-social score	Inattentive score	Clumsy	Hand-eye co-ordination	Neurotic -anxious
Quite serious	0.36	0.77	1.23	-1.28	0.57
Moderate	0.34	0.50	0.64	-0.60	0.42
Not easily noticed	0.12	0.21	0.31	-0.32	0.31
No other defect	-0.02	-0.03	-0.04	0.04	-0.03
Between Groups F	15.14	38.41	81.42	78.54	36.60
	$p<0.00001$	$p<0.00001$	$p<0.00001$	$p<0.00001$	$p<0.0001$
Deviation from Linearity F	0.59	0.12	1.16	2.22	2.53
	ns	ns	ns	ns	ns

3.27 Speech Defects and Behaviour in the Classroom

The children's class teachers made an estimate of the amount of time during a work period each child spent concentrating, being interested in other tasks, talking to other children, moving around the class, fidgeting and displaying serious behaviour aberrations.

Children with severe stammers or stutters concentrated for less time than children with milder or no defects. Children with the more serious stammers or stutters spent more time moving around the class, fidgeting, talking to other children and day dreaming, (Table 3.10). The same was true for children with other speech defects. There was one notable exception, they did not spend more time talking to other children. (Table 3.11).

Both the health and educational parts of the data contain a wealth of information about the children's behaviour. It has been described by the mothers, the clinical medical officers and the teachers. In both parts of the study an inventory of behaviour items has been completed for each child. In each part of the study the inventory items have been subjected to principal components analysis (see Appendix). The results from the educational part of the study are presented here, Table 3.12. Children with serious stammers or stutters or other speech defects tend to be more antisocial, more inattentive, more clumsy, have poorer hand-eye coordination and be more anxious than children with milder or no speech problems.

3.28 Children with speech difficulties in school

We are beginning to test wide ranging models of the factors from the children's homes and school environments which affect their educational attainment. The preliminary work on the educational environment is presented in section 4 of this report.

There is much work still to be done. We end this examination of the effect of speech difficulties on attainment by considering one or two of the factors which can be used to describe the school environment.

3.28.i Time allocated to particular activities connected with speech and language

Each class teacher was asked to report how many hours a week each study child was engaged in activities such as assembly, instructional reading work, mathematics, science subjects, foreign languages, etc, during the school period.

The time reported to be given to instructional reading, reading for pleasure and literature and poetry did not differ between the two speech difficulty groups, that is the children with stammers or stutters and the 'other speech difficulty' group, nor with the severity of the difficulty. The exception to this was the amount of time for reading for pleasure allocated to children with 'other speech difficulties'. This was inversely proportional to the severity of their difficulty. The same was true for creative writing, (Table 3.13).

More time was allocated for drama to children with stammers or stutters. The children with more severe stammers or stutters received the most experience in drama. This was not the case for children with other speech defects.

The amount of time allocated to teaching mathematics was also inversely proportioned to the severity of stammers or stutters or other speech difficulty experienced by the children.

Table 3.13a

How many hours a week is the child engaged in the following activities during school periods?

	Stammer/stutter Hours per week	'Other' Speech Defect Hours per week
i INSTRUCTIONAL READING		
Quite serious	1.99	2.17
Moderate	2.12	2.12
Not easily noticed	2.00	1.96
No defect	1.94	1.93
	F = 1.04 ns	F = 1.74 ns
ii READING FOR PLEASURE		
Quite serious	1.90	1.36
Moderate	1.62	1.63
Not easily noticed	1.78	1.75
No defect	1.80	1.81
	F = 1.40 ns	F = 4.74 $p<0.003$
iii LITERATURE AND POETRY		
Quite serious	0.65	0.75
Moderate	0.89	0.98
Not easily noticed	0.93	0.96
No defect	0.95	0.95
	F = 0.73 ns	F = 1.72 ns

Table 3.13b

	Stammer/stutter Hours per week	'Other' Speech Defect Hours per week
iv CREATIVE WRITING		
Quite serious	1.63	1.13
Moderate	1.52	1.50
Not easily noticed	1.56	1.67
No defect	1.56	1.55
	F = 0.21 ns	F = 6.94 p<0.0001
v DRAMA		
Quite serious	0.70	0.46
Moderate	0.49	0.38
Not easily noticed	0.40	0.39
No defect	0.39	0.39
	F = 5.76 p<0.0007	F = 0.48 ns
i MATHEMATICS		
Quite serious	4.13	3.95
Moderate	4.52	4.68
Not easily noticed	4.56	4.64
No defect	4.72	4.71
	F = 5.72 p<0.00007	F = 7.28 p<0.0001

Missing data = 159 (1.8%)

Table 3.14

Attendance at Speech Therapy in the past few years

	Frequently	Occasionally	Not at all	Not stated	Number of Children
1 Stammers or stutters					
Severe/serious	5 23.8%	4 19.1%	8 38.1%	4 19.1%	21
Moderate	2 1.3%	20 13.4%	71 47.7%	48 32.2%	149
Not easily noticed	13 2.6%	19 3.7%	344 67.7%	132 26.0%	508
No stammer or stutter	39 0.5%	82 1.0%	6350 78.7%	1593 19.8%	8064
Not stated	3 3.6%	7 8.3%	32 38.0%	52 61.9%	84

	Frequently	Occasionally	Not at all	Not stated	Number of Children
11 'Other' speech defects					
Severe/serious	12 23.5%	17 33.3%	10 19.6%	12 23.5%	51
Moderate	29 12.1%	43 17.9%	96 40.0%	72 30.0%	240
Not easily noticed	5 1.3%	25 6.6%	254 66.8%	95 25.0%	380
No 'other' speech defect	15 0.2%	43 0.5%	6241 79.8%	1515 19.4%	7820
Not stated	1 0.3%	4 1.2%	204 59.1%	119 34.5%	345
Number of children	63 0.7%	132 1.5%	6812 77.12%	1829 20.7%	8836

Note: The groups of children with stammers or stutters and with other speech defects overlap, thus it is likely that children who received speech therapy in the 'no stammers or stutters' group in fact had 'other' speech defects, and this probably also applies to children with no 'other' speech defect who received therapy.

3.28.ii Speech Therapy

The Quirk Report (1972) on the speech therapy services concluded that about 3 percent of children in ordinary schools suffered from some kind of speech disorder and 2 percent were in need of speech therapy.

Most of our detailed information on the use of the speech therapy services resides in the health data which we are about to link child by child with the educational data.

According to the teachers 2.2 percent of the children had received speech therapy during the past few years. The children with the more serious problems being more likely to receive therapy (Table 3.14a and b).

The missing data from the stammer or stutter and other speech defect descriptions is of the order of 0.8 percent but the missing data for attendance at speech therapy is in the order of 20 percent. The 'not stated' category in the Table 3.14a and b includes a 'not known' response which was given for 6.2 percent of the children. Once the health data and the information from local authority records on the use of services and the parent's account of use of services is available we should be able to throw further light on this overlarge 'no information' category.

We must bear in mind therefore that the use of the speech therapy service given in these tables probably represents a minimal estimate. Nevertheless, the information used in subsequent analyses is restricted to children for whom we have a definite response from the teacher on attendance or non attendance at speech therapy.

The language development, articulation and communication scores were compared for children who had attended and had not attended speech therapy during the past year. The mean scores for these children are given in Table 3.15 and 3.16.

Table 3.15

Mean Language Development, Articulation and Communication score for children who have received speech therapy in the past few years

	Frequently	Occasionally	Not at all	Do not know
Language development	0.77	0.38	-0.05	0.20
	F = 46.07 p<0.00001			
Articulation	1.00	1.14	-0.09	0.22
	F = 127.95 p<0.00001			
Communication	0.33	0.04	-0.01	0.06
	F = 4.45 p<0.005			

High scores in Table 3.15 indicate poor language development, articulation and communication. Children with poorer scores in these three aspects of language had attended speech therapy in the past few years. The poorest scorers had attended therapy most frequently. These alternative measures of language difficulty indicated that speech therapy was being received by those who needed it.

This can also be seen in Table 3.16 where attendance at speech therapy by stammers or stutters and children with other speech defects is considered. The three scores, language development, articulation and communication are however effectively repeated measures on the same children in the group.

Table 3.16

Mean Language Development, Articulation and Communication scores and attendance at speech therapy during the past few years. (a) stammers or stutters, (b) other speech defects

(a) Stammer/stutter	Attended speech therapy	Has not attended speech therapy or teacher did not know if attended
1 Language Development score		
Severe/serious	0.67	0.20
Moderate	0.62	0.31
Not easily noticed	0.69	0.27
No stammer or stutter	0.66	0.12
2 Articulation score		
Severe/serious	1.92	2.09
Moderate	1.35	1.24
Not easily noticed	1.26	0.73
No stammer or stutter	0.93	-0.52
3 Communication		
Severe/serious	0.21	0.10
Moderate	0.45	0.21
Not easily noticed	0.11	0.08
No stammer or stutter	0.19	0.02

(b) 'Other' speech defect	Attended speech therapy	Has not attended speech therapy or teacher did not know if attended
1 Language Development score		
Severe/serious	0.88	0.45
Moderate	0.66	0.30
Not easily noticed	0.07	0.12
No stammer or stutter	0.42	0.20
2 Articulation score		
Severe/serious	1.67	1.95
Moderate	1.31	1.27
Not easily noticed	1.43	0.64
No stammer or stutter	0.63	-0.02
3 Communication		
Severe/serious	0.34	0.74
Moderate	0.22	0.08
Not easily noticed	0.03	0.11
No stammer or stutter	0.25	0.06

These three scores are however effectively repeated measures on the same children so the group of children with severe 'other' speech defects who have attended speech therapy have worse (higher) language development scores than those who have not attended speech therapy but better (lower) articulation and communication scores.

3.28.iii Additional Special Educational Help

We have shown that children with stammers or stutters or other speech defects do less well than other children in language comprehension, reading and writing. Class teachers were asked if the children were receiving therapeutic or special help in school and what form the help took. They were also asked if the child would benefit from special educational help over and above any special help already being received.

For children without speech defects, children reported that 12.8 percent would benefit from additional help. The number of children with speech defects who would benefit was far higher: 21 percent of children with serious stammers, 32.6 percent with moderate, 28.3 percent of children with not easily noticed stammers (Table 3.17a). 31 percent of children with severe or moderate other speech defects, 21 percent with not easily noticed other speech defects in this national cohort would benefit from additional special educational help over and above any already being received, (Table 3.17b).

Table 3.17a
Child would benefit from special educational help over and above any special help already being received

Stammer/stutter	Yes	No	Not stated	Number of Children
Severe and quite serious	21.1%	78.9%	-	21
Moderate	32.6%	61.7%	5.7%	141
Not easily noticed	28.3%	68.0%	3.7%	509
No stammer/stutter	12.8%	82.7%	4.5%	8070
Not stated	20.9%	51.6%	27.5%	95
				8836

Table 3.17b

Child would benefit from special educational help over and above any special help already being received

'Other' speech defect	Yes	No	Not stated	Number of Children
Severe and quite serious	31.4%	58.8%	9.8%	51
Moderate	31.7%	61.3%	7.1%	240
Not easily noticed	21.6%	73.4%	5.0%	380
No 'other' speech defect	12.8%	82.9%	4.2%	7820
Not stated	21.2%	67.2%	11.6%	345
				8836

We are reminded of the statement in the Warnock Report[7] about children with speech and language difficulties.

> 'The special educational needs of this group of children are only slowly becoming recognised and understood ... Although speech therapy services work intensively with many of the children, the development of language and communication should be an important part of the educational programme provided for them ... We believe that in the immediate future medical officers, speech therapists and teachers should work more closely to develop appropriate forms of both special education and teacher training in this field.'

3.30 Children with Reading Difficulties

> 'Within the directional constraint of the printer's code, language and visual perception responses are purposefully directed in some integrated way to the problem of extracting meaning from clues in a text, in sequence, to yield a meaningful communication, conveying the author's specific message.'
>
> From '<u>What is Reading</u>?' in Clay, 1979.[8]

The skills required for the reading process involve good control of oral language. We have seen in the previous section how poor oral language is associated with poor literacy skills, particularly reading. Clay[8] has argued that a child learning to read must be able to coordinate what he hears in language and sees in print and have enough hand and eye coordination so that he can learn the controlled, directional movement patterns required for reading.

One of the major difficulties, however, is that there are no agreed criteria for distinguishing children of average or above average intelligence with severe and long term difficulties in reading, writing and spelling from others who may require relatively short term remedial teaching in these areas. The difficulties are exacerbated by the fact that the former appears to a most heterogeneous group of children.

Among the characteristics of such children may be poor visual discrimination and memory for words; poor auditory memory for words or for individual sounds in words; persistent reversal of words syllables or letters in reading, writing and speech; rotation or inversion of letters; reversed sequence of letters and syllables; mirror-writing; transposition of numbers; poor recall for reproduction of simple geometric forms; poor memory for auditory or visual sequences; weakly established handedness, clumsiness and poor hand control; immature articulation; overactivity and distractibility. In addition such children can show large discrepancies between their verbal and non verbal scores on intelligence tests. Definitive educational research is dependant on the identification of homogeneous subgroups in this ill-defined sample. Then, given children who exhibit the same difficulties, the chances of developing appropriate educational techniques to help them overcome their learning difficulties are greatly enhanced.

The present study provides detailed information on the education attainment of a national population of 10 year old children at the e of the primary school period. We are therefore in the interesting position of being able to identify groups of poor readers, poor mathematicians, poor spellers, poor writers, overactive children, disorientated children, children with poor attention spans, children with poor auditory discrimination, children with poor visual discrimination, children with poor body images, children with confusion over handedness, children with poor fine motor control, children with poor gross motor control, children with immature articulation and so on.

In fact, what we shall do initially is to examine and compare the scores on some of the attainment tests across groups of children with reading difficulties and difficulties in mathematics.

3.31 Identifying Children with Reading Difficulties

The criteria used for defining children with reading difficulties have always been a problem. We begin by examining the relationship between attainment in reading and the total score from four of the co scores of British Ability Scales in a sample of 8,836 from a total of 13,091 children, on whom educational attainment information is available from the national study. The four BAS scores are made up of two verbal scores, word definitions and similarities, and two non-verbal scores, matrices and recall of digits. Both the total BAS score and the score from the shortened Edinburgh Reading Test have been standardised to give a mean of 100 and a standard deviation of 15. Examination of Table 3.18 shows the relationship between the reading and total BAS scores in the sample.

There are approximately equal proportions of children with readi and BAS scores below 0 standard deviations as above; 39.8 percent compared with 38.9 percent. Ten percent of children have reading scores above 0 standard deviations and BAS scores below and 11 percen have reading scores below 0 standard deviations and BAS scores above.

In the group of children with reading and BAS scores below 0 stan deviations, three quarters have scores between 0 and 1½ standard devi below the mean on both tests.

Table 3.18 Reading Score and Total British Ability Scales score

Reading scores in half SDs	Total British Ability Scale Score divided into ½ Standard Deviations															
	-4 to -3½	-3½ to -3	-3 to -2½	-2½ to -2	-2 to -1½	-1½ to -1	-1 to -½	-½ to 0	0 to ½	½ to 1	1 to 1½	1½ to 2	2 to 2½	2½ to 3	3 to 3½	3½ to 4
-3½ to -3	8	1	2	1	-	-	-	-	-	-	-	-	-	-	-	-
-3 to -2½	1	7	8	9	5	3	-	-	-	-	-	-	-	-	-	-
-2½ to -2	-	3	13	38	32	24	16	7	-	-	-	-	-	-	-	-
-2 to -1½	-	-	11	60	96	103	67	38	10	4	-	1	-	-	-	-
-1½ to -1	-	-	8	42	130	285	244	197	156	15	3	-	-	-	-	-
-1 to - ½	-	-	1	12	70	194	305	287	151	56	9	4	-	-	-	-
- ½ to 0	-	-	-	6	33	163	380	530	411	182	46	13	2	-	-	-
0 to ½	-	-	-	-	1	42	152	374	427	351	131	44	5	2	-	-
½ to 1	-	-	-	-	-	10	46	207	406	461	263	92	16	6	-	-
1 to 1½	-	-	-	-	1	1	6	40	115	230	189	103	20	5	1	-
1½ to 2	-	-	-	-	-	-	-	4	35	87	93	71	26	11	3	1
2 to 2½	-	-	-	-	-	-	-	1	8	18	31	40	16	7	-	-
2½ to 3	-	-	-	-	-	-	-	-	1	5	11	12	14	2	-	-
3 to 3½	-	-	-	-	-	-	-	-	-	-	1	4	1	1	-	-

Note: Each cell contains the number of children whose Edinburgh Reading scores fall within a particular range and whose BAS scores fall within a particular range, eg 163 children had a reading score between -½ and 0 standard deviations and a BAS score between -1½ and -1 standard deviations.

For our initial analyses we defined seven groups of readers. The groups were defined in terms of 1½ standard deviations from the mean on the reading and total BAS (cognitive function) score, (Table 3.19).

Table 3.19 Groups of readers defined by their standardised total reading score and total BAS score

Standardised total score Shortened Edinburgh Reading Test	BAS Total Standardised Score: -3 to -1½ SD	-1½ to 0 SD	0 to +1½	+1½ to +3 SD
-3 to -1½ SD	Group I 295 3.4%	Group III 258 3.0%	Group V 964 11.1%	
-1½ to 0 SD	Group II 302 3.5%	Group IV 2585 29.9%		
0 to 1½ SD +1½ to +3 SD	Group VI 885 10.2%		Group VII 3366 38.9%	

Total sample N = 8836, Missing data N = 181 (2.0%)

3.31.1 Poor Readers and Reading Subskills

The mean scores for the total reading score and the reading test subscores, which have also been standardised are given in Table 3.20. There are significant differences in the total scores and subscores between the seven groups ($p < 0.00001$). If we look at the rank order of the means of the standardised subscores within each group there is no difference in rank order between groups I and II; nor between groups III, IV and V; nor between groups VI and VII. There is a significant difference however between these three sets of groups. The good readers (groups VI and VII) appear to have comprehension scores which are better than their vocabulary and recall scores whereas the poor readers groups, II, IV and V, have comprehension scores which are worse than their vocabulary and recall scores. The low intelligence poor readers groups I and II appear to score worst on the vocabulary subscore and best on the recall score.

ble 3.20 Total Edinburgh Reading Score and Subscore means for different groups of readers

Total inburgh eading Score		Total British Ability Scale Score -3 to -1.5 SD	-1.5 to 0 SD	0 to +3 SD
to .5 SD	**Group I** / **Group III** / **Group V**			
	Total Edinburgh Reading Score	69.48	72.87	93.87
	Vocabulary sub-score	69.73	73.12	99.27
	Recall subscore	75.49	75.91	97.44
	Comprehension of sentences and sequences subscore	70.14	74.06	95.19
	Comprehension of passage and picture subscore	74.08	75.77	93.02
.5 to SD	**Group II** / **Group IV**			
	Total Edinburgh Reading Score	85.52	90.43	
	Vocabulary sub-score	88.38	94.30	
	Recall subscore	89.41	94.27	
	Comprehension of sentences and sequences subscore	84.61	90.87	
	Comprehension of passage and picture subscore	85.13	89.60	
to 3 SD	**Group VI** / **Group VII**			
	Total Edinburgh Reading Score	106.58		113.67
	Vocabulary sub-score	105.91		109.26
	Recall subscore	106.05		108.71
	Comprehension of sentences and sequences subscore	108.44		112.61
	Comprehension of passage and picture subscore	108.09		113.76

3.31.ii Poor Readers, Language Comprehension and Mathematics

The mean standardised language comprehension scores for the seven groups of readers are shown in Table 3.21. High intelligence poor readers and low intelligence good readers appear to have fairly similar scores on the language comprehension test and fairly similar scores on the mathematics test (Table 3.22).

Table 3. 21 Pictorial Language Comprehension score for different groups of readers

<table>
<tr><th rowspan="2">Total Edinburgh Reading Score</th><th colspan="3">Total British Ability Scales Scores</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
80.88</td><td>Group III
90.57</td><td rowspan="2">Group V
100.81</td></tr>
<tr><td>-1.5 to 0 SD</td><td>Group II
85.19</td><td>Group IV
93.02</td></tr>
<tr><td>0 to +3 SD</td><td colspan="2">Group VI
99.67</td><td>Group VII
108.84</td></tr>
</table>

Table 3. 22 Total Mathematics Score for different groups of readers

<table>
<tr><th rowspan="2">Total score on the maths test</th><th colspan="3">Total British Ability Scales Scores</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
72.89</td><td>Group III
81.77</td><td rowspan="2">Group V
99.77</td></tr>
<tr><td>-1.5 to 0 SD</td><td>Group II
82.88</td><td>Group IV
91.85</td></tr>
<tr><td>0 to +3 SD</td><td colspan="2">Group VI
100.52</td><td>Group VII
111.74</td></tr>
</table>

3.40 Children with Mathematics Difficulty

Mathematics is given a high degree of priority in the curriculum in primary schools. The HMI survey of primary education in England in 1978 identified items in mathematics which occurred in the curriculum of over 80 percent of the survey classes.

Work was done to enable children to use language appropriate to the properties of number, size, shape and position; to recognised relationships in geometrical shapes, numbers, ordered arrangements and everyday things; to appreciate place value and recognise simple number patterns; to carry out suitable calculations involving +, -, x and ÷ with whole numbers; to understand money and the value of simple purchases; to use numbers in counting, describing and estimating. In the 11 year old classes children were taught to estimate and use measurements of length, weight, area, volume and time; to work with the four rules of number; to calculate using decimals; to use fractions; to appreciate the idea of equivalence and to apply fractions to everyday things; to use various forms of visual presentation including three dimensional and diagrammatic forms.

The coverage of items, however, varied from class to class and showed no overall consistency. In mathematics there was a one hundred percent coverage is only one area of work, that of calculations involving the four rules with whole numbers.

In the 10 year follow up study we asked teachers to indicate which mathematics curriculum areas had been covered by the study child's class. The curriculum areas selected for the test were those which CHES mathematics advisers as well as documentation from the Assessment Performance Unit[27] suggested should have been taught by the ages of 10 or 11. Teachers were asked to answer regardless of whether the study child had mastered the areas (Table 3.23).

Table 3.23

Areas of the mathematics curriculum covered by the study child's class

	Number of children whose classes had covered the area	Percentage
Four rules	8,723	98.7%
Measure	8,381	94.9%
Fractions	8,146	92.2%
Other number operations	6,929	78.4%
Geometry	5,851	66.2%
Statistics	2,399	27.2%
Algebra	1,856	21.0%

It was necessary to make this check so that we could establish how much a poor score on the mathematics test reflected a lack of exposure to some of the areas covered by the test. This work has yet to be completed. It can be seen from Table 3.23, however, that nearly all the children had been taught the four rules, measure and fractions and just less than 80 percent had been taught other number operations.

3.41 Identifying Poor Mathematicians

The relationship between the mathematics score and the total BAS scores in the sample is shown in Table 3.24.

For the initial analyses, seven groups of mathematicians were identified in terms of 1½ standard deviations from the mean on the mathematics and total BAS score. These groups are shown in Table 3.25. They contain very similar numbers of children as the reading groups. There are about one hundred more children in the group V, high BAS low mathematics score than in the corresponding reading group V and one hundred fewer in group VII, high BAS, high mathematics score. Again, as with the reading score, three quarters of children who score below 0 on the BAS and the mathematics test, actually scored between -1½ standard deviations and 0 on both tests.

Table 3.24 Mathematics Score and Total British Ability Scale Score

Reading scores in half SDs	Total British Ability Scale Score divided into ½ Standard Deviations															
	-4 to -3½	-3½ to -3	-3 to -2½	-2½ to -2	-2 to -1½	-1½ to -1	-1 to -½	-½ to 0	0 to ½	½ to 1	1 to 1½	1½ to 2	2 to 2½	2½ to 3	3 to 3½	3½ to 4
-3½ to -3	7	3	-	1	-	-	-	-	-	-	-	-	-	-	-	-
-3 to -2½	2	7	8	16	2	5	-	1	-	-	-	-	-	-	-	-
-2½ to -2	-	1	15	46	32	26	17	9	3	2	-	-	-	-	-	-
-2 to -1½	-	1	15	45	85	98	59	34	9	1	1	-	-	-	-	-
-1½ to -1	-	-	4	38	134	248	223	144	49	23	3	-	-	-	-	-
-1 to -½	-	-	1	12	74	269	391	379	210	75	14	16	-	-	-	-
-½ to 0	-	-	-	7	30	119	300	486	392	201	61	9	3	1	-	-
0 to ½	-	-	-	2	7	45	164	350	426	322	122	41	6	2	-	-
½ to 1	-	-	-	-	1	11	46	187	313	396	207	80	9	4	-	-
1 to 1½	-	-	-	-	-	1	8	48	170	240	205	101	18	6	1	-
1½ to 2	-	-	-	-	-	-	2	11	34	117	114	83	30	9	1	-
2 to 2½	-	-	-	-	-	-	1	-	6	20	37	47	21	11	2	1
2½ to 3	-	-	-	-	-	-	-	-	1	7	9	10	12	1	-	-
3 to 3½	-	-	-	-	-	-	-	-	-	-	2	1	3	-	1	-
3½ to 4	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-

Note: Each cell contains the number of children whose mathematics scores fall within a particular range and whose BAS scores fall within a particular range

Table 3.25

Groups of mathematicians defined by their standardised total mathematics score and total BAS score

Standardised Total maths score	-3 to 1½ SD	-1½ to 0 SD	0 to +1½ SD	+1½ to +3 SD
-3 to -1½ SD	Group I 286 3.3%	Group III 249 2.9%	Group V 1063 12.3%	
-1½ to 0 SD	Group II 300 3.5%	Group IV 2559 29.7%		
0 to 1½ SD	Group VI 914 10.6%		Group VII 3251 37.7%	
+1½ to +3 SD				

Total sample N = 8863, Missing data N = 114 (1.3%)

3.42 Poor Mathematics and Reading Skills

The mean Edinburgh Reading Test scores and subscores are shown for the seven groups of mathematicians in Table 3.26. It can be seen from this table that the high BAS, poor mathematicians, group V, have very similar reading scores to the low BAS, good mathematicians, Group VI .

Table 3.26 Total Edinburgh Reading Test Score and Subscore Means for different groups of mathematicians

Total score on the maths test		Total British Ability Scale Scores: -3 to -1.5 SD	-1.5 to 0 SD	0 to +3 SD
-3 to -1.5 SD		Group I	Group III	Group V
	Total Edinburgh Reading Score	72.11	80.47	
	Vocabulary subscore	71.99	82.29	
	Recall subscore	78.37	83.02	
	Comprehension of sentences and sequences subscore	72.56	81.42	
	Comprehension of passage and picture subscore	75.58	83.36	
-1.5 to 0 SD		Group II	Group IV	
	Total Edinburgh Reading Score	82.53	91.78	100.76
	Vocabulary subscore	85.32	94.78	100.54
	Recall subscore	86.38	94.79	100.64
	Comprehension of sentences and sequences subscore	81.67	92.48	102.27
	Comprehension of passage and picture subscore	81.04	91.53	101.09
0 to +3 SD		Group VI		Group VII
	Total Edinburgh Reading Score	99.91		112.04
	Vocabulary subscore	101.45		108.46
	Recall subscore	101.86		108.01
	Comprehension of sentences and sequences subscore	100.94		110.79
	Comprehension of passage and picture subscore	100.34		111.75

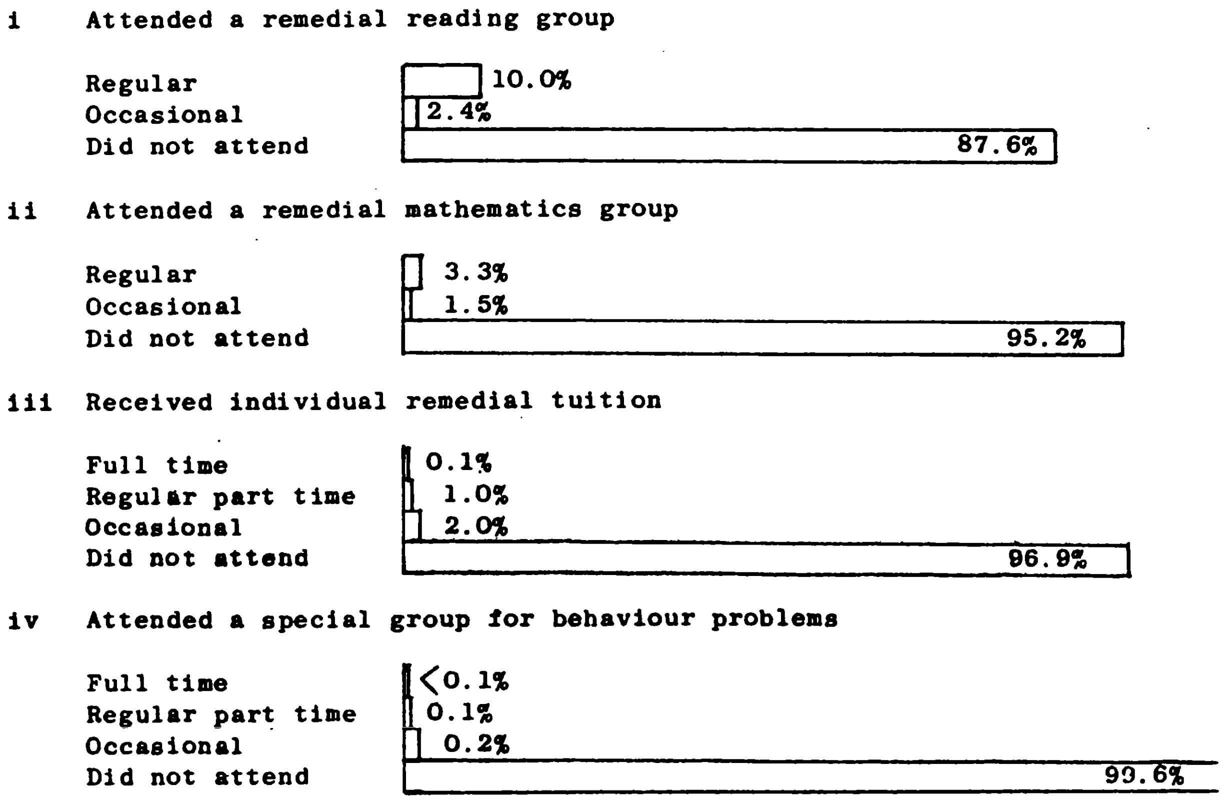
3.42 Remedial help for Poor Readers and Poor Mathematicians

In the sample of 8,836 CHES children 1,422, 16.1 percent, were receiving therapeutic or special help inside school. Six percent of the children attended remedial or special classes; just over 1 percent attended such classes full time; 4.1 percent attended on a regular part time basis and 0.9 percent attended occasionally.

The type of help they received are shown in Figure 3.5.

Figure 3.5

Types of help received in school: Percentage of children receiving help



Ten percent of the sample were attending regular remedial reading groups and 3.3 percent were attending regular remedial mathematics groups. Three percent received individual remedial tuition. Just over 0.3 percent were attending special groups for behaviour problems; 0.2 percent received individual school counselling for behaviour problems.