

PUBLICATIONS OF THE SCOTTISH COUNCIL FOR  
RESEARCH IN EDUCATION

V

THE INTELLIGENCE OF  
SCOTTISH CHILDREN  
A NATIONAL SURVEY OF AN AGE-GROUP

# THE INTELLIGENCE OF SCOTTISH CHILDREN

A NATIONAL SURVEY OF  
AN AGE-GROUP

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## PREFACE

THE most ambitious project which The Scottish Council for Research in Education have so far undertaken is the 1932 Scottish Mental Survey, and the importance of the issues involved justifies the publication of the Report of the Committee which conducted the inquiry.

The Council desire to acknowledge the ready response of Education Committees to the request for permission to apply in the schools the necessary group and individual tests. The fact that of the thirty-five Education Committees not one refused this request enabled the Survey to be truly national.

The ascertainment and collection of the facts required by the investigators threw a great burden of extra work upon the shoulders of officials and teachers, and without their whole-hearted aid given during the summer term of 1932 the intricate and complex task of assessing 100,000 pupils could not have been carried to a successful conclusion.

The Council are greatly indebted to the teachers in a number of areas who, under arrangements made by the Local Associations of the Educational Institute of Scotland, undertook the correction of scripts and the tabulation of scores, and to the staff and students of Moray House Training College, who worked indefatigably to correct the scripts for the remaining areas and to assemble the results.

The special gratitude of the Council is due to the

training college lecturers, directors of education, school psychologists, school medical officers, teachers, and students in training who, under the direction of Mr D. Kennedy-Fraser, gave their spare time to the individual testing of the thousand Binet cases.

The Council desire to express thanks for their kind co-operation to the directors of education and teachers in the English areas where the Group Test was given preliminary trials, to Dr Mary MacTaggart for permission to incorporate in the Group Test certain items from her Tests in Practical Ability, and to Dr A. C. Aitken, of the Mathematical Department of the University of Edinburgh, for his services as consultant to the Statistical Sub-Committee.

As the International Examination Inquiry Committee of the Research Council intend to use the data of this Survey in connection with their investigations, they felt justified in contributing out of their grant from the Carnegie Corporation of America to the cost of the Survey and of printing this Report.

The items of the Group Test employed in the Survey have been rearranged in the light of an answer pattern obtained by an analysis of a thousand worked papers. This version of the test with instructions can be purchased through the publishers of The Scottish Council for Research in Education, the University of London Press, Ltd.

# THE SCOTTISH COUNCIL FOR RESEARCH IN EDUCATION

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Mr W. A. F. HEPBURN.

Chairman of the Sub-Committee on Group Testing and of the Statistical Sub-Committee, Professor GODFREY H. THOMSON.

Chairman of the Sub-Committee on Individual Testing, Mr D. KENNEDY-FRASER.

I

INTRODUCTION



# I

## INTRODUCTION

PROBLEMS of curricula, school equipment, and teaching technique cannot be solved, or indeed adequately discussed, unless the age, sex, physique, temperament, and capacity of the pupil are kept in mind. The investigation here reported has reference to capacity, or, as it is more frequently termed, intelligence.

Exactly fifty years have passed since an English scientist<sup>1</sup> suggested the possibility of testing and measuring the differences of individual minds, and while it is not necessary, if indeed it were possible, to summarise here the immense development which this announcement heralded, a brief indication may be given of the place which the present inquiry claims to occupy in the history of the problem.

### ORIGIN OF THE INVESTIGATION

Until the United States of America in time of war was faced with the task of assessing within a period of a few months the intelligence of almost 2,000,000 army recruits, the methods of mental testing were for the most part oral and individual. When the technique of group testing devised to meet a national emergency proved successful, the way was open for the adaptation

<sup>1</sup> F. Galton, *Inquiries into Human Faculty and its Development* (1883).

and use of tests the results of which would throw light upon the many important questions which have their origin in individual differences in capacity.

During the past twelve years the group technique has been used in England in connection with competitive examinations for clerical posts in the Civil Service, and in that country, and to a much smaller degree in Scotland, in connection with scholarship and promotion examinations, notably at the close of the primary school period; but in both countries the tendency has been to use the tests to provide supplementary evidence in regard to individuals selected by some other method. At one end of the scale attempts, more or less sporadic, have been made to discover gifted pupils with the intention of providing them with special opportunities to rise to the height of their capacity; while at the other end, inspired by the pioneer work of Binet and Simon, and encouraged by the reported results of individual testing, efforts have been directed to select those for whom the usual teaching methods are unsuitable, and who should therefore be rejected from the ordinary school system, or find accommodation in what have come to be called special schools and classes.

To deduce from the results of such inquiries as the above the distribution of intelligence throughout the community has been hazardous in the extreme, and the inquirer who is aware of the pitfalls has hitherto tended to qualify his conclusions until they have had only a theoretical significance. It is true that confusion in the terminology employed in designating the various grades of intelligence has led on occasion to exaggerated statements respecting the number of mental defectives in the school community, and in recent years generalisations of

an alarmist nature have frequently been made regarding the increase of mental deficiency in the population as a whole.

Under the circumstances the publication of ascertained facts is important. The work of Dr Lewis and the publication in 1929 of the Report of the Mental Deficiency Committee have done much to provide such a corrective, and have placed in the hands of research workers a mass of evidence in regard to certain areas of England. The Report aroused great interest among educationists in both countries, and repeated expression was given to the opinion that a comparable inquiry in Scotland was desirable.

Professor Drever with this in mind made the suggestion that *The Scottish Council for Research in Education* should undertake a mental survey in Scotland. At the Council Meeting on 16th May 1931 "the Council approved of the decision of its Executive Committee to proceed with a survey of mental deficiency in Scotland on the lines followed in the *Report on an Investigation into the Incidence of Mental Deficiency in Six Areas, 1915 to 1927*, by Dr E. O. Lewis."

#### EXTENSION OF REMIT

It was early recognised by the Committee appointed to prosecute the inquiry that its objective could be achieved and the value of the investigation greatly enhanced if a complete cross-section of the community were made the subject of study. The Committee accordingly, with the consent of the Council, decided to extend its remit. Not only has the more general designation, Mental Survey Committee, avoided misunderstandings apt to be aroused by the label Mental

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Deficiency, and thereby contributed in no small degree to the success of the whole undertaking, but the extension of the scope of the inquiry has enabled the Committee to make available for the first time in any country some evidence regarding the intelligence of a complete age-group of the community.

### OFFICIAL DATA AVAILABLE

At the outset of its inquiry the Committee was fortunate in having at its disposal a recently published analysis of the Census made on 26th April 1931.<sup>1</sup> This analysis showed that the population of Scotland was 4,842,554, of whom 2,325,867 were males and 2,516,687 were females. The population was distributed as follows:—

		Per cent.
Four chief cities . . .	1,870,257	38·6
Other large burghs . . .	760,906	15·7
Small burghs . . .	730,221	15·1
Landward . . .	1,481,170	30·6

The Return also indicated for each county the towns regarded as “chief cities,” “large burghs,” or “small burghs,” thereby facilitating the weighting of the different elements in the community in the event of failure to survey the whole country.

The Scottish Education Department issues in alternate years *Statistics in Respect of Education Areas*, and those for the year 1930–31 were available,<sup>2</sup> but the tables there given mass together all the pupils between 7 and 12.

<sup>1</sup> *Census of Scotland, 1931. Preliminary Report on the Fourteenth Census of Scotland.* Edinburgh: published by H.M. Stationery Office, 1931.

<sup>2</sup> *Education (Scotland) Statistics in Respect of Education Areas for the Year 1930–31.*

The Scottish Education Department, however, kindly supplied the analysis of the scholars of these ages on the registers on 31st July 1930 (see p. 8).

The statistics were of inestimable value for the Committee, enabling it to base its calculations on accurate and up-to-date information.

#### THE WHOLE AGE-GROUP OR A SELECTION?

To make the plan workable it was suggested that the test should be applied to one-third of an age-group; but the difficulties of securing a representative "random sample" were regarded as insurmountable, and it was agreed that an attempt should be made to test a whole age-group. As facilities might not be granted in every area, it was calculated that two-thirds of an age-group would amount to approximately the same number as that covered in Lewis's investigation in England, viz. 66,000. So whole-heartedly was the project received, however, that a complete survey of the 1921 age-group became practicable.

#### SPECIAL TYPES

The question of including bilingual pupils was raised. Of the Gaelic-speaking population in Scotland (137,149 according to the 1931 Census), 7069, or 0.15 per cent., speak Gaelic only. It was considered, however, that as the pupils tested in the Gaelic-speaking districts would be bilingual and could command adequate English for the purpose of the test, they should be included. The same arguments applied to the groups of Lithuanian pupils in Lanarkshire and neighbouring counties.

Blind and deaf children, however, were excluded on

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Education Authority.	7 and under 8.	8 and under 9.	9 and under 10.	10 and under 11.	11 and under 12.	Total 7 and under 12.
<i>Cities</i>						
Aberdeen . . .	3,010	3,046	3,200	3,602	2,064	14,922
Dundee . . .	3,325	3,334	3,617	3,701	2,156	16,133
Edinburgh . . .	6,801	7,086	7,239	7,969	4,852	33,947
Glasgow . . .	20,282	21,633	21,664	23,424	15,944	102,947
<i>Counties</i>						
Aberdeenshire . . .	2,918	3,046	3,032	3,323	2,343	14,662
Angus . . .	1,608	1,583	1,694	1,837	1,346	8,068
Argyll . . .	928	973	1,003	1,050	766	4,720
Ayrshire . . .	5,300	5,629	5,956	6,261	4,391	27,537
Banffshire . . .	1,154	1,271	1,254	1,417	958	6,054
Berwickshire . . .	418	418	471	459	370	2,136
Bute . . .	225	257	273	225	195	1,175
Caithness . . .	498	478	489	500	347	2,372
Clackmannan . . .	605	624	671	713	498	3,111
Dumfriesshire . . .	1,523	1,576	1,571	1,699	1,236	7,605
Dunbartonshire . . .	2,666	2,901	3,076	3,138	2,414	14,195
East Lothian . . .	840	869	903	992	683	4,287
Fife . . .	5,140	5,583	5,824	6,449	4,367	27,363
Inverness-shire . . .	1,345	1,448	1,441	1,462	1,226	6,922
Kincardineshire . . .	518	551	527	534	454	2,584
Kirkcudbrightshire . . .	539	550	556	569	409	2,623
Lanarkshire . . .	10,312	10,877	11,595	12,003	9,199	53,986
Midlothian . . .	1,770	1,766	1,976	2,103	1,459	9,074
Moray and Nairn . . .	900	922	972	1,035	739	4,568
Orkney . . .	350	358	368	367	306	1,749
Peeblesshire . . .	214	211	228	253	146	1,052
Perth and Kinross . . .	2,014	2,018	2,131	2,203	1,573	9,939
Renfrewshire . . .	5,500	5,545	5,918	6,371	4,708	28,042
Ross and Cromarty . . .	1,068	1,280	1,163	1,298	970	5,779
Roxburghshire . . .	705	726	792	821	528	3,572
Selkirkshire . . .	323	375	402	392	232	1,724
Stirlingshire . . .	3,084	3,355	3,322	3,747	2,700	16,208
Sutherland . . .	247	277	244	294	207	1,269
West Lothian . . .	1,717	1,817	1,894	2,015	1,577	9,020
Wigtown . . .	550	604	598	651	433	2,836
Zetland . . .	308	358	335	429	258	1,688
Totals . . .	88,705	93,345	96,399	103,366	72,054	453,869

account of the small numbers involved, the difficulty of devising a test of equivalent difficulty for the blind, and the retardation in reading ability of the deaf.

If facilities were granted, pupils in Private Schools were to be included, and the Directors of Education to the various Education Committees were requested to furnish copies of the Register of Private Schools in their respective areas. With very few exceptions all the Private Schools approached replied that they were willing to apply the test, and the Research Council is grateful for their co-operation.

*Institutional Children.*—An attempt was made to include every residential institution in which pupils of the age in question were likely to be located, and no difficulty was experienced in having these pupils tested.

*Ineducable Children.*—Although few in number, these children are concentrated at one end of the scale; it was therefore deemed advisable to determine their number. Once certified as ineducable, they are no longer the concern of Education Committees, and are accordingly more difficult to trace, but County Clerks provided such information as was in their possession regarding this type of child.

#### AGE-GROUP TO BE TESTED

The testing of a complete age-group does not present the same difficulties in Scotland as in England, where pupils of the same age-group are distributed throughout various schools. In the towns and cities in Scotland it is not unusual to find the pupils of all age-groups in the same school under the same head master; no great difficulty, consequently, presents itself in assembling,

from different school classes for examination purposes, all the pupils in the school of the same chronological age.

While it is easier to apply group tests to older pupils to whom the reading of the tests and the interpretation of the instructions present few difficulties, the assembling of such pupils even in Scotland presents some difficulties which the Committee considered the schools should be spared. A further objection to the testing of older pupils was that some of these were likely to have previously undergone testing with group tests, and might also be undergoing other examinations about the time of the Mental Survey. If a following-up and a re-testing of the pupils taking the Group Test were contemplated, younger age-groups would be an advantage, and for this reason the age-group  $10\frac{1}{2}$ - $11\frac{1}{2}$  was selected. To simplify the calculation of ages, etc., it was decided that the children born in 1921 should be tested.

#### TIME OF YEAR WHEN TEST SHOULD BE APPLIED

It has been customary in England in the application of mental and achievement tests to calculate the pupils' ages as at 1st August and to apply the tests half-way through the school year, viz. on or about 1st February. By reason of the incidence of illness among pupils at this time of the year, and of the fact that in rural areas and remote parts the roads are frequently impassable, this was regarded as an unsuitable date for Scotland. The period of June to September was excluded owing to school holidays; and as it was affirmed that after the potato-lifting holidays in October there was an increase in the incidence of illness among pupils who had been engaged in this occupation, the early part of November was consequently considered unsuitable. It was desir-



able that the test should be applied when the schools and the teachers were not too preoccupied with other tests and examinations, and although the 1st of June was admittedly not ideal from this standpoint, and fell in the week after the Scottish half-yearly term when removals take place, it was finally agreed that an attempt should be made to have the test applied in the week in which the 1st of June 1932 fell.

#### INFORMATION REQUIRED REGARDING PUPILS TESTED

In deciding what information should be required of pupils tested, the headings of the (*A*) *Census, Scotland, 1931 Schedule* were considered. Certain scholastic information was also desirable, and ultimately it was agreed that the information set forth below should be required:

Name and surname.

Sex.

Name of county,<sup>1</sup> burgh or parish, school.

Date of birth.

Class in school.

#### SIZE OF BOOKLET

The tests were printed on quarto-size paper, foolscap size being regarded as unmanageable by reason of the dimension of school desks.

#### PRELIMINARY PRACTICE TEST

In order to familiarise the pupils with what was to be required of them, the usual procedure of setting a preliminary practice test, not to be evaluated in the results, was followed.

<sup>1</sup> Future workers should require the name of the Education Authority in which the school is situated rather than the name of the county.

## NATURE OF TEST

Tenders were invited for well-known tests from a firm of repute publishing mental test material, but even with the special terms quoted for large quantities the cost (almost £700 for 100,000) was prohibitive. The Committee was consequently compelled to devise its own test, and was fortunately placed to undertake the task, as several of its members had considerable experience of the preparation of tests. Professor Godfrey H. Thomson kindly offered to place at the Committee's disposal a group test which he had prepared for a scholarship examination in certain English counties, and agreed to undertake the Chairmanship of a small Sub-Committee to be responsible for the preparation of the test.

The scholarship test offered was tried out, so that a table might be prepared indicating the number of times each item in the test was answered correctly by pupils of various ages. The order of difficulty for pupils of 11 years of age could thus be determined, and the items arranged accordingly.

As the scholarship test was designed to give "head-room" for the brighter pupils, it was realised that it might fail to distribute the pupils at the lower end of the scale. It was therefore decided to introduce picture tests to provide pupils at the lower end with opportunities to score.

## DISTRIBUTION OF TEST

The arrangements for the distribution of the test were effected by a Sub-Committee acting under the Chairman of the General Committee. An outline of the administrative arrangements is presented in the succeeding chapter.

## CORRECTION OF TEST

At the outset it was thought advisable that the correction of the Group Test should be undertaken by a body of workers acting under the expert direction of the Research Council; but the magnitude of the task rendered this impossible, and an urgent appeal was made through the Chairman of the Mental Survey Committee and the Convener of the Educational Institute of Scotland Research Committee for help from the Local Associations of the Educational Institute of Scotland. The response was remarkable. Not only were the scripts for the largest areas corrected by the teachers, but the results were also tabulated for each school, and for many areas a cumulative tabulation for the whole area was prepared. As some of these areas comprise 6000 to 12,000 pupils of the age-group tested the labour involved was immense, and the expedition with which this work was accomplished may be inferred from the fact that many of these returns were in the hands of the Committee by the middle of July.

The correction, tabulation, etc., of the remaining areas and of the Private Schools were undertaken by the staff and students of Moray House Training College.<sup>1</sup>

## RESULTS

The results of the Group Test are presented in a later chapter. The Nominal Rolls, giving each pupil's score

<sup>1</sup> All calculations, where not made by the Chairman of the Sub-Committee on Group Testing (Professor Godfrey H. Thomson), were checked by him. Valuable assistance was given by Mr D. M. Johnstone, Mr A. J. D. Lothian, and Mr Boris Semeonoff in assembling the Verbal and Picture, the Binet, and the Bressak grids respectively. Mr John Gray calculated many of the percentile points, least-square lines, correlation coefficients and ratios. Mr Johnstone also assembled the Answer Patterns.

in the Picture and Verbal Tests separately, have been bound for each area, and are preserved for future reference in the office of the Research Council.

### INDIVIDUAL TESTING

To serve as a control on the Group Test a thousand pupils were tested individually with the Terman revision of the Binet scale; and to satisfy the requirements of a "random sample" these pupils were selected, at the suggestion of Dr Shepherd Dawson, from those born on the 1st of June 1921, or as near thereto as possible, and according to a prearranged plan on a geographical basis.

The individual testing was placed by the Committee under the supervision of Mr D. Kennedy-Fraser, and an account of this aspect of the Survey will be found in a later chapter.

II

THE ADMINISTRATION OF THE TEST



## II

### THE ADMINISTRATION OF THE TEST

#### THE APPROACH TO THE EDUCATION COMMITTEES

NECESSARILY the first step in framing administrative arrangements was to secure the approval of the various Education Committees. In Scotland there are 35 such Committees, the smallest of which had only a few scores of pupils in the selected age-group, while the city of Glasgow had over 20,000. Most of the Committees willingly agreed to grant the necessary facilities; the very few who were inclined to be suspicious or sceptical were won over in the end without much difficulty, and the inquiry became nation-wide.

#### ENLISTING THE SUPPORT OF THE TEACHERS

The next vitally important step was to secure the interest of the members of the various teaching staffs who were to be responsible for the actual testing arrangements inside the schools. To this end the chief education official in each area was asked to send out a Circular Letter to each school in his area, in which stress was laid upon the educational significance of the undertaking, an outline of the programme as it affected the school was given, and an appeal was made for the keen personal interest of the Head Teachers. The importance of submitting to the Test every pupil of the appropriate age, whatever his school, class, or educational status, was specially mentioned. A specimen letter was drawn up

by the Committee which could be used as framed or adapted to meet local needs.

#### THE DISPATCH OF THE VARIOUS PAPERS

It was naturally the wish of the Committee that additional work should not be thrown upon the staffs of Education Offices, and throughout the somewhat anxious weeks which preceded the 1st of June this object was kept clearly in view.

After the dispatch of the Circular Letter two sets of papers had to be sent out to schools. The first, which had to arrive several days before the day appointed for the Test, comprised General Instructions and Rolls on which were to be entered (sexes separately) the names and dates of birth of the pupils concerned. For the sake of convenience and to avoid expense, this set was sent to some schools accompanied by the Circular Letter. In every area but one these papers were sent in bulk to the Education Offices and thereafter distributed.

The second set of papers comprised the Special Instructions and the Test Booklets. Approximately one-half of the areas accepted the Committee's offer to send direct from the printer to each school the required number of Special Instructions and Test Booklets, and supplied postal addresses and number of pupils in each of their schools. In these instances the printer was given an order in respect of each school (approximately 1500 in all), and a date on which the parcel should be dispatched. The latter precaution was necessary to make certain that the Tests would reach all parts of Scotland—the accessible towns and cities and the remote schools of the north and west—one or two days before the 1st of June.



The areas which themselves undertook the distribution received in bulk their quotas of Special Instructions and Test Booklets a few days before the end of May.

Private schools not controlled by a local authority presented no great problem. Once particulars as to number of scholars, etc., had been received, the arrangements for the distribution of papers were made by the officials of the Research Council.

The programme worked almost without a hitch. Only one school reported that the booklets had not arrived on the appointed morning.

#### THE DATE OF THE TEST

The 1st of June was selected as Test day in all areas save two, where local circumstances compelled a choice in one case of the second and in the other of the third of the month.

### COPIES OF RELEVANT CIRCULARS AND FORMS

#### I. LETTER FROM HONORARY SECRETARY TO THE COUNCIL SENT TO DIRECTORS OF EDUCATION

In spite of the many statements, some of them rash and misleading, which have from time to time been made regarding the mentality of Scottish school pupils, no investigation has yet been undertaken on a sufficiently extensive scale in Scotland to admit of valid inferences regarding the distribution of intelligence in the community. The Scottish Council for Research in Education, as suggested in a previous note<sup>1</sup> to you requesting a list of the Private Schools in your area, has

<sup>1</sup> See p. 28.

consequently constituted a Mental Survey Committee to secure the best evidence it can on the point. This Committee is desirous of testing out a complete age-group, viz. all pupils born in 1921, and of making the investigation as comprehensive as possible: only thus can adequate data be secured on which to base general conclusions. The Committee, after much deliberation, has decided that a group test which is being specially prepared for the purpose should, if possible, be given to the pupils of this age-group throughout the whole of Scotland in the week in which the 1st June falls this year. The test will require only about one hour of the pupil's time. Sufficient copies for the pupils in your area will be supplied free, and any costs incurred in postage, etc., will be defrayed by the Research Council.

The assessing of the test will be done by a body of workers acting under the expert direction of members of the Research Council, and in any reports which may be issued no reference will be made to a school or area without the express and written consent of the chief education official of the area. Any request from an Education Committee for a report regarding the data collected within their area will receive sympathetic consideration.

It is unnecessary to explain to you at any further length the importance of the results to be obtained only by such a national survey carried out at one and the same time, but I should be glad if you would commend this proposal to your Education Committee and secure their consent to the application of the test in all the schools of your area.

The Research Council also trusts that it may be allowed to avail itself of your own experience in

organising control and qualifying examinations in your County/City, and would much appreciate your help in the distribution and supervision of the group tests.

## II. LETTER SENT BY CHAIRMAN OF THE MENTAL SURVEY COMMITTEE TO DIRECTORS OF EDUCATION

### *Mental Survey of Scottish Schools*

In consultation with certain Directors of Education who are members of the Committee undertaking on behalf of The Scottish Council for Research in Education the mental survey of Scottish Schools, I have drafted the enclosed circular; we suggest you should send out this or another on similar lines at a convenient time not later than the 15th of May to all schools in your area. To secure uniformity of procedure throughout the whole country, and to prevent leakage of tests through schools in adjoining counties, it is desirable that the test should be given on the same day, and you will note that the 1st of June is the day mentioned in the circular letter. Local arrangements may make it difficult to adhere to this date, and we suggest that if it be found impossible to carry out the test in all your schools on the 1st of June, the nearest date suitable to all be fixed upon.

In their difficult task of distributing and collecting close on 100,000 tests, it will be of the greatest help to the Committee if you will be good enough to complete at your earliest convenience the enclosed questionnaire.

## III. SPECIMEN CIRCULAR LETTER FROM DIRECTOR OF EDUCATION TO HEAD TEACHERS

### *Mental Survey*

I desire to bring to your notice an investigation which is being undertaken by The Scottish Council for Research

in Education with the object of securing data for a mental survey of Scottish Schools. This involves the testing of a complete age-group of school pupils, and in furtherance of this aim the Research Council has asked and has received the consent of the Education Committee to apply an Intelligence Test, which has been specially prepared for the purpose, to every pupil in this area who was born in the year 1921, and who will be in attendance at school during the week in which this year the 1st of June falls. The test, which will occupy about one hour, will be given in this area during the morning session of Wednesday, 1st June.

In view of the valuable results which are likely to accrue from this inquiry, I should be very glad if you would take a keen personal interest in the arrangements necessary and make certain that every pupil of the appropriate age, in whatever class or division of your school he or she may be placed (including mentally defective and physically defective pupils), takes the test and that it is performed in strict accordance with the instructions accompanying it.

A set of general instructions is enclosed, together with Rolls on which to enter particulars regarding the pupils taking the examination. Detailed instructions to be read by the teacher on the day on which the test is given will be forwarded with the test booklets.

If no instructions are received to the contrary, the completed scripts should be returned to the Director of your area.

I may add that the Research Council is primarily interested in the data from a national point of view, and that care will be taken that the results are not used for invidious comparisons between individual schools or areas.

## IV. GENERAL INSTRUCTIONS

The Group Test is intended to be given to all the pupils present on the day of the test who were born in 1921. The object of the Survey, which is to obtain data about the whole distribution of the intelligence of Scottish pupils from one end of the scale to the other, would be entirely defeated if some pupils were intentionally kept out of the test. Even although a teacher may consider, and perhaps rightly, that a certain pupil can do nothing at all in the test, nevertheless the pupil should be given exactly the same opportunity as all other pupils, and a test form should be returned for him or her.

There is no intention whatever of making any comparisons between schools; and teachers can rest assured that the results of no individual pupil, class, school, or small district will be published.

The test proper is preceded by a ten minutes' Preliminary Practice Test, the object of which is to familiarise the pupils with the type of question to be asked in the test proper. As the front page of the Preliminary Practice Test is exactly the same as that of the test proper, the pupils have practice in filling in their names and the other information required. This should be checked carefully by the teacher. The Preliminary Practice Test should be given on the same morning as the test proper. It should not be returned as it does not count in the results.

The test proper should be given, after a short interval, during the same forenoon as the Preliminary Practice Test. The actual working time is 48 minutes, so that with allowance for distribution and the reading of instructions, about an hour is required, in addition to the time for the Preliminary Practice Test.

The pupils do their work on the pages of the test booklet, in pencil. Each pupil should be supplied with two sharpened pencils and nothing else—no rulers, india-rubber, jotting paper, or blotting paper. The pupils should be seated at distances from one another such as are customary in school examinations.

Before distributing the booklets, the supervisor will say: "Do not turn over or open any of these books until you are told." As some of the questions are on the back page, care must be taken to distribute the books right side up. For the distribution of the booklets, for the filling up of the front page (name, etc.), and for settling down, about ten minutes are required, or less in small centres.

As the timing of the tests must be done very exactly, each supervising teacher should see that on the morning of the test he or she is in possession of a *watch with a seconds hand*.

Where possible there should be two supervisors. One will stand at the desk facing the pupils, reading the instructions when necessary, keeping the time with a watch before him, observing that no pupil looks at his neighbour's paper, and generally supervising the whole arrangements. He should not permit himself to be distracted by callers entering the room, by talking to other teachers, by reading the test booklet himself, or by attempting to do work of his own during the period.

The second supervisor should patrol the room quietly and unobtrusively. He should have with him a reserve supply of pencils. Besides watching that no pupil copies, he should be on the alert for any pupil who has not turned to the right page, or has failed to notice that there are questions on the back page, etc. As a rule

it will only be obvious blunderers who need a special eye on them, and an indication with the finger or a whispered word of explanation is all that is needed. *Otherwise no assistance is to be given, and no questions whatever are to be answered.*

In small centres one supervisor will be sufficient, though where possible a second should be present.

The special instructions will be forwarded with the booklets, and should not be opened until the morning of the test, when they should be carefully studied by the supervisor both before giving the Preliminary Practice Test and in the short interval which should be allowed between this and the test proper. They must be exactly followed, and nothing should be said to the pupils in the way of instructions except what is there laid down.

## V. ROLL OF ALL PUPILS BORN IN 1921

BOYS

NAME OF COUNTY OR CITY-COUNTY.	BURGH OR PARISH.	SCHOOL.							
NAMES. Surname first, to be entered in order of birth, Jan., Feb., etc.		FOR OFFICE USE ONLY.							
		DATE OF BIRTH.		SCORE.					
		Day.	Month.	Page 2.	Page 3.	Pages 4-8.	Total.		
1.	.....	.....	.....	.....	.....	.....	.....	.....	.....
2.	.....	.....	.....	.....	.....	.....	.....	.....	.....
3.	.....	.....	.....	.....	.....	.....	.....	.....	.....
4.	.....	.....	.....	.....	.....	.....	.....	.....	.....
5.	.....	.....	.....	.....	.....	.....	.....	.....	.....
6.	.....	.....	.....	.....	.....	.....	.....	.....	.....
7.	.....	.....	.....	.....	.....	.....	.....	.....	.....
8.	.....	.....	.....	.....	.....	.....	.....	.....	.....
9.	.....	.....	.....	.....	.....	.....	.....	.....	.....
10.	.....	.....	.....	.....	.....	.....	.....	.....	.....
11.	.....	.....	.....	.....	.....	.....	.....	.....	.....
12.	.....	.....	.....	.....	.....	.....	.....	.....	.....
13.	.....	.....	.....	.....	.....	.....	.....	.....	.....
14.	.....	.....	.....	.....	.....	.....	.....	.....	.....
15.	.....	.....	.....	.....	.....	.....	.....	.....	.....
16.	.....	.....	.....	.....	.....	.....	.....	.....	.....
17.	.....	.....	.....	.....	.....	.....	.....	.....	.....
18.	.....	.....	.....	.....	.....	.....	.....	.....	.....
19.	.....	.....	.....	.....	.....	.....	.....	.....	.....
20.	.....	.....	.....	.....	.....	.....	.....	.....	.....
21.	.....	.....	.....	.....	.....	.....	.....	.....	.....
22.	.....	.....	.....	.....	.....	.....	.....	.....	.....
23.	.....	.....	.....	.....	.....	.....	.....	.....	.....
24.	.....	.....	.....	.....	.....	.....	.....	.....	.....
25.	.....	.....	.....	.....	.....	.....	.....	.....	.....

NOTE.—If a pupil is absent on the day of the Examination, write "Absent" in the columns headed "Score."



## VI. QUESTIONNAIRE

SCOTTISH COUNCIL FOR RESEARCH IN EDUCATION  
MENTAL SURVEY OF SCOTTISH SCHOOLS

To be completed at your earliest convenience and returned to

W. A. F. HEPBURN, EDUCATION OFFICES, AYR

Date selected for the test in the educational area of.....

Number of schools in the area.....

Number of copies required of circular letter to Head Teachers (sample enclosed).....

Number of pupils in the 1921 group in the whole area.....

Number of instruction sheets required (one needed for each supervisor).....

Do you wish the tests sent in bulk to you for distribution?.....

If so, the number of Rolls required (25 names to a Roll). Boys and girls to be entered on separate Rolls (specimen enclosed).....

Do you wish the tests sent direct by printer to individual schools?.....

If so, please return with your reply a list of your schools, showing—

(a) Postal address.

(b) Nearest railway station.

(c) Number of pupils in the 1921 group in each school.

(d) Number of instruction sheets required (one for each supervising teacher).

*Alternative Methods of Return of Completed Scripts**(Printed address labels will be supplied)*

(a) Do you wish Head Teachers to return completed scripts direct to the Research Council, Edinburgh?.....

(b) Do you wish Head Teachers to return completed scripts to you in the first instance for forwarding in bulk to Edinburgh by passenger train?.....

If (a) be chosen,

Do you wish Head Teachers to send direct to Edinburgh a note of the postages incurred?.....

or

Do you prefer that they intimate the cost to you so that you can render an account to the Research Council?.....

If (b) be chosen, please render an account of the total cost to the Research Council.

Signature of Education Officer.....

Date.....

VII. ORDER FORM USED WHEN TESTS WERE SENT  
DIRECT TO THE SCHOOLS

## MENTAL SURVEY

Name, Address of School.....  
 .....  
 .....  
 .....

Number of Rolls to be sent to school.....Boys.....Girls.  
 Number of General Instructions.....  
 Number of Special Instructions.....  
 Number of Tests.....  
 Date of Posting.....

VIII. LETTER FROM HONORARY SECRETARY SENT TO  
DIRECTORS OF EDUCATION REGARDING PRIVATE SCHOOLS  
*Mental Survey*

The Scottish Council for Research in Education has decided to undertake a mental survey of pupils attending schools in Scotland, and a letter will later be sent you inviting your co-operation. The age-group to be tested will be the children born in 1921, and it is proposed to apply the test this year in the week in which the 1st June falls. The Committee engaged in this Survey would like all children of the above age-group to be tested, including children in private schools. A list of such schools, together with the numbers attending or/and the number born in 1921, will be required in order that the number of tests to be printed may be estimated. I should consequently be obliged if you could let me have, before 18th February, an up-to-date copy of your

Register of Private Schools, together with the number of pupils in each born in 1921, or, if such is not readily available, the number of pupils in attendance.

IX. LETTER FROM HONORARY SECRETARY SENT TO  
HEAD TEACHERS OF PRIVATE SCHOOLS

The Scottish Council for Research in Education has constituted a Mental Survey Committee to secure the best evidence it can on the mentality of Scottish school pupils. This Committee is desirous of testing a complete age-group, and has decided that the test should be applied to all pupils in Scotland born in 1921, and should be given in the week in which the 1st June falls this year. A group test is being specially prepared for the purpose.

The value of the results will depend to a large extent on the comprehensiveness of the survey and on the representative character of the schools participating. The Committee expect that permission to apply the test to the pupils of the age-group indicated above will be granted by all the Education Committees in Scotland, and would esteem it a favour if you would be good enough to allow the pupils in your school to be included in the survey. The test will require only about an hour of the pupils' time, and, as full instructions will be sent for its administration, it will not involve the entrance to the school of any outsider. The scoring of the test will be undertaken by a body of workers acting under the expert direction of members of the Research Council. While the results of individual pupils and of individual schools will be treated as strictly confidential, any request from you for a report regarding the data collected in your

school will receive sympathetic consideration. Sufficient copies for your requirements will be supplied free, and any costs incurred in postage, etc., will be defrayed by the Research Council.

The Research Council, realising that you will appreciate the very great importance of such a national survey carried out by means of the same test at one time, invites your co-operation. A stamped addressed envelope is enclosed for reply, and I should be obliged if, in your reply, you will indicate how many pupils born in 1921 (boys and girls separately) would be likely to take the test.

III

INDIVIDUAL TESTING  
OF A REPRESENTATIVE SAMPLE



### III

## INDIVIDUAL TESTING OF A REPRESENTATIVE SAMPLE

It was decided that some method should be adopted whereby the scores obtained on the Group Test might be interpreted in terms of some internationally recognised measure of intelligence, *e.g.* the Terman Revision of the Binet-Simon Scale. In this way the Group Test scores could be converted, with due reservations, into mental ages and intelligence quotients.

Since it was impossible to apply an individual test to all the Scottish children born in 1921, the Committee decided to try to obtain a sample of 1000 children—500 boys and 500 girls—who might be regarded as representative of the whole year-group, and to apply an individual mental test to each of the children in this sample.

Finally, by comparing the distributions, for boys and girls separately, of the Group Test scores of this sample and of the whole year-group, it was expected to obtain a measure of the extent to which the smaller sample was really representative of the whole, and if necessary to adjust the proportions of children at each level of intelligence in accordance with the larger distribution. In this way it was hoped to obtain a true picture of the actual distribution of intelligence for the whole group.

Before the actual testing was begun, the Committee outlined the following programme as an ideal to be aimed at. The geographical and social distribution of the

sample should correspond as closely as possible to that of the whole age-group. The testing should be as uniform as possible—ideally by one individual tester. All testing should be completed within three months before or after the date of application of the Group Test. The sample should be as free as possible from any bias on the part of those selecting the children to be tested.

Since the testing was undertaken on a voluntary basis by a large number of individuals in their holiday and other spare time, it was not possible to carry out this programme in full, as it might have been done by the full-time employment of a duly qualified tester for six months. The extent to which the ideal was approximated may be gathered from the following account of the actual procedure.

#### THE TEST WHICH WAS USED

After some discussion it was resolved to use the Stanford Revision of the Binet-Simon Test standardised by Professor L. M. Terman, with a few necessary translations from American terminology for use with Scottish children,<sup>1</sup> and the elimination of test 3 at year XIV owing to the unfamiliarity of the term President, and the substitution of the alternative test in year XIV.

#### THE CHOICE OF THE REPRESENTATIVE SAMPLE OF CHILDREN

From data supplied by the Scottish Education Department<sup>2</sup> it was possible to work out a geographical distribution of the children of the 1921 group actually

<sup>1</sup> See p. 51.

<sup>2</sup> See p. 8.



attending the schools in the 35 administrative educational areas, viz. 4 cities and 31 counties. Table I (p. 36) shows:

- (1) The distribution of those in attendance in each area estimated before the group testing took place, and reduced to a total of 1000.
- (2) The actual distribution of those who took the Group Test, similarly reduced.
- (3) The distribution of the 1000 children whose test records were used in the final calculations, with (4) and (5) figures for boys and girls separately.

The discrepancies between (2) and (3) arose mainly from the geographical distribution of the available testers and the attempt to obtain as many records as possible from children born near the 1st of June.

The actual geographical distribution differs from the estimated mainly in the following respects. The north is inadequately represented, and the necessary additional cases had to be taken from the south. The rural areas, owing to the scattered distribution of the children, are also inadequately represented, with a corresponding over-weighting with urban pupils. This is especially so in the north-west, since unfortunately all the cases in the counties of Inverness and Argyll are urban. On the other hand, the two largest administrative areas, Glasgow and Lanarkshire, were further subdivided into their School Management areas, and a due proportion of children selected from each of these smaller areas.

#### FREING THE SAMPLE FROM BIAS IN SELECTION

In order to obtain a random sample free from any bias on the part of the testers or the teachers, it was resolved, on the suggestion of Dr Shepherd Dawson,

TABLE I

For explanation of headings see previous page

	(1).	(2).	(3).	(4).	(5).
Cities—					
Aberdeen . . .	33	37	23	14	9
Dundee . . .	37	37	37	19	18
Edinburgh . . .	79	76	92	40	52
Glasgow . . .	228	228	231	116	115
Counties—					
Aberdeenshire . . .	32	33	14	10	4
Angus . . .	17	11	17	8	9
Argyll . . .	10	10	10	6	4
Ayrshire . . .	61	63	65	35	30
Banffshire . . .	13	13	12	7	5
Berwickshire . . .	5	5	5	2	3
Bute . . .	3	3	5	2	3
Caithness . . .	5	5	0	0	0
Clackmannan . . .	7	7	8	4	4
Dumfriesshire . . .	17	16	18	9	9
Dunbartonshire . . .	31	32	30	16	14
East Lothian . . .	9	9	6	3	3
Fife . . .	60	63	62	30	32
Inverness-shire . . .	15	15	10	5	5
Kincardineshire . . .	6	5	6	5	1
Kirkcudbrightshire . . .	6	6	8	4	4
Lanarkshire . . .	117	119	132	60	72
Midlothian . . .	19	18	19	10	9
Moray and Nairn . . .	10	10	9	5	4
Orkney . . .	4	4	4	4	0
Peeblesshire . . .	2	2	0	0	0
Perth and Kinross . . .	22	22	23	12	11
Renfrewshire . . .	60	60	52	24	28
Ross and Cromarty . . .	13	11	8	4	4
Roxburghshire . . .	8	7	8	4	4
Selkirkshire . . .	4	4	4	4	0
Stirlingshire . . .	35	35	33	16	17
Sutherland . . .	3	3	3	2	1
West Lothian . . .	19	21	23	12	11
Wigtownshire . . .	6	6	19	6	13
Zetland . . .	4	4	4	2	2
Totals . . .	1000	1000	1000	500	500

to ask at each school for those children who were born on 1st June 1921 or as near that date as possible, preferably in the month of June. This also eliminated the need for applying an age correction to the group scores before correlating the results of group and individual tests, as would have been necessary had children with birthdays from January to December been included in the sample.

In field work involving widespread travelling it is not always easy to obtain exactly the required pupils, but in the sample of 1000 children, 847 were born in June and a further 101 in May, leaving only 52, 46 of whom were born in April or July.

#### THE TESTERS

Since the ideal procedure of employing one qualified tester to do all the testing was not possible, the following measures were adopted to ensure the maximum of uniformity in the testing. The testers had to be chosen from a group who were already trained, and who were further able and willing to give some of their spare time gratuitously to the work. They were all personally recommended by some member of the Committee, and included training college lecturers, directors of education, school psychologists, school medical officers, teachers, and students in training, all of whom had special training in mental testing. Mr Kennedy-Fraser was appointed Chairman of the Sub-Committee on Individual Testing. Two meetings of testers were held, one in Edinburgh and one in Glasgow, at which general instructions as to procedure were given by the Chairman and areas of testing were allocated. Each tester undertook to test at least ten pupils, but several did many more. In order to provide a control group to detect the effects

of individual variations among testers, Mr Kennedy-Fraser himself tested 187 children, and also checked the scoring of the remainder of the 1000 cases from the records sent in on the Abbreviated Filing Record Cards supplied to the various testers.

In order to minimise travelling expenses, testers were asked to work near their own homes or near their holiday quarters, and the Committee is very grateful to those testers who gave up from one to seven weeks of their holiday time to the work, which could not otherwise have been completed in the short time between May and October.<sup>1</sup>

#### THE INFORMATION ENTERED ON THE RECORD CARDS

The following items were entered on each card: The child's name, sex, date of birth, chronological age, mental age, intelligence quotient, school, city or county, father's occupation and address, and the examiner's name and the date of the test. Opposite each item of the test the child's success or failure was noted, and the Drawing Test results were made on the back of the card.

The child's class in school had already been entered on his group script. The father's occupation (where known) was required in order to attempt an assessment of the social distribution of the sample compared with the general social distribution of the population.

After the individual test records were sent in to the Chairman, the corresponding group scripts were extracted from the general files and matched with the individual

<sup>1</sup> Special thanks are due to those who undertook to arrange for the proper distribution of the cases within the larger administrative areas, viz. Dr Burnett, Mr Donald, Mr Hepburn, Dr Krause, Miss Paterson, Miss Thomson, and Miss Young.

tests, and from these a general table of scores was drawn up by counties, giving an identification number, the total group score, the intelligence quotient, the verbal score, and the scores for pages 2 and 3 of the Picture Tests separately for each of the 1000 children, whose sex was indicated by the use of the letters B or G in the identification number. This table<sup>1</sup> formed the basis of the statistics of distribution and intercorrelation of individual and group scores of the representative sample of 1000 children.

Similar calculations were also made for the smaller group of 187 children tested by Mr Kennedy-Fraser.

#### CHILDREN IN SPECIAL SCHOOLS FOR MENTAL DEFECTIVES

Although all the children born in 1921 who were already "ascertained mental defectives" and were attending special schools or classes were given the Group Test and their results included in the general statistics, it must be carefully noted that none of these children were included in the sample 1000. Thus the six children below 70 I.Q. in the unadjusted distribution of individual test scores are really unascertained "mental defectives."

#### THE SUPERIORITY OF THE SAMPLE

When the group scores of the 500 boys and 500 girls who had been individually tested were compared with those of all boys and girls born in 1921, it was found (see Ch. V, pp. 94 and 95) that, in spite of all precautions taken to make the sample really "representative," it was superior. From a careful survey of all the material

<sup>1</sup> See pp. 43-50.

available, a partial explanation may be found in the opportunities provided for the testers. Those testers who were not confined to one school—*e.g.* lecturers, directors, psychologists, school medical officers, and teachers who were granted facilities for testing outside their own schools—seem to have been able to obtain a fairly representative sample of the available children. On the other hand, those teachers who had no opportunity of testing outside their own schools seem, in the main, to have been quite unintentionally responsible for an undue proportion of higher intelligence quotients. This has affected the results particularly for the boys in one of the cities, and consequently also the summarised results for the boys from the four cities.

Table II gives the broad distribution of the intelligence quotients of the children as actually obtained for the sample of 1000; and, for comparison, Terman's similar table for 905 unselected American children of all ages from 5 to 14.

Table III gives similar figures for comparing the four cities with the counties. The girls do not seem to show any significant difference, but the boys in the cities tend to be definitely superior. Unfortunately, it is not possible to discover how much of this is due to the location of the testers, as indicated above.

INDIVIDUAL TESTING

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TABLE II

*Summary of Percentages at Different Levels of Intelligence  
(uncorrected for Superiority of Sample)*

Intelligence Quotients.	Boys.	Girls.	All.	Terman. <sup>1</sup>
Above 129	6.2	6.0	6.1	1
110-129	26.8	20.2	23.5	18.4
90-109	43.2	46.4	44.8	60.0
70-89	23.2	26.8	25.0	19.6
Below 70	.6	.6	.6	1.0
Number	500	500	1000	905
Mean	103.0	100.2	101.6	99 (Median)

The mean chronological ages of the boys and girls are virtually identical, as shown in age distribution table on p. 50.

TABLE III

COMPARISON OF FOUR CITIES AND THIRTY-ONE COUNTIES

*Percentages at Levels of Intelligence  
(uncorrected for Superiority of Sample)*

I.Q.	Boys.			Girls.		
	Cities.	Counties.	All.	Cities.	Counties.	All.
Above 129	7.8	5.1	6.2	5.9	6.1	6.0
110-129	31.3	24.0	26.8	19.3	20.7	20.2
90-109	44.8	42.3	43.2	50.1	44.3	46.4
70-89	16.1	27.7	23.2	24.7	28.0	26.8
Below 70	..	.9	.6	..	.9	.6

<sup>1</sup> Ages 5-14 (*The Stanford Revision, etc.*, Warwick and York, 1917, p. 42). Terman's categories are 51-70, 71-90, 91-100, 101-120, 121-150.

Table IV shows that both for boys and girls the correlations between the Binet Intelligence Quotients and the Verbal Group Test Scores are higher for the group of children individually tested by one examiner than for those tested by a variety of examiners. As regards girls the difference,  $\cdot 090$ , is nearly five times its probable error,  $\cdot 0179$ , and is significant; as regards the boys,  $\cdot 054$  is less than thrice  $\cdot 0235$ , and thus is doubtful.

TABLE IV

*Correlations between Binet I.Q. and Verbal Group Scores*

	Boys.			Girls.		
	Number.	$r$ .	P.E.	Number.	$r$ .	P.E.
All . . . .	500	$\cdot 80$	..	500	$\cdot 76$	..
Tested by Chairman	99	$\cdot 842$	$\cdot 0197$	88	$\cdot 845$	$\cdot 0206$
Tested by others .	401	$\cdot 788$	$\cdot 0128$	412	$\cdot 755$	$\cdot 0143$
Difference .	..	$\cdot 054$	$\cdot 0235$	..	$\cdot 090$	$\cdot 0179$



# INDIVIDUAL TESTING

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## SCORES OF THOUSAND BINET CHILDREN<sup>1</sup>

				I.Q.	V.	P2.	P3.					I.Q.	V.	P2.	P3.					I.Q.	V.	P2.	P3.
B.Y	112	45	13	8	G.X	98	28	27	7	G.Y	73	10	40	5									
B.Al	110	45	31	6	B.X	99	48	40	8	B.X	110	42	14	9									
B.My	108	36	38	8	B.X	99	29	10	6	G.Y	91	25	33	8									
G.My	107	44	22	8	G.Y	98	39	19	7	B.Y	106	40	24	7									
G.Y	101	44	29	9	G.X	90	44	24	9	G.Y	108	47	29	7									
G.My	97	39	15	6						G.Y	93	29	16	7									
B.Y	92	33	15	8	G.X	89	33	15	7	G.Y	90	20	21	6									
G.My	92	32	24	7	G.X	89	21	36	7	G.Y	97	33	2	6									
B.My	87	12	32	6	B.X	80	17	40	8	G.Y	103	40	27	8									
G.My	87	38	32	8	B.X	77	16	26	2	G.Y	100	31	9	6									
					G.X	73	17	27	3														
B.Y	126	58	39	9	G.Y	95	49	32	8	G.X	79	21	40	6									
B.J	88	46	40	7	B.Y	88	34	20	9	G.X	104	49	21	8									
G.Y	95	39	40	6	G.Y	104	44	23	8	B.X	95	29	20	8									
B.My	120	56	28	9	B.Y	77	36	28	6	B.X	99	58	39	9									
G.My	96	42	40	5	B.Y	94	51	23	7	B.Y	148	72	40	9									
B.Y	98	43	40	9						B.Y	115	44	39	9									
B.Y	96	38	33	8	G.Y	85	18	12	8	B.X	87	32	32	8									
G.Y	107	53	35	9	G.X	92	38	17	9	G.Y	110	45	21	9									
B.Y	79	40	40	9	B.X	102	53	40	9	B.Y	95	43	29	8									
G.Y	119	59	40	9	B.X	113	52	22	8	G.X	92	37	40	8									
					G.X	106	53	31	9														
B.Mh	107	42	40	8	B.X	127	56	37	8	G.X	95	47	40	9									
B.Al	93	41	39	5	B.Y	121	44	25	9	G.Y	99	50	40	9									
B.My	108	52	36	8	B.X	110	44	40	9	G.X	106	42	19	6									
G.Y	155	66	40	9	B.Y	114	38	21	8	G.X	111	31	34	5									
G.X	141	63	39	9	G.X	84	23	18	7	G.X	104	44	29	8									
G.X	134	58	39	9						G.Y	81	29	26	6									
G.X	132	38	17	6	B.X	86	42	28	9	G.X	84	28	40	8									
G.X	125	56	40	9	B.X	92	39	40	7	G.Y	76	7	3	6									
B.Y	112	33	27	8	B.Y	120	59	40	7	G.My	89	19	31	8									
B.X	105	28	14	9	G.J	92	45	30	7	G.Y	94	24	16	6									
					B.Y	92	8	26	4														
B.X	103	44	40	9	B.X	80	18	15	4	G.X	89	15	32	5									
B.X	102	19	24	8	G.X	111	43	23	9	B.Y	101	33	33	8									
B.X	96	26	0	7	G.Y	111	34	26	7	B.X	86	3	25	4									
B.X	101	42	21	8	B.Y	105	36	16	1	B.X	120	55	34	8									
G.X	100	47	40	8	G.Y	102	34	19	8	G.Y	114	55	40	9									

<sup>1</sup> In this table the individual results of testing 1000 Binet children are recorded as follows:—

In Column 1, sex is denoted by B. for boys and G. for girls, and pupils tested by the Chairman by an asterisk.

Date of birth by Mh for March, Al for April, My for May, X for June 1-7, Y for June 8-30, J for July, At for August, and N for November.

Column 2 gives the Intelligence Quotients derived from Binet Tests.

Column 3 gives the scores in the Verbal Group Test.

Column 4 " " " " Picture-Digit Substitution Test.

Column 5 " " " " Pictorial Classification Test.



# INDIVIDUAL TESTING

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				I.Q.	V.	P2.	P3.					I.Q.	V.	P2.	P3.
*G.Y	138	65	22	9	G.Y	116	59	32	9	G.X	111	35	38	9	
*B.Y	130	66	27	9	G.Y	119	62	26	8	G.Y	95	37	40	9	
*B.X	102	25	24	7						G.Y	105	62	40	9	
G.X	100	36	39	4	G.Y	148	65	40	9	G.Y	102	33	40	7	
G.X	107	39	31	4	B.Y	160	70	21	9	G.Y	102	42	17	7	
G.Y	93	33	30	8	B.X	143	59	32	8	B.Y	114	48	40	9	
G.Y	87	37	40	7	B.Y	124	54	32	9	G.X	84	3	40	5	
G.X	120	55	40	9	*B.Y	106	51	16	9						
					*B.X	96	23	16	8	B.X	105	51	21	7	
G.Y	126	58	39	9	*G.Y	111	36	40	8	B.X	141	70	40	9	
*B.Y	87	9	40	9	*B.X	84	14	14	7	G.X	94	31	39	8	
*B.X	83	10	38	7	G.X	113	49	20	9	*B.X	112	12	16	5	
*B.Y	105	31	39	2	G.Y	117	49	40	7	*G.X	137	55	40	9	
*G.X	112	52	22	6						*B.Y	124	55	40	7	
*G.Y	135	54	39	9	G.X	114	47	28	8	*G.Y	92	23	18	8	
*B.Y	89	38	32	6	G.X	117	57	23	4	*G.Y	111	55	40	9	
G.Y	114	47	19	9	B.Y	104	32	28	2	*B.Y	91	30	9	6	
G.Y	113	48	23	6	B.X	119	42	30	6	*B.Y	91	18	40	8	
G.Y	88	37	14	6	*G.Y	73	11	25	8						
					*B.Y	121	55	36	9	*G.Y	87	21	40	6	
G.X	106	24	23	2	*B.Y	110	48	32	8	*B.Y	127	58	40	8	
B.X	113	33	40	9	*G.Y	119	34	28	7	*B.X	102	32	30	6	
G.X	100	32	40	6	*B.Y	101	46	40	7	*B.My	116	49	40	9	
G.Y	96	26	23	4	*G.Y	102	41	40	6	*B.X	109	50	33	9	
B.X	104	37	28	7						*G.X	88	24	30	8	
B.Y	111	20	28	7	*B.Y	130	61	40	6	B.Y	90	25	39	6	
G.X	97	23	20	4	*B.X	118	51	37	8	B.X	133	67	20	9	
G.X	101	29	30	7	*B.Y	145	68	40	9	G.Y	117	35	21	8	
*B.Y	122	51	21	8	*B.Y	123	56	24	8	G.Y	127	56	40	9	
*B.Y	94	27	20	8	*G.Y	113	50	19	7						
					*G.X	96	27	40	9	B.Y	89	40	21	7	
*G.Y	87	13	27	4	*G.X	85	35	29	5	B.Y	94	44	37	8	
*B.Y	98	26	24	6	*G.Y	143	64	20	9	G.X	90	32	33	6	
G.Y	104	45	40	8	*G.Y	85	18	21	6	G.X	93	29	30	6	
G.Y	98	45	40	9	*G.Y	84	18	32	5	G.X	123	49	26	7	
B.X	109	47	24	9						G.X	123	51	30	7	
B.X	101	36	40	4	*G.Y	109	47	29	7	B.Y	108	25	27	4	
*B.Y	107	19	16	7	*B.Y	104	49	40	9	G.Y	109	38	40	7	
*G.Y	80	16	29	6	*G.X	111	39	31	4	*B.My	107	44	22	5	
*B.Y	108	52	32	7	*G.X	90	33	24	5	G.Y	98	31	40	8	
*G.X	84	26	22	5	*B.My	86	23	40	7						
					*B.X	91	47	39	6	B.Y	98	34	14	7	
*B.Y	113	58	40	9	*B.Y	104	42	23	6	G.Y	111	45	25	8	
*B.Y	91	37	40	8	*B.Y	84	14	16	5	B.X	125	55	32	9	
G.Y	109	34	40	9	*B.Y	102	37	28	8	*B.X	100	33	40	9	
G.Y	137	49	40	9	*B.X	103	46	40	7	*G.X	86	35	40	7	
*B.X	117	54	40	9						*B.Y	117	53	39	8	
*B.Y	86	5	39	4	*B.Y	86	23	36	9	*G.X	95	41	40	9	
*G.Y	120	49	16	8	*B.Y	104	25	32	7	B.Y	101	30	40	6	
*G.Y	89	14	27	7	*B.X	90	32	39	7	B.Y	95	28	30	8	
										B.Y	92	35	26	7	

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	I.Q.	V.	P2.	P3.		I.Q.	V.	P2.	P3.		I.Q.	V.	P2.	P3.
G.Y	91	23	28	5	B.Y	73	7	40	9	B.My	95	54	20	6
G.Y	105	39	40	8	G.X	85	45	37	9	B.Y	109	42	16	9
G.Y	87	15	14	5	G.X	88	37	36	1	G.Y	90	16	40	7
B.X	93	37	24	7	B.J	128	46	32	9	B.My	83	30	26	0
B.Al	111	50	22	9						B.My	125	59	30	7
G.Y	121	54	38	9	B.Y	122	56	29	8	G.X	93	36	30	8
B.X	110	49	16	9	G.Y	95	35	24	7	B.Y	88	17	18	4
G.Y	71	20	40	8	G.My	90	23	31	5	B.Y	125	60	21	8
B.Y	112	37	33	7	G.J	90	36	22	7					
B.X	143	58	17	9	B.X	118	54	39	6	B.My	96	42	39	8
					G.X	81	25	40	5	G.Y	78	40	40	8
B.Y	105	44	24	9	G.Y	112	43	40	8	G.Y	98	38	36	8
B.My	113	45	40	7	B.Y	109	42	24	8	G.Al	121	49	38	6
G.X	101	38	40	7	B.My	77	30	39	6	B.My	126	66	34	9
B.Y	85	17	5	7	B.My	93	43	23	9	B.Y	83	39	16	6
B.Y	90	28	30	6						G.My	105	57	16	9
G.My	108	54	40	9	G.My	83	29	26	4	B.J	146	62	40	8
B.J	112	59	38	8	B.X	85	34	13	7	G.X	79	22	25	3
G.Y	123	37	20	9	G.X	103	34	18	9	G.My	103	40	40	8
G.Y	118	45	36	8	B.X	102	45	32	8					
B.Y	115	33	40	8	G.X	131	52	36	7	B.Y	83	12	17	3
					B.My	71	7	20	5	B.My	107	62	40	9
B.X	114	61	21	8	G.My	87	33	28	7	G.X	98	55	37	9
B.Y	100	27	9	8	B.Y	84	26	13	2	B.My	99	36	40	9
B.X	91	25	25	8	G.Y	76	7	26	8	G.X	95	51	20	7
G.Y	89	15	29	7	B.My	92	24	27	3	G.X	97	40	25	9
G.Y	88	43	24	9						B.J	100	37	40	9
G.X	124	58	40	9	G.My	98	26	40	8	G.My	87	36	15	7
B.Y	115	43	40	9	G.My	102	38	40	9	B.My	107	51	24	6
B.X	103	58	31	9	B.X	78	20	40	8	B.Y	86	37	16	8
G.Y	102	55	36	7	B.X	123	62	40	8					
B.My	99	40	40	8	B.X	113	54	19	9	B.Y	102	41	30	8
					G.My	92	29	28	5	G.Y	79	18	38	9
G.Y	97	37	39	7	B.My	143	67	17	9	G.Y	105	51	37	8
B.X	93	34	22	7	G.My	106	49	40	6	B.X	112	58	38	9
G.X	86	39	26	7	G.Y	139	70	26	9	B.Y	101	55	26	8
G.Y	77	13	13	8	G.Y	89	34	26	6	G.Al	89	41	40	9
*B.Y	141	56	30	6	G.Al	91	37	40	9	G.Y	98	44	40	6
*B.Y	71	2	14	3	B.My	125	49	35	9	B.My	94	46	13	7
*G.Y	117	53	19	9	B.Y	119	50	20	6	B.Y	92	33	16	6
*G.X	93	28	32	7	G.My	120	60	40	8	B.My	97	25	16	1
B.J	150	65	38	9	B.X	84	17	14	4					
B.My	110	41	33	8	B.Y	95	36	40	6	G.N	96	46	40	8
					B.Y	131	60	40	9	*B.Y	85	20	40	6
B.Y	106	48	20	9	B.Y	81	17	40	8	*B.X	99	35	39	7
G.J	90	40	16	7	G.Y	74	36	39	7	*G.X	91	32	28	4
B.Y	79	14	33	4	B.Y	96	58	35	7	*G.X	135	57	40	9
G.Y	77	24	24	6						G.My	121	54	24	9
B.X	89	37	40	8	G.Y	108	48	40	8	G.My	120	66	28	9
G.X	106	55	33	7	G.Y	90	38	30	8	B.At	104	52	26	9

## INDIVIDUAL TESTING

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	I.Q.	V.	P2.	P3.		I.Q.	V.	P2.	P3.		I.Q.	V.	P2.	P3.
B.Mh	107	53	40	7	B.Y	106	57	38	9	G.X	84	40	27	9
B.Y	135	55	40	8	B.Y	100	30	23	5	G.X	100	39	21	7
					B.Y	89	32	31	6	B.Y	90	42	28	9
G.Y	116	54	19	9	*G.X	112	37	40	7	G.Y	76	6	19	6
B.Y	110	37	32	9	B.X	88	41	40	9	B.Y	95	43	24	9
G.Y	104	53	32	6	G.Y	85	40	21	9	B.X	89	29	25	7
B.X	85	20	29	7	G.X	84	17	20	7	B.Y	87	27	31	7
G.Y	92	40	25	9						G.X	74	20	40	8
G.X	93	38	40	1	B.Y	92	30	40	7	G.X	107	45	40	9
B.Y	113	48	40	7	G.Y	84	37	40	7	G.Y	110	49	37	9
B.Y	92	15	40	7	B.Y	83	29	30	5					
G.Y	92	47	40	8	*G.Y	91	40	40	9	G.Y	122	55	28	9
B.Y	111	49	25	8	B.Y	128	45	40	8	G.Y	119	41	29	6
					G.X	72	13	21	3	B.Y	116	34	19	8
B.X	109	61	15	9	G.Y	90	25	11	7	B.X	87	29	40	9
B.Y	106	49	40	9	B.Y	72	8	15	3	B.X	125	52	40	7
G.X	116	56	40	9	G.My	126	58	40	9	G.Y	113	46	40	9
*G.X	95	38	40	8	B.X	122	46	40	8	G.X	102	53	40	9
*G.X	82	34	20	9						B.X	123	56	40	9
*B.Y	102	43	35	7	B.Y	120	55	39	9	G.Y	120	51	40	9
*G.Y	132	52	40	9	B.X	115	67	40	8	G.X	123	51	23	8
G.Y	134	56	25	9	B.X	95	36	29	6					
G.X	107	38	30	7	B.X	82	15	22	7	B.Y	96	52	40	8
G.X	95	41	32	7	G.X	99	43	40	7	G.Y	120	46	40	8
					G.X	96	34	7	3	G.Y	108	40	40	8
G.J	144	58	40	9	G.X	75	40	39	8	G.Y	99	35	40	8
G.X	95	43	32	9	G.Y	67	3	38	2	B.Y	89	12	24	7
G.X	91	36	15	6	G.Y	123	58	40	8	B.Y	141	49	40	8
G.X	122	41	27	7	B.Y	85	28	39	6	B.My	115	39	40	6
G.X	95	42	28	3						G.Y	132	58	39	9
B.X	111	48	17	6	G.X	133	56	28	9	G.Y	126	60	40	8
B.X	92	25	23	6	B.X	121	56	18	9	G.X	101	45	40	9
B.X	108	49	40	8	B.X	99	42	32	8					
B.Y	87	34	32	8	G.Y	111	27	40	8	G.My	98	36	20	9
B.X	114	50	10	8	B.X	86	23	29	7	G.Y	119	57	33	9
					B.Y	86	21	20	6	B.Y	122	39	33	6
B.X	111	46	24	7	B.X	90	15	38	1	B.Y	98	24	26	6
B.X	119	51	31	7	B.Y	88	30	39	7	B.Y	142	69	40	9
G.Y	123	58	20	8	G.Y	130	56	34	9	B.Y	90	38	32	6
G.Y	67	5	40	2	G.X	84	15	34	7	B.Y	106	47	40	8
G.X	131	54	40	7						B.Y	84	33	27	8
G.X	89	30	40	8	B.X	84	34	40	7	G.Y	110	51	16	7
G.X	85	17	19	7	G.Y	93	41	40	8	B.Y	107	42	40	8
B.X	94	26	26	6	B.X	139	56	32	9					
B.X	132	54	26	9	B.Y	101	46	40	8	B.Y	88	31	33	6
B.Y	126	46	40	7	B.Y	91	36	39	9	B.My	75	21	28	7
					G.Y	75	14	27	8	B.Al	101	49	32	9
B.Y	94	40	12	6	B.Y	94	32	40	4	B.At	90	46	15	7
B.Y	86	6	40	6	B.Y	101	44	19	7	B.My	110	53	39	9
B.X	94	31	3	3	G.Y	126	54	21	9	G.Y	79	7	40	5
					G.Y	121	63	35	7					



## INDIVIDUAL TESTING

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	I.Q.	V.	Pz.	P3.		I.Q.	V.	Pz.	P3.		I.Q.	V.	Pz.	P3.
G.Y	100	43	35	7	B.My	97	50	36	3	G.J	80	19	27	6
G.Y	107	47	16	7	B.Al	96	28	40	7	B.J	94	36	36	0
G.X	91	39	18	7						G.Al	89	38	24	4
B.Y	70	4	13	3	G.X	99	46	23	9	B.X	93	41	40	7
G.Y	112	43	25	8	G.Y	80	3	16	5	G.My	85	29	23	1
B.Y	117	56	40	9	B.Y	98	31	15	8	B.X	95	32	39	7
G.Y	108	36	14	8	G.Y	87	21	18	6	G.My	86	36	40	7
					G.Y	123	45	37	7					
B.Y	145	68	39	7	G.Y	115	30	19	8	B.Y	108	43	27	9
B.Y	100	42	32	8	G.Y	68	0	7	3	B.X	73	2	30	5
G.Y	114	52	36	9	G.Y	83	16	27	1	G.Y	105	57	39	7
G.Y	91	41	30	8	G.Y	102	25	40	6	B.My	122	55	40	9
B.Y	90	39	8	7	G.Y	110	40	23	6	B.Y	97	45	40	8
G.Y	90	27	40	5						B.X	100	43	40	8
B.Y	100	49	26	7	B.Y	96	23	17	5	B.My	117	44	25	7
B.Y	87	36	17	8	G.Y	99	26	27	3	B.X	105	42	32	7
G.Y	96	50	37	9	G.Y	97	32	40	5	G.Y	107	42	24	8
B.X	106	48	40	8	G.X	102	38	24	8	G.X	96	35	40	9
					B.X	120	46	40	9					
G.Y	96	34	30	6	G.Y	102	36	37	7	G.Y	99	33	40	6
B.My	121	54	24	9	G.Y	78	5	24	1	B.X	138	56	40	9
B.Y	91	32	7	7	B.X	75	8	15	6	B.Y	111	47	40	9
G.Y	81	34	9	8	G.X	83	29	25	6	B.X	88	39	40	7
G.J	111	53	32	6	G.Y	89	29	40	8	G.Y	88	26	36	6
B.Y	102	45	16	9						B.X	76	24	30	5
B.My	95	40	37	9	B.Y	86	34	14	5	G.Y	118	38	40	6
G.My	95	41	19	7	B.Y	108	40	40	9	*C.Y	110	51	28	8
B.X	124	65	37	9	B.X	90	34	37	0	G.X	113	51	24	8
B.Y	132	59	40	9	G.Y	95	43	24	8	G.Y	92	28	39	7
					B.Y	92	33	12	6					
G.Y	88	32	16	3	G.Y	82	27	28	7	*G.Y	116	34	24	7
B.X	103	34	21	9	B.Y	85	36	18	5	G.Y	84	28	40	4
G.My	91	25	40	7	G.Y	88	39	26	8	*G.X	114	48	39	8
G.Y	118	56	32	9	B.X	123	46	40	8	G.Y	97	31	28	6
B.Y	90	27	27	6	B.My	121	47	26	6	G.Y	80	6	2	0
B.Y	86	18	8	3						G.X	90	25	21	9
B.Y	89	22	17	6	B.X	90	16	19	1	G.Al	108	49	40	1
B.Y	126	62	33	9	B.X	126	49	40	8	G.Y	111	49	39	9
G.X	87	28	24	7	B.X	105	51	40	9	G.X	103	48	17	8
G.Y	94	38	27	8	G.X	114	55	26	9	G.My	90	20	19	7
					G.J	87	37	39	8					
B.X	96	25	39	4	G.Y	87	43	33	8	G.Y	104	29	19	4
G.Y	89	27	36	7	B.X	85	30	28	8	G.Y	113	45	23	6
B.X	103	46	29	8	G.My	84	13	31	0	G.Y	107	48	10	8
B.X	95	11	26	7	G.X	82	31	12	6	*B.Y	78	2	30	5
G.X	89	34	27	6	B.My	124	48	35	9	*B.Y	86	29	24	5
G.X	112	52	21	7						B.Y	121	58	39	9
B.My	100	63	21	8	B.My	110	44	30	7	B.X	78	22	40	2
G.My	84	17	20	7	G.My	120	61	31	9	B.Y	93	13	39	7
					B.J	126	53	40	9	B.Al	98	35	40	0
										B.X	87	28	39	0

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	I.Q.	V.	P <sub>2</sub>	P <sub>3</sub>		I.Q.	V.	P <sub>2</sub>	P <sub>3</sub>		I.Q.	V.	P <sub>2</sub>	P <sub>3</sub>
B.Y	71	3	26	2	B.Y	107	51	23	9	G.X	98	53	40	6
B.Y	64	9	30	6	B.Y	73	7	22	5	G.X	109	48	40	8
*B.Y	98	16	16	8	B.Y	89	28	16	7	B.My	83	8	40	2
B.J	114	57	40	3	B.Y	98	41	39	8					
B.J	90	15	40	7	B.Y	98	54	26	7	B.My	96	51	40	9
*B.Y	85	6	11	7	G.X	136	70	40	9	G.Y	96	52	40	7
B.Y	104	45	38	8						B.My	69	4	14	2
B.Y	101	40	4	6	G.Y	111	40	31	7	G.Al	99	53	40	8
B.Y	101	35	40	8	B.X	109	45	20	6	G.My	81	38	30	8
B.My	89	42	32	8	G.Y	99	30	29	6	G.J	84	40	15	9
					G.Y	105	43	17	7	G.My	107	41	19	5
G.Al	106	65	32	9	G.Y	95	44	26	5	G.My	86	31	16	7
B.At	112	50	36	9	G.Y	96	36	39	5	B.My	74	13	17	1
B.Y	126	60	40	9	G.Y	112	45	35	6	G.My	82	24	27	9
B.Y	111	44	39	9	G.Y	116	51	39	5					
B.Y	84	33	16	6	G.Y	90	25	36	7	G.Y	93	41	28	9
B.Y	90	19	19	5	G.My	103	40	17	9	G.My	78	23	31	2
*G.Y	101	41	40	9						B.Y	87	13	15	7
*G.My	99	16	28	9	B.Y	128	48	39	9	G.J	102	41	40	8
*B.Al	124	53	40	7	B.Y	105	36	40	7	G.X	85	28	24	6
*B.My	96	41	28	9	B.My	88	16	40	7	B.J	72	16	40	8
					G.J	108	55	20	9	G.Y	110	47	40	9
*B.Y	93	45	38	8	B.J	115	53	32	9	B.Y	148	67	27	9
*B.Y	122	60	29	9	B.J	102	45	26	8	G.X	115	53	26	9
*G.My	102	33	13	7	B.J	105	43	18	7	B.X	104	45	40	7
*G.My	100	45	16	1										

## AGE DISTRIBUTION

	Boys	Girls	All
March . . . .	2	0	2
April . . . .	9	7	16
May . . . .	52	49	101
June 1-7 . . . .	162	166	328
June 8-30 . . . .	257	262	519
July . . . .	15	15	30
August . . . .	3	0	3
November . . . .	0	1	1



INSTRUCTIONS FOR MODIFYING FOR SCOTTISH USE  
 TERMAN'S CONDENSED GUIDE FOR THE STAN-  
 FORD REVISION OF THE BINET-SIMON TESTS

P. 9,	III, 6.	Read <i>pussy</i> for <i>kitty</i> .
P. 10,	IV, 4.	„ <i>just</i> here for <i>right</i> here.
P. 11,	IV, 7.	„ <i>pussy</i> for <i>kitty</i> .
P. 13,	VI, 4.	„ <i>somewhere</i> for some place.
P. 13,	VI, 5.	„ <i>3d., 1d., 1/-, 6d.</i> for <i>nickel</i> , etc.
P. 13,	VI, 6 (b).	„ <i>holidays</i> for <i>vacation</i> .
P. 15,	VII, 6.	„ <i>just</i> for <i>right</i> .
P. 15,	VIII, 1.	„ <i>cricket-ball</i> for <i>baseball</i> .
P. 16,	VIII, 4.	„ <i>orange</i> for <i>peach</i> .
„ „	„ „	„ <i>motor-car</i> for <i>automobile</i> .
P. 17,	IX, 3.	„ <i>pence</i> for <i>cents</i> .
„ „	„ „	„ <i>toffee</i> for <i>candy</i> .
„ „	„ „	„ <i>shopkeeper</i> for <i>storekeeper</i> .
		Change figures to 4d. and 6d., 9d. and 1/-, 5d. and 2/-.
P. 18,	X, 1.	„ 15 for 10.
P. 19,	X, 2.	„ (b) <i>engine-driver</i> for <i>engineer</i> .
		„ (b) <i>carriages</i> for <i>cars</i> .
		„ (d) <i>railway</i> for <i>railroad</i> .
		Change order to (a), (b), (d), (e), (c).
P. 19,	X, 4.	„ <i>Manchester</i> for <i>New York</i> .
„ „	„ „	„ <i>centre</i> for <i>center</i> .
„ „	„ „	„ <i>pounds</i> for <i>dollars</i> .
P. 21,	XII, 3.	„ <i>cricket-ball</i> for <i>baseball</i> .
P. 25,	XIV, 3.	Use XIV alternative.
P. 26,	XIV, 5.	„ <i>shillings</i> for <i>dollars</i> .
„ „	„ „	„ <i>pence</i> for <i>cents</i> .
P. 31,	XVIII, 7.	Use list 1 only.
		No. 50 <i>conspiracy</i> for <i>complot</i> .



IV

THE GROUP TEST



## IV

### THE GROUP TEST

THE Group Test consisted of two pages of picture items and five pages of verbal items. It is printed in Appendix III, together with the instructions to the pupils. A ten-minutes' Preliminary Practice Test in the verbal items was given beforehand (Appendix II). The picture pages were timed separately (one minute and two minutes respectively, but see Special Instructions<sup>1</sup>) and the verbal items followed immediately, with a block time of forty-five minutes.

The first picture page asked for forty *Picture-Digit Substitutions*. For reasons given below, the results from this page were ultimately rejected. The second asked for nine selections, each from five pictures, of an article similar to three pictured articles shown, a kind of identification parade. The test may be called *Pictorial Classification*.

The *Verbal Test* was in "omnibus" form, *i.e.* items of different sorts were mixed together and were not separately timed. The items do not admit of exact sorting into categories, for a Directions Test item might, for example, involve a small reasoning problem, but in a rough classification they were as follows:—

---

<sup>1</sup> Appendix I.

Following Directions . . . . .	14 items, <i>e.g.</i> No. 1.
Same-opposites . . . . .	11 items, <i>e.g.</i> No. 49.
“Different” Word (a Classification Test) . . . . .	10 items, <i>e.g.</i> No. 22.
Analogies . . . . .	8 items, <i>e.g.</i> No. 6.
Practical (MacTaggart) . . . . .	6 items, <i>e.g.</i> No. 44.
Reasoning Tests . . . . .	5 items, <i>e.g.</i> No. 13.
Proverbs . . . . .	4 items, <i>e.g.</i> No. 17.
Arithmetical . . . . .	4 items, <i>e.g.</i> No. 11.
Geometrical . . . . .	4 items, <i>e.g.</i> No. 68.
Mixed Sentences . . . . .	3 items, <i>e.g.</i> No. 54.
Cypher Test . . . . .	2 items, <i>e.g.</i> No. 66.
Other items . . . . .	4.
	<hr/>
	75 items (76 marks).

(There are 71 numbered questions, but 44 and 56 have each three items, and item 66 has two points of score. These features occurred as the test grew.)

The marking key and the instructions for tabulation are printed in Appendix IV and Appendix V. The markers were also supplied with cardboard strips with the answers spaced on them to fit the child's answers on the scripts. Unfortunately the cardboard strips omitted some of the explanations given in the full marking key (*e.g.* the sentences “No point in 60 to 65 unless properly underlined or crossed out. No point if more than one word is marked unless . . .”), and this led to some misunderstandings, delays, and possible errors in cases where the leader of a team of markers had not emphasised these points in a preliminary talk.

## THE VERBAL ITEMS OF THE GROUP TEST

*Previous History of the Verbal Test*

The Verbal Test of 76 points began life in the autumn of 1930 as Moray House Test 12, one of the tests prepared annually by Professor Godfrey H. Thomson and his staff and senior students for use by English Local Education Authorities in their "eleven-plus" examination, given to children completing their primary school education and competing for places in secondary and central schools. It was given a preliminary standardisation during the winter 1930-31 on a few hundred children in the towns of E. (Scotland), N. and P. (England), and was compared with two of its predecessors, Moray House Tests 7 and 11.

In the spring of 1931 it was used for regular testing at Ilkeston (England), where by arrangement it was given to *all* the children of the three age-groups 9, 10, and 11 years old, 1891 in number, *i.e.* about 50 per month. A diagram of the results obtained at Ilkeston is given in a paper by Thomson, "The Standardisation of Group Tests and the Scatter of Intelligence Quotients."<sup>1</sup> But the results there portrayed cannot be compared with those given later for Scotland, as at that time more than one point was given for certain of the harder items, so that the maximum was not 76 but 98.

From the Ilkeston scripts an Answer Pattern was prepared—that is, a table showing how often each item was correctly answered, and as a result some few changes and rearrangements were made in the items. At Ilkeston also the correlations of Moray House Test 12 with

<sup>1</sup> *Brit. Journ. Educ. Psychol.*, February 1932, p. 105.

ordinary examinations in Arithmetic and in English for 484 of the candidates in the age-group  $10\frac{1}{2}$  to  $11\frac{1}{2}$  were :

	235 boys.	249 girls.
Arithmetic and Test . . .	0.700	0.677
English        "       " . . .	0.703	0.713

where age allowances had first been given, and the formula used was

$$\rho = 1 - \frac{6\sum d^2}{n(n^2 - 1)}.$$

In the summer of 1931 Moray House Test 12 was again used in the county of N. (England) for 2326 candidates for admission to secondary schools. As these pupils were a selected group (and not as at Ilkeston the whole uncreamed age-group) the data were less useful for standardising purposes; some information was nevertheless gained.

When in the autumn of 1931 the Research Council Mental Survey Committee decided to give a Group Intelligence Test to all the 1921 age-group of Scottish children, but found that the expense of buying published tests was too great, Professor Thomson placed the Moray House Tests at the disposal of the Committee, and No. 12 was chosen. As, however, it had been designed to spread out the able more than the dull children, it was also decided to supplement it by Picture Tests given with oral instructions. These are described on p. 78 *et seq.*

It was also decided in the interests of simplicity to abandon the more complicated system of marking referred to above, and to give simply one mark per item, making a total of 76 marks for the Verbal Tests.

Two slight changes were made in the test. One of the items had referred to the hands of a clock;



and as some of the classrooms might, and others might not, have a clock within view of the children, this was replaced by an equally difficult item from another Moray House Test. Further, six of the items of the original Moray House Test 12 were concerned with a multiplication and a division sum with obliterated numbers. Now the method of setting out such sums is different in different parts of Scotland, and these items were therefore abandoned. At the suggestion of Dr Rusk they were replaced by six items chosen from Dr Mary MacTaggart's "Non-Scholastic Tests for Backward Pupils,"<sup>1</sup> which form Questions 44 and 56 of the test as finally used.

An opportunity now arose for a final try-out of the whole test, as Professor Thomson was asked to examine the 11- and 12-year-old age-groups of the town of Halifax (England), and with the kind co-operation of the Secretary to the Education Committee it proved possible to rehearse there the whole of the Scottish procedure, including the Picture Tests, and the Binet testing<sup>2</sup> of a proportion of the 11-year-old age-group. Before being employed in Scotland, therefore, the Verbal Test had been tried out on not less than 6035 pupils in all, namely,

Preliminary groups—more than . . . . .	218 cases
All 9-, 10-, and 11-year-olds at Ilkeston . . . . .	1891 "
Secondary School Candidates, N.	2326 "
All 11-year-olds at Halifax . . . . .	1278 "
A background group at Halifax, 8 to 14 years old . . . . .	322 "

<sup>1</sup> *The Forum of Education*, 1927, v, pp. 102-112.

<sup>2</sup> Thanks are due to Dr Dorothy Heynemann and Miss M. Womersley, who administered the Binet Tests without any expense whatever to the Research Council.

excluding the 12-year-old group at Halifax, which was not used for this comparison.

At each stage comparisons had been made with chronological age, Answer Patterns had been worked out for samples of the children, items which appeared too hard or too easy had been eliminated, and ambiguities had been removed. For many groups correlations had been obtained with teachers' opinions, and items which did not assist in separating the intelligent from the unintelligent (as judged by the teachers) were discarded or modified. Since the test was one of a number of Moray House Tests, the work done on the other tests, including inquiries into after-careers of children and statistical calculations in which separate parts of the tests were intercorrelated and their relative importance adjusted, also assisted in guaranteeing the validity of this test.<sup>1</sup> The Committee felt, therefore, fairly confident that the test would perform its function in Scotland adequately and that it was a valid measure, if not of exactly the same "intelligence" as is measured by a Binet Test, at least of something closely allied thereto.

#### MARKING AND TABULATING

As has been explained in Chapter I, the marking and tabulating were largely done by the local associations of the Educational Institute of Scotland; but the scripts from certain areas were marked by volunteer parties of students, and those from other areas were both marked and tabulated in the same way. During August, September, and October a good deal of time was spent

<sup>1</sup> Cf. J. W. Collier, "The Predictive Value of Intelligence Tests for Secondary Education," *Brit. Journ. Educ. Psychol.*, February 1933, pp. 65-70.

in tracking down errors (mainly errors of tabulation, for very few errors of marking or of recording were discovered), and in a few instances of inquiring into anomalous dispersions in particular schools. All of these were finally cleared up. There remained a small number of scripts where the nature of the results made it appear possible that the conditions of the test had not been thoroughly understood or exactly complied with; after careful inquiry some scores were removed from the tables. No doubt a few others remain undiscovered. But these, probably not more than two or three dozen in all, must form an insignificant portion of the huge total of 87,498 scripts, and cannot have made any important difference in the tables which follow.

These tables give the number of individuals born in each month of 1921 who obtained each level of score in the Verbal Test: for example, 326 children born in January failed to reach 10 points, 611 born in that month scored from 10 to 19 points, and so on.

## ALL-SCOTLAND, BOYS AND GIRLS BORN IN 1921

## VERBAL TEST, MAXIMUM 76 POINTS

	0-9.	10-19.	20-29.	30-39.	40-49.	50-59.	60-69.	70-76.	Total.
January .	326	611	979	1,596	1,790	1,328	401	17	7,048
February .	374	588	959	1,491	1,653	1,145	378	16	6,604
March .	414	681	1,200	1,720	1,923	1,226	354	25	7,543
April .	492	779	1,199	1,864	1,987	1,265	369	9	7,964
May .	529	857	1,321	1,914	1,979	1,169	334	11	8,114
June .	544	829	1,231	1,835	1,751	1,070	267	15	7,542
July .	535	851	1,274	1,784	1,648	877	228	8	7,205
August .	517	887	1,321	1,767	1,680	843	187	9	7,211
September	554	920	1,372	1,753	1,549	761	190	3	7,102
October .	623	935	1,264	1,682	1,564	695	159	6	6,928
November	637	975	1,276	1,656	1,381	632	163	10	6,730
December	778	1,189	1,487	1,827	1,441	635	146	4	7,507
	6,323	10,102	14,883	20,889	20,346	11,646	3,176	133	87,498

## ALL-SCOTLAND, BOYS ONLY

## VERBAL TEST

	0-9.	10-19.	20-29.	30-39.	40-49.	50-59.	60-69.	70-76.	Total.
January .	180	317	478	755	881	700	230	10	3,551
February .	219	295	439	737	798	600	217	10	3,315
March .	240	331	582	830	957	635	187	13	3,775
April .	288	409	580	884	1,008	660	205	7	4,041
May .	300	439	669	940	985	620	188	7	4,148
June .	308	417	599	909	851	571	152	10	3,817
July .	305	417	622	870	824	506	141	3	3,688
August .	264	435	667	824	829	438	109	5	3,571
September	327	473	660	857	792	419	102	2	3,632
October .	338	487	603	825	754	380	87	4	3,478
November	358	480	647	824	660	329	94	7	3,399
December	441	604	717	868	725	349	88	3	3,795
	3,568	5,104	7,263	10,123	10,064	6,207	1,800	81	44,210

## ALL-SCOTLAND, GIRLS ONLY

## VERBAL TEST

	0-9.	10-19.	20-29.	30-39.	40-49.	50-59.	60-69.	70-76.	Total.
January .	146	294	501	841	909	628	171	7	3,497
February .	155	293	520	754	855	545	161	6	3,289
March .	174	350	618	890	966	591	167	12	3,768
April .	204	370	619	980	979	605	164	2	3,923
May .	229	418	652	974	994	549	146	4	3,966
June .	236	412	632	926	900	499	115	5	3,725
July .	230	434	652	914	824	371	87	5	3,517
August .	253	452	654	943	851	405	78	4	3,640
September	227	447	712	896	757	342	88	1	3,470
October .	285	448	661	857	810	315	72	2	3,450
November	279	495	629	832	721	303	69	3	3,331
December	337	585	770	959	716	286	58	1	3,712
	2,755	4,998	7,620	10,766	10,282	5,439	1,376	52	43,288

## CALCULATION OF STANDARDS FOR THE VERBAL TESTS

Among the many calculations which can be made on these tables only the simpler and more obvious (and therefore doubtless the more important) can be reported here. Others must wait for greater leisure on the part of the investigators; but as for many reasons it is desirable not to delay publication, these more complicated considerations will if necessary be given in the scientific journals.

For each monthly distribution of the whole table of 87,498 results, the 84 percentile, the median or 50 percentile, and the 16 percentile<sup>1</sup> scores were found and are as follows:—

Born in	Age on day of test in months.	Number.	Percentiles.		
			16.	50.	84.
January . . .	136½	7048	21·45	39·57	54·16
February . . .	135½	6604	20·49	38·76	53·71
March . . .	134½	7543	20·43	38·08	52·75
April . . .	133½	7964	19·53	37·61	52·41
May . . .	132½	8114	18·48	36·56	51·35
June . . .	131½	7542	17·49	35·86	50·86
July . . .	130½	7205	16·76	34·78	49·26
August . . .	129½	7211	16·68	34·48	48·82
September . . .	128½	7102	15·83	33·52	48·32
October . . .	127½	6928	14·69	33·32	47·91
November . . .	126½	6730	14·01	32·38	47·53
December . . .	125½	7507	13·06	31·14	46·61

<sup>1</sup> The  $x$  percentile score cuts off  $x$  per cent. of the children from the bottom of the list. The method by which these percentiles were calculated is set out in Appendix VI. The 84 and 16 percentiles are chosen because in a Gaussian normal distribution these correspond to one standard deviation above and below the mean. In general, the medians and percentiles are chosen instead of the mean and "sigma" so that any skewness may be given due weight; also for the practical

To these three sets of twelve points, which are shown in fig. 1, were next fitted "best-fitting" straight lines by the method of least squares (see Appendix VII) which are found to be

$$\begin{array}{ll} 84 \text{ percentiles} & \cdot \quad S = \cdot 708a - 42 \cdot 396 \\ \text{Medians} & \cdot \quad S = \cdot 739a - 61 \cdot 349 \\ 16 \text{ percentiles} & \cdot \quad S = \cdot 754a - 81 \cdot 362, \end{array}$$

where  $S$  = score in verbal tests,  
 $a$  = age in months.

These lines are shown in fig. 1, and represent, at three levels of ability, the smoothed growth from month to month during the year.

The three equations at which we have arrived show that the actual amounts of growth in marks from month to month during the year at a high, medium, and a low level of ability are 0.708, 0.739, and 0.754 marks per month respectively. These are so nearly alike that, as a first approximation, it is probably permissible to take three-quarters of a mark per month as a flat rate equally applicable at all levels, to the clever as well as to the dull. But, as we shall see later, at the very highest and lowest levels a smaller age allowance is needed. That such a flat rate is very often the correct plan is common knowledge among those accustomed to advise statistically on examinations and tests for children of this age; and it is also in accordance with much other experience that, if there should be any tendency to depart from this in the higher levels of ability, not a larger but a smaller age allowance per month than the average must be made, as here 0.708 instead of 0.754.

reason that the mean and "sigma" are not easily calculated when one of the steps is different in size (as here 70 to 76, the other steps being all decades).

This is at variance with the ordinary idea of an intelligence quotient, which would lead one to expect a greater

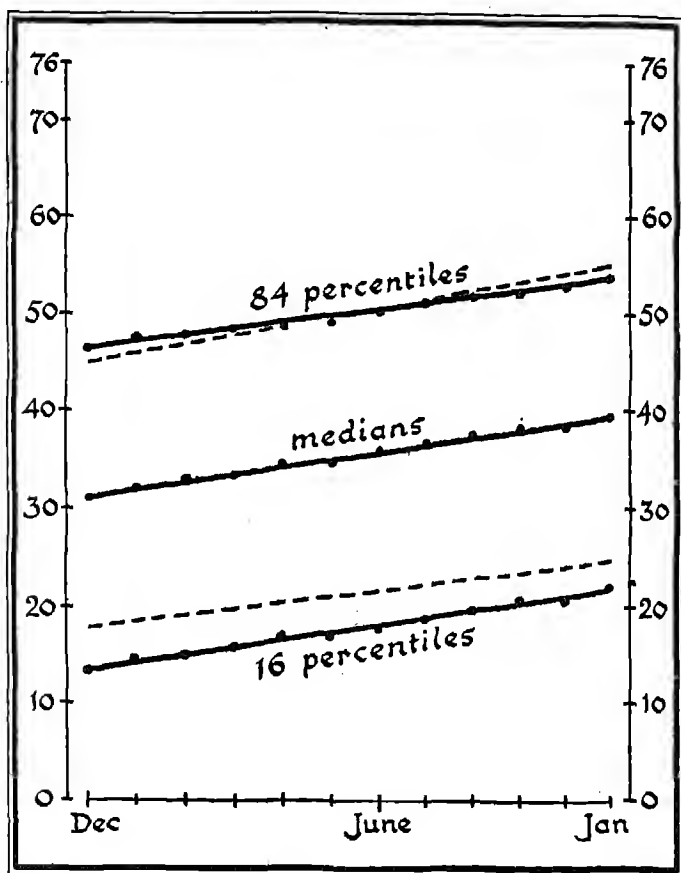


FIG. 1.—The three unbroken lines represent the scores made by children who are superior in this test to 84 per cent., 50 per cent., and 16 per cent. of their comrades, respectively.

growth in the more able. And indeed there may well be actually such a greater growth; but its expression in score is hindered by what Thomson has called the "ceiling effect," that is, by the increasing difficulty of

scoring more marks as the maximum score for the test is approached. And similarly, as zero is neared, the opposite phenomenon is observed, a difficulty in scoring fewer marks.

It is of interest to see what the I.Q. procedure would here lead one to expect in lieu of the above lines for the 16 and 84 percentiles, if one takes the line of medians as a line of norms for mental age, extending it both ways. If the standard deviation of I.Q. be taken for the moment as 15, then the 84 percentile line ought to correspond to the median line with age multiplied by 1.15, and the 16 percentile line ought to correspond to the median line with age multiplied by 0.85. These two lines would be therefore

$$S = .739 \times 1.15a - 61.349$$

$$\text{and } S = .739 \times 0.85a - 61.349.$$

They are shown in fig. 1 as dotted lines, and it will be seen that the upper one falls on top of our experimental line, but is slightly steeper, while the lower one is much nearer to the median than our experimental line and is flatter. This suggests tentatively that the standard deviation of I.Q.'s of Scottish children is somewhat greater than 15 points, for the upper full line (even held down as it is by the "ceiling effect") corresponds to 15 above, and the lower full line to a good deal more than 15, perhaps to 18 below. The later consideration of the Binet results (pp. 93-105) supports this estimate.

#### THE THREE-YEAR "BACKGROUND" IN THE K. DISTRICT (SCOTLAND)

In the K. district, in order to obtain an extension of the norms over three years, the Group Test was given on



the same day (1st June) to all the children born in the years 1921, 1922, and 1923:

	Boys.	Girls.
Number born in 1921	505	555
1922	461	498
1923	432	441

The results from these six groups were as follows:—

Boys			
Born.	16 percentiles.	Medians.	84 percentiles.
1921	17·9	36·6	50·6
1922	9·9	24·9	42·4
1923	4·3	15·3	29·2

GIRLS			
Born.	16 percentiles.	Medians.	84 percentiles.
1921	17·6	34·8	49·4
1922	8·8	24·3	41·0
1923	4·1	15·5	31·4

In fig. 2 these facts are shown by curves joining the above points (averaging boys and girls); and on the same figure the three lines for the All-Scotland 1921 Group (boys and girls together) are again shown. On the whole, since K. is only a sample, the two sets of lines are not inconsistent with each other.

#### BOYS' AND GIRLS' STANDARDS SEPARATELY

Calculations similar to those shown above were made separately on the boys' and girls' tables, and not only at three levels but at many. The results shown in the tables on p. 69 are most carefully calculated in the case of the 84, 50, and 16 percentiles. The other calculations were carried to fewer decimal places and the slide-rule was employed.

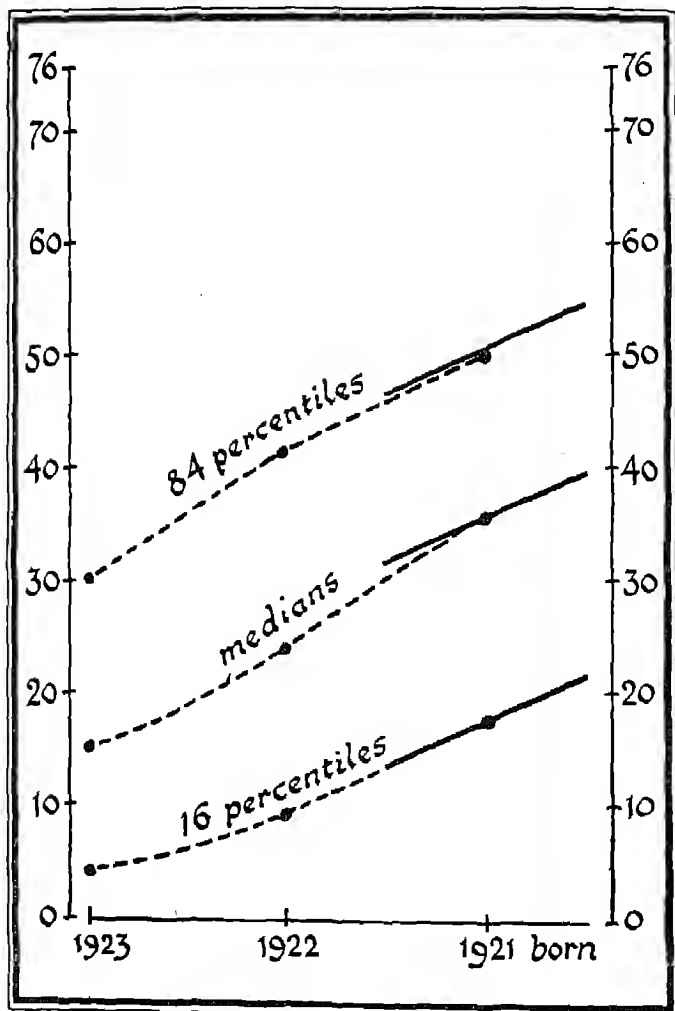


FIG. 2.—The unbroken lines are those of all Scotland, the dotted lines are for the district of K., where children born in 1922 and 1923 were also tested.

THE GROUP TEST

VERBAL TEST. BOYS (44,210)

RAW PERCENTILE POINTS

P.R.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
95	62.2	62.3	60.1	60.0	59.3	59.9	58.7	58.0	57.9	57.3	57.4	56.7
90	57.9	57.8	56.7	56.6	56.0	55.7	55.1	54.0	53.3	52.7	52.2	51.2
84	54.8	54.4	53.1	52.9	51.9	51.6	50.7	49.3	48.8	48.4	47.7	47.2
80	52.8	52.2	50.8	50.5	49.3	49.1	48.4	47.6	46.9	46.5	45.7	45.1
70	48.1	47.4	46.3	46.1	45.2	44.7	44.0	43.2	42.3	41.9	40.6	39.9
60	44.0	43.2	42.4	42.1	40.9	40.2	39.5	38.9	37.9	37.5	36.2	35.4
50	40.0	39.1	38.4	37.9	36.6	35.9	35.3	34.6	33.7	33.3	32.1	31.1
40	35.4	34.6	33.8	33.3	32.2	31.7	31.0	30.3	29.4	28.9	27.6	26.1
30	30.7	30.1	29.1	28.4	27.1	26.5	25.7	25.1	23.9	23.1	22.3	20.8
20	24.0	22.9	22.7	21.4	20.9	20.1	19.8	19.7	17.9	16.8	16.2	14.8
16	21.0	19.9	20.1	18.3	17.8	16.8	16.3	16.6	14.9	14.0	13.4	12.3
10	15.0	13.3	13.7	12.3	12.1	11.3	11.0	11.6	10.3	9.5	9.0	8.1
Age	136½	135½	134½	133½	132½	131½	130½	129½	128½	127½	126½	125½ months.

VERBAL TEST. GIRLS (43,288)

RAW PERCENTILE POINTS

P.R.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
95	59.7	59.7	59.3	59.0	58.6	58.2	57.2	57.0	57.0	56.4	56.4	55.1
90	56.8	56.5	56.1	55.8	55.0	54.4	52.5	52.5	52.0	50.9	51.9	49.1
84	53.4	52.9	52.3	51.9	50.7	50.0	48.3	48.4	47.9	47.5	47.3	46.0
80	51.2	50.5	49.8	49.4	48.6	48.1	46.6	46.7	46.0	45.8	45.5	44.0
70	46.8	46.3	45.8	45.4	44.6	44.0	42.3	42.4	41.4	41.5	40.8	39.0
60	43.0	42.4	41.9	41.4	40.6	39.8	38.2	38.3	37.3	37.4	36.5	35.1
50	39.1	38.5	37.8	37.4	36.5	35.8	34.3	34.4	33.4	33.4	32.7	31.2
40	34.9	34.1	33.6	33.3	32.5	31.8	30.5	30.5	29.5	29.3	28.4	26.8
30	30.8	29.8	29.3	29.2	27.8	26.9	25.5	25.4	24.7	24.1	23.1	22.0
20	24.7	23.5	22.9	22.9	21.7	21.0	20.1	19.9	19.8	18.5	17.3	16.4
16	21.9	21.0	20.8	20.4	19.2	18.2	17.2	16.8	16.8	15.5	14.6	13.9
10	16.4	15.4	15.3	14.6	13.5	12.8	12.3	12.0	12.2	10.8	10.6	10.1
Age	136½	135½	134½	133½	132½	131½	130½	129½	128½	127½	126½	125½ months.

To each of the rows of these tables straight-line equations were fitted by the method of least squares explained in Appendix VII. The resulting equations are shown on the right of the next two tables, and the nearest integral score found for each cell of the table from these equations.

## VERBAL TEST. BOYS (44,210)

## SMOOTHED INTEGRAL PERCENTILE POINTS

P.R.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Equation.
95	62	61	61	60	60	59	59	58	58	57	57	56	$.49a - 5.1$
90	58	58	57	56	56	55	55	54	53	53	52	52	$.61a - 25.0$
84	55	54	53	53	52	51	50	50	49	48	48	47	$.725a - 44.13$
80	53	52	51	51	50	49	48	48	47	46	46	45	$.69a - 41.7$
70	48	47	47	46	45	45	44	43	42	42	41	40	$.73a - 51.5$
60	44	43	43	42	41	40	40	39	38	37	36	36	$.77a - 61.0$
50	40	39	38	38	37	36	35	34	34	33	32	31	$.786a - 67.38$
40	36	35	34	33	32	32	31	30	29	28	28	27	$.79a - 72.3$
30	31	30	29	28	27	27	26	25	24	23	22	21	$.88a - 89.2$
20	24	23	23	22	21	20	19	19	18	17	16	16	$.78a - 82.4$
16	21	20	19	19	18	17	16	16	15	14	13	13	$.764a - 83.31$
10	15	14	13	13	12	12	11	11	10	10	9	9	$.55a - 60.6$
Age	$136\frac{1}{2}$	$135\frac{1}{2}$	$134\frac{1}{2}$	$133\frac{1}{2}$	$132\frac{1}{2}$	$131\frac{1}{2}$	$130\frac{1}{2}$	$129\frac{1}{2}$	$128\frac{1}{2}$	$127\frac{1}{2}$	$126\frac{1}{2}$	$125\frac{1}{2}$	months = $a$

## VERBAL TEST. GIRLS (43,288)

## SMOOTHED INTEGRAL PERCENTILE POINTS

P.R.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Equation.
95	60	60	59	59	58	58	58	57	57	56	56	56	$.41a + 4.1$
90	57	57	56	55	55	54	53	53	52	51	51	50	$.67a - 34.1$
84	53	53	52	51	51	50	49	49	48	47	47	46	$.680a - 39.36$
80	51	50	50	49	49	48	47	47	46	46	45	44	$.62a - 33.6$
70	47	46	46	45	44	44	43	42	42	41	40	40	$.67a - 44.4$
60	43	43	42	41	40	40	39	38	38	37	36	35	$.70a - 52.4$
50	39	38	38	37	36	36	35	34	34	33	32	32	$.693a - 55.47$
40	35	34	34	33	32	32	31	30	30	29	28	28	$.69a - 59.1$
30	31	30	29	29	28	27	26	25	25	24	23	22	$.79a - 77.0$
20	25	24	23	22	22	21	20	20	19	18	17	17	$.70a - 71.0$
16	22	21	21	20	19	18	18	17	16	15	15	14	$.730a - 77.58$
10	16	16	15	14	14	13	13	12	12	11	10	10	$.57a - 61.7$
Age	$136\frac{1}{2}$	$135\frac{1}{2}$	$134\frac{1}{2}$	$133\frac{1}{2}$	$132\frac{1}{2}$	$131\frac{1}{2}$	$130\frac{1}{2}$	$129\frac{1}{2}$	$128\frac{1}{2}$	$127\frac{1}{2}$	$126\frac{1}{2}$	$125\frac{1}{2}$	months = $a$

The coefficients of  $a$  (age in months) in the equations on the right of these tables are the age allowances in marks per month at their respective levels. In both tables they are highest round about the 30 percentile, and decrease near the top and bottom of the table—they

decrease towards the top because the older children cannot readily score any more marks since they are so near the maximum, and towards the bottom because the younger children get a few marks by luck, and the lowest scores do not differ significantly from zero.

These tables can be used to convert a raw score in the verbal part of the test into Percentile Ranks thus: in the proper column for the child's age find his raw score, his P.R. will then be found on the left of the row.

*Example:* Boy, age 133½ months (born April 1921, tested 1st June 1932), raw score 42, Percentile Rank 60.

If the raw score falls between two rows, take an intermediate P.R. For example, if the above boy had scored 44 his P.R. would have been 65. For many purposes it would be sufficient to record this as 60+.

A Percentile Rank shows the percentage of the pupil's comrades to whom he is superior. Thus a P.R. of 73 indicates that the pupil possessing it is superior to 73 per cent. of his fellows of the same age, and inferior to 27 per cent. (With scores moving in integral steps some of course will be exactly equal to him, and of this group half may be supposed better, half worse, than he is.)

It is unsafe to attempt from this test to specify *exact* Percentile Ranks higher than 95. Such ranks should be recorded as 95+.

A comparison of the boys' and girls' tables on the previous page shows that the boys are practically equal to the girls along the median or 50 percentile line, and distinctly superior along the 95 percentile, but distinctly inferior along the 10 percentile—the boys, that is, are more scattered than the girls. This is also shown by

the standard deviations of the verbal scores in the tables on p. 62 (15.9 for boys and 15.0 for girls).

Yet another way of reaching the same conclusion is to take the proportions of boys and girls who score very high, or very low, marks, from the tables on p. 62.

<i>Percentage Scoring High and Low Marks</i>		
	Boys.	Girls.
Over 59 marks	. 4.25 %	3.30 %
Under 10 marks	. 8.07 %	6.36 %

The equations given on the tables of percentiles also show that the boys are growing in the ability which this Verbal Test measures slightly more quickly than the girls at this age of eleven, for most of the coefficients of *a* are larger for boys than for girls.

#### COMPARISON WITH HALIFAX (ENGLAND)

Three months before it was used in Scotland, Moray House Test 12 was given in England in the town of Halifax to all the children<sup>1</sup> in a year-group (uncreamed by any premature promotions to secondary schools) who on the day of the test ranged from 128 months to 139 months of age, with a median age of 133½ months, numbering 660 boys and 618 girls, 1278 in all; and it was also given to 232 children in a "background" school of that town, ranging in age from 8 years to 14 years.

The year-group of 1278 children were undergoing the annual test or examination which determines which of them shall obtain free places in a secondary school, a fiercely competitive matter in England, and it is desir-

<sup>1</sup> But excluding 18 children in a school for the mentally defective, and 13 in an open-air school. Such children were given the Group Test in Scotland.

able to note this at the outset, as it probably explains the differences between the Halifax results and those of Scotland.

The distribution of the Halifax children in the Verbal Test was as follows:—

Marks.	Boys.	Girls.	Total.
70-76	6	3	9
60-69	45	36	81
50-59	135	152	287
40-49	198	191	389
30-39	148	131	279
20-29	74	59	133
10-19	29	36	65
0-9	25	10	35
	<hr/>	<hr/>	<hr/>
	660	618	1278
	<hr/>	<hr/>	<hr/>

In passing it may be noted that this table again shows more boys than girls both at the head and the foot of the table.

If we assume that the 18 children in the school for the mentally defective, and the 13 children in the open-air school, would all have been below the 16 percentile point, we have for the 1309 cases the following values for comparison with Scotland:—

	Halifax (England) (133½ months).	Scotland (133½ months).	
84 percentile . . .	55.3	Boys 53	Girls 51
Median . . . . .	42.4	„ 38	„ 37
16 percentile . . .	25.4	„ 19	„ 20

It may occur to the reader that the reason for the difference lies in the superior intelligence or superior schooling of town children over rural children which has sometimes been asserted. But when a town is selected in Scotland which in both these respects can certainly

be expected at least to equal Halifax, the difference is only slightly reduced. It is more probable that the additional incentive at Halifax, and the fact that similar tests have been given for several years are the reasons for the higher scores. When teachers are used to such tests they are able to give them smoothly and without flurry. Moreover, questions of similar nature, using the devices of underlining words, filling blanks, etc., can be used by the teachers in their ordinary work, and the children become accustomed to the form of reaction required.

In short, we are naturally inclined to hope that the poorer performances in Scotland at all levels of ability are sufficiently explained by the less intense motivation in Scotland (where nothing depended on the test) and the total absence in most districts of previous experience of such tests, or of coaching for them. Equally naturally, however, the Secretary to the Halifax Education Committee is not inclined to admit that this explanation is adequate. He writes:

“For years we have prided ourselves on freedom in our Elementary Schools from Inspectors and their examinations, on our schools each being individual in its work, resulting in higher intelligence rather than more knowledge. We have a minimum of regulations or codes. For the past three years I have abolished the competitive examination for admission to places of higher education, children being selected on their previous school record, together with your <sup>1</sup> Intelligence Test. I shall be glad to send you details if you wish it. Even before this system was adopted we endeavoured to frame an examination in English and Arithmetic only, for which coaching beforehand would be little advantage.

<sup>1</sup> *I.e.* one of Professor Godfrey H. Thomson's.



The background school was in no respect remarkable—just an ordinary elementary school; but then you must remember that our M.D. children have, since 1898, been withdrawn into a special school, and the physically weak children are at an Open-Air School. In fact, I believe I am justified in claiming that our education system is one of the most efficient in the United Kingdom, but as proof of that claim I have had hitherto no evidence to give except the fact that our Public Libraries are more used than any in England.”

The fact that 50 of the Halifax group were given individual Binet Tests enables the situation, however, to be viewed from another angle. If the Halifax children are really more intelligent, their Binet I.Q.'s, as well as their Verbal Group Scores, ought to be higher. If, however, the Verbal Group Scores alone are higher, then the hypothesis is supported that stronger motivation and familiarity with Group Tests are the explanation of the difference.

One of the 50 has to be rejected because this pupil turned over two pages in the Group Test and did not discover her error. The other 49 gave the following results:—

Average age on day of Group Test . . . . .	133 months
<i>Average</i> Verbal Score (raw) . . . . .	40·8 marks
Average Binet I.Q. . . . .	101·8 points
Average Binet Mental Age on day of Group Test . . . . .	135·4 months

The fact that the Binet Average I.Q. of 101·8 is more than 100 is of course not in itself evidence that the Halifax children as a whole are over normal intelligence, for the 49 pupils are unlikely to be an exactly representative sample. But we can fairly make their mental age a basis of comparison in the following way.

The average Verbal Score of Scottish children of the same Binet age as these 49 Halifax children can be found (since, as we shall show later, the Scottish average I.Q. is about 100) by calculating the actual average Verbal Score of the 6604 Scottish children born in February 1921, who, on the day of *their* Group Test, 1st June 1932, averaged  $135\frac{1}{2}$  months of actual and also mental age. That average can be found from the table on p. 61, of which the February line reads—

0-9.	10-19.	20-29.	30-39.	40-49.	50-59.	60-69.	70-76.
374	588	959	1491	1653	1145	378	16

Centring these groups at the points

$4\frac{1}{2}$	$14\frac{1}{2}$	$24\frac{1}{2}$	$34\frac{1}{2}$	$44\frac{1}{2}$	$54\frac{1}{2}$	$64\frac{1}{2}$	73
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we find for their average 37.3, which is 3.5 marks less than the Halifax Binet children attain in Verbal Score.

Here, therefore, we have what seems to be a fair comparison of 49 Halifax with 6604 Scottish children of the *same* average Binet age: and the Halifax children score 3.5 marks more on the average in the Verbal Test. It is difficult to resist the conclusion that this is due either to the Halifax children being under a stronger incentive in the Verbal Test (a competition, whereas their Binet Test was not), or to greater familiarity with Group Tests.

There is another simple comparison which can be made and which is less emphatic. A group of 49 children at Halifax of average age 133 months had average Binet I.Q. 101.8 and M.A. 135.4 months, and average Verbal Score 40.8 marks. A group of 1000 children in Scotland of average age about  $131\frac{1}{2}$  months had average Binet I.Q. 101.6 and M.A.  $133\frac{1}{2}$  months, and average Verbal Score

37.9 marks. The difference of 2.9 marks of Verbal Score can be accounted for only in part by the difference in M.A., about 1.5 marks being due to this since the age-allowance at the mean is about 0.75 per month. There remain 1.4 marks superiority. In this present comparison this might merely be due to sampling, since 49 is a small number. But the discrepancy is in the same direction as in the other comparisons. The main fact is that given on p. 73, that at 133½ months 1309 Halifax children had a median of 42.4 marks, while the Scottish medians at that age were 37.9 for boys and 37.4 for girls (4041 boys and 3966 girls). In this there is practically no sampling, as all the children except absentees were tested. Of this difference of some 4 or 5 points we feel convinced that some 3 points at any rate are due to the differences in motivation and in familiarity with tests. Finally, we compared the Halifax average (not median) of 40.5, obtained by assuming the 31 special school children to have scored less than 10 marks, with the average of 836 children in two Scottish cities of the highest educational reputation, being all the children born in April 1921, and therefore of the same age on the day of their test as the average of the Halifax ages. These 836 children's average was 37.0 marks, a deficiency of 3.5 points. Their age was the same, their schools probably as good, and their reputation for intelligence as high.

It seems to us indeed that we have here an excellent measure of the maximum amount of difference which familiarity with tests, and strong motivation, can make in a Group Test score, a difference equivalent to about 4 months of apparent mental age, or about 3 points of I.Q. At least it should be emphasised that the norms

given above (in the Percentile Rank tables) are norms for children unused to such tests, and not under any strong competitive motivation.

Before leaving Halifax, it may be mentioned that the "background" school there, when compared with the K. background district in Scotland, shows differences of the same nature as those between the two complete year-groups. The figures are:

*Median Scores in One School in Halifax (England)*

Age <sup>1</sup>	.	.	121½	133½	145½ months
Number	.	.	48	58	52
Score	.	.	28·5	39·2	47·3

### THE PICTURE TESTS

#### *Preliminary Trials*

The object of the picture pages of the Group Test was to spread out the children who obtained very low marks in the Verbal Test. As the Otis Primary Test had been used in the survey conducted by Dr E. O. Lewis in England and Wales, two pages similar to parts of that test were designed, a Picture-Digit Substitution Test and a Pictorial Classification Test. These were chosen mainly on the advice of persons familiar with the Otis Test, who had found them more useful than the other portions. With the drawings<sup>2</sup> shown in Appendix III several small trials were conducted, usually with groups of about 30, to ascertain the best wording of the instructions for Scottish children, and to obtain some idea of the marks likely to be scored by them.

<sup>1</sup> At the other ages tested the numbers were too small to give results worth quoting.

<sup>2</sup> By Mr F. Craik Stewart.

Later a third test, Counting Cubes, was added (see Appendix IX), and some small groups of children of known I.Q. were tested with all three picture pages.

An opportunity now arose for a large-scale trial in Ilkeston (England), where a whole age-group of 683 eleven-year-old children was tested, the Picture-Digit Substitution and the Pictorial Classification Tests being used, with fairly explicit instructions, not unlike those ultimately employed in Scotland. The results suggested that shorter instructions and timing might be sufficient.

The next trial was the full-dress rehearsal at Halifax, where all the eleven-year-olds were tested with no exceptions other than absentees, giving a total of 660 boys and 618 girls. In addition, about the same number of twelve-year-olds were tested. This twelve-year-old group was not quite complete, having been "creamed" the previous year; but this was largely balanced by including 93 boys and 85 girls from the secondary school. Lastly, the whole of one school was tested, from 8 years of age up to over 14, adding 232 to the numbers. In all, over 2800 children were tested at Halifax. The Pictorial Classification and the Counting Cubes Tests were employed, with shorter instructions and time allowances than at Ilkeston, as follows:—

#### INTELLIGENCE TEST

##### *Special Instructions<sup>1</sup> to Supervisors (Halifax)*

The Intelligence Test this year has had added to it two pages of Picture Tests. The booklet is an 8-page booklet, the outer page (on which name, etc., are to be written as usual) being

<sup>1</sup> Readers are reminded that these are not the instructions ultimately used in Scotland, for which see Appendix I.

page 1, and the Picture Tests occupy pages 2 and 3, *i.e.* the double page seen when the book is first opened.

These picture pages require separate timing (two minutes for each), and each supervisor must therefore see beforehand that he or she is in possession of a watch with a seconds hand. After the filling in of the names, etc., at *zero* time the supervisor should say clearly and slowly, but without delays:

*Turn over. Look at the left-hand page of pictures. The top row begins with three flowers (pause 5 seconds). Then there are five other drawings in the row, and you have to find one which is like the first three (pause 5 seconds). Which is it? (do not wait for an answer). It is the rose, so put a cross in the little square beside the rose to make it the same as the other three flowers (pause 5 seconds). Now do the other rows in the same way.*

(Notice that these verbal instructions by the teacher are included in the two minutes. There should be no delay in starting to speak as soon as the children have turned over, and no "waiting for complete silence" or the like.)

At exactly two minutes from zero, by the seconds hand, the supervisor should say:

*Now look at the next page, with pictures of piles of blocks. In each circle write how many blocks there are in the pile. The first two have been done for you to show you what is meant. Go on to do the others in the same way.*

(Notice that there is no pause between the end of the first two minutes and the beginning of the second two minutes.)

At exactly four minutes after zero say:

*Now turn over. You will have three-quarters of an hour for all the rest of the test, and you must turn over the pages as you come to them. But you must not look at the pictures any more.*

After exactly 45 minutes at the Verbal Test (that is, 49 minutes from zero) say *Stop*, and allow no more work to be done.

So far as the Pictorial Classification Test was concerned, the Halifax results confirmed the likelihood of its success, though the instructions afterwards were again lengthened and revised and some ambiguities eliminated (*e.g.* that arising from the similarity in sound of the words *rose* and *rows*). It was included in the Scottish test, with the instructions and timing given in Appendix I.

In the Counting Cubes Test, however, not only were there, as in the other test, too many zero scores and other peculiarities, suggesting that the instructions were too short to be understood by some even of the intelligent (that might have been obviated, as in the Pictorial Classification Test, by more explicit instructions), but there was also a strong sex difference, boys counting the Cubes much better than girls, and the test was therefore rejected in favour of the Picture-Digit Substitution Test. The Picture Tests ultimately employed in Scotland, therefore, were Picture-Digit Substitution and Pictorial Classification.

As the Counting Cubes data from Halifax are of some interest in themselves, and may be of service to other workers, it seems worth while to give them here (see Appendix VIII).

After the Group Test had been given in Scotland, a number of reports came in indicating that the Picture-Digit Substitution Test had not worked very well. In part it had proved impossible to prevent children, especially dull children, from returning to this first Picture Test and spending further time on it after they found the verbal items too difficult (in any future arrangement, if short-timed tests are bound up with block-timed tests, we shall print the former upside

down); and in part there had been trouble over the instruction, "Now put a three under the chair just like the three under the chair in the top line." Some children took this to mean a three exactly like the printed three, and wasted much time drawing very careful digits. As the tabulations involved an enormous amount of work, tabulation of the first Picture Test was accordingly stopped as possibly not worth while (at any rate while more useful work could be proceeding), and attention was concentrated on the Pictorial Classification Test, which on the whole appeared to have worked well. The data for All-Scotland are given in the three tables on p. 84.

The equations for best-fitting lines to certain percentiles are—

*Boys.*

50 percentile	$S = \cdot 043a + 1\cdot 576$
16 "	$S = \cdot 094a - 7\cdot 257$
5 "	$S = \cdot 094a - 10\cdot 381$

*Girls.*

50 percentile	$S = \cdot 045a + 1\cdot 303$
16 "	$S = \cdot 070a - 4\cdot 169$
5 "	$S = \cdot 080a - 8\cdot 207$

*Boys and Girls together.*

50 percentile	$S = \cdot 044a + 1\cdot 524$
16 "	$S = \cdot 082a - 5\cdot 66$
5 "	$S = \cdot 086a - 9\cdot 187$

In relation to the maximum possible score of the Pictorial Test (9 points) these age allowances are of about the same size as those of the Verbal Test, namely, about 1 per cent. of the maximum per month (here about 0·09 per month out of 9, in the Verbal about 0·76 out of 76).

The marginal percentiles of the three large tables



on p. 84, calculated according to the conventions of Appendix VI, are—

## PICTORIAL CLASSIFICATION TEST

	Boys.	Girls.	Both.
50 percentile . . .	7·27	7·24	7·25
16 " . . .	5·11	5·03	5·07
5 " . . .	1·88	2·16	2·02
Mean . . .	6·80	6·80	6·80
Standard deviation . . .	2·12	2·08	2·10

This shows practically no difference between the sexes. The discrepancy between median 7·25 and mean 6·80 is a sign of the extreme skewness of the distribution, which was intended to be only a tail, to spread the unintelligent. The standard deviation 2·10 is, however, even here very near to the difference between the median and the 16 percentile (7·25 minus 5·07).

The K. "background" (see p. 67) of some 500 boys and 500 girls in each of three years gave the following results with this Picture Test:—

	Medians.		Means.	
	Boys.	Girls.	Boys.	Girls.
1921	7·46	7·28	6·87	6·75
1922	6·52	6·68	6·10	6·22
1923	5·85	6·01	5·18	5·38

The correlation between the verbal portion of the Group Test and the Pictorial Classification Test was first investigated by forming grids for all the June-born children in Berwickshire, Edinburgh, Shetland, Stirlingshire, Argyll and Ross, and Kincardine, together with enough boys and girls from Roxburghshire to make 500 of each (practically the whole of Roxburghshire was needed). This sample is referred to as the Bressak sample from the initials of its constituent districts. The correlation was found to be about 0·5. The grids appear on pp. 85 and 86.

## PICTORIAL CLASSIFICATION TEST

(THE SECOND PICTURE TEST, p. 3) BOYS AND GIRLS TOGETHER

	0.	1.	2.	3.	4.	5.	6.	7.	8.	9.	Total.
Jan.	72	109	128	179	226	368	1,004	1,434	1,703	1,825	7,048
Feb.	113	96	165	154	203	394	926	1,342	1,553	1,658	6,604
Mar.	129	127	161	190	238	414	1,074	1,597	1,817	1,796	7,543
April	137	107	147	221	256	451	1,178	1,667	1,900	1,900	7,964
May	156	164	176	214	263	439	1,222	1,709	1,989	1,782	8,114
June	123	129	177	235	239	435	1,118	1,679	1,789	1,618	7,542
July	137	135	184	240	292	462	1,118	1,513	1,612	1,512	7,205
Aug.	149	163	168	231	261	412	1,132	1,515	1,759	1,421	7,211
Sept.	144	149	180	241	268	446	1,170	1,497	1,653	1,354	7,102
Oct.	144	140	175	236	248	395	1,146	1,519	1,618	1,307	6,928
Nov.	148	130	179	221	260	435	1,133	1,507	1,473	1,244	6,730
Dec.	192	190	247	310	265	532	1,252	1,640	1,635	1,244	7,507
Total	1,644	1,639	2,087	2,672	3,019	5,183	13,473	18,619	20,501	18,661	87,498

## Boys

	0.	1.	2.	3.	4.	5.	6.	7.	8.	9.	Total.
Jan.	34	61	67	94	101	173	512	760	840	909	3,551
Feb.	61	56	93	68	88	195	457	674	806	817	3,315
Mar.	72	75	76	89	108	180	538	842	911	884	3,775
Apr.	69	52	74	107	118	216	604	843	992	966	4,041
May	93	82	81	103	127	212	632	873	1,067	878	4,148
June	66	70	97	111	104	197	554	894	920	804	3,817
July	92	65	92	136	147	208	543	762	879	764	3,688
Aug.	76	76	72	100	123	193	566	785	885	695	3,571
Sept.	91	88	100	115	118	216	624	740	846	694	3,632
Oct.	85	71	87	124	114	184	571	749	868	625	3,478
Nov.	82	73	84	129	126	220	561	769	767	588	3,399
Dec.	102	121	120	146	129	243	630	839	825	640	3,795
Total	923	890	1,043	1,322	1,403	2,437	6,792	9,530	10,606	9,264	44,210

## GIRLS

	0.	1.	2.	3.	4.	5.	6.	7.	8.	9.	Total.
Jan.	38	48	61	85	125	195	492	674	863	916	3,497
Feb.	52	40	72	86	115	199	469	668	747	841	3,289
Mar.	57	52	85	101	130	234	536	755	906	912	3,768
April	68	55	73	114	138	235	574	824	908	934	3,923
May	63	82	95	111	136	227	590	836	922	904	3,966
June	57	59	80	124	135	238	564	785	869	814	3,725
July	45	70	92	104	145	254	575	751	733	748	3,517
Aug.	73	87	96	131	138	219	566	730	874	726	3,640
Sept.	53	61	80	126	150	230	546	757	807	660	3,470
Oct.	59	69	88	112	134	211	575	770	750	682	3,450
Nov.	66	57	95	92	134	215	572	738	706	656	3,331
Dec.	90	69	127	164	136	289	622	801	810	604	3,712
Total	721	749	1,044	1,350	1,616	2,746	6,681	9,089	9,895	9,397	43,288

CORRELATION BETWEEN VERBAL TEST AND SECOND  
PICTURE TEST IN BRESSAK

JUNE-BORN BOYS ONLY

*Picture Test, p. 3*

Verbal Score.	0	1	2	3	4	5	6	7	8	9	
75-76											
70-74										2	2
65-69						2			1	4	7
60-64								1	5	15	21
55-59		1			1	1	3	3	11	16	36
50-54				1			4	3	9	18	35
45-49				2			6	10	12	24	54
40-44		1		2	1	1	10	15	26	13	69
35-39		2				2	8	13	26	10	61
30-34		1	2	2	1	3	8	15	15	5	52
25-29	1		1			5	4	11	6	1	29
20-24	4	1	6	2	1	4	5	13	5	4	45
15-19		1	2	1	2	4	5	8	2	1	26
10-14		1		1	3	1	6	6	1	2	21
5-9	1	1	2	3	4	2	3	3	2	1	22
0-4	1	3	4	2	1	3	3	2	1		20
	7	12	17	16	14	28	65	103	122	116	500

Verbal mean . . . 35.60  $\sigma$  16.3Picture mean . . . 6.84  $\sigma$  2.16

$$r = .52$$

$$\eta = .55$$

$$\eta = .57$$

In all the tables the correlation ratio given first is that referring to the rows and the horizontal margin.

CORRELATION BETWEEN VERBAL TEST AND SECOND  
PICTURE TEST IN BRESSAK

JUNE-BORN GIRLS ONLY

*Picture Test, p. 3*

Verbal Score.	0	1	2	3	4	5	6	7	8	9	
75-76											
70-74											
65-69							1	1	2	3	7
60-64									3	8	11
55-59							3	6	10	11	30
50-54							2	7	13	23	45
45-49					1		6	9	9	17	42
40-44		1		1		7	12	17	19	33	90
35-39		1		3	3	3	9	17	17	9	62
30-34			1	1	5	6	8	15	18	9	63
25-29		1	1	2	5	7	11	12	5	3	47
20-24			2	1	4	3	9	15	5		39
15-19				4	1	3	3	7	2	2	22
10-14	1		2	3		4	4	7	1		22
5-9	2	1	1	3		2	3		2		14
0-4		2	1	1		1	1				6
	3	6	8	19	19	36	72	113	106	118	500

Verbal mean . . . 36.28  $\sigma$  14.05Picture mean . . . 6.94  $\sigma$  1.91 $r = .54$  $\eta = .57$  $\eta = .56$ 

Later, similar grids became available for the Binet Thousand. They give a very similar value for the correlation of the Verbal Test with the Pictorial Classification Test.

## ANSWER PATTERNS OF THE TESTS

The following tables show the number of times each item was correctly answered by 500 boys and 500 girls (in the Verbal Test), and by 450 boys and 450 girls (in the Pictorial Classification Test). These scripts were selected "at random" by the Marking Committees. A first judgment as to the random character of the selection can be made by comparing the *average* marks here with the *median* marks for All-Scotland in the following table:—

Test.	Boys.		Girls.	
	This Sample.	Scotland.	This Sample.	Scotland.
Verbal .	37.09	34.66	35.54	34.41
Picture (p. 3)	6.83	6.80	6.72	6.80

## NUMBER OF TIMES EACH ITEM CORRECTLY ANSWERED.

VERBAL TEST					
Question.	Number correct (out of 500).		Question.	Number correct (out of 500).	
	Boys.	Girls.		Boys.	Girls.
1	467	450	21	430	420
2	450	456	22	197	185
3	248	239	23	335	312
4	456	458	24	363	353
5	388	401	25	348	345
6	393	383	26	145	151
7	357	389	27	149	143
8	359	338	28	156	121
9	248	232	29	373	344
10	280	297	30	179	172
11	408	408	31	348	315
12	403	391	32	376	314
13	396	386	33	375	347
14	316	315	34	216	167
15	322	300	35	119	100
16	382	393	36	408	408
17	168	172	37	177	229
18	64	87	38	193	214
19	308	282	39	195	179
20	149	141	40	218	220

VERBAL TEST—*continued*

Question.	Number correct (out of 500).		Question.	Number correct (out of 500).	
	Boys.	Girls.		Boys.	Girls.
41	389	396	56 (b)	216	129
42	397	391	„ (c)	137	99
43	331	328	57	91	81
44 (a)	188	186	58	159	126
„ (b)	137	124	59	162	147
„ (c)	83	48	60	261	255
45	278	248	61	176	179
46	226	163	62	190	199
47	159	142	63	81	87
48	175	157	64	24	52
49	380	366	65	34	27
50	251	239	66 (a)	23	24
51	128	119	„ (b)	11	19
52	276	267	67	232	224
53	150	138	68	157	137
54	355	337	69	184	147
55	236	238	70	53	43
56 (a)	133	130	71	221	220

## PICTURE TEST

Question.	Number correct (out of 450).	
	Boys.	Girls.
1	431	437
2	416	413
3	399	392
4	386	375
5	402	398
6	389	375
7	179	184
8	268	251
9	205	198

These Answer Patterns will be used to make a few changes in the serial order of the items when the test is republished. Helpful criticisms of certain items were also received which will lead to some minor changes.

V

RELATION OF GROUP AND INDIVIDUAL  
TESTING





## V

### RELATION OF GROUP AND INDIVIDUAL TESTING

THE care taken to ensure that the Binet pupils were a fair sample of the whole population has been described above; in the main, reliance was placed on selecting the pupils according to the census map, and in requiring that they should be born in the first week in June, though it was found necessary to relax both these restrictions very slightly. Despite all precautions, it was not to be expected that the sample would give a true picture of the whole population, and it has also to be borne in mind that no children in special schools were included in the Binet selection. The distribution of the scores of the Group Test provides a further check on the fairness of the Binet sample, and enables corrections to be made for sampling error.

#### USE OF VERBAL TEST AND BINET SAMPLE TO ESTIMATE BINET I.Q.'s OF THE ALL-SCOTLAND GROUP

The correlations of the Binet I.Q.'s with the verbal portion of the Group Test are shown in the two following grids for boys and girls.

92 THE INTELLIGENCE OF SCOTTISH CHILDREN

CORRELATION BETWEEN BINET I.Q. AND VERBAL SCORE  
IN GROUP TEST

Boys

*Binet I.Q.*

Verbal Score. 55 60 65 70 75 80 85 90 95 100 105 110 115 120 125 130 135 140 145 150 155 160

70															1	0	0	1	1	0	0	1	4
65													1	1	1	1	1	3	6	1	0	0	15
60											1	2	3	3	1	0	2	0	1				17
55														2	2	5	2	15	8	1	3	3	43
50																							53
45																							63
40																							63
35																							56
30																							51
25																							41
20																							25
15																							26
10																							17
5																							17
0																							9

I 1 1 14 14 29 59 58 54 56 48 48 25 37 24 6 5 8 9 1 1 1 500  
 I.Q. mean . . 102.95  $\sigma$  17.35      Verbal mean . . 38.60  $\sigma$  15.70  
 $r = .803$        $\eta = .83$        $\eta = .82$

CORRELATION BETWEEN BINET I.Q. AND VERBAL SCORE  
IN GROUP TEST

Girls

*Binet I.Q.*

Verbal Score. 65 70 75 80 85 90 95 100 105 110 115 120 125 130 135 140 145 150 155

70																								2
65																								6
60																								13
55																								42
50																								44
45																								48
40																								69
35																								74
30																								55
25																								48
20																								39
15																								27
10																								16
5																								12
0																								5

3 10 22 45 57 69 65 49 49 42 25 24 10 15 7 4 2 1 1 500  
 I.Q. mean . . 100.19  $\sigma$  16.07      Verbal mean . . 37.15  $\sigma$  14.3  
 $r = .76$        $\eta = .78$        $\eta = .79$

Calculations on these grids just as they stand give the following figures:—

	Boys.	Girls.
Median I.Q. . . . .	101·2	97·9
Mean I.Q. . . . .	103·0 ± 0·5	100·2 ± 0·5
Standard deviation . . . . .	17·4 ± 0·4	16·1 ± 0·3
Median Verbal Score . . . . .	40·2	37·8
Mean Verbal Score . . . . .	38·6 ± 0·5	37·2 ± 0·4
Standard deviation . . . . .	15·7 ± 0·3	14·3 ± 0·3
Correlation coefficient. <sup>1</sup> . . . . .	0·80	0·76
Correlation ratios . . . . .	0·83	0·78
	0·82	0·79

If we could feel confident that these samples were, in the mathematical sense, random samples, we would conclude from these data that the boys' mean I.Q. was significantly superior to 100, since the difference of 3 points is six times the probable error; but that the girls' mean I.Q. was not significantly different from 100. Similarly we would conclude that there was a significant difference in mean I.Q. between boys and girls, since the difference between their means can be found by calculation to be 3·9 times the probable error of that difference, corresponding to odds of about 250 to 1 against the difference being due to the chances of sampling. Turning to the difference between boys and girls in standard deviation of I.Q., we would find a difference of  $1·28 \pm 0·51$ , which we would think less significant than that between the means, for the odds against it happening by chance sampling are only 22 to 1.

These conclusions would, however, be somewhat misleading. The samples in our case (and almost always in experiments with human beings) are not perfectly random: the children were not equally accessible as are equal-sized balls in the urn of a theoretical example in

<sup>1</sup> The reader should remember that age was practically constant.

probability. And from their verbal scores we have, what is usually lacking, the possibility of comparing our samples with the whole population which they represent, *i.e.* the children born in Scotland in 1921.

From a comparison of their verbal averages with those of the whole 1921 group, or with those of all the children born in May and June 1921, which are given in the following table, it is clear at once that both boys and girls of the Binet Group are somewhat superior samples:—

	All 1921 Boys.	May- June Boys.	Binet Boys.	All 1921 Girls.	May- June Girls.	Binet Girls.
Number	44,210	7,965	500	43,288	7,691	500
Mean Verbal Score	34.50	35.13	38.6	34.41	35.11	37.2
Standard deviation <sup>1</sup>	15.93	15.87	15.7	15.02	15.01	14.3

A comparison of medians instead of means leads to the same conclusion. A more complete comparison of the three distributions is given in the next table, and the Binet and complete May-June groups are also compared in fig. 3 (p. 97):—

Verbal Score.	Binet Boys.	All 1921 Boys.	Ratio.	May- June Boys.	Ratio.	Binet Girls.	All 1921 Girls.	Ratio.	May- June Girls.	Ratio.
	%	%		%		%	%		%	
70 and over	0.8	0.2	0.23	0.2	0.27	0.4	0.1	0.30	0.1	0.29
60-69	6.4	4.1	0.64	4.3	0.67	3.8	3.2	0.84	3.4	0.89
50-59	19.2	14.0	0.73	15.0	0.78	17.2	12.6	0.73	13.6	0.79
40-49	25.2	22.8	0.90	23.0	0.91	23.4	23.7	1.02	24.6	1.05
30-39	21.4	22.9	1.07	23.2	1.08	25.8	24.9	0.96	24.7	0.96
20-29	13.2	16.4	1.24	15.9	1.21	17.4	17.6	1.01	16.7	0.96
10-19	8.6	11.5	1.34	10.7	1.25	8.6	11.5	1.34	10.8	1.25
0-9	5.2	8.1	1.55	7.6	1.47	3.4	6.4	1.87	6.0	1.78

<sup>1</sup> The standard deviations are calculated from the data grouped in tens of points, and no corrections such as Sheppard's have been made. The group 70-76 points was treated as if it were also a group of ten. The omitted refinements of calculation would make no substantial change in the results.

It will be seen that the tables for both Binet boys and girls tend to have too many cases in the upper parts and too few in the lower. Their Binet distributions do not adequately represent Scotland.

Various statistical devices to estimate the distribution of I.Q.'s in all Scotland can be used.

(a) *Row Factors*.—The simplest and most readily understood method is to multiply each row of the above grids by the factor necessary to make its total the correct one, *i.e.* by the factors given in the table immediately above as the ratios of the complete unselected groups to the Binet Group. This was done separately, using first the ratios with the whole year-group, and second the ratios with all those born in May and June. As the All-Scotland distribution is only in steps of ten points of Verbal Score, it is necessary for this purpose to put two rows together in the grids; and at the same time, for simplicity, the columns were also grouped in pairs, giving the following simpler grids:—

BOYS

Verbal.	Binet I.Q.												1921 Factor.	May- June Factor.
	50	60	70	80	90	100	110	120	130	140	150	160		
70								1	0	2	0	1	0.23	0.27
60						3	3	7	6	11	2		0.64	0.67
50				8	18	27	35	5	3				0.73	0.78
40		1	5	29	48	27	15	0	1				0.90	0.91
30			2	25	37	26	14	3					1.07	1.08
20			6	26	26	7	1						1.24	1.21
10			5	24	11	2	1						1.34	1.25
0	1	2	14	8	1								1.55	1.47

## GIRLS

Verbal.	Binet I.Q.										1921 Factor.	May- June Factor.
	60	70	80	90	100	110	120	130	140	150		
70							2				0.30	0.29
60					3	2	6	3	4	1	0.84	0.89
50				10	15	26	19	14	2		0.73	0.79
40		2	7	32	43	23	7	2	0	1	1.02	1.05
30		2	28	50	31	15	2	1			0.96	0.96
20		10	32	38	6	1					1.01	0.96
10		11	28	4							1.34	1.25
0	3	7	7								1.87	1.78

We can now multiply each row by the factor shown, and add the columns to get the modified Binet distribution, doing this separately for the whole 1921 factors and for the May-June factors. This procedure assumes that although we may have too many, or too few, cases in any part of the verbal scale, those we do have in that row are properly distributed over the Binet scale. The assumption is certainly not entirely justified, especially in the bottom row, but the procedure, nevertheless, will do something to correct the sampling even if the assumption is only partly true. The resulting grids have for their Binet margins the following:—

	1921 Comparison.		May-June Comparison.	
	Boys.	Girls.	Boys.	Girls.
160-	0.23	..	0.27	..
150-159	1.28	1.86	1.34	1.94
140-149	10.59	4.82	11.16	5.14
130-139	7.49	16.34	7.92	17.37
120-129	46.97	27.97	49.15	29.62
110-119	63.49	59.53	65.24	61.83
100-109	97.44	93.15	98.78	95.19
90-99	120.06	131.68	119.27	130.98
80-89	108.05	116.95	104.77	112.41
70-79	38.88	41.89	37.16	39.83
60-69	3.10	5.61	2.94	5.34
50-59	1.55	..	1.47	..
	<u>499.13</u>	<u>499.80</u>	<u>499.47</u>	<u>499.65</u>

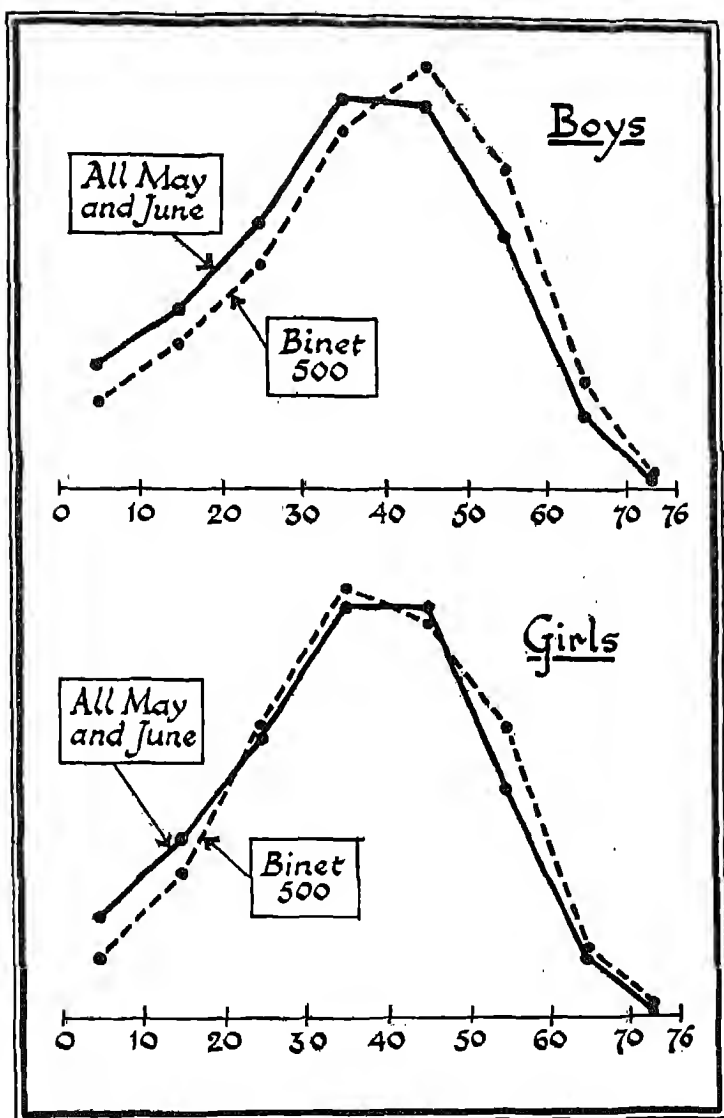


FIG. 3.—Showing that the Binet samples included too many cases with high scores in the Verbal Group Test, and too few with low scores.

The difference of the totals from 500 is due to the factors being taken to two places of decimals only.

The modified grids give the following measures of the intelligence of Scottish children aged 11 years:—

	1921 Comparison.		May-June Comparison.	
	Boys.	Girls.	Boys.	Girls.
Mean I.Q. . . . .	99·6	98·1	100·1	98·6
Standard deviation	16·8	16·1	16·8	16·2
Correlation of Binet I.Q. with Verbal Score . . . . .	0·77	0·75	0·77	0·75

This row-factor method certainly gives improved values for the mean I.Q. and the standard deviation. Fig. 3 and the tables upon which it is based indicated quite clearly that the raw mean I.Q.'s of 103·0 and 100·2 were somewhat too high, and this method has reduced them. It is very important, however, that the limitations of the method should now be pointed out, as it might be too hastily assumed that the above complete distributions of Binet I.Q.'s were correct for Scotland. This is certainly not so for the part of the distributions below 70 I.Q.; for the method, while doing something to correct for the absence from the Binet sample of children in special schools, cannot do all that is necessary. A consideration of the extreme case will show that this is so. Suppose *all* children below 70 I.Q. were in special schools. There would then have been no cases at all below 70 I.Q. in the Binet sample, and no correcting factor could have increased zero to something. It is quite conceivable that a normal Gaussian distribution with the mean and standard deviation found will give a more correct lower "tail" to the table. Before



discussing this point further, however, we turn to the other correction methods tried.

(b) *Column Factors*.—Instead of assuming, as in the above use of row factors, that the cases with the same Verbal Score are properly distributed among the Binet I.Q.'s, we may assume that the cases with the same Binet I.Q. are properly distributed among the Verbal Scores. That is, we may affix to each *column* of the raw Binet-Verbal grids a weight,  $w_1, w_2, w_3, \dots$ . Each row of the Binet grid will then provide an equation in which a number of  $w$ 's, with coefficients given by the raw cell-contents, will be equated to the proper All-Scotland (not the Binet) margin on the right. If the grid is first so manipulated that there are as many rows as columns, this will give as many equations as there are  $w$ 's, which can then be calculated by determinantal methods.

This plan, however, failed, for it gave rise to negative weights. Evidently the equations were too sensitive to slight changes in the cell-contents.

(c) *Selection-formula Method*.—This method and the next are based upon Pearson's "Selection-formulæ."<sup>1</sup> The actual form of the formulæ used here is due to Dr A. C. Aitken, Edinburgh University.

If the means, standard deviations, and correlations in the complete population and in the sample are—

	Population.	Sample.
Binet mean . . . . .	$\bar{X}$	$\bar{x}$
Binet standard deviation . . . . .	$\Sigma_X$	$\sigma_x$
Verbal mean . . . . .	$\bar{Y}$	$\bar{y}$
Verbal standard deviation . . . . .	$\Sigma_Y$	$\sigma_y$
Correlation . . . . .	$R_{XY}$	$r_{xy}$

<sup>1</sup> "On the Influence of Natural Selection on the Variability and Correlation of Organs," by Karl Pearson, *Phil. Trans. Roy. Soc. London*, 1902, vol. cc, A, pp. 1-66. A summary is given in chap. vii of *The Essentials of Mental Measurement*, by Brown and Thomson.

then, if normal distribution is assumed, and if the assumption is also made that the sample was selected on the basis of its Verbal Test Scores, it can be shown that

$$\bar{X} = \bar{x} + r(\bar{Y} - \bar{y}) \frac{\sigma_x}{\sigma_y},$$

$$\Sigma_x = r\sigma_x / R_{XY},$$

$$R_{XY} = \frac{r}{\sqrt{s^2 + r^2(1 - s^2)}},$$

where  $s = \frac{\sigma_y}{\Sigma_y}$ .

The application of these formulæ leads to the values—

	1921 Comparison.		May-June Comparison.	
	Boys.	Girls.	Boys.	Girls.
Mean I.Q.	99.3	97.9	99.9	98.5
Standard deviation	17.5	16.5	17.5	16.5
Correlation of Binet I.Q. with Verbal Score	0.81	0.78	0.81	0.78

(d) *Selection-formula Method (ii).*—The last method assumed that the selection of the Binet pupils was made on the basis of their Verbal Group Test Scores. But really the selection was a much more complicated matter, and the changes in Verbal Test Score and in Binet I.Q. were both of them *indirectly* produced by various circumstances and limitations. If we assume that this selection was equally influential in changing both Verbal and Binet means, then the factors  $r$  and  $R$  in our first two equations disappear and we get simply

$$\bar{X} = \bar{x} + (\bar{Y} - \bar{y}) \frac{\sigma_x}{\sigma_y},$$

$$\Sigma_x = \sigma_x \Sigma_y / \sigma_y$$

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with the following results:—

	1921 Comparison.		May-June Comparison.	
	Boys.	Girls.	Boys.	Girls.
Mean I.Q. . . . .	98.4	97.1	99.1	97.9
Standard deviation . . . . .	17.6	16.9	17.5	16.9

On the general question whether the selection was likely to be more highly correlated with the Binet I.Q., or with the Verbal Test, or equally with both, our opinion is that there was probably a higher correlation with the Verbal Test and that therefore method (*c*) is more correct than method (*d*). The Binet I.Q. was of course unknown until after the child was selected and tested, whereas the Verbal Score of pupils tested after 1st June might be known or could be guessed at, and might conceivably have given rise to an unconscious bias in the selection of the special group. We do not, however, think that either teachers or testers were in fact influenced to any appreciable extent in this way. In the areas accessible to them the testers tested practically every child born in June whom they could find. Our belief that the selection was probably associated more with the Verbal than with the Binet Test is based rather on the fact that the superiority of the Thousand Binet Pupils is in the main due to town children and superior schools being over-represented. It seems probable that such children would be more proficient in the Group Verbal Test than in the Binet Test, since the former is almost certainly more dependent on school opportunity than is the latter. And we are supported in this view by the comparison with Halifax made in detail in Chapter IV.

If now we sum up the results of our calculations, the Row-factor method gives boys 100.1, girls 98.6 (using the May-June comparison only as being the more

accurate), while the Pearson formulæ give boys 99.9 or 98.4, girls 98.5 or 97.9. In the values derived from the Pearson formulæ we have given our reasons for thinking that the higher number is the more accurate. The probable errors of these estimates it would be difficult to give exactly, for the distributions are not normal, and the calculations are indirect. But they cannot well be less than about 0.7 points of I.Q.

From all this it would seem that the average I.Q. of Scottish boys born in 1921 is very close to 100, and not less than 99. There is some suggestion in our data that the average I.Q. of Scottish girls born in 1921 may perhaps be less, but we do not think there is any proof of a significant difference between boys and girls in average I.Q. The actual raw average of 500 girls was 100.2: and although the methods of correcting this for sampling error have given lower values, it must be remembered that the mean Verbal Scores for the whole 1921 group were 34.50 (boys) and 34.41 (girls); and similarly for all those born in May and June, 35.13 (boys) and 35.11 (girls). This does not suggest any significant difference in average intelligence between boys and girls *when there are no variations in the methods of sampling*. In spite therefore of the fact that in the samples themselves the odds appear to be 250 to 1 against the difference of nearly 3 points of I.Q. between boys and girls being due to sampling, we think it is nevertheless so caused, since in the whole 1921-born population there is practically no difference in mean Verbal Scores. Indeed, the data appear to us to show what care is needed before differences are deduced even from quite large samples of 500, so far removed is such human sampling from the kind of sampling envisaged by the mathematician. For

both boys and girls, therefore, we are inclined to take 100 as the central figure.

There seems, however, fairly definite proof that the intelligence quotients of the boys are more widely scattered than those of the girls. All the tables point in this direction. The actual samples of 500 boys and 500 girls gave standard deviations of 17.4 and 16.1, the difference being  $1.28 \pm 0.51$ . This difference in itself is less significant than the difference in means, which we have just rejected. But here the difference is amply confirmed by the evidence of the Verbal Test on the whole 1921-born population of 44,210 boys and 43,288 girls where the standard deviations of Verbal Score were for boys  $15.93 \pm 0.04$  and  $15.02 \pm 0.03$ , with a difference of  $0.91 \pm 0.05$ . Here the difference is therefore eighteen times its probable error, and the odds far more than a thousand million to one against this difference being due to sampling—sampling here meaning that the 1921-born boys and girls are themselves only samples of all the children past and present of Scotland. We feel entitled therefore to conclude that there is probably also a real difference in scatter of I.Q.'s between boys and girls, a difference which seems from all the evidence to be something like one point of I.Q. in standard deviation, and we propose, therefore, to adopt as the most probable values for Scottish children—

	Boys.	Girls.
Mean I.Q. . . . .	100	100
Standard deviation . . . . .	17	16

In fig. 4 normal curves with these standard deviations are shown on top of the actual histograms.

This standard deviation of 17 or 16 which results from our consideration of the Binet sample is definitely

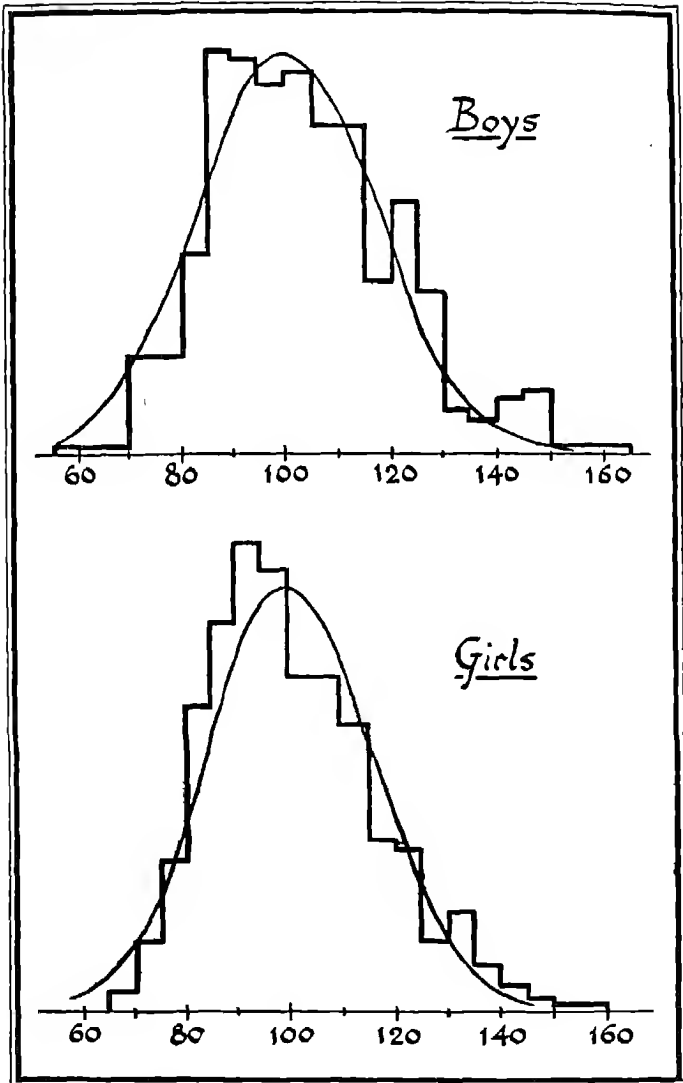


FIG. 4.—Histograms of Binet I.Q.'s (uncorrected for sampling); and normal curves of centre 100, standard deviations 17 (boys) and 16 (girls), for comparison.

larger than the 13 points found by Terman in his original standardisation of the Stanford Binet Tests upon 905 Californian children. But there has been a good deal of evidence in recent years that 13 is too low: Terman, in *The Genetics of Genius*,<sup>1</sup> seems to speak of 15 as the usual number: and if the line of norms of the Verbal Test alone be taken to obtain mental ages and hence I.Q.'s, the resulting "standard deviation" of the latter, or rather the distance from the 50 to the 84 percentile, is (see fig. 1) about 15 points in the upward direction, and perhaps 18 points in the downward (50 to 16 percentiles) direction. In short, we feel unable to avoid placing the figure as high as 16 or 17.

This possesses considerable importance for educational administrators and teachers. The scatter of intelligence appears to be even greater than has hitherto been assumed. The following table gives in round

*Theoretical Scatter of I.Q.'s,<sup>2</sup> assuming Gaussian Distribution*

Standard deviation.	13.	16.	17.
Above 130 I.Q.	1	3	4
110-130	21	24	24
90-110	56	46	44
70-90	21	24	24
Below 70 I.Q.	1	3	4
	100	100	100

numbers the proportion of children at different levels of intelligence, *if normal*, i.e. *Gaussian, distribution is assumed* and standard deviations of 13, 16, and 17 points be taken,

<sup>1</sup> Vol. iii, p. 29.

<sup>2</sup> For a fuller table see Thomson, *Brit. Journ. Educ. Psychol.*, 1932, vol. ii, p. 101.

corresponding to Terman's first value, Scottish girls, and Scottish boys respectively.

If, therefore, we take I.Q. 90 to 110 as representing the range of the "average" child, somewhat *less* than half of the school population are in this sense average, and not somewhat more than half, as has hitherto been assumed. Thus far we can speak with considerable assurance. But when it comes to the categories above 130 and below 70 I.Q. great caution is necessary. The proportions of 3 or 4 per cent. in the above table are only the proportions which would be found *were the distribution of I.Q.'s symmetrical and Gaussian*, and we have very little evidence from our present investigation to offer in proof of either symmetry or Gaussian distribution, though the bulk of other work on I.Q.'s suggests at least symmetry.

Our difficulty here is due to the erratic nature of the Binet sample and also to the absence from the sample of "ascertained" defectives below I.Q. 70, *i.e.* of pupils in special schools. There is also, in the boys' sample, a strong suggestion that pupils between 140 and 150 I.Q. (see fig. 4) are much over-represented. The consequence is that the raw distributions of Binet I.Q.'s are, in fact, very definitely neither symmetrical nor Gaussian. If we put boys and girls together into a group of 1000, distribute the scores in steps of ten points of I.Q., fit the best Gaussian curve, and calculate Pearson's measure of goodness of fit, we get, with thirteen steps in the distribution,  $\chi^2=71$ , which corresponds to a probability of less than 1 in 100,000 that the distribution is Gaussian.

Whether, however, the distribution would have been Gaussian had the sample been random is the real question.



There were actually found, among the 1000 Binet pupils, six below 70 I.Q., *i.e.* six unascertained defectives. We estimate, from the best official information available to us, that the "ascertained" and "ineducable" pupils over all Scotland amount together to not less than 7 per 1000. Putting these two together we reach the figure of 13 per 1000 as a minimum for the number below 70 I.Q.; we say a minimum, because all study of the Binet distributions points to the number of pupils in the lower part of the table being too few even apart from the absence of the special school pupils. All in all, therefore, while we cannot press the numbers 3 and 4 per cent. below 70 I.Q. which arise from the best values of the general standard deviation (since we are not sure of the symmetry of distribution of I.Q.'s), we certainly are of opinion that more than  $1\frac{1}{2}$  per cent. are to be found in this category, and probably about one-third more boys than girls. Further suggestions on this point arise out of the consideration of the Binet Group's Picture Test Scores (pp. 114-117).

In addition to the above calculations on the Binet sample taken as a whole, grids have also been made and constants calculated for (*a*) the 327 pupils out of the 1000 who were born in the first week in June, and (*b*) the 63 pupils born actually on 1st June. The latter must form about one in four of the existing cases.

The consideration of these two sub-classes adds little to the argument. The 327 born in the first week in June (taking boys and girls together) give—

Mean I.Q.	.	.	.	100.95
Standard deviation	.	.	.	16.6
Mean Verbal Score	.	.	.	37.53
Standard deviation	.	.	.	14.3

They are still a superior group, with 2 pupils above 69 verbal (instead of 0.5), and with only 7 pupils below 10 verbal (instead of 22).

The 63 pupils born on 1st June give—

Mean I.Q.	. . . . .	98.5
Standard deviation	. . . . .	16.3
Mean Verbal Score	. . . . .	35.7
Standard deviation	. . . . .	15.3

#### USE OF THE BINET RESULTS TO CONVERT VERBAL SCORES INTO I.Q.'s

We have at an early stage renounced any attempt to calculate mental ages, and thence I.Q.'s, from the Group Test Verbal Scores alone. Fig. 1 (p. 65) shows that such an attempt would result in incorrect allowances for age for all the higher and lower scores remote from the normal, and in a very skew distribution of I.Q.'s, the reason being that the gradient of a Group Test Score is a function not only of the child's growth in intelligence, but also of the "ceiling" of the test, since it is increasingly difficult to add to one's score the nearer that score approaches the maximum possible.

But with the knowledge gained from the thousand Binet pupils we are now in a position to convert the Group Test Verbal scores into I.Q.'s in another way, by turning them first into percentiles and thence into I.Q.'s (though in actual practice we shall short-circuit this and omit the percentile ranks). Before we even begin, however, it is important to remind ourselves that such derived I.Q.'s will be considerably less certain than Binet I.Q.'s obtained direct.

If the tables already given (p. 70) are used to find

RELATION OF GROUP AND INDIVIDUAL TESTING 109

Percentile Ranks, these can be converted into quasi-I.Q.'s by the following table:—

Percentile Rank.	Boys' I.Q. ( $\sigma=17$ ).	Girls' I.Q. ( $\sigma=16$ ).
95	128	126
90	122	121
84	117	116
80	114	113
70	109	108
60	104	104
50	100	100
40	96	96
30	91	92
20	86	87
16	83	84
10	78	79

The process can, however, be short-circuited by using the following table, which serves for either boys or girls:—

I.Q.	80	85	90	95	100	105	110	115	120	125	130	135	140	Age. Months.
January .	18	23	28	33	39	44	49	53	57	61	64	67	68	136½
February	17	22	27	32	38	43	48	52	56	60	64	67	68	135½
March .	17	22	27	32	38	43	48	52	56	60	63	66	68	134½
April .	16	21	26	31	37	42	47	51	55	59	63	66	68	133½
May .	15	20	25	30	36	41	46	50	54	58	62	65	68	132½
June .	14	19	24	30	36	41	45	49	53	57	61	65	68	131½
July .	14	19	24	29	35	40	45	49	53	57	61	64	67	130½
August .	13	18	23	28	34	39	44	48	52	56	60	64	67	129½
September	12	17	22	28	34	39	43	47	51	55	59	63	67	128½
October .	11	16	21	27	33	38	42	46	50	54	58	62	66	127½
November	11	16	21	26	32	37	42	46	50	53	58	61	66	126½
December	10	15	20	25	31	36	41	45	49	53	57	61	66	125½
I.Q.	80	85	90	95	100	105	110	115	120	125	130	135	140	

We have ventured in this table to give higher I.Q.'s up to I.Q. 140, based upon calculations of the 98 and 99 percentiles. But we give these columns, and indeed the whole table, with repeated cautions that such I.Q.'s

at second hand are to be treated as very approximate only (the "probable error" exceeds seven points).

The preceding table was made by fitting percentile lines to the data, and identifying each line with that I.Q. which cuts off the appropriate percentage from a distribution with centre 100 and standard deviation 17 (boys) or 16 (girls). The boys' and girls' tables were then found to be practically identical, and nearly quite so when only integral scores were taken.

Lest any reader should think that the proper line of relationship between the Verbal Group and the Binet Tests should be one of the regression lines, we refer him to papers by Otis ("The Method of Finding the Correspondence between Scores in Two Tests," *Journ. Educ. Psychol.*, December 1921, p. 529), and by Karl Pearson ("On Lines and Planes of Closest Fit to Systems of Points in Space," *Phil. Mag.*, 1901 (6), vol. ii, pp. 559-572); and to a Note on these by Thomson, *Psychol. Rev.*, 1928, vol. xxxv (5), pp. 409, 410.

THE PICTORIAL CLASSIFICATION SCORES  
OF THE BINET THOUSAND

These are shown in the following grids:—

CORRELATION BETWEEN VERBAL SCORE AND SECOND  
PICTURE SCORE

Boys

*Picture Test, p. 3*

Verbal Score.	0	1	2	3	4	5	6	7	8	9	
70									1	3	4
65								1	1	13	15
60							1	0	7	9	17
55				1	0	0	1	5	12	24	43
50				1	0	1	4	10	13	24	53
45				0	0	1	7	12	22	21	63
40		1	0	0	0	2	5	12	18	25	63
35	3	1	0	0	2	2	11	13	18	6	56
30	2	0	2	1	1	4	13	12	12	4	51
25	1	1	2	0	2	4	11	12	6	2	41
20	0	0	1	2	0	2	5	10	4	1	25
15	0	2	1	1	3	1	2	9	7	0	26
10	0	1	0	1	2	2	1	10	0	0	17
5	0	0	2	1	3	3	3	2	1	2	17
0	2	0	2	2	1	2	0	0	0	0	9
	8	6	10	10	14	24	64	108	122	134	500

Verbal mean . . . 38.60  $\sigma$  15.70

Picture mean . . . 7.11  $\sigma$  1.98

$r = .539$

$\eta = .57$

$\eta = .59$

CORRELATION BETWEEN VERBAL SCORE AND SECOND  
PICTURE SCORE

GIRLS

*Picture Test, p. 3*

Verbal Score.	0	1	2	3	4	5	6	7	8	9	
70										2	2
65										6	6
60								1	4	8	13
55					1	1	0	4	4	32	42
50	1				0	1	5	9	9	19	44
45		2			0	0	6	9	16	15	48
40		0		1	0	5	6	15	24	18	69
35		2	1	0	4	4	8	20	19	16	74
30		0	0	4	2	8	13	13	7	8	55
25		1	0	2	6	5	10	12	8	4	48
20		0	3	4	1	4	9	9	7	2	39
15	0	2	0	1	0	6	3	9	4	2	27
10	1	1	0	4	1	2	2	1	3	1	16
5	1	1	2	0	2	1	2	2	1		12
0			1	1		3					5
	3	9	7	17	17	40	64	104	106	133	500

Verbal mean . . . 37.15  $\sigma$  14.3Picture mean . . . 7.00  $\sigma$  1.96 $r = .51$  $\eta = .52$  $\eta = .55$

CORRELATION BETWEEN BINET I.Q. AND SECOND PICTURE SCORE

Boys

Picture Test, p. 3

Binet I.Q.	0	1	2	3	4	5	6	7	8	9	
160										1	1
155									1	0	1
150									0	1	1
145								1	1	7	9
140							1	0	2	5	8
135							0	0	1	4	5
130							1	0	1	4	6
125						1	1	3	6	13	24
120						0	1	4	12	20	37
115						0	5	2	10	8	25
110				1	0	2	2	9	15	19	48
105		2	1	0	1	1	4	10	11	18	48
100		0	1	0	1	2	7	11	21	13	56
95	1	1	0	1	2	2	10	11	18	8	54
90	3	2	0	2	2	2	13	20	9	5	58
85	1	0	1	2	3	5	11	23	7	6	59
80	1	0	2	1	3	4	4	9	5	0	29
75	0	0	2	0	1	2	3	4	1	1	14
70	1	1	2	3	1	3	0	1	1	1	14
65	0	0	1				0				1
60	0						1				1
55	1										1
	8	6	10	10	14	24	64	108	122	134	500

I.Q. mean . . . 102.95  $\sigma$  17.35

Picture mean . . . 7.11  $\sigma$  1.98

$r = .486$

$\eta = .54$

$\eta = .54$

CORRELATION BETWEEN BINET I.Q. AND SECOND  
PICTURE SCORE

## GIRLS

*Picture Test, p. 3*

Binet I.Q.	Picture Test, p. 3												
	0	1	2	3	4	5	6	7	8	9			
160													
155											1		1
150											1		1
145											2		2
140											4		4
135											7		7
130							2	3	1		9		15
125							0	1	3		6		10
120							1	5	8		10		24
115	1				1	1	3	3	6		10		25
110	0				1	2	6	6	10		17		42
105	0	1	1		2	3	4	13	10		15		49
100	0	1	0		2	1	6	12	14		13		49
95	0	0	1	5	2	8	10	13	11		15		65
90	0	2	1	2	2	8	6	17	18		13		69
85	0	3	1	2	3	6	13	15	10		4		57
80	2	1	0	1	2	7	8	12	7		5		45
75		1	1	3	2	2	5	2	5		1		22
70			0	3		2		2	3				10
65			2	1									3
	3	9	7	17	17	40	64	104	106	133			500

I.Q. mean . . . 100.19  $\sigma$  16.07Picture mean . . . 7.00  $\sigma$  1.96 $r = .41$        $\eta = .44$        $\eta = .47$ 

A consideration of the distribution of the Pictorial Classification Test<sup>1</sup> leads one to think that scores of zero to four differ mainly by chance, for the numbers

<sup>1</sup> See p. 84.



increase comparatively slowly until score 4 is reached and then jump suddenly after score 4:

0.	1.	2.	3.	4.	5.	6.	7.	8.	9.
1,644	1,639	2,087	2,672	3,019	5,183	13,473	18,619	20,501	18,661

In the same way, a consideration of the distribution of the Verbal Test Scores (pp. 61 and 62) makes it doubtful whether the scores below 10 there have any but a chance or luck origin. Those children who score *neither* 4 in the Picture Test nor 10 in the Verbal Test may be regarded as definitely needing further inquiry: and the Bressak tables (pp. 85 and 86) show us that 17 boys and 11 girls out of 500 of each sex failed to reach either of these very low standards, *i.e.* 3.4 per cent. boys and 2.2 per cent. girls. It appears possible that this double standard (4 in the Picture Test and 10 in the Verbal Test) marks a threshold below which individual inquiry is likely to show the need for special and separate instruction. The scores of the 15 children in the Binet Thousand who fell below this double standard are shown in the following list:—

Verbal.	Pictorial.	Binet I.Q.
0	3	68
0	0	73
2	3	71
3	2	67
3	0	57
3	2	71
4	2	69
4	3	70
5	2	67
5	2	72
5	1	78
6	0	80
7	2	86
8	2	83
8	3	72

The Binet I.Q. shows that 5 of these 15 are below 70 I.Q., and only 4 of them are over 73 I.Q. In this connection it should be remembered that the Binet Thousand include no children in special schools for mental defectives.

The double standard of 10 in the Verbal and 4 in the Pictorial Classification Test therefore detects five of the six pupils shown by the grids to be below 70 I.Q., and indeed a double standard of 6 in the Verbal and 4 in the Pictorial would have detected them and would have included only one pupil whose I.Q. (78) can be said to be significantly above I.Q. 70. To throw further light on this Mr Kennedy-Fraser supplied the following grid:—

SUMMARY OF VERBAL GROUP AND PICTURE (p. 3)  
SCORES FOR 113 MENTAL DEFECTIVES

		PICTURE TEST SCORE									All.	
		0	1	2	3	4	5	6	7	8		9
VERBAL GROUP SCORE	0	26	17	10	6	2	2	2	3	1		69
	1	4	1	2	1		2					10
	2	2	2	2		2			1			9
	3	1	1	1	1	2		1	1			8
	4	1		1		1	2		3			8
	5			1	1							2
	6		1	1				1				3
	7					1	1					2
	8											
	9								1			1
	10											
	11								1			1
		34	22	18	9	8	8	3	10	1	113	

It will be seen that below this double standard of 6 in the Verbal and 4 in the Pictorial there fall 81 of the 113 mental defectives in the table.

It seems, therefore, that children who fail to reach this last double standard (6 Verbal, 4 Pictorial) are almost certainly below 70 I.Q. and should be in special schools. This does not exclude the possibility, indeed the certainty, that others somewhat above the double standard are nevertheless below 70 I.Q.

A more detailed analysis of the Bressak group with this new standard shows that there are 14 boys and 5 girls who fail to reach it, making 19 in all out of 1000, or 1.9 per cent.; not inconsistent with our estimate on p. 107 that the proportion below I.Q. 70, though possibly not as high as 3 per cent. or 4 per cent., is greater than  $1\frac{1}{2}$  per cent.



VI

SUMMARY AND CONCLUSIONS



## VI

### SUMMARY AND CONCLUSIONS

DESPITE the many difficulties associated with a nationwide undertaking, the Committee's ambitious attempt to test a complete cross-section of the community was entirely successful. A small number of children enrolled in a very few private schools and those absent through sickness or for some other cause at a time of the year when absence is at a minimum were not included in the survey, but with these negligible exceptions all children born in 1921, enrolled in the private and public schools and institutions of Scotland, were given a group test during the first week of June 1932. In all areas save two this group test was given on Wednesday, the 1st of June. The number of cases from which the results of the investigation were deduced reached the impressive total of 87,498. Of these, one thousand were also tested individually by the Binet Scale.

For various reasons, the chief of which was the condition under which the work had to be done, namely, by the employment of a number of workers who volunteered their services during holidays or other spare time, the geographical distribution of the thousand pupils to whom individual tests were applied fell short of the ideal. The rural areas, especially in the north, did not supply their full quota (Table I, p. 36), and, in certain counties in the north-west, country pupils were not adequately represented in the sample tested. This mal-distribution, while regretted, is not considered to have had an important bearing upon the Committee's conclusions. Since no children in special schools were included in the individual testing programme it was expected that the

sample would not be quite representative, but it was hoped that it would be otherwise free from bias. In spite of all precautions (pp. 35-37) it actually proved to be definitely superior. In the summarised results of the individual testing for the boys from the four cities, particularly in the results in regard to the boys of one of the cities, the bias showed itself, and allowance had to be made for this in estimating the distribution of intelligence quotients in the whole population.

The average I.Q. of Scottish boys born in 1921 may be stated to be 100. While the data suggest that the average I.Q. of Scottish girls born in 1921 falls slightly short of this figure, this difference between boys and girls can be accounted for by the variations referred to above in the method of sampling. It can therefore be affirmed that there is no certain evidence of any significant difference in average intelligence between the boys and girls born in Scotland in 1921 (p. 100).

There seems fairly definite evidence that the intelligence quotients of the boys are more widely scattered than the intelligence quotients of the girls. The difference in standard deviation appears to be one point of I.Q. Scale (pp. 93 and 100).

The standard deviation of 17 points for the boys and 16 for the girls is definitely larger than the deviation of 13 points found by Terman in his original standardisation of the Stanford Binet Tests. This scatter of intelligence, considerably greater than has hitherto been assumed, is of significance for educational administrators and teachers. If I.Q. 90 to I.Q. 110 is taken to represent the range of what is termed the average child, somewhat fewer than half of the school population are in this sense average, and not somewhat more than half, as has hitherto been held. The groups which range themselves on either side of the average and are usually termed superior and



retarded respectively are greater than has hitherto been believed.

This finding in regard to the wide variation of intelligence among children of the same age supports the modern tendency to adjust subjects and methods of instruction to the mental age of the child. It should heighten expectation of what may be attained by a selected few, but should also damp the ardour of those who believe without reliable evidence that many of the group (more than 25 per cent.) with I.Q.'s below 90 are able to do work which comes readily within the grasp of the average child.<sup>1</sup>

Since no children enrolled in special schools or classes were submitted to individual testing (although six "unascertained cases" were found among the thousand pupils so tested in the ordinary schools), the main evidence for the extent of "mental deficiency" so called had to be found from the distribution of the group test scores. If 70 I.Q. be taken as the boundary line separating the dull from the "mentally defective," it appears that not fewer than  $1\frac{1}{2}$  and not more than 3 per cent. of children born in 1921 fall within this category. Of these the boys exceed the girls by one third (pp. 103-104, 112-114).

It must be noted, however, that these conclusions regarding the incidence of "mental deficiency" are derived from a single group test of a predominantly verbal type. Without further testing which should be individual and which should include performance as well as verbal tests, it would be rash in the extreme to assume that the "mental defectives" in Scotland represent as many as 2 per cent. of the school population. Nevertheless it seems clear that educational policy must take into consideration the fact that low verbal intelligence—

<sup>1</sup> See Table on p. 105.

that is, the kind of intelligence appealed to in ordinary school work—is somewhat more prevalent than has been generally supposed.

The testing of a group of 1278 children in the English town of Halifax was undertaken for the sake of trying out and improving the group test before it was used in Scotland and not with the intention of comparing the intelligence of the Halifax group with the intelligence of Scottish children. The data, as given in Chapter IV, are, it is considered, insufficient to enable a valid comparison to be made. The practice which Halifax teachers have had over a period of years in preparing for and supervising this type of test, and the competitive conditions (*pace* the Secretary of Education who is quoted on p. 74) under which the test was given in England can be held to account for the higher average performance of the Halifax pupils. The results show that even under such extreme conditions not more than four points need be added to the raw score required for a given Percentile Rank (p. 76).

Educationists in Scotland have hitherto been dependent on English and American investigations for their knowledge of the distribution of intelligence amongst school children, and in concluding their task the Committee may claim to have removed the handicap under which all in Scotland have laboured in their attempts to interpret adequately the results derived from local or school surveys of intelligence. The Committee present this Report as a contribution to the study of the intricate problems which confront a democracy in its endeavour to organise educational opportunity suited to the widely varying needs of the younger generation.

## APPENDICES



# APPENDIX I

## SPECIAL INSTRUCTIONS

### PRELIMINARY PRACTICE TEST

AFTER the leaflets have been distributed the teacher should supervise the filling in by the pupils of name, sex, date of birth, name of county or city-county, burgh or parish, and school. This should not take more than 10 minutes, or less in small centres. The name of county, burgh or parish, and school may be written on a blackboard for pupils to copy.

The teacher should then call the pupils to attention, see that none have turned the leaflet over, and should then read to them the following:—

“There are some questions on the other side which you have to answer in pencil on this paper itself” (pointing to leaflet) “just exactly as it tells you. You will have exactly 10 minutes, and you should begin at the beginning and go straight through. If you cannot do any question after trying it, leave it out and go on to the next. You must not ask any questions—do just what the test tells you to do. *Ready—turn over and begin.*”

After exactly 10 minutes say, “*Stop. Pencils down.*” The teacher should then go rapidly round the class to see if the pupils have understood the *manner* of answering, and may give a word of explanation where necessary. *There should, however, be no coaching in how to answer certain types of question.*

The class should now have a short interval, if possible in the open air, before the test proper, while the practice scripts are collected.

### THE TEST PROPER

Give out booklets and have names, etc., written as before. See that no pupil opens the book or turns it over. Call to attention and say, clearly and without haste, and without any marked pauses except where indicated:

“Turn over to the first page. Notice the row of pictures at the top of the page. There is a door with a 1 under it,

a table with a 2 under it, a chair with a 3 under it, a wheelbarrow with a 4 under it, a garden-roller with a 5 under it. You have to put the same numbers under the same pictures below the line. Look at the first row of pictures below the line. There you see a table, a chair, a wheelbarrow, etc. *Take your pencils* and put a 2 under the table like the 2 under the table in the top line." (Pause 5 seconds.) "Now put a 3 under the chair just like the 3 under the chair in the top line." (Pause 5 seconds.) "Now put a 4 under the wheelbarrow like the 4 under the wheelbarrow in the top line." (Pause 5 seconds.) "Now what goes under the next chair?" (Do not wait for an answer, say) "Yes, a 3. Put a 3 under the chair. Now you have to do all the others in the whole page. Put under each picture the number that belongs to it. Work quickly and see how many you can get done before I say stop. *Go on.*"

After 1 minute from this point say, "*Stop. Pencils down.*"

The whole will have taken about  $2\frac{1}{4}$  minutes.

The teacher must be careful to keep the place in the instructions during the 5 seconds' pauses, as it is easy to make an error which would confuse the pupils. He should have a test booklet before him as well as these instructions.

The great majority of the pupils will score high marks in this test item, which is intended to be easy.

After only 5 seconds' pause say:

"Now look at the next page. You see that the first three pictures in the first line with little crosses under them" (hold up booklet and point so that all may see) "are *alike*, because they are all pictures of flowers. Now who can see another flower in that line?" (Do not wait for an answer, but say) "Yes, this picture of a rose" (point). "So take your pencils and put a little cross under the rose to show that it is *like* the first three, because they are all flowers." (Pause 5 seconds.) "Now look at the second line of pictures. The first three, that have little crosses under them, are alike. Look at the other five in the line and pick out the right answer—the one that is most like the first three—and put a cross in the little square under the answer." (Pause 5 seconds.) "Now in each line below, in the same way, look at the first three pictures and see how they are alike, then put a cross under the answer—the one that is *most like*

the other three. Remember that there is only one right answer in each row. *Go ahead.*"

After exactly 2 minutes from this point say, "*Stop. Pencils down.*" This page will have taken about  $3\frac{1}{4}$  minutes, making about  $5\frac{1}{2}$  to 6 minutes from the time when the pupils first opened the booklet. With only a few seconds' pause say:—

"Now the rest of the test is rather like the practice test you did before. Try each question as you come to it, but if you cannot do it, go on to the next. *Turn the pages over yourselves as you finish each page.* You will have three-quarters of an hour more, and I shall tell you the time every quarter of an hour. Work quickly. *Go.*"

AT THIS POINT THE TEACHER MUST CAREFULLY NOTE AND *WRITE DOWN* THE TIME WHEN *GO* WAS SAID, AND WRITE DOWN ALSO THE STOPPING TIME OF EXACTLY 45 MINUTES LATER. After 15 minutes say, "You have half an hour more." After 30 minutes say, "You have a quarter of an hour more." If a pupil at any time, *e.g.* after finishing the pages 4 to 8, turns back to the picture pages, tell him quietly that this is not allowed and that he ought to spend all the time left in revising pages 4 to 8. After 45 minutes say, "*Stop.*" See that pencils are laid down and booklets collected at once, boys separately from girls. Pack up booklets and dispatch at once according to instructions.

The Preliminary-Practice leaflets should not be returned.

The timing, it will be seen, is in summary as follows:—

First picture test.	Reading instructions about	.	$1\frac{1}{4}$	min.
	Working time exactly	.	1	"
Second picture test.	Reading instructions about	.	$1\frac{1}{4}$	"
	Working time exactly	.	2	"
Remainder of test (71 questions) exactly	.	.	45	"
			<u>50</u>	"
			$\frac{1}{2}$	"

The 1 minute, 2 minutes, and 45 minutes must be *exact*, the others as near as possible.

## APPENDIX II

### PRELIMINARY PRACTICE TEST

*Read each question carefully, and then answer it in the bracket, or by underlining, or as it tells you*

The alphabet is printed here to help you:—

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

BEGIN HERE:—

- (1) Do you understand that you must do your best and not ask questions? If so, write B ... .. ( )
- (2) Write the three letters between A and E and cross out the middle one ... .. ( )
- (3) Finger is to hand as toe is to what? The answer is one of the five words in the bracket. Underline the right word ... (foot, knee, arm, shoe, nail)  
You have nothing to write, only UNDERLINE what you think is the right answer.
- (4) Man is to clothes as what is to fur?  
(coat, animal, bird, skin, cloth)
- (5) Three boys are Scottish, Irish, and English. The English boy is taller than the Irish, but the Scot is tallest of all. Which is the shortest?  
(English, Irish, Scottish)
- (6) Underline the ONE of the four answers to this statement which seems to you to be correct:—  
Bathbrick is used for (making baths, building houses, cleaning, cooking).
- (7) If H comes before K, write X unless S comes before Q, in which case write Z ... .. ( )
- (8) Fill in the missing figure in this addition sum and write it in the bracket as well:

$$\begin{array}{r} 72 \cdot 3 \\ 4162 \\ \hline 11455 \end{array} \quad \dots \quad \dots \quad \dots \quad ( )$$



APPENDIX III  
THE TEST PROPER

**DO NOT OPEN THE BOOK UNTIL YOU ARE TOLD**

**SEX**

(indicate by X)

Boy.
Girl.

**MENTAL SURVEY**

**INSTRUCTIONS TO PUPILS**

Listen carefully to the teacher and do quickly and carefully what you are told to do

Surname :

Christian Names :

Name of Pupil  
in block capitals,  
Surname first

Name of County.	Burgh or Parish.	School.

Date of Birth <sup>1</sup>

Day.	Month.	Year.

<sup>1</sup> To be checked from register by teacher.

FOR MARKER'S USE ONLY

*To be completed by Teacher*

Class in School.....	
Post Primary V.....	
IV.....	
III.....	
II.....	
I.....	
Senior Upper.....	
Middle.....	
Lower.....	
Junior Upper.....	
Lower.....	
Infants.....	
Special.....	

PICTURE TESTS

Page.	Score.	Marked by
2		
3		
Total, Picture Tests.		

VERBAL TESTS

Page.	Score.	Marked by
4		
5		
6		
7		
8		
Total of pages 4 to 8.		

Checked by.....  
 Entered in  
 nominal roll by.....  
 Tabulated by.....

## 4

*Read each question carefully and then answer it in the bracket. Begin at the beginning and go straight through. Try each question as you come to it; but if you cannot do it go on to the next. The alphabet is printed here to help you with some of the questions.*

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

1. Do you understand that you must do your best and not ask questions? If so, write L in the bracket ( )
2. Write the letter which comes before M in the alphabet ( )
3. Write the odd numbers between 2 and 8 and then cross out the middle one ... .. ( )
4. Do you understand that you have to go on trying till time is up? If so, write 5 ... .. ( )
5. If 19d. is the same as 1/7 write G, if not write R ... ( )

Look at this example:—

Finger is to toe as hand is to what? (foot, knee, arm, shoe, nail)

The answer is one of the words in the bracket. The right answer is foot, and it is underlined.

Now look at this next example, and then underline the right answers in questions 6, 7, and 8.

EXAMPLE:—Man is to clothes as what is to fur?

(coat, animal, bird, skin, cloth)

6. Eat is to drink as bread is to (iron, water, lead, stones, grass)
7. Father is to son as mother is to  
(aunt, nephew, daughter, sister, cousin)
8. Foot is to man as hoof is to (leather, hard, cow, leg, boot)
9. Write the letter that comes most often in the word  
Constantinople ... .. ( )
10. If O and N come together in the alphabet write J, if  
not write C ... .. ( )

11. Fill in the number which has been left out in the top line of this addition sum, and write it in the bracket as well.

$$\begin{array}{r}
 3 \cdot 2 \quad \dots \quad \dots \quad \dots \quad ( \quad ) \\
 1766 \\
 \hline
 2118
 \end{array}$$

12. Fin is to fish as wing is to (feather, air, bird, sail, herring)
13. John is younger than Jim, and Jim is younger than Bill. Which is the oldest of the three? (John, Jim, Bill)  
(Do not write anything, just underline the right one in the bracket.)
14. Oak makes better piles for a pier than pine, but not so good as teak. Which wood makes the best piles? ... .. (oak, pine, teak)
15. If G and H changed places in the alphabet, what would the 8th letter be? ... .. ( )
16. If G is found before J in the alphabet and R is found before L, write S. But if only one of these is true write P ... .. ( )

Go on to NEXT PAGE without waiting to be told

## 5

17. Look at these three proverbs. Two of them mean nearly the same. Put a cross plainly after the other one.  
Well begun is half done.  
It's the first step that counts.  
Waste not, want not.
18. Do the same with these three. Find which of them mean nearly the same, and then put a cross after the other one.  
There's a skeleton in every cupboard.  
It's an ill wind that blows nobody good.  
Every cloud has a silver lining.
19. Fill in the missing number in this subtraction sum, and write it in the bracket as well.

$$\begin{array}{r}
 3 \cdot 845 \quad \dots \quad \dots \quad \dots \quad ( \quad ) \\
 25936 \\
 \hline
 13909
 \end{array}$$

20. Duck is to bird as iron is to (water, goose, metal, steel, lead)  
 21. I have three uncles. Uncle Fred lives farther away than Uncle Alec, but Uncle Jack lives farthest away of all. Which lives nearest to me?

(Fred, Alec, Jack)

Look at these five words:—Dog, elephant, sparrow, cow, lion. One of them is different from the other four, and so it is underlined. Sparrow is different because all the others are animals.

Look at this example:—Hot, freezing, warm, cold, wet.

Here wet is different because all the others are about temperature. Now underline the “different” word in these five:—

22. Right, night, bright, black, fright.

Do the next three in the same way:—

23. Rain, water, calico, wine, milk.

24. Boy, waggon, kitten, girl, puppy.

25. Knife, saucer, spoon, fork, tart.

26. Meeow is to bow-wow as what is to dog?

(hen, cat, donkey, speech, bark)

27. Bullet is to lead as what is to gold?

(paper, coin, silver, copper, purse)

28. Write the letter which is midway in the word BLUE-BIRD between the two letters which are the same ( )

29. EGAI RRAC is a word written backward. Write it as it usually appears ... .. ( )

30. If the letter A occurs most often in the word CANADA write the middle letter of the word SLEEP unless P and R come next to one another in the alphabet, in which case write Y instead ... ( )

31. Dog is to terrier as what is to Liverpool?

(city, cow, horse, state, cotton)

Go on to NEXT PAGE without waiting to be told

## 6

Underline the “different” word in each of the next three questions:—

32. Radiator, violin, flute, piano, saxophone.

33. Rain, snow, storm, mast, hail.

34. Sheep, lily, cart, trout, thrush.  
In a certain secret writing  
l z q k c o f u ,      f t t r      y g g r      means  
STARVING,      NEED      FOOD
35. In the same secret writing you find this. Write below it what it means:—  
y o c t      k g c t k l      r t q r.
36. "Tragu" is cheaper than "vashol," and "vashol" is dearer than "spongop." Which is the dearest?... ( )
37. John's mother has no brothers or sisters. His father has a bachelor brother Frank, and a married sister Mary who has two daughters and one son (Annie, Elizabeth, and Timothy). How many aunts has John? ... ( )
38. How many nieces has John's father? ... ( )
39. Establish is to abolish as begin is to  
(work, year, end, commence, despair)
40. Suppose every fourth letter (D, H, L, and so on) were lost, what would then be the tenth letter? ... ( )

Underline the "different" word in each of the next three questions:—

41. Sixpence, shilling, penny, farthing, franc.
42. Eye, pen, nose, chin, ear.
43. Cheap, sweet, sour, salty, bitter.
44. Underline the ONE of the four answers to each statement which seems to you to be correct:—  
If your clothes catch fire—(roll yourself in rug or blanket, run about, 'phone fire-brigade, pour on petrol).  
A window to ventilate properly must be—(made of stained glass, open top and bottom, polished with chamois leather, covered with curtains).  
To prevent tools from rusting rub with—(sandpaper, tar, vaseline, file).
45. If  $\frac{1}{8}$  is larger than  $\frac{1}{8}$  write Q, if not write E ... ( )

46. If I am facing the west with my arms stretched sideways, in what direction is my left arm pointing? ... .. ( )

Go on to **NEXT PAGE** without waiting to be told

## 7

47. Two of these proverbs have somewhat similar meanings. Mark the other one with a cross:—

Two heads are better than one.  
Too many cooks spoil the broth.  
Many hands make light work.

48. Do the same with these three. Find which of them mean nearly the same, and then put a cross after the other one:—

Time and tide wait for no man.  
It's an ill wind that blows nobody good.  
Make hay while the sun shines.

49. Underline the word in the bracket which means nearly the SAME as little ... (large, round, small, bent, wide)

Do the same with:—

50. accept ... .. (take, give, hear, learn, find)

51. appeal ... .. (split, cleave, remind, beseech, revoke)

Cross out with an X, plainly, the word in the bracket which is nearly the OPPOSITE of

52. good ... .. (fine, bad, nice, clever, dark)

53. cautious ... .. (publish, appoint, suit, careful, heedless)

54. The words in this sentence have been mixed up. Write it as it ought to be, beneath the printed sentence:—

HUMP CAMEL HAS A HIS A BACK ON

55. Do the same with this:—

TRUE BOUGHT CANNOT FRIENDSHIP BE

56. Underline the ONE of the four answers to each statement which seems to you to be correct:—

Vitamine is found in—(fresh milk and fruits, lard, dried fruits, stale bread).

Metals can be joined together by—(gluing, riveting, nailing, polishing).



The forecastle of a ship is at the—(bow, stern, bridge quarterdeck).

57. Write the two letters in the word TRENCH which have three letters between them in the alphabet ( )
58. Three posts are at the corners of an equilateral, that is an equal-sided, triangle. From where I am standing, the post nearest to me seems to be exactly half-way between the other two. If I now take two sidesteps to the left, will the posts look like this I I I  
or like this? I I I

Mark the right one with tick ✓.

Go on to NEXT PAGE without waiting to be told

## 8

59. Which is the first month after Midsummer Day which has an *r* in its name? ... .. ( )

Look at the word in front of the bracket, and in the bracket find one word which is either nearly the same, or nearly the opposite. Underline it if it is the same, cross it out with an X if it is opposite.

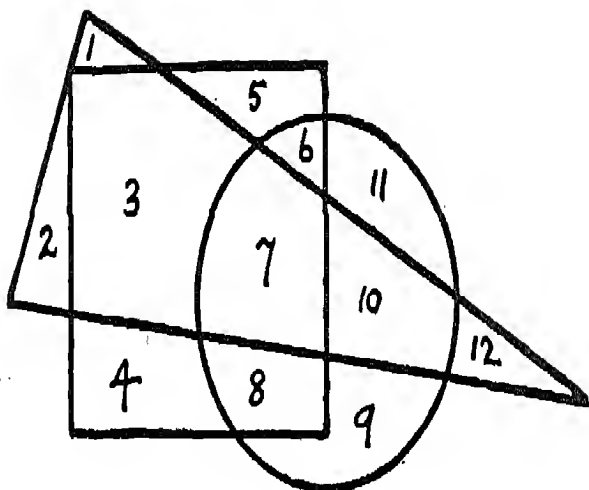
60. jumps ... .. (leaps, runs, flies, swims, rests)
61. bring ... .. (take, think, make, mend, drop)
62. no... .. (thanks, please, yes, perhaps, what)
63. fragrant ... (transparent, odorous, critical, brave, fragile)
64. legislature (executive, municipal, parliament, court, palace)
65. oscillate ... .. (bring, swing, king, sing, bright)

The next question is written in the secret writing you have already seen in question 35. Write down what it means and answer it. You can get most of the letters from the explanation in front of question 35, but there are some letters you will have to guess.

66. o l z g r i q n D g f r q n ? ... ( )  
Answer ... .. ( )

67. Write this sentence as it ought to read:—

BELL MOST TELEPHONES HAVE ATTACHED A



68. What number is in the triangle and square but not in the circle? ... .. ( )
69. What is the sum of the two numbers which are in the circle only? ... .. ( )
70. Subtract the number which is in the circle and triangle but not in the square from the sum of all the numbers which are in the square but outside the circle ( )
71. If there are more I's in DIMINISHING than in TRINITARIAN write P, unless there are more N's in the second than in the first, in which case write R ... .. ( )

THE END. Look over your work on pages 4 to 8 again.

## APPENDIX IV

### MARKING INSTRUCTIONS AND KEY

Where possible, markers should work as a team, one person always marking the same page and passing the open test on to the next member of the team. But it is also quite possible for one person to mark the whole test.

Every page should be checked by a different person from the first marker.

*Markers* should be provided with *red* pencils, and should tick each correct item (ignoring the wrong items and making no mark). They should count the correct items as they are ticked, and on the completion of each page should turn to the front page and enter the number correct on that page in the appropriate pigeon-hole. If working in a team, they should then pass on the *open* test to the next marker.

*Checkers* should be provided with *blue* pencils. They should examine each ticked item and satisfy themselves that it is correct, without themselves marking it, and should mark with a blue cross each incorrect item. Items not attempted should be left unmarked. They should count the number of red ticks on a page, and tick the red number in the pigeon-hole on page 1 with a blue tick.

Markers working in a team and doing the same page all the time will find that they will soon memorise the answers for that page in a rhythm. They should, however, refer to the Key from time to time.

Markers who are working in teams at centres or who are marking the tests of very large schools will be supplied with slips on which the answers to pages 4-8 are printed, the answers being spaced to fit against the pupil's answers in the test booklet.

One point is to be given for each item in the Key, but notice that questions 44, 56, and 66 have more than one item in them. The possible number of points is therefore:—

Page 2	40	Page 4	16
Page 3	9	Page 5	15
Total (pictures)	49	Page 6	17
		Page 7	14
		Page 8	14
		Total (pages 4 to 8)	76

The verbal total (of 76 possible) is to be kept separate from the picture total (of 49 possible).

Note that in the picture pages the items which are done with the supervisor while instructions are being read are nevertheless counted in to the pupil's score.

A pupil's answer to an item is in general to be counted right if it agrees with the Key, even if it is not given in the manner intended, *e.g.* a pupil who writes "calico" instead of underlining the word gets credit. But in items 49 to 53 and 60 to 65 proper underlining or crossing out is essential. Alterations are allowed if they are perfectly clear.

In so extensive a survey *the Key must be strictly followed*, even if occasionally a case may arise where some other answer appears plausible.

## KEY

Page 2:

2	3	4	3	2	4	1	2
4	5	2	1	4	5	3	1
2	3	1	5	3	4	1	5
1	5	2	3	4	5	2	4
3	4	1	5	2	3	1	5

Page 3:

Rose No.	3
Hat	„ 4
Owl	„ 3
Chair	„ 2
Goat	„ 5
Basin	„ 1
Ear	„ 5
Eight	„ 2
J	„ 4

Page 4:

1. L.
2. L.
3. 3/7.
4. 5.
5. G.
6. water.
7. daughter.
8. cow.
9. N.
10. J.
- \* 11. 5.
12. bird.
13. Bill.
14. teak.
15. G.
16. P.

Page 5:

- \*\* 17. Waste not, want not.
- \*\* 18. There's a skeleton in every cupboard.
- \* 19. 9.
20. metal.
21. Alec.
22. black.
23. calico.
24. waggon.
25. tart.
26. cat.
27. coin.
28. U.
29. Carriage.
30. E.
31. city.

\* Give the pupil credit for the right number in either place unless he has written a wrong number in the other.

\*\* Give the pupil credit if he indicates in any manner the right proverb.

Page 6:

- |                          |   |                                      |
|--------------------------|---|--------------------------------------|
| 32. Radiator.            | 41. franc.                              |                                      |
| 33. mast.                | 42. pen.                                |                                      |
| 34. cart.                | 43. Cheap.                              |                                      |
| 35. Five Rovers<br>dead. | 44. roll yourself in rug or<br>blanket. | } 3 points, one for<br>each portion. |
| 36. Vashol.              | open top and bottom.                    |                                      |
| 37. One.                 | vaseline.                               |                                      |
| 38. Two.                 | 45. E.                                  |                                      |
| 39. end.                 | 46. South or S.                         |                                      |
| 40. M.                   |   |                                      |

Page 7:

47. Too many cooks spoil the broth.
  48. It's an ill wind that blows nobody good.
  49. small.
  50. take.
  51. beseech.
  52. bad. X (*i.e.* crossed out).
  53. heedless. X.
- } In items 49 to 53 give no point unless the word is properly underlined, or crossed out (X), as the case may be.

54. A camel has a hump on his back.  
On his back a camel has a hump.  
Has a camel a hump on his back? (With or without question mark.)
55. True friendship cannot be bought.  
Bought friendship cannot be true.  
Cannot true friendship be bought? (With or without question mark.)  
Cannot bought friendship be true? (With or without question mark.)  
Friendship cannot be bought true.
56. fresh milk and fruits. }  
riveting. } 3 points.  
bow. }
57. R and N, or *vice versa*.
58. The upper diagram is right, I I I

Page 8:

59. September.
60. leaps. }  
61. take. X (*i.e.* crossed out). } No point in 60 to 65 unless  
62. yes. X. } properly underlined or  
63. odorous. } crossed out. No point if  
64. parliament. } more than one word is  
65. swing. } marked unless one mark is  
clearly withdrawn by alteration.
66. Is to-day Monday? (Answer) No. (Note that occasionally a pupil writes "No" in the secret writing, and should be given credit as though written in ordinary script.)  
One point for the sentence *exactly* correct, and one point for the answer, making two points.
67. Most telephones have a bell attached.  
Have most telephones a bell attached? (With or without question mark.)  
Most telephones have attached a bell.
68. 3.
69. 20.
70. 2.
71. P.

*Entering Scores in Nominal Rolls :*

After the tests are marked, the scores should be entered in the nominal rolls, the scores for the two picture tests being entered separately in the first two columns, and for the verbal tests in the third column, with the grand total in the fourth. ("For office use only" at top of columns in Pupil's Roll should read "For marker's use.")

*Tabulating :*

Where the number of scripts at any one marking centre or in any large school where the scripts are being marked exceeds the number of places on the nominal roll (*i.e.* more than 25 boys or/and 25 girls), Tabulation Forms will be supplied for the collation of the results.

*Return of Rolls and Tabulation Forms :*

The complete Rolls of Pupils and Tabulation Forms should be forwarded to the Secretary, The Scottish Council for Research in Education, 47 Moray Place, Edinburgh, on or before 30th June 1932.

*Disposal of Scripts :*

After the tests have been marked and the results entered on Rolls and tabulated, the scripts should be returned to the source from which they were originally distributed, *e.g.* Education Office of area. In cases of doubt, reference should be made to the Secretary, The Scottish Council for Research in Education, 47 Moray Place, Edinburgh.

APPENDIX V—TABULATION FORM

Area.....  
Boys or Girls.....

After the tests are marked and the scores entered in the nominal rolls, four tabular statements for boys and four for girls should then be prepared for the area or district, one for each picture test, one for the total verbal tests, and one for the grand total, showing in each case the distribution of marks monthly, as set forth below. These should then be entered on the following blank forms. The number to be entered in each pigeon-hole is the number of pupils who obtain marks within the range shown on the left and were born in the month shown at the top.

SCORES. PUPILS BORN IN 1921 IN THE MONTH OF—

Picture Test. Page 2.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Totals.
40													
35-39													
30-34													
25-29													
20-24													
15-19													
10-14													
5-9													
0-4													
Totals													







PUPILS BORN IN 1921 IN THE MONTH OF—

GRAND TOTAL.

In Whole Test.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Totals.
120 and over													
110-119													
100-109													
90-99													
80-89													
70-79													
60-69													
50-59													
40-49													
30-39													
20-29													
10-19													
0-9													
Totals													

.....  
*Signature of Leader of Marking Committee*.....  
 .....  
*Name of Area*.....

It would finally be of great assistance if, in addition to the above necessary tables, each Marking Committee could, for a random sample of 1 per cent. of the boys' papers and 1 per cent. of the girls' papers, supply an "Answer Pattern" for the test—that is, could count how many times each answer in the whole test was given correctly. This return could conveniently be made on a blank copy of the test, showing on the outside the number of cases in the sample and the name of the area, and in the inside, against each question, the number of times (not the percentage) it was correctly answered.

*Copyright*

## APPENDIX VI

### CALCULATION OF PERCENTILE POINTS

Take the January row of the Verbal Test Tabulation for boys and girls together (p. 61) as example:—

Form the continued sum of the numbers in the row thus:

up to	9.5	19.5	29.5	39.5	49.5	59.5	69.5	76
	326	937	1916	3512	5302	6630	7031	7048

This reads, for example, "5302 children obtained marks below 49.5," *i.e.* marks 0 to 49.

The fifty percentile or median is the mark which separates the lower 3524 children from the upper 3524 children. It is clearly just above 39.5. If straight-line interpolation is adopted for simplicity, it is

$$39.5 + \frac{10(3524 - 3512)}{1790} = 39.57,$$

where 1790 is the number of cases in the group 40 to 49 marks. The reader may perhaps expostulate that the mark 39.57 still actually leaves 3512 of the cases below it and 3536 above it, and is not therefore the median. He will, however, appreciate that if the marks had been a continuum instead of a series of integral steps, so that the children obtaining the exact mark 40 were spread out from 39.5 to 40.5, there would then have been a point which would exactly have halved the total of 7048 cases: and 39.57 is this hypothetical but useful point.

An exactly analogous process is used to obtain the 84 percentile (using 84 per cent. of 7048, *i.e.* 5920.32). It is true that at the 84 percentile, and at the 16 percentile where the same plan was adopted, the device of straight-line interpolation or interpolation by proportional parts is less justified, since the percentile graph is there curved; and later, no doubt, when time permits, refinements will be made. But in the meantime this process suffices for our purpose.

## APPENDIX VII

### FITTING LEAST-SQUARE LINES

The least-square lines are fitted by the following process,<sup>1</sup> which treats each of the twelve points as of equal importance or weight, *i.e.* it ignores the differences in numbers of children from month to month. The much longer calculation, taking these differences into account, would in fact give substantially the same results. The medians on page 63 are taken as an example, and are written six of them down the first column, and then six *up* the next column, and their algebraic differences are multiplied by the odd-number series shown. The sum of the resulting column is then multiplied by  $7/2000$ , a very close approximation to the decimal which actually arises from the Normal Equations.

(a).	(b).	(a - b).	Multiplied by	
39·57	31·14	8·43	11	92·73
38·76	32·38	6·38	9	57·42
38·08	33·32	4·76	7	33·32
37·61	33·52	4·09	5	20·45
36·56	34·48	2·08	3	6·24
35·86	34·78	1·08	1	1·08
<hr/>				
226·44	199·62	26·82		211·24
				7
				<hr/>
				2000)1478·68
				<hr/>
				·739

Then 0·739 is the slope of the line, or the age allowance per month, in the equation

$$S = 0·739a - 61·349,$$

and the term 61·349 is found by taking 0·73934 times 131 months (the median age on the day of the test) *less* the average of the twelve medians, which is  $(226·44 + 199·62) \div 12$ .

<sup>1</sup> Cf. Thomson, *Brit. Journ. Educ. Psychol.*, vol. ii (ii) June 1932, p. 135.

## APPENDIX VIII—

## INTELLIGENCE TEST—SUMMARY OF RAW SCORES OF ELEMENTS

Age on Test Day.	128 Months.			129 Months.			130 Months.			131 Months.			132 Months.			133 Months.			
	Marks.	B.	G.	Total.	B.	G.	Total.	B.	G.	Total.	B.	G.	Total.	B.	G.	Total.	B.	G.	Total.
18	1	..	1	..	..	..	..	2	2	2	..	2	1	..	1	..	..	..	..
17	2	2	4	1	..	1	1	..	1	1	1	2	..	..	..	..	3	3	3
16	1	..	1	2	..	2	4	..	4	2	..	2	5	2	7	4	1	5	1
15	1	1	8	1	3	4	3	2	5	6	1	7	1	1	2	1	..	1	1
14	2	1	3	2	2	4	6	4	10	2	1	3	5	3	8	..	1	1	1
13	4	4	8	4	1	5	5	..	5	7	2	9	2	6	8	3	1	4	4
12	4	2	6	1	4	5	3	2	5	3	2	5	6	2	8	9	3	12	12
11	4	..	4	3	2	5	5	1	6	2	..	2	4	2	6	2	3	5	5
10	2	6	8	4	2	6	3	3	6	4	2	6	5	2	7	5	1	6	6
9	3	5	8	4	5	9	4	2	6	2	5	7	3	7	10	5	1	6	6
8	1	5	6	6	2	8	5	5	10	5	3	8	5	2	7	8	6	14	14
7	7	7	14	6	6	12	6	15	21	4	10	14	6	7	13	5	5	10	10
6	5	7	12	6	9	15	6	9	15	3	9	12	2	7	9	4	5	9	9
5	1	3	4	4	3	7	2	3	5	2	3	5	1	2	3	2	5	7	7
4	..	2	2	1	2	3	1	1	2	2	..	2	1	2	3	1	..	1	1
3	1	2	3	3	3	6	2	2	4	3	3	6	..	1	1	2	2	4	4
2	1	3	4	1	3	4	..	3	3	1	2	3	1	2	3	..	..	..	..
1	1	1	2	..	3	3	2	2	4	3	1	4	2	4	6	1	..	1	1
0	3	4	7	..	5	5	3	7	10	3	4	7	2	4	6	2	3	5	5
	50	55	105	49	55	104	61	63	124	57	49	106	52	56	108	54	40	94	94

## THE CUBES TEST AT HALIFAX

TARY SCHOOL PUPILS—MARCH 1932—PICTURE TEST (CUBES)

134 Months.			135 Months.			136 Months.			137 Months.			138 Months.			139 Months.			Totals.		
B.	G.	Total.	B.	G.	Total.	B.	G.	Total.	B.	G.	Total.	B.	G.	Total.	B.	G.	Total.	Boys.	Girls.	Total.
5	1	6	1	2	3	..	..	..	1	..	1	2	..	2	3	1	4	16	6	22
..	1	1	2	..	2	4	..	4	2	3	5	4	1	5	4	1	5	21	12	33
3	3	6	2	..	2	3	3	6	5	1	6	..	1	1	5	4	9	36	15	51
3	..	3	..	1	1	3	2	5	3	1	4	3	1	4	6	3	9	37	16	53
2	1	3	4	3	7	2	3	5	5	2	7	1	3	4	11	6	17	42	30	72
4	4	8	4	2	6	5	1	6	6	6	12	3	3	6	7	4	11	54	34	88
4	3	7	4	2	6	4	3	7	5	..	5	7	2	9	5	2	7	55	27	82
6	1	7	2	..	2	2	1	3	4	1	5	4	1	5	6	3	9	44	15	59
4	..	4	3	..	3	7	2	9	3	3	6	2	2	4	2	4	6	44	27	71
6	4	10	1	1	2	6	2	8	9	3	12	4	1	5	4	2	6	50	38	88
4	2	6	7	3	10	2	6	8	6	6	12	4	5	9	7	5	12	60	50	110
5	3	8	7	11	18	1	6	7	4	10	14	8	8	16	5	7	12	64	95	159
4	7	11	5	3	8	7	8	15	3	7	10	4	8	12	3	9	12	52	88	140
..	1	1	..	2	2	1	..	1	..	2	2	3	5	1	..	1	16	27	43	
1	1	2	2	..	2	1	1	2	3	3	6	1	1	2	..	5	5	14	18	32
1	1	2	1	1	2	1	2	3	1	3	4	1	2	3	..	4	4	16	26	42
1	4	5	1	1	2	..	1	1	1	1	2	1	2	3	..	2	2	8	24	32
..	4	4	..	2	2	..	3	3	1	1	2	1	4	5	1	2	3	12	27	39
1	3	4	1	1	2	2	2	4	1	2	3	..	3	3	1	5	6	19	43	62
54	44	98	47	35	82	51	46	97	62	55	117	52	51	103	71	69	140	660	618	1278

Average scores 9.93, 7.62.

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