The use of Irish in Teaching Children from English-Speaking Homes :

A Survey of Irish National Schools.

by

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INTRODUCTION

Since the establishment of the Irish Free State in 1922 the revival of Irish has been one of the principal aims of Irish education. But the movement for revival is older than the state; it had already begun by the middle of the nineteenth century, though it reached full strength only through the spread of the Gaelic League in the last decade of the nineteenth and the first two decades of the present century. Dr. Douglas Hyde, founder and first president, in the address[1] which really launched the League, called for a return to the language, manners, and culture, of the Gaelic past, and above all for the 'deanglicising' of Ireland. He and the other founder members felt that Irish people by adopting English ways and the English language had been untrue to themselves, and had abandoned what was finest in their cultural heritage. The feeling, of course, was not new, for as long ago as the late seventeenth century the Munster poet, Dáivi Ó Bruadair, satirised those of his

1. See Hyde (1931), pp.33 and 40 particularly. The address referred to was given to the Cumann Liteardha Náisiúnta in 1892; the Gaelic League was founded in the following year.

contemporaries who affected to speak <u>gósta gairbh-Bhéarla</u> ('a feeble imitation of the harsh English tongue').
What <u>was</u> new was the determination to effect the restoration of Irish. The more positive aspects of the Gaelic League's views about the Irish language would coincide with those of Thomas Davies who wrote[1]: 'the language which grows up with a people, is conformed to their organs, descriptive of their climate, constitutions and manners, mingled inseparably with their soil, is fitted beyond any other language to express their prevalent thoughts in the most natural and efficient way'.

The Gaelic League was also to a great extent the source of inspiration for the political movement which culminated in the establishment of the Irish Free State[2]; so it is not surprising that one of the first acts of the native government was to lay down that 'the Irish language be taught, or used as a medium of instruction, for not less than one full hour each day in all National schools where there is a teacher competent to teach it'[3]. The enactment was an immediate result of a National Programme Conference,

1. Cited in Ministry of Education (1954), p.41.

2. See Corkery (1954), p.127.

3. Department of Education (1954), p.66.

representative of many Irish organisations, called the previous year (1921) by the Irish National Teachers' Organisation (INTO). The Conference proposed that the work of the infant classes, and the teaching of history, geography, singing, and physical training, in the other classes should be conducted where possible through the medium of Irish. A second National Programme Conference, convened by the Minister for Education at the request of the INTO in 1925, reiterated this proposal, and advocated that the use of Irish as teaching medium be extended 'as far as possible'. The Department of Education adopted the resolutions of the second Conference and in 1934 made them obligatory on all national school teachers.[1]

Already, however, doubts had been expressed about certain aspects of the Irish language policy and especially about the wisdom of teaching children from English-speaking homes through the medium of Irish. Indeed the Second National Programme Conference received a number of protests which, agreeing with the experience of many of its members, caused the Conference to counsel prudence. Thus it insisted that the teachers should be competent to teach through Irish, and children be capable of profiting by it, before teaching

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1. Department of Education (1954), p.70. For the position of Irish in national schools at the present time, see below pp. 105 sq.

through Irish be attempted[1]. These qualifications were incorporated in the Department of Education's regulations governing the use of Irish as a teaching medium in national schools.

Growing misgivings however prompted the INTO ~~in~~ 1935 to issue a questionnaire to all its members 'to inquire into the use of Irish as a teaching medium'. The report[2], published in 1941, stated that the majority of replies were to the effect that 'the vast majority of the pupils do not receive anything like equal benefit from instruction through the medium of Irish, as compared with instruction through the medium of English'.

In 1950 a council was appointed by the Minister for Education to investigate the functions of the primary school and its curriculum, and inevitably the question of the place of Irish in national schools was considered. On this subject the majority of the council favoured[3] the use of Irish as medium of instruction; but a minority reported differently: 'The objective study carried out by the INTO has reinforced our conviction that the use of Irish as medium of instruction is particularly harmful'[4]. Opinion in the council about

1. Op. cit., pp. 68-70.
2. INTO (1941). This report is analysed in greater detail below in pp. 71 sq. and pp. 93 sq.
3. Department of Education (1954) paragraph 233.
4. Op. cit., p.304.

Irish as a school subject was also divided: 'the majority consider that the programme of the infant classes is essentially a language programme designed to give young children from English-speaking homes a basic and vernacular command of Irish and, having regard to the national aims in relation to Irish, they recommend that the present position be maintained'[1]; whereas a minority believed that 'the introduction of Irish in the primary school at the age of 10 - 11 would be in accordance with what is regarded as sound educational practice'[2].

More recently in a paper[3] read in Dublin (1957) before the British Association for the Advancement of Science, Reverend Dr. E.F. O'Doherty, Professor of Logic and Psychology at University College, Dublin, criticised the national school programme for reviving Irish, and recommended that children be taught through the medium of their mother tongue. He stated that, as a result of the revival policy, Irish children by mid-adolescence were retarded by a year to a year and a half. Moreover, clinical experience over twelve years, he claimed, had shown that the policy gave rise to much emotional disturbance in young people, and was a contributory cause of

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1. Op. cit., p.276.
2. Op. cit., p.304.
3. O'Doherty (1958 a).

emigration. In a subsequent address to Tuairim, Professor O'Doherty (1958b) developed the above points and added that dull children were particularly handicapped when taught through Irish. Since then the great debate has gone on; but neither before nor since, it must be said, has either side adduced in support of its views experimental evidence strictly applicable to Irish schools.

The following report of the first large scale investigation of a psychometric character carried out in national schools in the Irish Republic is limited in scope and objects. Its scope is confined to scholastic attainments in Irish, English, and arithmetic, which however (if we exclude religion) account for some 88%[1] of children's time in national schools. The two main objects of the investigation are: (i) to discover the effect on arithmetical attainments of teaching arithmetic through the medium of Irish to children from English-speaking homes; and to determine whether their attainments in Irish and English are effected by the language used in teaching arithmetic; (ii) to discover the effect of the entire programme for reviving Irish in national schools on the level of English attainment. The first object was pursued by comparing the attainments in arithmetic, Irish and English, of Irish children who were taught arithmetic through

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1. See below, p. 350 sq.

the medium of Irish with those of similar children who were taught arithmetic through the medium of English; the second object was pursued by comparing the attainments in English of Irish children with those of children in Great Britain.

However, before describing the present investigation and its findings, we must review the literature relevant to it.

CHAPTER 1.

REVIEW OF LITERATURE: 1 - LANGUAGE.

Each of the studies we are about to consider in the present chapter is an attempt to assess the effect, if any, of knowing or learning one language on a person's knowledge of, or capacity to learn, another language - the effect which a major part of our own survey in national schools was designed to investigate. Perhaps the most satisfactory way of determining whether there is such an effect or not would be to gain the ear of a large number of bilingual married couples and persuade one half of them, selected at random, to teach their children two languages, the other half to teach their children only one language. Then it would be possibhe to determine whether the bilingual children's command of the language they had learned in common with the monoglots were in any way affected by their learning simultaneously a second language. Such an experiment has never been carried out. Even if it had, the results would apply to the learning of only the two languages involved in the experiment, and to the introduction of the second language only at a particular age. It is unlikely that the results would be the same whether the two languages were French and Spanish or English and Chinese. If the experiment were carried out a number of times, varying the pair of language each time, we should probably find that the extent of the effect, always supposing there is one, would be related to the degree of resemblance between the two languages[1].

A further series of experiments, varying the age at which the bilingual children were introduced to the second language, would be required to ascertain whether this variation is related to the effect we wish to study.

The vast majority of investigators have had to be content with studying the advantages and disadvantages of bilingualism in situations over which they had no control. They have sought out two groups of children, one bilingual, the other monoglot, tested them for knowledge of the language common to both, and compared results. Where the comparison revealed a difference between the two groups, it could be attributed to the bilingualism of one group only on condition that the groups were equally matched in all factors which promote or hinder an individual's progress in learning a language, bilingualism excepted. The investigator's task is complicated by the fact that no-one knows all the relevant

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1. There are of course other factors which affect language learning in the case of bilinguals, such as, whether both parents are bilingual, the age at which parents learned the second language, methods of teaching the two languages to their children, schooling, etc., - it might be possible to randomise these, or alternatively to plan the research to take acfount of them.

factors. However, he can be reasonably sure that these are the principal ones: the home, the school, and the child's capacity to learn language[1].

Bernstein (1958 and 1961) has shown how different is the English spoken in middle class and working class homes. The experimental means most frequently employed to control those differences is a rating of the father's occupation which, though not an entirely adequate index to the influence of a home on language learning, enables the investigator to control gross differences in home influence. McCarthy (1954, p.586) cites several studies which show that there is a strong connection between socio-economic status of the family (determined by father's occupation) and the child's linguistic development. Schools too vary very much in their ability to increase children's command of language. Such variation can be controlled by selecting monoglots and bilinguals[2] in equal proportions from the same schools. Alternatively, where this is impracticable, ratings of teachers' ability to help children develop command of a language serve to control differences between teachers and between schools.

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1. We leave the detailed discussion of these variables and the methods of controlling them to the chapter in which our own method of controlling them is discussed. The brief note on each variable here is simply to make our comments on the research we are about to review intelligible.

2. I prefer 'bilingual' to the more common 'bilinguist'; and I beg the reader's leave to use it as a noun in place of the more cumbersome 'bilingual children'.

Finally, there are differences in children's capacity to learn language, which cannot be assessed with certainty or great precision. However, non-verbal IQs give a fairly good indication of this capacity, while they are remarkably independent of the factor of bilingualism. Thus, they can be reasonably used to control much of the variation in this capacity without at the same time interfering with or disturbing differences in linguistic performance which may arise because of bilingualism. None of the three devices for removing bias is wholly adequate on its own, yet taken together they should make possible a reasonably unbiased comparison.

A source of continual confusion in the literature on bilingualism is the words 'bilingual' and 'bilingualism'. One writer, Lee (1932), classes as bilingual all new Brunswick students who had one relative in their homes who was a native speaker of a foreign language; the bilinguals tested by other writers were able to converse fluently in two languages before they went to school. Thus the question of what is meant by the term 'bilingualism' arises continually. Confusion has however been lessened by the introduction of the term 'degree of bilingualism'[1], though it too has been used rather loosely. For example a writer who has studied the English vocabulary of Spanish-speaking children in the U.S.A. may mean no more by 'degree of bilingualism' than the extent to which Spanish is spoken in the children's homes. For other writers 'degree of bilingualism' refers to both languages, being the ratio of time during which Spanish is spoken in the home to that during which English is spoken. In neither of these senses however is the children's grasp of the two languages assessed directly, though one would agree that grasp of a language is closely related to the length of time during which children use it. 'Degree of bilingualism', in either sense, is determined by means of a questionnaire about the language or languages of the home. There is only one study among those to be considered in which 'degree of bilingualism' was determined by means of tests of children's knowledge of the two languages. Peal and Lambert (1962)

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1. Mackey (1962) shows what a wealth is enclosed in this portmanteau 'degree of bilingualism' by distinguishing the phonological, grammatical, graphic, lexical and semantic, aspects of any language; and by distinguishing a person's command of these aspects in speaking, listening, reading, or writing. For example a person might have a more perfect command of the grammar of language A than of language B, but his reading vocabulary in language B might be larger than in language A. So far as we know, no psychological studies in bilingualism have employed so elaborate a scheme of linguistic skills in determining degree of bilingualism. See also Diebold (1961).

assigned Montreal children to monoglot and bilingual groups according to their scores on certain tests of English and French. The children were all native French-speakers; only those were accepted for the bilingual group whose command of English as revealed by these tests was equal to their command of French. Monoglots and bilinguals were then compared for attainments in French. The procedure raises a thorny problem which the authors fail to solve. Perhaps only the more linguistically gifted French-Canadians were capable of acquiring by the age of 10, when they were tested, a command of English equal to their command of French. If so, comparisons in linguistic performance of monoglots with these bilinguals are biased in favour of the latter. It would seem, then, that a home-language-questionnaire has a certain advantage over Peal and Lambert's tests as a means of assessing degree of bilingualism, since replies to the questionnaire are unlikely to be related to linguistic ability except in so far as they are related to socio-economic status.

Almost all studies in bilingualism are of children or young persons who are learning or have learned two languages simultaneously; for example, Texan children who are learning Spanish and some English at home, English only at school. If the learning of Spanish hinders the learning of English one would expect the effect to be proportional to the extent to which Spanish is spoken in the home. This hypothesis is the starting point of several investigations. The hypothesis usually takes the form of a question: is degree of bilingualism, as measured by a home languages questionnaire, related to progress made in one or both languages, as measured by linguistic tests? As the effect in question, if it exists, is often presumed to be a detrimental one, it may be called a 'balance effect'[1], e.g., the more Spanish a child learns the poorer his knowledge of English and vice versa.

The great majority of studies find that there is a balance effect; however, there are a few in which the opposite was observed, i.e., the learning of one language appeared to help the learning of a second, and a few in which the learning of one language appeared to have no influence on the learning of a second. Part of our task will be to examine the reasons why findings differ. We shall also attempt to ascertain whether any generalisation about the effect of bilingualism on language learning is possible on the basis of the evidence which has hitherto been collected.

Because the literature ~~about~~ the linguistic effects of bilingualism has not been fully reviewed elsewhere, it will be reviewed here in detail, grouping the various papers so that the implications of the findings are as clear as possible. However, since

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1. In the sense of weighing scales.

the number of papers is large, and the variety of linguistic attainments studied very great, a general summary and discussion of findings will be given to round off the review.

In a number of studies, arithmetic tests, as well as tests of language, were administered. We shall consider the arithmetical attainments of bilingual children in a separate chapter.

(1) <u>Studies in which bilinguals excelled monoglots:</u>

<u>Malherbe</u> (1946) tested more than 18,000 white South Africans in standards IV. to X. He claims that the results show that children from monoglot homes who were taught through the medium of the second language (English in some cases and Africaans in others) excel in linguistic skills similar children taught through the medium of their mother tongue. Children who attend 'bilingual' schools, he says, excel children who attend 'unilingual' schools[1] in knowledge of their second language whether it be English or Africaans,

1. The 'unilingual' school uses only one of the two languages as a medium of instruction, but all schools teach both languages. There is a variety of 'bilingual' schools depending on whether there are separate streams for the different media, or whether the same class is taught now through English, now through Africaans, or at one level through one language, at another level through the second language.

while in their 'mother tongue there is no loss whatsoever on the part of those attending the bilingual school.' Children who are **below** average in IQ do best of all in a bilingual school: 'not only do they more than hold their own in their first language but in their second language their gain was nearly twice as big as that registered by the higher intelligence groups' in other schools.

Malherbe's report, which is described as a preliminary one and which so far has not been superseded by a fuller one, is quite inadequate. We are not told how the children were selected in the first place, or the numbers in each linguistic group at each age level. All the children tested appear to be bilingual to some extent, but it is not possible to learn from the report the extent to which any linguistic group used the two languages, or to learn variations in this respect within a group. Malherbe does not appear to have made any adequate attempt to control such variables as teaching or socio-economic status. When we are told that 'intelligence was kept constant' we cannot discern from the context what is meant. Tests of both verbal and non-verbal reasoning were employed, but we are not told how these were used to match groups; the defect is tantalising because we are told that linguistic groups attending different types of schools vary significantly in mean IQ. In order to evaluate the work we should require much more information about the tests employed[1] than is given; about the manner in which the results of different language tests were combined to yield a composite score, for some tests (we are not told which ones) were given more weight (how much we do not know) than others; about the statistical treatment of data - we are simply told that certain differences are significant and that others are not. Finally, one may well question the value of comparisons based on composite scores which are obtained by adding English and Afrikaans scores together as Malherbe does in one instance.

Especially interesting is a study of English - Afrikaans bilingualism in Natal carried out by McConkey (1951). Natal had in 1942 introduced an ordinance (1) that $2\frac{1}{2}$ to 4 hours per week be devoted to teaching the 2nd language above substandard 2; (11) that part of the curriculum be taught through the medium of the 2nd language for $2\frac{1}{2}$ to 5 hours per week in and above standard 2 - previous to this children were generally taught through the medium of their mother tongue exclusively. McConkey was commissioned to investigate the effect of the 2nd part of the ordinance, for which purpose he administered vocabulary tests of English and Afrikaans to all the 7th, 8th and 9th standard pupils in the State.

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1. We read that most of them were standardised tests, but we are not told which ones or for what age levels they were standardised.

Both forms of the test had been standardised for S. Africa before the war, so the author was able to compare pre-war performance level with the level in 1949, when he carried out the testing. By 1949, 7th and 8th standards had been educated in accordance with the new ordinance, but 9th standard which had started out under the old regulations had continued under them, at least as regards use of the 2nd language as medium of instruction. McConkey hoped to be able to assess the effect of the 2nd ordinance on vocabulary by comparing the test results for 9th standard with those for the other two standards. He found that children in 7th and 8th standards whose mother tongue was English[1] obtained significantly higher means for Afrikaans vocabulary than the pre-war norms for such children; 9th standard showed no such improvement. In English these same 7th and 8th standard children obtained higher means than the pre-war norms, while the 9th standard children obtained a lower mean than the norm. (The statistical significance of these differences is not discussed.) Children in 7th, 8th and 9th standards whose mother tongue was Afrikaans

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1. That is, the majority of children in 'English-medium schools' for which McConkey's figures were obtained; but these schools contained a proportion of children whose mother tongue was Africaans. Naturally if the proportion of Africaans speakers varies from class to class, comparisons between classes in knowledge of vocabulary are upset - but McConkey does not discuss this point.

obtained means for English which were all significantly higher than the pre-war norms; in Africaans the means obtained by all three standards were also higher than the pre-war norms.

Yet one cannot be completely confident about these results. Firstly, the pre-war norms were for S. Africa as a whole and not for Natal alone; hence they can be used for the purpose of inter-standard comparisons only. Secondly, the impression is gained from the findings for 9th standard native Africaans-speakers that other factors besides the ordinance have been operative, since these children's norms both in Africaans and in English are higher than the pre-war norms, though they had not been taught through the medium of English. Thirdly, the fact that, alone of the three standards whose mother tongue was English, 9th standard obtained means which are lower than the norms in both English and Africaans suggests that there is an uncontrolled variable upsetting the comparisons which McConkey wishes to make. These observations are in keeping with the comments of teachers who for the most part thought that the use of the children's second language as medium of instruction in no way affected their command of either language; and that where the use of the 2nd language as medium was accompanied by improved command of the 2nd language, the improvement was to be attributed to factors other than its use as medium, e.g. to better teaching methods, or increased interest in the 2nd language on the part of parents. The author found considerable resistance by teachers and children alike to the use of the 2nd language as medium of instruction. The teachers considered it an inefficient way of teaching. Finally, it must be observed that non-verbal IQ, socio-economic status, and variations between teachers in teaching ability, were not controlled.

Two studies of Jewish children, one by Davies and Hughes (1927) in London and the other by Lee (1932) in New Brunswick must also be mentioned here. Davies and Hughes found that Jewish children aged 8 to 14 years obtained higher mean scores than monoglots in the same schools when tested with the Northumberland Standardised Tests of Intelligence, English and Arithmetic. The authors do not state, however, that theirs was a study of bilingualism. In fact they do not use the word bilingual or bilingualism at all. The only reason for mentioning the study in this context is that it has been cited in such papers as Arsenian (1937), Darcy (1953) and in the Aberystwth biliography of bilingualism (1960) as a study of bilingualism. Lee found that her Jewish group excelled all other bilingual groups as well as a monoglot group when tested with a non-verbal reasoning test (Otis Self Administering Test) and a test of history vocabulary[1]. Her Ss were 11th and 12th year students of

1. Lee composed a vocabulary test of the sorts of English words encountered in studying modern European and American history. Many of the words in the test are not technical and might be encountered in subjects other than history.

Modern European and American History in New Brunswick Senior High School. Socio-economic status, however, was not adequately controlled, a particularly serious defect in a comparison of Jewish with non-Jewish children[1]. Moreover, we are not told the extent to which the Jewish group was bilingual. The group included any child who came from a home where even one member of the family knew Yiddish! The groups were not matched in non-verbal reasoning ability and the statistical analysis was inadequate.

The best reported study to be reviewed under this sub-heading is that of Peal and Lambert (1962) who matched for age, sex, and socio-economic status[2] a group of bilingual (French and English) with a group of monoglot (French) children in Montreal. All the children were in their 11th year and attended one of six French schools under the jurisdiction of the Catholic Commission of Montreal. The six schools were 'considered middle class by the school

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1. For a fascinating comparison of Jewish and Italian attitudes to education and their influence on child rearing see Strodtbeck (1961). He shows how deceptive comparisons of Jewish and non-Jewish children are likely to be, unless the research worker is aware of these attitudes and is able to make the appropriate allowance for them.

2. Socio-economic status was determined 'on the basis of information received from the child, the school records, the school principle and the parents'. The authors used 7 socio-economic classes, and matched the groups by ensuring that the numbers of bilinguals and monoglots in each of the 7 classes were equal.

commission'. The two groups of children, 160 in all, were chosen from a much larger number by means of four measures of bilingualism. Next the children sat a variety of tests which included the Lavoie-Laurendeau Test of General Intelligence[1] (LL) and the number subtest of the Primary Mental Abilities (Thurstone) which was administered in French. Each child's marks in French dictée, lecture, composition, and his grade in class at the school mid-term examination, were also obtained.

Bilinguals achieved significantly higher LL non-verbal and total IQs than monoglots; bilinguals also obtained significantly higher school grades than monoglots and significantly higher scores in the LL vocabulary (French) subtest. Differences between groups in the PMA number test, dictée, lecture, and composition, were not significant. The authors compared mean LL verbal IQs, adjusted by analysis of covariance for difference in mean LL non-verbal IQs; the adjusted means did not differ significantly. The authors did not compare mean LL vocabulary, number, dictée, lecture, or composition, scores adjusted for differences in mean LL non-verbal IQs; these adjustments might have affected the interpretation of the entire study appreciably.

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1. Lavoie and Laurendeau (1960) - the test is not unlike the WISC; it enables non-verbal, verbal, and total, IQs to be calculated for each S. The test was standardised on Ss whose native tongue was French.

Peal and Lambert point out that their research does not enable them to determine (1) whether the bilingual children became bilingual because they possessed a greater facility for learning language than monoglots; or (2) whether the learning of two languages tended to augment each child's abilities in those respects over which the comparison extended. The authors appear to favour the second interpretation, but the present writer favours the first for the following reasons.

Peal and Lambert's words are interesting: 'In a bilingual community such as Montreal, it is a very great asset and at times a necessity for French-Canadians to know English. These advantages may be realized more fully by parents of higher intelligence who may be more inclined to encourage these children to learn English. Parents of higher intelligence may be expected to have more intelligent children .... The more intelligent children may themselves realize the value of knowing English and therefore seek opportunities to learn it'. We may add that intelligent parents are also more likely than dull ones to help their children to achieve a higher standard of French (the mother tongue) attainments if only through conversation of greater conceptual clarity and discernment[1]. To lend force to these observations we must note that bilinguals excelled monoglots by 14 points in LL non-verbal IQ, 11 points in LL verbal IQ and 14 points in LL total IQ. Indeed one could argue that the bilinguals had not developed their knowledge of French as well as could be expected in view of their superiority in IQ, since their marks for dictée, lecture, and composition, were no better than those of the monoglots[2]. If one seeks to answer the question whether the bilinguals' IQs are higher than the monoglots' because their bilingualism has enhanced their reasoning ability or because the children who tend to become bilingual in Montreal possess greater reasoning ability to begin with, we have - apart from the argument given above - Peal and Lambert's summing up of previous studies in bilingualism: 'the weight of evidence so far presented seems to support the contention that there is no significant difference between monolinguals and bilinguals on non-verbal intelligence,

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1. Terman and Merrill (1937) say that the vocabulary Test is 'the most valuable single Test' in their revision of the Stanford-Binet scale. Correlations for single age groups between vocabulary score and IQ had a mean of .81 - p.302. The reader will recall that it was in the LL vocabulary test that bilinguals were superior to monoglots.
2. M.D. Vernon (1958), pp.75-77 cites several studies in which correlations of the order of .35 were obtained between measures of reading ability and non-verbal reasoning with children of about the same age as those tested by Peal and Lambert; between measures of reading and verbal reasoning ability the correlations ranged from about .6 to .7. P.E. Vernon (Ed. 1957), pp.125-127, cites studies where correlations of the order of .5 were observed between English essay marks and verbal IQs in the case of 11 + children in Britain.

but the bilinguals are likely to be handicapped (obtain lower scores) on verbal intelligence measures'. Finally, we should like to repeat the comment on the method of selecting bilinguals and monoglots which we made in the introduction to this chapter. In selecting for the bilingual group native French-speakers who had become balanced bilinguals, the authors probably selected children who on the whole were highly gifted and had a flair for language learning. So any linguistic comparison between these children and the monoglots was biased in favour of the former.

The only conclusion which one can base on these four studies is that they fail to isolate or adequately control the influence of bilingualism and therefore do not reveal its effect on the development of children's linguistic skills.

(ii) Studies revealing no difference between bilinguals and monoglots.

Ronjat (1913) who studied his bilingual son's progress in French and German in great detail, claims that bilingualism need not have any ill effects on a child's knowledge or command of either language. Leopold (4 vols. 1939-50) makes a similar claim which he bases on his observations of his bilingual daughter. Castillejo (1933) ran an experimental school of language learning in Madrid where children were taught at least two foreign languages in addition to their mother tongue. He says: 'the children of ten and eleven years have been sent to take examinations in other schools, and this test has enabled us to verify that they are not in the least retarded compared with children of the same age, who have received twice the number of hours of teaching in the mother tongue.' Unfortunately none of these three works is a scientific comparison of bilingual and monoglot children; they are mentioned here because they have been cited so frequently in support of the thesis that bilingualism produces no linguistic ill-effects.

Ladd (1933) divided 315 American children in grades 3 to 5 into three groups of varying degrees of bilingualism. The groups were equated for chonological age and Pintner Non-Language mental age. When each child's ability to read English was measured, it was observed that reading age decreased as the degree of bilingualism increased; but, the author goes on to say, the differences are not significant. Results obtained by Jews and Italians when considered separately led the author to the same general conclusion. However, it would appear that she has made an erroneous judgment since she regards no difference as significant unless it is three times as great as its standard error. (It is accepted as a rule of thumb that a difference which is three times as great as its probable error is significant.) Using the standard deviations of means[1] for the different linguistic groups the present writer was able to show that the differences in RA between monoglots and Jews who heard a foreign language at home is significant; and that the difference in RA between monoglots and Italians who spoke Italian at home is significant. Clearly this study is misplaced in this section and ought to be placed in the next one; the only reason for placing it here is Dr. Ladd's own statement that differences between linguistic groups are not significant. For the sake of completeness it must be added that though a measure of socio-economic status was obtained it does not appear to have been employed in the above comparisons (which are only subsidiary to Dr. Ladd's main purpose), and that differences in non-verbal IQ between monoglots and the various linguistic categories of Jews and Italians were not controlled.

Another study which resembles Ladd's is that by Schiller (1934). She compared in English attainments such as reading and vocabulary two groups of elementary school Jewish children in New York, one roughly speaking bilingual

1. In the formula $SE_{m_1 - m_2} = \sqrt{\frac{SD_1^2}{N_1} + \frac{SD_2^2}{N_2}}$

(Yiddish and English), the other roughly speaking monoglot (English). While the monoglots obtained higher scores for the most part, the mean differences were not significant. Conclusions about the effect of bilingualism ought not to be drawn from this work, however, since Schiller did not take account of variations in age, non-verbal reasoning ability, or socio-economic status, in the above comparison.

Jewish children were also studied by Murdoch, Maddow and Berg (1928). The children were 149 girls living in New York who were in grade 7 at school. Degree of bilingualism was measured by means of a home-language questionnaire, filled in by the children, which was supplemented by interviews in doubtful cases. The children sat three tests: Otis Intelligence Scale (verbal), Dodd's International Test (verbal) and Thorndike Word Knowledge (English). Correlations between measures of bilingualism and each of the three tests scores were not significant. It must be noted, however, that non-verbal IQs and ratings of socio-economic status were not obtained and used as means of control[1].

Professor Bovet (1935) reported an interesting

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1. A regression analysis would have been required to control the inter-correlations of the various variables; all the more so as CA was found to correlate negatively and significantly with the two measures of degree of bilingualism employed. In calculating correlations raw scores were employed.

experiment carried out by the director of a South African school, M.E.T. Logie. The pupils in Mr. Logie's school were taught bilingually, the same lesson being taught in Afrikaans and then repeated in English or vice versa. After four years of experiment these pupils together with others in unilingual schools were tested in English, Afrikaans, arithmetic and geography. The bilinguals were not excelled in any of these subjects by the monoglots. As described by Professor Bovet, however, the research does not appear to have been sufficiently scientific, in that important variables were not adequately controlled, and consequently it cannot be taken as illuminating the effects of bilingualism.

Symonds (1924) compared two groups of children of Chinese parentage attending two public elementary schools in Hawaii. One group took lessons in Chinese outside school hours while the other did not; the groups did not differ significantly in age, school grade or in the amount of Chinese spoken in the home. Both groups were tested in English reading, word knowledge, sentence completion and in non-verbal reasoning ability. There was not a significant difference between group means in any of the four tests.

This study does not teach us very much about the effects of bilingualism because, apart from the fact that socio-economic status was not taken into account, no attempt was made to measure knowledge of Chinese, and so we do not know whether the group which took Chinese lessons was really more bilingual than the other group. Moreover, the fact that one group took Chinese lessons voluntarily while the other did not may mean that the groups differed in various respects, such as parental attitude to education, which reduce the value of the comparison.

Professor Terman (1918) studied the relationship between mental age (MA) and the English vocabulary of bilingual American children who spoke either Italian or Portugese as well as English. Controlling MA (based on a verbal-reasoning test) he found that the children with a MA of about 12 years or more had as large a vocabulary as American monoglots (English speaking), though in the lower MA ranges they were excelled by the latter. The study suffers from serious defects however. Almost certainly Terman diminished the difference which he wished to study by equating groups in verbal MA. Moreover, neither mean CAs nor numbers of the children in each subdivision are given. Again no attempt was made to control socio-economic variation or differences between schools. In short this study, which is so often cited, can form no basis for satisfactory conclusions about the effects of bilingualism on vocabulary.

Three studies remain. One is by McCarthy (1930) who compared 14 bilinguals aged $1\frac{1}{2}$ to $4\frac{1}{2}$ years with monoglots of the same age and socio-economic status. The groups did not differ in 'mean length of response, which when applied to larger groups, has proved a very reliable index' of linguistic development. Her number of bilinguals was very small however, and she did not control non-verbal reasoning ability (it would have been difficult to do so in the case of children so young), so one cannot be confident about her conclusions.

The two other studies, one by Spoerl (1944) and the other by Black and Grinder (1959), are of grown-up bilinguals in the U.S.A. Spoerl compared 24 women and 45 men bilinguals (they had been bilingual before going to primary school) with a group of monoglots matched for age, number and sex. All Ss. took the Hermon-Nelson Test of Mental Ability (which contains two language, two number, and one non-verbal reasoning, section) and the Perdue Placement Test in English (which contains questions on punctuation, grammatical classification, identification of grammatical mistakes, sentence structure, reading, vocabulary, spelling). No significant difference was found between group means in either of the tests or in any sub-section of either test. Many have taken this result as proof that the handicap of bilingualism, if real, disappears with age. But that conclusion is doubtful for the following reason. A great many of the papers to be considered in the next section show that there is a marked tendency for bilingual children in the U.S.A. to be retarded in school grade by comparison with monoglots (i.e. to be much older than monoglots in the same grade) and to leave school at a point lower down the academic ladder than monoglots. It is quite likely then that those bilinguals who reach university level possess greater linguistic ability and also greater intelligence than their monoglot fellow student; and so it is quite likely that Spoerl's results were biased in a way which she does not consider. The likelihood of bias is increased by her failure to control adequately the socio-economic variable.

The same qualifications apply to the work of Black and Grinder who tested 40 Japanese-English bilinguals and 37 monoglots (English). All came from poor families which had immigrated to the U.S.A. three generations previously; all spoke pidgin English; all were college freshmen. No difference in mean score between the two groups (which are both very small) on a variety of English tests was statistically significant. Even if Black and Grinder had avoided the difficulties which they shared with Spoerl, it would have been interesting had they included a control group of English-speaking stock to see whether either of their groups had achieved the English standards of the latter.

In this subsection twelve papers have been reviewed. In none was the bilingual factor isolated and controlled adequately, and so one has insufficient evidence upon which to base a satisfactory generalisation about the effect, or lack of effect, of bilingualism on language learning. Even taking them together their impact is slight.

(III) Studies in which monoglots excelled bilinguals.

Ten studies can be found in which Spanish-English bilinguals were compared with English-speaking monoglots for knowledge of English. The first is the 1925 survey[1] of the Porto Rican education system which involved setting achievement tests to about 8,000 bilinguals in public elementary and secondary schools. The children, whose mother tongue was Spanish, had been taught English in all grades, while English was the medium of instruction for all school subjects, except physiology, in 5th and all higher grades. The Stanford Achievement Test, modified to suit local conditions, was administered in English to the children who were being taught through the medium of English. Children in grades lower than 5th took the mechanical arithmetic test. In all aspects of English thus tested,

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1. International Institute of Teachers College, Columbia University (1926).

spelling excepted, Porto Rican performance was very much inferior to American as indicated by the test norms. A Spanish translation[1] of an alternative version of the Stanford Achievement Test was administered to a different (apparently) sample of children at the same grade levels as previously. The results obtained by and large, were superior to those obtained with the English version in Porto Rico, but still inferior to those obtained in the U.S.A. It was found from a study of children's ages that Porto Ricans were older, grade for grade, than American children by about $1\frac{1}{2}$ years per grade on an average.

The authors do not claim that Porto Rican performance was poorer than American because of a language handicap - the two countries differ in too many respects to allow of such a conclusion - but they believed that the former in sitting the Stanford Achievement Test in English laboured under a handicap, since their performance with the Spanish version was better. Their conclusion however, rests on two unverified assumptions: (1) that the children tested

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1. Though great pains were taken to make the translation equal in difficulty with the original, no tests were carried out to ascertain whether the translators were successful in their endeavours. Such tests might have been carried out with 'balanced bilinguals' - a term familiar to readers of Professor Wallace E. Lambert's papers-meaning bilinguals whose command of one language is as great as their command of the second.

with the two versions were comparable in all relevant respects, and (2) that the difficulty level of the two versions is the same (i.e. for 'balanced bilinguals').

Arsenian (1937) reports an enormous study by H. Von Stecker in Mexico on the basis of which the latter concluded that in either language the linguistic skills of bilinguals are on the average inferior to those of monoglots; though he adds that other things being equal bilinguals acquire a new language with greater ease than monoglots. Arsenian points out that Stecker does not report on his method of research and does not give his data, so we have no way of assessing the validity of Stecker's conclusions.

Eight of the remaining nine studies of Spanish - English bilinguals may be considered together, those by Manuel and Wright (1929), Delmet (1930), Fritz and Rankin (1934), Manuel (1935), Kelley (1935), Johnson (1938), Demarest (1946) and Keston and Jimenez (1954). They report research carried out in five states, Texas, California, Kansas, Arizona and New Mexico covering an age range which extends from the 2nd grade of elementary school to the 4th grade of high school. A total of 1909 bilinguals and 3554 monoglots were tested with a great variety of English tests, the results of which revealed that there is a very marked difference between the groups, monoglots being superior. Delmet, Fritz and Rankin, Kelley, Manuel, and Johnson, mention another important difference between the groups, i.e., grade for grade bilinguals are considerably older than monoglots. Koch & Simmons (1926) and Garretson (1928) had previously observed this difference. Since the comparisons reported in the first six papers mentioned at the beginning of this paragraph were between bilinguals and monoglots in the same grades, the difference in English score must be interpreted in conjunction with the difference in age. Almost certainly the difference in score would have been greater had children of the same age rather than children of the same grade been compared. Indeed Manuel gives his results first grade by grade and then age by age and shows that bilinguals and monoglots differ more in the second comparison than in the first; the reading ages of bilinguals fell on an average 3.6 years below chronological age, those of monoglots fell on an average .3 years below chronological age. Additionally, two of the papers, those of Manuel and Kelly, report a tendency for the number of bilinguals in the higher grades to be smaller than the number in the lower grades, a tendency which was not found to nearly the same extent in the case of monoglots. Manuel and Wright found that very few bilinguals by comparison with monoglots reached university. There would, then, appear to be a tendency for Spanish-English bilinguals in the U.S.A. to finish their schooling at a lower level than monoglots.

The work of Keston and Jimenez deserves to be treated in a little more detail. They selected 22 bilingual boys and 28 bilingual girls at random from five city schools in Albuquerque, New Mexico. The children were about 8½ years old. They were tested with the 1937 revision of the Stanford-Binet test, Form M being administered in English and Form L in Spanish. The Spanish translation had been made by Professor Cebrain of the National Institute of Psychotechniques in Madrid. The mean IQ obtained with Form M (English) was 86.0, with Form L (Spanish) 71.8. From these results the authors conclude that the bilinguals' knowledge of Spanish was even poorer than their knowledge of English. However, it is necessary to qualify, without denying, their conclusion (based on so large a difference in mean score) by noting (i) that the mean difference may be due in part to differences other than linguistic ones between the two forms of the test; (ii) that we do not know whether 'balanced' Spanish-English bilinguals in America would obtain equal IQs with the English and Spanish Forms used; (iii) that we do not know how valid a test of linguistic attainments the Stanford-Binet test is.

The eight studies we have been discussing share the defect that differences in socio-economic status between the groups compared were not controlled. Manuel, who classified his Ss in socio-economic categories, shbwed that the groups he studied differed markedly in socio-economic status, there being a greater proportion of monoglots than bilinguals in the higher categories and a smaller proportion in the lower categories. Fritz and Rankin reported a similar difference which they attempted to counteract by matching 12 monoglots with 12 bilinguals, selected from their total of 131 Ss, for socio-economic status, age, and verbal IQ. The 12 monoglots still excelled at English as assessed by the New Stanford Achievement Test, Form V, but the numbers compared are too small to support a general conclusion.

A second defect is that differences between groups in non-verbal reasoning ability were not studied and controlled. For the most part the authors seems to have simply selected (by means of interview or questionnaire) all the bilinguals and monoglots in the school or schools or area of their choice, and tested these children in English. There is danger, therefore, of serious disparity between monoglots and bilinguals in non-verbal reasoning ability, which, while largely independent of linguistic environment, is related to performance on tests of language.

In four of the papers, those by Manuel and Wright, Manuel, Kelley, and Johnson, we are told little about degree of bilingualism except that the bilinguals came from Spanish-speaking homes. Delmet, and Keston and Jimenez, interviewed parents to ascertain that the children spoke both languages at home. Fritz and Rankin classed their Ss as English-speaking, 'usually foreign-speaking' (speaking a foreign language at home) and a third group which they termed 'English-Foreign' (in whose home a language other than English was sometimes spoken); they did not test this third group.

In most of the studies differences between schools were controlled reasonably well by selecting representatives of both types of children from the same schools. Manuel's study is an exception, for he states that there were for the most part separate schools for bilingual and monoglot children in the Rio Grande Valley where he conducted his research.

In spite of these qualifications we are left with a firm impression that differences in socio-economic status, non-verbal reasoning, and possibly schooling, between Spanish-English bilinguals and English-speaking monoglots in the U.S.A. (leaving aside for the moment Porto Rico and Mexico) cannot fully explain differences in performance level on tests of English, so great are the latter differences. The impression is further strengthened by Carrow's (1957) findings in a well-controlled comparison. Carrow selected 50 bilinguals in 3rd grade from three schools in San Antonio, Texas, whom she matched for age (mean age 8½ years) and socio-economic status (Backman Scale) with 50 monoglots in the same schools. The bilinguals spoke Spanish and English in their homes and had been able to converse in either from the age of three. The groups did not differ significantly in non-verbal reasoning as assessed by means of the Otis Quick-Scoring Mental Ability Test, Alpha. The California Test of Achievement (silent reading, spelling, arithmetic reasoning), the Durrell-Sullivan Reading Capacity Test (to test 'hearing vocabulary'), the Gilmore Oral Reading Test (accuracy and comprehension) and the Fairbanks test of Articulation for Non-Readers (articulatory proficiency) were administered to all Ss. Further, a three minute sample of each child's speech in re-telling a story he had just heard was recorded and analysed under a number of headings such as, length of clause, number and type of grammatical errors etc. The mean score obtained by monoglots in each of the tests was greater than that obtained by bilinguals; but only in oral reading accuracy and comprehension and in 'hearing vocabulary' was the difference significant.

Monoglots used a significantly larger vocabulary than bilinguals in the recorded speech, though the groups did not differ significantly in the actual number of words spoken, in the length of clause used, or in 'degree of subordination'. Articulatory defects were observed in the speech of 52% of bilinguals and of only 14% of monoglots. Bilinguals made about twice as many grammatical errors as monoglots, the main sources of error in the speech of the former being the misuse of tenses and prepositions. These deficiencies of bilinguals in oral and aural command of English may reasonably be attributed to their linguistic home background.

We conclude from these eight studies of Spanish-English bilinguals in the U.S.A. that bilinguals have not as good a knowledge of English as English-speaking monoglots, and that as a result their school work suffers. No study was found which disagrees with this conclusion.

The precise reason however for the inferiority of bilinguals in English is not obvious. It might be due to the 'balance effect', i.e., to an inability to learn two languages simultaneously as well as the monoglot learns either of the two by itself; or it might be due simply to a deficiency in their family's knowledge of English. In America, families which speak both Spanish and English are usually in process of loosing the former and learning the latter. In some cases such families will not have had sufficient time or opportunity to learn English properly, and naturally the English they teach their children will not be better than their own. The evidence does not permit us to choose between the alternatives, so we shall rest content for the present with raising the difficulty.

Italian-English: Colvin and Allen (1923), Grabo (1931), and Lee (1932), studied the Italian-English bilinguals' knowledge of English. Colvin and Allen found that the bilinguals' marks in English were very much[1] poorer than those of English-speaking monoglots. Grabo attempted to measure the vocabularies of bilinguals (Italian-speaking homes) and monoglots (English-speaking homes) matched for 'mental ability'. He claims that the monoglots knew as many words in English as the bilinguals knew in English and Italian together. The bilinguals' English vocabulary was about two-thirds the size of that of the monoglots. Lee, whose work has been mentioned previously[2], found that the 'history vocabulary' in English of her Italian-English bilingual group was smaller than that of any other group which she studied, bilingual or monoglot. To these studies may be added that by Ladd (1933), also mentioned previously[3], since the present writer was able to show that the difference in ability to read between monoglots and bilinguals who spoke Italian at home was significant.

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1. The present writer was able to test these differences by means of the X^2 test and show that they are significant.

2. See above, p. 20 .

3. See above, p. 26 .

These studies suffer from the same defects as the majority of Spanish-English ones: failure to control differences in socio-economic status and in non-verbal reasoning ability, and failure to assess degree of bilingualism. But one feels sure that even had these variables been controlled, monoglots would still have been found to have a better knowledge of English than bilinguals, so great in most cases were the differences between the two types of children tested. And Grabo's work would seem to show that the bilinguals' knowledge of Italian was inferior to that of Italian speaking monoglots, (we are reminded of Keston and Jimenez's findings), Of course Italians, like Spaniards, in the U.S.A. are in process of loosing their ancestral tongue and learning English; and so we do not know whether children of Italian parentage are weak at English because they cannot learn two languages as well as monoglots learn one, or because the English taught them by their parents is bad English.

Welsh-English: There are seven studies of Welsh bilinguals.

Saer (1922) tested all the children between the ages of 7 and 12 in five rural and two urban schools. They numbered about, 1,400, some of whom were from Welsh-speaking homes, some from English-speaking ones, while for all, English was the language used in school. Saer used the first

100 words of the Stanford Scale to test their English vocabulary; he tested Welsh vocabulary with a newly constructed test. All the children were asked to write an essay in English on a given topic; the bilinguals were asked to write a second essay in Welsh, and the monoglots in English, on another topic. On analysing the results Saer claimed that monoglots had a more extensive vocabulary in English than the bilinguals had in either language. As regards Welsh vocabulary, his conclusions rest on an unsupported assumption that the Welsh and English vocabulary were of equal difficulty. The bilinguals' English essays, Saer thought, were not as good as their Welsh ones. Their English essays were written in short rather disconnected sentences; their Welsh essays were written in a 'clear lucid style' showing good command of conversational idiom and continuity of thought.

Smith (1923) by means of tests and essays followed the progress in English of the children in four schools for a period of three years. There were roughly equal numbers of bilinguals and monoglots in each school. The children were in 3rd class when he began his research. He sums up his findings with the words: 'Monoglot children, between the ages of 8 and 11, make better progress than bilingual children in their power of expression, their choice of vocabulary, and their accuracy of thought. So far from bilingualism being an "intellectual advantage", it seems to be exactly the reverse, at least under the present organisation of schools in Wales'.

Barke and Parry-Williams (1938) administered the Thorndike Test of Word Knowledge, Form A in Welsh, Form B in English, to the children aged 10½ to 11½ of six schools in the same area. About half the 200 children tested came from Welsh-speaking, half from English-speaking, homes. The authors designate them respectively bilinguals and monoglots, somewhat erroneously since 3% of the 'monoglots' spoke Welsh at home while quite a few had learned some Welsh at school. The groups did not differ significantly in non-verbal IQ (Pintner). On the results of the tests of word knowledge the authors concluded that monoglots had a larger English vocabulary that the bilinguals had in either English or Welsh. Once again we meet the unsupported assumption that results obtained with the English and Welsh vocabulary tests were directly comparable.

These three studies lack something in scientific precision. Saer and Smith place considerable weight on subjective assessments of essays, while some of Smith's tests have been criticised on grounds of unreliability (Arsenian 1937, p.49). None of the authors assessed degree of bilingualism very accurately; and none attempted to control socio-economic status quantitatively, though

Smith and Barke and Parry Williams attempted to control it by selecting monoglots and bilinguals from the same schools. The groups tested by Barke and Parry Williams did not differ in non-verbal IQ, but neither Saer nor Smith guarded against bias from this source.

The remaining four Welsh studies, with which the name of Mr. W.R. Jones is associated, are more scientific in design and analysis of data.

Jones (1952), taking account of a probable drop of one year in average reading age (RA) since pre-war (1939-45) days, when one of the tests he employed (Schonell, Graded Reading Vocabulary Test) was standardised, concludes his investigation of the RAs and non-verbal IQs of 117 bilinguals (from homes where Welsh was always spoken) aged about 11 years, thus: 'one may estimate that the mean RA of Welsh-speaking pupils whose IQs fall below 90 is about 2½ years lower than their mean chronological age; pupils whose IQs fall between 90-110 have a mean RA about one year lower than their mean chronological age, and those whose IQs are in the 110 + category have a mean RA which corresponds to their mean chronological age'. It must be added that the children he tested belonged to families in the skilled manual, semi-skilled manual and unskilled classes.

Jones (1953) classified 115 children between the ages of 10 and 12 as monoglots or bilinguals by means of replies to a Language Questionnaire. To these he administered a test of non-verbal reasoning (Jenkins Scale of Non-Verbal Mental Ability) and a silent reading test (Schonell). The groups did not differ significantly in mean non-verbal IQ; they did differ significantly in mean silent reading score, monoglots achieving the higher mean score.

<u>Jones</u> (1955) analyses the results obtained with Schonell's Silent Reading Test and Jenkins' Scale of Non-Verbal Mental Ability in the <u>1951 Bangor Survey</u>. In this survey all the children in Caernarvonshire between the ages of 10 and 12 were classified under one of four heads - Welsh, Mixed-Welsh, Mixed-English, English, by means of a Language questionnaire and head teachers' ratings. The four classifications represent intervals on a scale running from homes where Welsh is almost always spoken (Welsh) to homes where English is always spoken (English). The children, who numbered 2,565, all knew some English since it was taught in school. The children in the 'Welsh' group obtained a mean silent reading score which was significantly lower than that obtained by the other three groups. Since the groups differed significantly in mean non-verbal IQ, an analysis of covariance was carried out to adjust silent reading scores for differences in IQ. After adjustment the 'Welsh' group's mean score was still

significantly lower than that of the other three groups.

Jones et al. (1957) report the findings of a survey conducted at the request of the Welsh Joint Education Committee in 1954. About 750 children between the ages of 10 and 11, divided in the manner described by Jones (1955) into four linguistic categories, 'Welsh', Welsh-English, English-Welsh and English', were set the non-verbal reasoning and silent reading tests which had been employed in the 1951 Bangor Survey and in addition Moray House English Test 21; the Welsh and Welsh-English groups were also set a test of Welsh usage and a test of Welsh reading (comprehension). The 'Welsh' group's mean non-verbal IQ was significantly lower than that obtained by other groups; so analysis of covariance was employed to make adjustments to mean attainment scores. Thus adjusted, the only significant mean differences in silent reading (English) and MHE 21 were between the 'Welsh' group on the one hand and the 'English-Welsh' and 'English' groups on the other. In both tests of the Welsh language, the 'Welsh' group was superior to the 'Welsh-English' group. Thus it would appear at first sight that the Welsh group gained their knowledge of Welsh only at the expense of a certain degree of competence in English; which would appear to be confirmation of a 'balance' effect in the learning of two languages.

Lewis (1960) re-analysed the English test scores of some of these children classified on a somewhat different linguistic basis, but the general findings remain unaltered.

In the four studies associated with the name of Mr. W.R. Jones, the control of non-verbal IQ is adequate. Jones (1959), however, states that the socio-economic variable, which he discovered to be an important one was not controlled adequately. Nevertheless, the use of analysis of covariance to adjust for differences in non-verbal IQ probably helped to reduce differences between the groups in socio-economic status, since the two are positively correlated. From these four studies together with the three earlier Welsh ones it seems clear that bilingual children from Welsh-speaking homes do not in general know English as well as children from English-speaking homes. Lewis (1960) remarks that all the former 'can speak English with reasonable fluency', but as Colvin and Allen (1923), point out, bilingual persons who speak the second language (in this case English) with 'reasonable and accurate fluency' may still suffer from a 'pronounced linguistic handicap' in that language. We cannot, of course, be sure whether or not the learning of two languages simultaneously is itself the explanation, in whole or in part, for the 'Welsh' children's weakness in English (granting that it exists). It does not appear to be the whole explanation, since 'Welsh-English' and 'English-Welsh' children in the 1951 and 1954 surveys were not inferior to 'English' children on the results of the English tests. Very possibly the 'Welsh' group's weakness is to be explained in part by lack of opportunity to learn English in their homes, chapels and playgrounds.

<u>Irish-English:</u> Only two investigations of a psychometric character into the effects of bilingualism in Ireland can be found, both of them reported in unpublished theses.

<u>Kellaghan</u> (1959) compared the English vocabularies of the 6th standard boys in two Dublin primary schools. Both groups were bilingual in so much as they had learned Irish as a second language in School. The difference between them lay in the fact that in one school (A) the boys had been taught all subjects (English excepted) through the medium of Irish, in the other school (B) they had been taught through the medium of English, the mother tongue. The author matched 13 pairs of boys for age, (12 to 13 years), socio-economic status, and non-verbal IQ (Raven's Progressive Matrices); the schools were considered to be reasonably well-matched in academic standards, any difference between them in this respect being to the advantage of School A. The boys wrote three essays a piece, each essay on a different day. Titles were given them for two of the essays; the theme for the third was presented by means of

a picture.

Four measures of the extent of the vocabulary used in each essay were obtained; these were simply the number of different[1] words in the first three segments of 50 words each and in the first 150 words as a whole. Extent of vocabulary in the first 150 words of a boy's three essays taken together was also measured.

The schools did not differ significantly in extent of vocabulary employed in the three essays taken together, nor did they differ in extent of vocabulary employed in two of the essays. The vocabulary employed by the less bilingual boys (B) was significantly greater in the case of the 'picture' essay. The author suggests that the reason for the significant difference may be that the boys of School B, not being drilled to the same extent as those of School A to write essays to a given title as in public examinations, were more adaptable than the latter to the novel task of writing an essay on a theme suggested by means of a picture. Finally, the measures of vocabulary for each boy's three first segments, his three second segments, and his three third segments of 50 words each, were combined. Analysis of variance of the combined measures revealed that, while groups did not differ significantly in the extent of vocabulary employed in the first and second segments, they did differ significantly in the extent of

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1. In the sense of 'not used previously in the passage.'

vocabulary employed in the third segment, the boys in school B displaying a larger vocabulary than those in school A (the more bilingual school). The author suggests that the latter found it more difficult than the former to maintain the same 'level of word variety' towards the end of the essay because of 'verbal fatigue'. Crewsdon (1941) observes that bilinguals tend to tire in conversation more readily than monoglots as though language failed them sooner. It may be that the boys of school A had not as good a command of English as the others and that the difference between them made itself apparent in the former's experiencing 'verbal fatigue' sooner.

MacNamara (1959) tested about 200 5th standard boys in four Dublin primary schools. The schools were matched in pairs by primary school inspectors, a school where all subjects were taught through Irish with one where all subjects were taught through English. There were approximately equal numbers in each school. A rating of socio-economic status obtained for each boy showed that there was no gross discrepancy between matched pairs of schools in this respect; the rating was not used in the statistical analysis of test scores. Jenkins' Scale of Non-Verbal Mental Ability and Moray House English Test 32 were administered, and an analysis of covariance carried out to adjust English quotients for differences in non-verbal

IQ. The analysis showed that English-taught boys obtained significantly higher English quotients than Irish-taught boys. The author tentatively attributed this difference to the fact that the boys who had been taught Irish were not as good at English reading and had not as good a knowledge of English usage, as tested by MHE 32, as the boys who had been taught through English.

We must not place too much faith in the findings of these two studies. Kellaghan's numbers were very small and it is difficult to interpret the differences in English vocabulary which he observed between Irish-taught and English-taught boys. Macnamara's study, though on a larger scale, lacked precise control of variations in socio-economic status. Both writers had to rely on subjective judgment in the matching of the different types of school. Neither writer claims that the boys he tested were fully representative even of Dublin primary school boys.

<u>Flemish-French.</u> <u>Toussaint</u> (1929 and 1935) and <u>Verheyen</u> (1929) report comparisons of small numbers of Flemish-French bilinguals with monoglot Walloons and monoglot Flemish children. Toussaint found monoglots vastly superior to bilinguals in tests of dictation; Verheyen found them superior in vocabulary. Interesting though these findings may be, they are based on poorly controlled comparisons and so they

cannot be regarded with much confidence.

Czech-German: Čouka (1929) found that the German vocabulary of a small number of second and third grade Czech children attending German schools was only about half the size of their vocabulary in Czech, (their mother tongue). He observed a considerable degree of linguistic 'interference'[1] from Czech in their use of German. On these grounds the author concludes that it is a drawback for children to receive instruction in any but the mother tongue.

Non-Indo-European Languages and English: Smith (1931 and 1935), having studied the progress of 13 American children (two families) who lived for a time in China and thus became bilingual, concludes that their English vocabularies were below average and that changing their linguistic environment confused them and retarded their development in speech.

Smith (1949) and Motoyama (cited in Smith, 1949) again studied the vocabulary of Chinese-English bilinguals, but this time their Ss were children of Chinese ancestry living in Hawaii. They found that the English vocabulary

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1. Weinreich (1953) calls the influence of one tongue on another in pronunciation, semanteme (area of meaning designated by a word), vocabulary, and syntax, 'interference'; op.cit. pp.8-33.

   See also Whatmough (1957) pp.63-67.

of 80 such pre-school children was much more limited than that of monoglots, though the bilinguals tested by Smith were above average in socio-economic status. Smith also found that the Chinese vocabulary of her 30 children was more limited than that of monoglots. It would seem, then, that where children must learn two such dissimilar languages as Chinese and English, they generally pick up the vocabularies of neither language as quickly as monoglot speakers of those languages.

Smith (1933 and 1957) extended her study of pre-school children of Chinese ancestry in Hawaii to other aspects of speech besides vocabulary. In 1933 such children were bilinguals, whereas by 1957 they had almost lost Chinese and become monoglots; and with the change from bilingualism came a great improvement in English. In 1957 they approximated closely to American standards of English in the length and complexity of their sentences, in their command of vocabulary, in their ability to use verbs correctly; while in 1933 they had been markedly retarded in all these respects. Smith believed that there were two reasons for the poor standards of 1933, linguistic interference due to bilingualism, and Pidgin English. Pidgin English is itself the product of linguistic interference; but once established in a community, it tends to perpetuate the effects of linguistic interference even when the cause of the interference, bilingualism, has disappeared. Thus, Smith considered that any defects in the English of the children she tested in 1957 must be attributed to the continued use of Pidgin in Hawaii.

In 1939 Smith extended her research to include children of various linguistic backgrounds in Hawaii. Altogether 1,000 children between the ages two and six, including children from Chinese, Filipino, Hawaiian, Japanese, Korean, Portugese, and English-speaking, homes. She found that all the bilingual children were seriously retarded in the use of English and that the degree of retardation was in proportion to the degree of bilingualism. 'They (bilingual children) are found to use more exclamatory and slightly fewer interrogative sentences (than monoglots), and to make much less frequent use of complex and compound sentences. Sentences that serve merely to name an object or person continues to a later age than with monoglot children.

'The evidence, although insufficient, suggests that pidgin English is more responsible[1] for incorrect English and bilingualism for the overuse of interjections, short sentences, immature type of questions when classed as to meaning, and lack of complex sentences.'

We shall conclude our review of Smith's work with

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1. Presumably: more responsible than bilingualism.

a brief reference to a paper published in 1942 in which she reports the findings of a study of bilingual students at Hawaii University. The bilingual groups (N = 364) she studied were much the same as those studied in her 1939 survey. Degree of bilingualism correlated negatively with students' scores in College Aptitude Tests (American Council Psychol. Examinations); but progress in university studies, as indicated by students' grade-point ratios, tended to be independent of degree of bilingualism. In evaluating these observations, however, it is well to bear in mind that university students are a highly selected group, and that if bilingualism results in a language-handicap many students, because of their bilingualism, never reach university; consequently there is great difficulty in isolating the bilingual factor when comparing groups of university students.

Japanese-American high school seniors, of whom 91% were born in America of Japanese parents, were tested by Portenier (1947) with the Iowa Silent Reading Test and the Ohio State Psychological Test, Form 21, which has vocabulary and reading sections.

We are told little about the students' command of Japanese and English beyond that a small number of them had studied Japanese in Japan and that some in their homes and religious services had kept in close contact with the Japanese language and culture; on the other hand their teachers thought the students 'thoroughly Americanized'. They lived in a more or less segregated Japanese-American community. The majority of families lived by gardening and relatively few of them belonged to the professional class. To judge by the norms of the tests these students were considerably retarded both in English reading and English vocabulary. A weakness in English reading on their part does not necessarily indicate a more general weakness in English; there is some work by Smith (1932) suggesting that where children learn to read in two languages which are read in different directions (such as Japanese and English) greater confusion results in the children's minds, and they make more errors of reversal than if they learned to read in one of them only. The result of the vocabulary test is more convincing evidence of the existence of a general disability in English, but we must remember that differences in schooling, socio-economic status, and non-verbal IQ, between them and the remainder of the population with which they were compared were uncontrolled.

Darsie (1926) selected at random 658 American born Japanese children between 10 and 15 years of age from the complete lists of such children in California. All these children knew English, except for a small number in country places. Most of the 658 knew some Japanese, and many attended Japanese language schools for periods of from 3 to 5 hours per week. As a group their socio-economic status was below that of 'Americans'. Though a measure of non-verbal (Army Beta) reasoning was obtained for each child, and though it would appear that the 'Japanese' children were not inferior to Americans in non-verbal IQ, it is difficult to be sure from the report that this variable was adequately controlled. The Stanford Achievement Test was administered to all Ss. In silent reading but not in spelling, the Japanese were found to be inferior to Americans whose attainment level was judged by means of the test norms at each of four ages, 10y-6m, 11y-6m/ 12y-6m and 13y-6m. Undoubtedly the findings represent fairly the relative standards of Japanese and American children in California (where the Stanford Achievement Test was standardised); but unfortunately the linguistic variable was not isolated, nor was degree of bilingualism adequately measured, and consequently we cannot determine the influence of bilingualism in bringing about the observed differences between groups. Indidentally Japanese children were found to be six months older than Americans per grade on an average.

Canadian Indians who had largely lost their ancestral languages and come to speak English were tested by <u>Jamieson and Sandiford</u> (1928). All could speak English, and the great majority could understand an Indian language to a certain extent, while 45% of them could speak one. The authors claim that the Indians' command of English was very inferior to that of white children of a corresponding social status, which was lower than average on Chapman's socio-economic scale. Their scores in silent reading, spelling, and writing, were well below average as indicated by the test norms and were taken by Jamieson and Sandiford as evidence of severe retardation in these skills. The cause of this apparently general disability in English is probably not simply bilingualism, if it is even partly that, since the Indians tested did not attend school as regularly as white children in the neighbourhood; and probably their parents, not knowing English as well as white parents, were unable to help their children to develop good command of the language. Moreover, the Indians' culture until relatively recently was very different from that of whites, and as a race the former may not yet have learned the full range of concepts which are traditional in white Canadian homes and of which English is normally the vehicle. Soffietti (1955) points out that retardation might arise from 'biculturalism' quite as much as from bilingualism.

The reservations which we have expressed about the source of language retardation in the findings of Jamieson and Sandiford apply with equal force to those of <u>Harris</u> (1948) and <u>Carroll</u> (1961). Harris found that Montana Indians, who appear to have been more familiar with English before coming to school than Pueblo Indians, made fewer mistakes in their English essays than the Pueblo Indians, though they wrote shorter compositions. Carroll, who counted the vocabularies of 6 coloured pupils of different ages in one primary school in Ghana, found that their vocabulary in their native tongue was many times as great as their vocabulary in English. We are not told how representative of the total school population the 6 children were, but even if the conclusions based on them have general application we cannot pinpoint the reason for such a difference in vocabularies. Of course Carroll's work is of great interest to the persons who must choose the language in which to teach the people of Ghana.

Studies Including Many Language Groups[1]:

Kirkpatrick (1926) administered a verbal and a non-verbal reasoning test as well as a reading test (Illinois Examination) to the children aged 11 years of certain schools in Massachusetts. Ninety-five native Americans, 140 Finns, 95 Italians, and 155 French-Canadians were tested; but the children of the different races were

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1. Some of Smith's papers considered in the preceding pages might well have been considered under this sub-heading, but it was thought more convenient to treat all her papers together.

not distributed in equal proportions over the different schools. The vast majority of those in the last three groups did not speak English in their homes. The Finns' median non-verbal IQ equalled that obtained by Americans, but the mean non-verbal IQs obtained by Italians and French-Canadians fell far below that obtained by Americans. Finns, Italians, and French-Canadians, obtained mean reading ages which were significantly lower than those obtained by Americans; the last two of these three groups obtained means which fell significantly below that obtained by the Finns. However, the study is defective in that there was no control of differences in non-verbal IQ and socio-economic status, though measures of these variables were obtained; also there was no control of differences between schools.

Jones (1928) studied the vocabulary of all the public school children of Aliquippa, Penn., in grades 1 to 8. They numbered 522, and their ages lay between 8 and 16 years. The parents of the children, who belonged to a large number of races including a number of monoglot Americans, earned a living mostly by working in steel foundries. The test used was the vocabulary list of the 1916 Stanford-Binet Test which had been standardised in part on the responses of monoglot American children in Aliquippa so that norms for the vocabulary test applying to that area were available. It was found that, except for monoglot Americans and children of Jewish origin who surpassed the norm on an average, the mean number of correct responses given by bilinguals fell far below the norm. The author claims that the bilinguals and monoglots lived 'under identical economic and similar social conditions'; but the groups were not equated for non-verbal IQ. Nonetheless so great are the mean differences that almost certainly they are not due to variations in non-verbal IQ alone.

Rigg (1928) tested about 10,000 St. Louis children (grades 3 to 8) divided into linguistic groups by their replies to the question, 'what foreign language is spoken in your home?' The main languages represented were Indo-European, namely, German, Yiddish, Italian, and Czech. 'Bilinguals', in whose homes one of these languages as well as English was spoken, were compared with the English-speaking monoglots of the sample in English reading (Thorndike McCall Reading Test). Monoglots scored significantly higher in reading. When reading scores were further analysed, it was found that the Italian-English group was the only one which fell far below the standard of monoglots. This difference between language groups is unexplained, but probably it is to be attributed in large part to differences in socio-economic status; it may also be due to differences in degree of bilingualism, in non-verbal IQ, and to differences between schools - none of these variables was controlled.

Andrews (1928) administered a test of the vocabulary used in mathematics to 366 first year high school students. The students were divided into four groups ranging from those in whose homes English was never spoken to those from homes where English was the only language. The foreign languages involved numbered 23. Andrews found some tendency for vocabulary score to increase with the amount of English spoken in the home. The scores were not further analysed for the various language groups, nor was degree of bilingualism or socio-economic status controlled; therefore, it would be unwise to place much confidence in this piece of research.

Sinclair (1931) matched 72 pairs of New Brunswick children, a bilingual with a monoglot, for age, grade (3, 4, and 5), and socio-economic status. Bilingualism was ascertained by means of a questionnaire. By and large the bilinguals' families kept closely in touch with their ancestral languages, the languages in question numbering 15. A verbal IQ was obtained for each child; the groups were roughly matched in IQ. Two measures of reading rate and comprehension, of vocabulary, and of word fluency, (the number of words a child could say in 10 minutes), were obtained for each child. The period between the first and second set of tests was five months. There was a general tendency for monoglots to obtain higher scores in all tests and, reading comprehension excepted, to show greater gains in score over the five months period. No statistical tests of mean differences were carried out. The results for the different language groups were not analysed separately; the numbers were too small to make such an analysis profitable. It would seem, however, that those children who were familiar with another language made less progress with their school work in English than the monoglots. Unfortunately we do not know how representative the groups were of either American bilinguals or monoglots.

Studies of Situations where the Language of the School was Changed:

With the exception of Castillejo's, M.E.T. Logie's, and McConkey's, work all the studies so far discussed were carried out in situations which the authors found already existing and which had in most cases existed for a long time. But there are a few studies of situations where through the intervention of the government or an experimenter the language of the school was changed, and an investigator was able to compare the results of old and new systems.

In the Philippine Islands very many children came from homes where English was not spoken, yet attended schools where until the late 1940s English was the language of instruction. In 1948 the Department of Education, Manila, (1953)[1] decided to investigate the effect of replacing English in the first and second grades by one of the many indigenous languages, Hiligaynon. For this purpose 14 schools in Iloila Province were selected, 7 to form an experimental group, and 7 a control group. Each school in the experimental group was closely matched with a school in the control group; while the children in the experimental group were matched for age, socio-economic status, and verbal IQ, with those of the control group. In grades 1 and 2 the children in the experimental group were taught to read Hiligaynon, and taught other subjects through the medium of Hiligaynon, but in higher grades they were taught English (no Hiligaynon) and other subjects through the medium of English; those in the control group were taught English (no Hiligaynon), and other subjects through the medium of

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1. I am grateful to Mr. Jose V. Aguilar, Co-Director of the Philippine Centre for Language Study, for copies of the 4 reports issued on this experiment.

English in all grades including 1 and 2. The progress of the children in arithmetic, (mostly mechanical) Language, (usage), Reading, (mostly comprehension), and Social Studies, (correct social and moral behaviour), was followed over four years, i.e., in grades 1 to 4. Tests of the four subjects were specially prepared in the two languages of the experiment, Hiligaynon versions being employed to test the experimental group at the end of the first and second years of the experiment, English versions to test them at the end of the third and fourth years, and to test the control group at the end of each of the four years. Throughout the reports of the experiment it is assumed, apparently without proof, that scores obtained with the two versions of the test are comparable. At the outset of the experiment there were 188 children in each group; by the end there were only 129. The majority of the children appear to have been to some extent bilingual (Hiligaynon-English). At the end of the first year the experimental group obtained significantly higher scores than the control group in Reading and Social Studies; at the end of the second year they obtained significantly higher scores in all subjects, the differences being quite substantial; at the end of the third year (both groups were now tested in English) the groups did not differ significantly in arithmetic, Language or Reading scores, but the experimental group obtained a significantly higher score in Social Studies than the control group; at the end of the fourth year the only significant difference between groups was in Language, and this was in favour of the control group. Thus it would appear that by the end of the fourth year the experimental group had lost the substantial advantage in score over the control group which it had at the end of the second year; and on the other hand, to judge by the fourth year tests, that it had not suffered much by having been taught through the vernacular even though it had to switch to English in the third year.

The comparison is one of the best controlled we have come across, and it is rather a pity that no information on the comparative difficulty levels of the two versions of the achievement tests is provided. The difficulty levels could only have been studied effectively by administering the tests to 'balanced bilinguals', but this does not appear to have been done. In all probability the versions of the arithmetic (largely mechanical arithmetic) and Social Studies tests did not differ very much in difficulty level; so the enormous advantage of the experimental group over the control group in these two subjects at the end of the second year implies an advantage in the use of the vernacular. It is not profitable to guess how the two versions of the language and reading tests stand with regard to one another; so we can conclude nothing from the experimental group's substantial advantage in Language and Reading at the end of the second year. While we cannot be sure about the quantitative advantages of teaching the children of Iloilo Hiligaynon, we can be reasonably sure of some qualitative ones. Mr. Pedro T. Orata (1953) after describing the Iloilo experiment, adds that the vast majority of parents thought their children showed more enthusiasm for school when they were taught Hiligaynon rather than English, and that the children preferred learning to read and write Hiligaynon than English.

Tore Österberg (1961) carried out an experiment in Sweden somewhat similar to the Iloilo experiment. The people of the Pitea district speak a dialect of Swedish which is 'impenetrable' to the outsider, initially, at least. When the children of the area go to school, at the age of 7 years, they are obliged to lay aside their dialect and learn to read and write standard Swedish. Österberg's experiment was designed to investigate the effect of teaching them to read and write their dialect for the first ten weeks of their school lives before changing them over gradually to standard Swedish. For this purpose he matched 10 pairs of infant mistresses for age, qualifications, and ability to teach as rated by the commune school head and the state school principal. One teacher in each pair was to teach her class dialect (D), the other to teach standard Swedish (R). There was not a significant difference in verbal IQ, socio-economic status, reading ability, or age, between the children assigned to D and those assigned to R at the outset of the investigation. A new school reader, hitherto unused in any school, was chosen as text for the experiment; the first 36 pages were translated into dialect and printed for the use of group D. The amount of time devoted to reading and writing, and the methods of teaching, were as far as possible kept uniform over all classes in the experiment.

At the end of the first ten weeks the ability to read of the 158 children in D and of the 173 children in R was tested. The tests were specially prepared and administered to D in dialect, to R in standard Swedish. Österberg hoped by basing his tests for both groups on the same passages in the text that the marks obtained by the two groups would be comparable. Group D (experimental) had a substantial and significant advantage over group R in reading speed, reading comprehension and ability to read out loud accurately.

After the first 10 weeks of school, group D was gradually changed from dialect to standard Swedish. At the end of the year all the children were given tests of reading and writing. Both groups were tested in the standard language and this time most of the tests were standardised ones. Group D obtained significantly higher scores than group R in word recognition, in speed and accuracy of reading, while in a test of attitude they showed themselves to be more interested in reading. The differences between the groups, always in favour of group D, were not significant in tests of comprehension, spelling and the auditory perception of words.

The experiment was well controlled and carefully carried out. It would appear to lead to the conclusion that children learn to read with greater ease in their mother tongue; and that Pitean children who learn to read the mother tongue first more than compensate for loss of time when later on they change over to the standard language. Broadly speaking the first part of this conclusion is in agreement with the results of the Iloilo experiment; so far as could be judged Iloilo children learned to read Hiligaynon (the mother tongue) with greater ease than they learned to read English. However, the initial advantage of Iloilo children who learned first to read Hiligaynon was not transferred to their English reading. A probable reason why the two experiments diverge with regard to the amount of transfer from reading the mother tongue to reading the second language is that the pairs of languages are not equally similar; Pitean is a dialect of Swedish, Hiligaynon is not an Indo-European language whereas English is. The experiments are in accord, however, in their findings about attitudes to reading; children taught to read their mother tongue first are more interested in reading a second language than children taught to read the second language only.

These two studies lead us to a third which was made in Ireland where between 1932 and 1948 children from English-speaking homes in national schools (between 97% and 98% of all such children) were taught Irish, not English, in infant classes and learned to read and write Irish before English. The study resembles the previous too in that the language of the school was changed; it differs from them in that the change was from the mother tongue to a second language, whereas in Pitea and Iloilo the mother tongue replaced a second language. <u>The Irish National Teachers Organisation</u> (INTO) issued a questionnaire to more than 9,000 teachers[1] in 1936 'to inquire into the use of Irish as a teaching medium'. By that time the great majority of primary teachers held qualifications entitling them to teach Irish as a subject and other subjects through the medium of Irish. A report in

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1. There were about 12,000 primary teachers in the country at the time.

which the replies were analysed was published in 1941[1]. About 1,300 of the 9,000 teachers replied. Each teacher was asked to answer those questions only which dealt with matters of which he had personal experience; thus the number of replies to a particular question was less than 1,300. The overwhelming majority (about 85%) of infant teachers who replied considered that infants who learned Irish alone did not acquire 'adequate powers of expression in regard to (their) everyday experience'. Though the report does not say so explicitly, the remark seems to apply to the power of self expression in English as well as in Irish.

The report outlined above is valuable since it is based on the impressions of teachers, the majority of whom had been teaching before Irish became compulsory in infant classes; and even though their judgments were not supported by 'objective' testing, they were in a position to judge the effects of the language programme enforced since 1931. Unfortunately only a small number of teachers replied, about 10% of the total number in the country, 14% of those to whom the questionnaire was sent, and we have no way of knowing how well the views of those who replied represent the views of the profession as a whole. Moreover, the meaning of

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1. INTO (1941).

parts of the questionnaire is vague, as for instance the following:

'Does the child acquire adequate powers of expression in regard to his every day experiences when taught solely through the medium of Irish?'[1] Whether the powers of expression are in English or Irish or both is not specified.

As they stand, the findings published by INTO (1941) support in a general way the findings of the Iloilo and Pitea experiments: children learn better to comprehend and to express thought when taught through the medium of the mother tongue than they do when taught through the medium of a second language.

Summary and Discussion - Linguistic Attainments.

Can any conclusion be drawn from these 67 studies of the relationship between linguistic attainments and bilingualism? Certainly no categorical conclusions emerge from the available evidence, which is for the most part not very firmly grounded. Yet there is some firmly grounded evidence pointing to a weakness in bilinguals' knowledge of language compared with that of monoglots. As examples of well grounded evidence Smith's findings in Hawaii and

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1. Question 7 in the Section dealing with infants.

Carrow's in Texas come to mind. Moreover a comparison of these two sets of findings suggests that the difficulty of bilinguals in learning their two languages is a function of the extent of the dissimilarity between the two languages. On the whole Smith found larger differences than Carrow between the two types of children, the former studying Chinese-English, the latter Spanish-English bilinguals. English and Spanish are both Indo-European tongues while Chinese is commonly classified as an Indo-Chinese[1] tongue. The few studies which found bilinguals superior to monoglots and the slightly more numerous ones which found no difference between them are all very poorly controlled; they therefore fail to outweigh the mass of evidence indicating that monoglots are superior.

It is possible to particularise the various types of finding on which our general conclusion rests. If we leave aside studies which were conducted in the more advanced classes of high schools and in universities, because such studies are very probably biased by selective processes, we find six[2] in which a general test of attainment

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1. See UNESCO (1953), p.141.

2. Colvin and Allen (1923), Porto Rican Survey (1926), Fritz and Rankin (1934), Stecker (in Arsenian 1937), Malherbe (1946), Macnamara (1959) - the last mentioned study compares children who were more bilingual with ones who were less so.

in the language which was common to monoglots and bilinguals was administered. With one exception (Malherbe 1946) monoglots obtained higher mean scores. Other studies deal with particular aspects of language learning.

Twenty-one papers in which vocabulary was tested have been reviewed: two of these found no difference between Jewish monoglots and bilinguals in the latter's 2nd language (Schiller 1934 and Murdoch et al. 1928); two found no difference between monoglots and bilinguals in the latter's first language (McConkey 1951, Peal and Lambert 1961); one found perplexingly, that the difference between monoglots and bilinguals (in favour of the former) decreases as mental age increases (Terman 1918). The remaining sixteen[1] found that monoglots were superior to bilinguals in the latter's second language. Andrews (1938) and Johnson (1938) found that bilinguals did not know as many of the words which are particular to certain subjects, such as mathematics and geography, as monoglots. Sinclair (1931) found monoglots showed greater word fluency than bilinguals; Carrow (1957) found monoglots superior in both 'hearing' and

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1. Saer (1922), Andrews (1928), Čouka (1929), Verheyen (1929), Grabo (1931), Sinclair (1931), Smith (1931, -33, 35, -49), Barke and Parry Williams (1938), Johnson (1938), Motoyama (1949), Carrow (1957), Kellaghan (1957), Carroll (1961).

'speaking' vocabulary. Moreover in the three studies (Saer 1922, Grabo 1931, Barke and Parry Williams 1938) where the vocabularies of bilinguals in both languages were compared with those of monoglots, the latter were found to be superior. Thus it seems most probable that bilinguals learn the vocabulary of neither of their languages as well as monoglot speakers of these languages.

Carrow's is the only study which examined articulation; and again monoglots were shown to be superior to bilinguals.

Four papers (Smith 1933, -39, -57; Carrow 1957) report investigations of the number of grammatical errors made by monoglots and bilinguals in speech; all four state that bilinguals made the greater number of errors. Smith's (1957) latest paper is particularly interesting because it shows that in Hawaii over the past twenty years children of Chinese origin have come to make fewer grammatical errors as they have become less bilingual (almost monoglot English-speakers).

Five attempts to compare bilinguals and monoglots in either length of response or length of phrase have been made (Saer 1922, McCarthy 1930, Smith 1933 and 1957, Carrow 1957). McCarthy and Carrow found no difference between them in length of response and length of phrase respectively, measures of each being obtained from the speech of children.

Saer says that when writing essays in English, bilingual Welsh-English children used shorter sentences than when writing in Welsh, their first tongue. Smith found that bilingual children used shorter phrases than monoglots; and over the years as her bilingual children became less so, their phrases increased in length. Saer's investigation was confined to written language, Smith's to an extraordinarily difficult language combination, English and Chinese; but McCarthy's and Carrow's work may be taken as satisfactory evidence that there is little difference between the two groups in length of phrase in spoken language where the two languages are of Indo-European stock.

Certain aspects of writing have been investigated. Toussaint (1929 and '35) reports that bilinguals were very much inferior to monoglots in a dictation test[1]; Peal and Lambert (1962) found no difference between the two in a similar test. The latter finding would seem most probably to be a result of the way in which the groups were selected (see above pp.23-4). The present writer is more inclined to be guided in this matter by Toussaint's findings.

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1. These findings are placed here for convenience sake, although such tests measure ability to understand speech as much as ability to write.

Spelling was investigated by five research workers (Darsie 1926, Jamieson and Sandiford 1928, Carrow 1957, Österberg 1961). Jamieson and Sandiford report that bilingual children were inferior to monoglots, but this might well be explained by the fact that their bilinguals were very irregular in attendance at school, as well as by the bilinguals' low socio-economic status compared with that of monoglots. Darsie and Carrow found no difference between the two types of children. Österberg found no difference in accuracy of spelling in standard Swedish between those who began by reading the local dialect of Swedish and those who had been introduced to reading in standard Swedish directly. The evidence would seem to lead to the conclusion that, other things being equal, bilinguals are neither better nor worse at spelling than monoglots.

Three papers deal with written composition. Harris' (1948) finding that Pueblo Indians who were more familiar with English before coming to school made fewer grammatical errors than those who were less so is hardly surprising, and is in keeping with the findings about grammatical errors in the speech of bilinguals. Saer (1922) considered the English compositions of Welsh-English bilinguals much poorer than their Welsh (their first language) ones. Peal and Lambert report that their bilingual group obtained a mean mark for compositions in French equal to that obtained by monoglots, French being the bilinguals' first language; but once again, it is necessary to observe that bilinguals had obtained mean verbal and non-verbal IQs very much higher than monoglots, so that we are surprised that bilinguals did not obtain higher marks in composition. It seems likely, particularly in view of the general findings cited above, that bilinguals do not write compositions of the same standard, linguistically at least, as those written by monoglots.

Next to vocabulary the attainment of bilinguals most frequently studied is reading. Three studies (Rigg 1928 , Schiller 1934, Peal and Lambert 1961) found no difference between certain groups of bilinguals and monoglots in a general test of reading. Carrow (1957) found no difference between them in a test of silent reading, though she found monoglots superior in a test of oral reading accuracy and reading comprehension. Thirteen studies[1] found monoglots superior in a variety of tests, including general reading tests, tests of silent reading,

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1. Darsie (1926), Kirkpatrick (1926), Rigg (1928), Jamieson and Sandiford (1928), Manuel and Wright (1929), Sinclair (1931), Ladd (1933), Manuel (1935), Kelley (1935), Jones (1952, 53, 55), Jones et al. (1957).

reading comprehension, reading rate and accuracy. On balance it seems probable that bilinguals are poorer at all aspects of reading than comparable monoglots. There is only one study (Manuel and Wright 1929) in which bilinguals' ability to read in both languages was examined; but the work is so poorly controlled that the findings to the effect that bilinguals were poorer readers in both languages than monoglots must be viewed with the utmost caution. The Iloilo experiment and that carried out by Österberg (1961) would seem to show that children make better progress when introduced to reading in their mother tongue rather than in a second language.

All in all then we may tentatively conclude that monoglots are generally superior to bilinguals in all the linguistic skills enumerated, with the exception of spelling, and that the two types of children do not differ in powers of self expression as measured by length of response or length of spoken phrase.

Reasons why the linguistic attainments of bilinguals are inferior to those of monoglots are more easily suggested than substantiated. Jespersen (1922, p.148) speaks of the 'brain effort required to master two languages' as though mental 'effort' was a constant, and as though the effort which a child can make was adequate for learning one language, but inadequate, generally speaking, for learning two. But wherever bilinguals have been found inferior to monoglots in knowledge of language there are alternative explanations of a more obvious character than mental or 'brain effort'.

Weinreich (1953) devotes a large part of his admirable book, Languages in Contact, to linguistic interference, i.e., the influence exercised by the sounds, vocabulary, syntax and semantemes[1] of one language upon those of another. Such interference was very apparent in the English of the Chinese-English bilinguals tested by Smith in Hawaii.

More recently Mackey (1962) has analysed the various types of interference which can occur:

1. Cultural - e.g., the introduction of the white man's greetings into certain American Indian dialects.
2. Semantic - e.g., the expression 'the house is all through other' which one sometimes hears in Ireland, a literal translation of the Irish expression 'Tá an teach tré na chéile'.

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1. By 'semanteme' is meant that which is symbolised by a separable unit of speech, e.g., the portion of the body symbolised by the word 'leg'.
The whole process of linguistic interference is remarkably similar to, and must bear some relation to, retroactive inhibition, for which see Woodworth and Schlosberg (1954), pp. 761 sq.

3. Lexical - e.g., the innumerable English words which have found their way into modern Irish such as 'jam', 'motor', etc.

4. Grammatical - e.g., the use of the past participle in English by Irish people as it is used in Irish. For example, 'I have it (a book) read' - 'Tá sé léite agam.'

5. Phonological - such interference is found in intonation, rhythm, catenation (linking speech sounds into a chain of speech), articulation.

The author goes on to show that the extent of the interference[1] depends on the (i) linguistic medium (speaking, writing, etc.), (ii) style (descriptive, narrative, etc.), (iii) register (social role of speaker - public or private), (iv) Context (place, persons addressed etc.); though it would appear that these are not mutually exclusive factors.

But the findings which we have discussed cannot all be attributed to linguistic interference, nor can any of them be fully explained by it; so we must extend our inquiry.

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1. Quite recently Dr. Cyril James (1963) has suggested that linguistic interference is also a function of the stage in a person's life when he learned the second language and of type of learning, merely oral, or formal (reading and writing) as well as oral; thus connecting Hebb's (1949) theories on early learning with the study of bilingualism.

Differences between languages are nearly always more deeply rooted than grammar books or even dictionaries reveal. The aspects of reality which receive most attention from the people of one culture are not always those which interest the people of another culture most. Snow is more important to the Laplander than it is to us; he has examined it more closely and has many words to designate different types of snow which we probably never notice. Brazilian Indians seem to be fascinated by different types of palm trees and parrots because they have a great number of names for them. Needless to say there are whole areas of thought which are familiar to us, which we have words for, e.g., different moods and emotions perhaps[1], of which the Laplander and the Brazilian Indian are unaware, and consequently cannot express in language[2]. If a Brazilian Indian wishes to learn English and speak it like an Englishman he has much more to learn than words and word orders; he must learn to

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1. See Snell (1953, p.196): ' ... among the early Greeks an actual psychology of moods and emotions was slow to take root.' I do not know whether such a psychology has been developed by Laplanders or Brazilian Indians, but I think it improbable that it has. We, of course, derive ours largely from the Greeks.

2. Brown (1956 - p.311) says: 'Language is nothing less than an inventory of all the ideas, interests and occupations that take up the attention of the community.' This paragraph is greatly indebted to Brown's essay.

see and analyse reality as the majority of Englishmen do, and for this purpose many of his earlier observations are without avail. Eventually, if he is successful, he will be 'bicultural'[1] as well as bilingual.

Speakers of different languages often share what is broadly speaking the same culture. Such people can learn each others languages without the need of learning a new culture[2]. These observations help to explain why Smith's Chinese Hawaiians, Jamieson and Sandiford's Canadian Indians, and Carroll's pupils in Ghana were so weak at English; in addition to learning a new language they needed to see reality through English eyes, and perhaps they had not yet learned to do this.

Frequently throughout this chapter it has been necessary to point out that the bilinguals studied were the descendants of immigrants who were loosing their ancestral tongue and learning a new one. Thus, the greater number of Spanish-speaking bilinguals in the U.S.A. learned Spanish

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1. Soffietti's (1955) paper pointing out that the difficulty of bilinguals are not only linguistic but also cultural has already been mentioned. He uses the word 'biculturalism.'

2. Even though two peoples share the same culture they never look at things in exactly the same way; it is always necessary to recast one's thought somewhat in order to use a foreign tongue, as any boy who is learning Latin knows.

and possibly English at home, English only at school. It is quite incredible that their knowledge of Spanish should be as good as that of Spanish-speaking monoglots who in addition to learning Spanish at home learn it at school. Moreover, when parents who originally spoke Spanish begin to lose interest in Spanish and to replace it with English, they are hardly likely to take as much care with their children's Spanish as if it were to be their children's main language through life. If the immigrant parents have learned English, they probably do not know it as well as native-speakers of English who improved their knowledge of their mother tongue through schooling and reading. Consequently the English vocabulary of immigrants may be quite limited, and some of their forms of speech may be ungrammatical. The mistakes of immigrant parents will doubtless show interference from Spanish, but the reason their children make the same mistakes may be not so much that they know Spanish but that they have learned them from their parents. Therefore, the investigator who finds such bilinguals' English deficient compared to that of monoglots cannot tell which of the possible factors have caused the deficiency.

The case of children who live in an area where one language is dying and another gaining ground, such as the Welsh-speaking areas of Wales or the Irish-speaking areas of Ireland, would appear to be similar to the case of immigrants' children. The English that children hear around them in such areas in Wales and Ireland is frequently broken English.

We come now to the fourth of our suggestions. It takes <u>time</u> to learn a language. How much time, one can scarcely specify; and no doubt the length of time required is a function of many variables such as age, ability and incentives. Yet it seems clear that part of the reason that bilingual children have so often been found inferior to monoglots may simply be that they have not had enough time to learn the language in which they have been compared with monoglots. Bilingual children, naturally, devote part of the time which monoglots spend learning one language to learning another one. The research which has been done does not enable us to determine whether in later life bilingual children generally make good their initial disadvantage: comparisons of older bilinguals and monoglots appear to have been biased by selected processes in favour of the former.

At the present position of research in bilingualism it is not possible to say which, if any, of the four causes of retardation in language learning that have been suggested is operative in a particular situation; nor is it possible to give the relative importance of each. This is hardly surprising when none but a tentative conclusion about the existence of linguistic retardation in bilinguals could be based on the research which has been reported.

CHAPTER 2.

REVIEW OF LITERATURE: II - ARITHMETIC.

The studies in bilingualism in which arithmetic tests were administered are with one exception (Pusey 1945) those which have been discussed in chapter 1. For details not given below the reader is referred to that chapter.

Bilinguals equal to or superior to monoglots.

Logie (in Bovet 1935) claims that S. African white monoglots who were taught bilingually, through the media of English and Africaans, progress as satisfactorily in arithmetic as those who were taught through the medium of their mother tongue alone. Malherbe (1946) states that children in bilingual schools make better progress in arithmetic than those taught through their mother tongue; while those taught exclusively through the medium of their second language suffer an initial handicap which disappears by the time they reach 6th standard. We have already seen that in the reports of these studies which were available to the present writer there are many defects, particularly lack of information about the tests.

Darsie (1926) compared the arithmetical attainments of Japanese children in California with those of the native white population (Americans), using the norms of the test which she administered (Stanford Achievement test) to indicate the average performance level of Americans. No significant differences were found between the groups in mechanical arithmetic (ages 10 to 15). slight inferiority in problem arithmetic on the part of Japanese children at each age level can be attributed to the fact that they were on an average six months older than American children in the same grades. However, the influence of bilingualism (if any) on the results was not isolated; moreover the degree of bilingualism was not measured.

In Rigg's (1928) poorly controlled investigation, German-English, and Jewish-English, 'bilinguals' in St. Louis obtained higher mean scores in mechanical arithmetic (Woody - McCall Arithmetic Fundamentals) than 'monoglots'. The American bilinguals whom Andrews (1928) tested succeeded as well as monoglots in tests of arithmetic though they showed a poorer knowledge than monoglots of arithmetical vocabulary. But Andrews study too is poorly controlled.

Thus the papers gathered under this sub-heading contribute little to our knowledge of the effect of bilingualism on attainments in arithmetic since in none can one be confident that its influence was isolated.

Monoglots excel bilinguals.

Three of the studies of Spanish-speaking American bilinguals included arithmetic tests, and in all three the performance level of bilinguals was lower than that of monoglots. Fritz and Rankin (1934) and Manuel (1935)[1] used The New Stanford Achievement tests; Carrow (1957) used the California Achievement test of problem arithmetic. Only Carrow's comparison was well controlled. She found a highly significant difference in favour of monoglots which is probably due to the monoglots' superior command of English; the test problems were set in passages of printed English. In passing, the survey of Porto Rican education may be mentioned since it included the arithmetic tests of the Stanford Achievement series. In the tests of mechanical arithmetic the means obtained by Porto Ricans excelled the test norms in each grade up to 6th, though from then on they fell below the norms. In tests of problem arithmetic in Spanish, means obtained by Porto Ricans excelled the test norms in each grade up to 7th, and in higher grades their means equalled the test norms. When the same test was administered in English their means, which were uniformly lower than those which they obtained with the Spanish version, equalled the test norms in each grade up to 7th, but in

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1. As there was a wide discrepancy in chronological age at all levels between his monoglot and bilingual groups we are guided in the above statement by a comparison with the test norms (which the monoglots equalled); bilinguals fell far behind the norms.

higher grades they fell below the test norms. It must be observed that grade for grade the Porto Ricans were older than the Americans who served as standardisation sample for the test.

Colvin & Allen (1923) tested Italian-English bilinguals and English-speaking monoglots in 5th grade with the Lippincott-Chapman Classroom Products Survey tests. The bilinguals' marks for mechanical arithmetic did not differ appreciably from those of monoglots; in problem arithmetic bilinguals' marks were on the average much poorer than those of monoglots[1]. Rigg (1928) found Italian-English bilinguals in the St. Louis survey obtained mechanical arithmetic scores significantly lower than those obtained by monoglots.

The Welsh Joint Education Committee survey, reported by Jones et al. (1957) included, among the tests administered, Schonell's Essential Mechanical Arithmetic Test, Form A, and Essential Problem Arithmetic Test, Forms A and B. The 750 children tested were divided into the four linguistic groups, 'Welsh, Welsh-English, English-Welsh and English', with which we are already familiar. Analysis

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1. The authors provide sufficient information to test the difference between groups in each case by means of the X^2 test: the difference in mechanical arithmetic is not significant, but in problem arithmetic the difference is highly significant.

of covariance was employed to make adjustments to mean arithmetic scores for significant differences between the Welsh group and the other groups in non-verbal IQ. Thus adjusted, the groups' mean scores in mechanical arithmetic did not differ significantly; in problem arithmetic (Form A) only the Welsh and English groups differed significantly, the difference being in favour of the latter group. A Welsh version of Form B of the problem arithmetic test had been administered to the Welsh and Welsh-English groups, and the English-version to the English-Welsh and English groups before Form A was administered. Our only interest in the results obtained with Form B is that there was no advantage for the Welsh and Welsh-English groups in sitting that particular Welsh translation of the test rather than the English original of Form A. All the children tested had been taught arithmetic through the medium of English for at least two years before the time of the survey. Jones (1959) statement that the study failed to control socio-economic status has already been noted. Furthermore, no attempt was made to control relevant differences between schools and teachers.

Lewis (1960) worked over some of the results of the 1954 Welsh survey using school means rather than individual children's scores as his basic unit. Schools, too, were rated for the proportion of monoglot Welsh-speakers in them. As a result of this analysis, which incidentally suffers from the same defects as does the work of Jones et al. (1957), he concludes that there is no significant tendency for mean arithmetic scores, mechanical or problem, to be related to school ratings on linguistic background.

Irish teachers who had experience of teaching arithmetic to children from English-speaking homes through Irish as well as English were asked to reply to a questionnaire about the two media[1]. About 70% of infant teachers who replied considered that infants had greater difficulty in developing number concepts when taught in Irish. About 83% of replies from teachers of classes other than infant classes were to say that children's (native English-speakers) progress in arithmetic was much retarded by the use of Irish instead of English as teaching medium. The majority, however, thought that the mechanical aspects of number work, such as learning tables, did not suffer when taught in Irish; the difficulty was with problem arithmetic, which required a greater command of language. It is a great pity that we do not know how representative of Irish teachers as a whole, or at least of Irish teachers who had taught arithmetic in both Irish and English, these most interesting views are.

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1. INTO (1941).

In Dublin, Macnamara (1959) administered Vernon's Arithmetic - Mathematics test in English to boys who had been taught arithmetic through English, in an Irish translation to boys who had been taught arithmetic through Irish. The results suggested that boys from English-speaking homes progress more slowly in arithmetic if taught in Irish rather than in English. An item analysis indicated that the difference between groups was more marked in the problem sections than in the mechanical sections of the paper, suggesting that the difference between groups was largely due to difference in language skills. Though in the comparison, non-verbal IQ was controlled by analysis of covariance, socio-economic differences and differences between schools were not adequately controlled precisely; and furthermore no evidence was provided that results obtained with the Irish and English versions of the test are comparable.

Toussaint (1935) found French-Flemish bilinguals weaker at arithmetic than monoglot French-speaking children. But his numbers were quite small and his comparisons rather poorly controlled.

Four studies involve a non-Indo-European language linked with an Indo-European one.

Pusey (1945)[1] compared the arithmetical attainments

1. This investigation has not been described above since it it was confined to arithmetic.

of Japanese children in the U.S.A. with those of American whites, using the norms of a standardised test (Metropolitan Advanced Arithmetic test) to indicate the average performance level of 'Amerivans'. Pusey's Ss were 484 Junior High School students at a Japanese Relocation Centre in California who had lost about six months schooling through being evacuated. Though the author does not discuss their knowledge of Japanese, a great many must have been bilingual (Japanese-English). Their mechanical arithmetic compares favourably with that of Americans, particularly if allowance is made for the six months absence from school; but there is a tendency for their mean problem arithmetic score to fall below the norm for Americans by an amount which increases from grades 7 to 9. Even when allowance has been made for their absence from school, the Japanese mean in problem arithmetic falls below the American norm by the equivalent of six months arithmetical age. In so much as our object is to isolate the influence of bilingualism, this study does not aid us greatly, because that influence is confounded with the uncontrolled influence of socio-economic status, non-verbal IQ and school factors; moreover degree of bilingualism was not measured.

The British Columbia Test of Fundamentals of Arithmetic (mechanical) was administered by Jamieson and Sandiford (1928) to 199 Ontario Indians, a large proportion of whom (how large is not stated) were bilinguals, understanding or speaking an Indian tongue as well as English. In mean arithmetic score they were 'approximately equal to ... white pupils who are classed one grade lower' than themselves. The degree of retardation is greater than appears, because the Indians were appreciably older than the whites in the same grade in rural Ontario. While the Indians' mean non-verbal IQ was not much lower than whites', the former's socio-economic status was very much lower. Moreover the Indians' attendance at school was quite irregular. Thus, their retardation in arithmetic cannot be attributed simply to a language disability.

Part of the plan of the Iloilo experiment[1] was to discover which medium, English or Hiligaynon (the mother tongue), Iloilo bilinguals found more helpful in arithmetic. Experimental (Hiligaynon) and control (English) groups were most carefully matched for age, socio-economic status, and verbal IQ, while the seven schools in each group were matched in pairs with equal care. At the end of the first and second years of the experiment the experimental group, which had taught arithmetic in Hiligaynon, was tested in Hiligaynon; at the end of the third and fourth years the group, now taught in English, was tested in English.

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1. Department of Education, Manila (1953).

The control group was tested each year in English.

At the end of the first year the groups did not differ significantly in mean arithmetic score; at the end of the second year the experimental group took a significant and substantial lead; at the end of the third and fourth years (both groups being now tested in English) group means did not differ significantly. The arithmetic tests employed appear to have been in very great part tests of mechanical arithmetic. There would have been little difficulty, therefore, in translating the tests from English to Hiligaynon, and results obtained with the two versions by Iloilo children may probably be compared without danger of serious error. It seems reasonable, then, to take the experimental group's substantial lead at the end of the second year as evidence that the experimental group had made more satisfactory progress in arithmetic than the control group. The experimental group failed to maintain or increase its lead, but fell back to the same level as the control group, once Hiligaynon was replaced by English as medium of instruction. It follows that in Iloilo at any rate the mother tongue makes for better arithmetic than the second language, English.

The final paper to be discussed is that by Kirkpatrick (1926) in which comparisons were made between the arithmetical ages of monoglot English-speaking Americans and those of bilingual children who were of Finnish, Italian, and French-Canaddian, extraction. The children tested were all those in their twelfth year in certain schools in Massachusetts. The test employed was the mechanical (apparently) arithmetic subtest of the Illinois examination. No appreciable difference in arithmetical age between monoglots and Finns was discovered; but both Italians and French-Canadians fell considerably behind the monoglots in arithmetical age. From our point of view the results are difficult to interpret because the Finns obtained a median non-verbal IQ equal to the test (Army Beta) norm, the median IQs obtained by the other two bilingual groups were much lower (a non-verbal IQ was not obtained for monoglots); moreover socio-economic and school differences were not controlled.

Summary and discussion - Arithmetic.

Eighteen papers which discuss the arithmetical attainments of bilinguals have been reviewed. Seven of these do not specify whether the tests used were tests of mechanical or of problem arithmetic, or they combine results obtained with the two types of test to give a composite score. Of the seven, one (Malherbe 1946) maintains that children taught bilingually obtain higher means than those who were taught through the medium of their mother tongue, while those who were taught through ~~through~~ the medium of their second language, though suffering an initial disadvantage, soon equal the performance of those taught through the medium of their mother tongue. A second paper (Logie, in Bovet 1935) maintains that children taught bilingually equal the performance of children taught through the medium of their mother tongue; a third (Andrews 1928) reports that no difference was found between monoglots and bilinguals. The remaining four papers (Jamieson and Sandiford 1928, Fritz and Rankin 1934, Manuel 1935, Toussaint 1935) found that monoglots excelled bilinguals at arithmetic.

Part of the reason for this lack of consistency in findings may be that, no distinction being made between mechanical and problem arithmetic, the weights attached to the two aspects may vary from paper to paper; for there is fairly strong evidence to show that bilinguals equal monoglots in mechanical but not in problem arithmetic. Ten papers specify mechanical arithmetic. Six of these (Colvin and Allen 1923, Darsie 1926, INTO 1941[1], Pusey 1945, Jones et al. 1957, Macnamara 1959) found no difference between

1. This paper deals with the effects of teaching Irish children from English-speaking homes arithmetic through the medium of Irish - all Irish children learn Irish, but only some are taught arithmetic through the medium of Irish.

the two types of children. A seventh (Rigg 1928) found some bilinguals better, some worse than monoglots. An eighth (Porto Rican experiment - Internat. Instit. Teachers College Columbia 1926) found that bilinguals were better than monoglots in lower grades, poorer than them in higher grades. A ninth (Kirkpatrick 1926) found no difference between a group of monoglots and a group of bilinguals who obtained a high mean non-verbal IQ, but found an appreciable difference between the monoglots and groups of bilinguals who obtained low mean non-verbal IQs (monoglots superior). The tenth[1] (Iloilo experiment) found that though bilinguals made more progress when taught through the medium of their mother tongue, they equalled the performance of bilinguals who had been taught from the beginning through the medium of their second language when they (the first group) changed over to the second tongue. Most of the discrepancies in these findings can readily be explained by failure to control relevant variables. The unusual findings of the Iloilo experiment may, perhaps, be attributed in part to the fact that the arithmetic tests employed contained a small proportion of problems and partly to the very great difference between Hiligaynon and English which are not of the same

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1. Really four papers, but since they describe a single experiment they are treated here as one, - Department of Education, Manila (1953).

linguistic stock. Taking one thing with another the evidence seems to show that bilinguals are the equals of monoglots in mechanical arithmetic.

Seven[1] of the eight papers which treat explicitly of problem arithmetic report that bilinguals are excelled by monoglots at problem arithmetic. The eighth (International Institute, Teachers College Columbia 1926) reports that bilinguals obtained higher marks with a Spanish version of the problem arithmetic test employed than with an English version, Spanish being their mother tongue. With the Spanish version they obtained mean scores in the lower grades above the test norms for Americans, while their means in the higher grades equalled the norms for Americans; with the English version they obtained means in the lower grades which equalled those for Americans, while their means in the higher grades were lower than the norms for Americans. If we take into account the fact that the bilinguals were older grade for grade than the monoglots we see that the results, at least with the English version, cloak a superiority on the part of monoglots. Thus these findings are not at variance with those of the other seven papers. All this

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1. Colvin and Allen (1923), Darsie (1926), INTO (1941), Pusey (1945), Carrow (1957), Jones et al. (1957), Macnamara (1959).

leads to the conclusion that monoglots excel bilinguals at problem arithmetic.

The evidence that bilinguals do not know either of their languages as well as monoglot speakers know theirs, which was set forth and discussed in the previous chapter, is at once a support for the findings of the present section, and is supported by them. In other words, on the linguistic evidence we should have expected monoglots to excel bilinguals at problem arithmetic. The fact that the groups are equal in mechanical arithmetic may indicate that the type of drill by which it was usually taught negatived the effect of the linguistic difference.

The present investigation has gained much from the experience of research workers in bilingualism, and from a critical appraisal of their work. As we shall see, steps were taken to exclude the defects which have been noted in much of the work which has been done, and it is hoped that by doing so the effects of bilingualism which the writer set out to study - the effect of bilingualism on attainments in Irish and English, and the effect of teaching children from English-speaking homes arithmetic through the medium of Irish - have been brought more clearly into focus.

Further, the conclusions which we reached in this chapter and the previous one will help us to interpret and explain some of the quantitative results obtained in the present inquiry.

CHAPTER 3.

THE SAMPLE

The survey which is the subject of this thesis was confined to national schools[1] in the Republic of Ireland. By confining the survey to national schools and excluding private schools about 10.6% of the children in the country at the level in which we are interested are excluded, according to the best estimate which we can make[2]. The reasons for excluding private schools

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1. A 'national school' is one which is erected and maintained partly at the expense of the Department of Education, partly at the expense of the Manager (usually the parish priest). The teachers' salaries are paid entirely by the Department of Education. It is subject to the Rules and Regulations of the Department of Education. It is a public school in the sense that parents have the right to send their children to it free. In all these respects it differs from a private school.

   In the following pages, 'Department of Education' is abbreviated to 'Department' where convenient, and 'inspector of the Primary Branch of the Department' to 'inspector'.

2. It is not possible to obtain precise figures for the number of children in private schools at any age level. The above estimate is based on the 9 to 10 year old group which is a good group to take because at that age school attendance is compulsory and yet no children will have transferred to secondary schools. The estimate is derived as follows: we know the number of children in each year group in 1946 (the census of that year is the only one for which such figures are available - Central Statistics Office 1960, p.24); we can estimate the number of deaths over any period of time (Op.cit. p.27); we know the number of children in each age group attending national schools in 1952 (Department of Education 1954, pp.322-4. The last mentioned figures are published in every fifth year only, and those for 1952 are the best to compare with the figures of the 1946 census). The number of children in the 9 to 10 year group attending national schools in 1952 is 50,915. The number of children in their fourth year (the corresponding group) in 1946 was 57,206. If we allow for 250 deaths in the group between 1946 and 1952, we find that 89.4% of the age group were at national schools in 1952 and 10.6% presumably at private schools.

   It is quite reasonable to assume that the ratio of national school to private school children did not alter appreciably over the intervening nine years to 1961.

were mainly practical. Firstly, the present writer was unable to obtain a list of all private schools in the country, and consequently he was unable to select a sample of such schools which would be representative of them; secondly, the inspectors who undertook to carry out the necessary testing have not the right of entry into private schools. The significance of excluding these schools is that, being fee-paying, they draw their pupils from better off homes; and since such children tend to score above average in intelligence and attainment tests, our results are not fully representative of the country as a whole. Children attending special schools for the physically and mentally retarded, of whom there were 1,933 in 1959[1], were also excluded, and so there is a second source of bias in our results. However it is important to observe that neither of these sources of bias is likely to affect our comparisons between groups of children in national schools, because the number of children not included[2] is unlikely to vary significantly

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1. Department of Education (1960) p.53. A more recent report, for the year 1959-60, appeared a few months ago, but since all the calculations of this chapter are based on the 1958-59 report it was judged best to quote almost entirely from the latter report. Since the survey was carried out in 1961 (figures not yet available), and since in any case the figures in the 1958-59 and the 1959-60 reports do not vary appreciably, there seemed to be little purpose in altering our calculations to base them on the later report.

2. As regards private school children this statement intends to convey that had all such children gone to their local national schools, the extra number would be approximately the same over all six groups of schools. As we shall learn from a study of the geographical distribution of the schools from which each group was selected the statement is not quite accurate, because private schools are mostly situated in cities and large towns; however the statement is substantially correct.

from group to group. But we are going ahead too quickly, and it will now be necessary to describe these groups and explain the precise nature of the differences between them.

The main purpose of our survey is to determine certain effects of teaching children from English-speaking homes through the medium of Irish. For this purpose five groups of such children in 5th standard were tested, the essential differences between groups being in the number of years during which the groups were taught through Irish. A sixth group of children in Irish-speaking districts[1] was added as a control.

A Department circular[2] issued in 1931 contains the regulations which governed the teaching of subjects through the medium of Irish under which the children with whom we are concerned were educated. We quote the following passages:

> "The use of Irish as teaching medium is now obligatory when the teacher is competent to give the instruction (through Irish) and the pupils are able to assimilate the instruction so given .... Teachers who hold Bilingual or Higher Certificates will, unless there be evidence to the contrary, be regarded as competent; but the possession of these certificates is not an essential condition for such teaching."

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1. These children were taught all subjects, English excepted, through Irish at all levels.

2. Department of Education (1954), pp. 330-344. Some changes were made in the regulations for junior classes in Spring 1960, but they are too recent to have affected the children who were tested in the present survey.

In 1959 some 81%[1] of primary teachers held the Bilingual Certificate. From 1934 forward special emphasis was placed on teaching infants entirely through Irish; but in 1948 a revised programme for infants was issued which permitted the teaching of English for half an hour per day.[2]

The effects of these regulations are not as wide spread as one might suppose. For instance the number of schools in English-speaking districts in which all subjects are taught through Irish (English excepted) is 155[3], out of a total of 4,642 schools in those districts. However the number of schools in English-speaking districts which teach some subject or subjects through Irish for varying numbers of years is very much greater than 155[4]. The subjects in which children were tested for the present survey are Irish, English and arithmetic; and of these the only one in which the medium of instruction varies is arithmetic[5]; Irish and English are invariably taught

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1. Department of Education (1960), p.66.

2. Department of Education (1954), p.70.

3. Department of Education (1960), p.56.

4. Complete figures are not available for these schools, but the figures in table 3.1 show the position as regards arithmetic.

5. Apart from religion which is taught through the mother tongue of the majority of children in the school, the only other subject widely taught in which the medium of instruction varies in junior classes (infants, 1st-3rd standard) is singing; history and geography are not introduced before 4th standard. For a more detailed discussion of the curriculum of national schools see below, Chapter 8, pp. 351 sq.

through the medium of Irish and English respectively. The Department graciously undertook to compile lists of all schools in which arithmetic is taught through Irish, giving in each case the number of classes to which it is so taught, and to compile another list of the schools in which arithmetic is not taught through Irish at all. However, it was found to be unnecessary to compile a list of the enormous number (3,630) of schools in which arithmetic is taught through Irish to infants[1] but to no other class, since these could be determined by exclusion. Table 3.1 summarises these lists.

TABLE 3.1

Number of Schools in which Arithmetic is Taught through Irish: English-speaking Districts

Infants English	Infants Irish	To 1st inclus.	To 2nd Inclus.	To 3rd inclus.	To 4th inclus.	To 5th & beyond.
62	3630[2]	342	297	52	39	220

Before going on to describe the method whereby schools in which

1. It appears from Department of Education (1957), Table 14, that arithmetic is taught to about 82% of infants in national schools.

2. This number, derived by subtracting the sum of the other numbers in the table from the total number of schools in English-speaking districts, 4,642, is slightly in error since a small number (no figures available) of schools have no infants department.

to carry out the survey were selected, we should like to set out our reasons for choosing to test 5th standard children rather than any others. Two principal requirements guided the choice; (i) that the children tested should be as nearly as possible a complete cross-section of national school children; (ii) that they should have been at school long enough to make a decisive assessment of the effects of the language policy possible. The figures in table 3.2 show that 5th standard is the one which meets the requirements best.

TABLE 3.2[1].

Number of Pupils enrolled in each standard for the years 1959 and 1960.

Year	1st	2nd	3rd	4th	5th	6th	7th	8th
1959	61,532	62,164	62,318	60,144	57,668	41,838	12,318	4,147
1960	61,972	61,399	61,192	60,434	57,038	42,699	12,083	4,430

There we observe that the first large falling off in numbers is in sixth standard. Only about 74% of the children who were in 5th standard in 1959 were in sixth standard in 1960, while about 95% of those who were in fourth standard in 1959 were

1. The figures in this table are taken from Department of Education (1961), table 13. The compulsory school age is from 6 to 14.

in fifth standard in 1960[1]. Thus it is apparent that fifth standard is the highest one where a good cross-section of national school children are to be found.

One of the drawbacks to testing fifth standard is that it contains children ranging in age from 8 to 16 years[2]. But the alternative, of testing a year group, has even greater drawbacks, since the children of the eleven plus groups for example are scattered throughout all the classes from infants to eighth standard[3]; and since each standard has a different curriculum, another variable more difficult than age to control would then be introduced. On balance it was decided that it was better to work with a standard than with an age group.

First Sample of Schools - Random.

With the aid of the Department's lists it was decided to select at random (by means of random numbers) 20 schools from each of the following types of schools in English-speaking districts:

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1. These relationships are more or less constant over many years, so it is reasonable to presume that about 95% of the children who were in fourth standard in 1960 were in fifth standard at the end of the year 1960-61; the figures in table 3.2 are for June 30th, the last day of the official school year.

2. Department of Education (1961) pp.85.

3. Ibid.

Type 1 - arithmetic taught through Irish to no class, (not even infants)

Type 2 - " " " Irish to infants alone.

Type 3 - " " " " up to 1st standard inclusive.

Type 4 - " " " " up to 3rd standard inclusive.

Type 5 - " " " " up to 5th standard or beyond.

A further 20 schools, bringing the total to 120, was selected from a list of the schools in what used to be called the Fíor-Ghaeltacht (literally, 'truly Irish-speaking districts'). These 20 schools in which all subjects (English excepted) are taught through Irish to all classes constitute a sixth type.

The sample excludes, besides private and special schools, all schools in what used to be called the Gaeltacht (Irish-speaking districts) and the Breac-Ghaeltacht (bilingual districts); type 6 is composed exclusively of schools in the Fíor-Ghaeltacht. In this way we have been able to exclude children who are unlikely to know Irish as well as those in the Fíor-Ghaeltacht but of whom a certain proportion are native Irish speakers, thus confining the survey on the one hand to children whose mother-tongue is Irish or who possess a native-like command of Irish (type 6) and on the other hand to children whose mother-tongue is English (types 1 to 5). The last report which employed the terms just mentioned was the one for 1955-56[1], and

1. Department of Education (1957), p.62. The reason for changing the terminology appears to have been that the old terms no longer described the situation adequately.

it classified the following numbers of schools under three headings:-

Fíor-Ghaeltacht	Gaeltacht	Breac-Ghaeltacht
179	62	58

Twenty-one of the 62 schools of type 1 are protestant. Since about 97%[1] of national school children are catholics, a random sample of schools from the 62 would include an unrepresentatively large proportion of protestants. For this reason protestant schools of type 1 were excluded from the sample; protestant schools of the remaining five types were not excluded, and in fact one of the schools in the sample is protestant.

Schools of type 2 were selected from the official 'List of National Schools Arranged in Alphabetical Order'[2] which contains every national school in the country on January 1st, 1953. The first 20 schools selected (by means of random numbers) from this list which answered the description of type 2 constitute the sample of schools of that type.

When they had been selected it was discovered that in all 20 schools of type 5 all subject (English excepted) were taught through Irish to all classes; though our aim had been merely to select schools in which arithmetic is taught through Irish to all classes up to 5th inclusive.

1. Department of Education (1960), p.58.
2. Stationery Office (1953).

The purpose of selecting schools which teach arithmetic through Irish for varying numbers of years was to see whether there were any systematic concomitant variations in Irish, English, and arithmetical, attainments.[1]

The method of selecting schools rather than pupils at random has several clear advantages. It recognises that pupils do not exist in isolation, but are members of a society which we call a school with a tradition peculiar to itself perhaps, and having teachers with individual personalities who hold certain views on education and use certain teaching methods; with the result that the children of a school have come under an influence, peculiar to that school, which affects their mean scores in attainment tests. By keeping classes intact and classifying them in a variety of ways we can add appreciably to the sensitivity of statistical tests comparing teaching methods. From the administrative point of view, too, it is preferable to select schools, because it is easier to test a large number of children in a small number of schools than to test the same number of children, selected independently of

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1. Owing to an omission in the Department's lists, discovered by Mr. Sean O'Conchobhair, Principal Officer of the Primary Branch, when it was too late to do anything about it, about half of the schools of types 3 and 4 which were selected teach arithmetic bilingually (Irish and English) for a year or more after they cease to teach it through Irish alone. The complication of bilingual teaching might have been avoided had it been discovered in time; but happily it is an unimportant one because the results for schools of types 3 and 4 show that differences between schools which teach arithmetic bilingually and those which teach it in English after they cease to teach it in Irish are not significant - see below, pp. 233 sq.

their schools, scattered through a very large number of schools.

In determining the size of sample to represent the schools of each type it was necessary to compromise between adequate sampling of the type and the difficulty for the private investigator of handling large numbers of tests and results. Twenty schools appeared to be a suitable sample. But table 3.1 shows that there are large differences between the number of schools in each type, and that while 20 schools are a more than adequate sample of types 1, 4, 5 and 6[1], they are not so adequate a sample, proportionately, of types 2 and 3. Nonetheless it was felt that 20 schools selected at random from the total number of any type (even a total of 3,000) provide a reasonably reliable estimate of the mean for that type of school in the tests which were employed. Lest the number of schools in sub-classifications of schools in each type should drop too low it was considered undesirable to select a sample of less than 20.

Our first task on drawing the sample of schools was to study their geographical distribution. Since Fíor-Ghaeltach districts exist in only 7 counties[2] the sample of schools of type 6 could not be distributed at random throughout the country; so our attentions were directed to schools of the other five types.

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1. There are 179 schools of type 6.

2. Cos. Donegal, Mayo, Galway, Kerry, Cork, Waterford, Meath.

The distribution of the latter is given in table 3.3, the most striking features of which are the relatively small number of schools of type 1 and the relatively large number of schools of type 5 in counties which traditionally[1] have Irish-speaking districts (marked G in table 3.3); suggesting a swing away from teaching through English and towards teaching through Irish in those counties. As we shall be referring to these counties which traditionally have Irish-speaking districts as a group continuously throughout the remainder of this work we shall for the sake of convenience use the term West to designate them since six of the seven are on the western seaboard; and counties other than these as a group we shall designate Rest. The hypothesis that the sample of schools of a particular type (1 to 5) is randomly distributed between West and Rest can be tested by means of the X^2 test[2], using the figures given in the column furthest to the right in table 3.3 to calculate the 'expected' frequencies. The hypothesis was tested in the case of each sample of 20 schools; and since the X^2 test is not

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1. 'Traditionally', to exclude Co. Meath in which the Gaeltacht is of recent importation - see note attached to table 3.3.

2. Several X^2 tests were carried out of the hypothesis that the population (as distinct from the sample) of schools of each type is distributed at random throughout the counties, from which it became apparent that (i) there are significantly fewer schools of type 1 in the West than would be expected if the hypothesis of random distribution were true; (ii) that there are significantly more schools of types 3, 4 and 5 in the West than would be expected if the hypothesis of random distribution were true. The tests were carried out in a manner similar to that described in the text; it is sufficient to record the findings without going into further detail.

TABLE 3.3

Number of Schools of Types 1 to 5 Selected in each County.

County	Type 1	2	3	4	5	No. of schools excluding Irish speaking districts +
Carlow						62
Cavan				2		197
Clare (G) /		3	1	1	3	164
Cork (G)	1	1	2		2	495
Donegal (G)			1	2		281
Dublin		2	4	1	1	386
Galway (G)	1		4	2	1	258
Kerry (G)		2	2	1	4	222
Kildare						99
Kilkenny		1	1		1	140
Laois		1			1	98
Leitrim	1					128
Limerick	1		2	2	1	213
Longford			1	2		73
Louth						84
Mayo (G)	1	3	1	2	4	287
Meath		2		1		121
Monaghan	4		1			143
Offaly	2					102
Roscommon	2	1				163
Sligo		1			1	147
Tipperary	2	1				247
Waterford (G)		1				103
Westmeath				2	1	105
Wexford	4	1				147
Wicklow	1			2		114
Total:	20	20	20	20	20	4,579

\+ The numbers in this column are the numbers given in Department of Education (1960), p.49, but the number of schools in the three types of Irish-speaking districts have been deducted from the totals for each county.

/ Counties which have (G) after their names are counties in which there are Irish-speaking districts.
A (G) was not affixed to Co. Meath because the Irish-speaking district in it was created 'artificially' by settling Irish-speakers from the West coast there, and for that reason the rest of the county is best classed for our purposes with the English-speaking counties.
A (G) was affixed to Co. Clare, because, although it contains no Fíor-Ghaeltacht district, it contains areas which were classed until 1956 as Gaeltacht and Breac-Ghaeltacht.

reliable if an expected frequency is less than 5, the counties of the West and those of the Rest were combined into two separate groups to afford expected frequencies of 7.91 and 12.09 respectively. Because there is only one degree of freedom in each test it was necessary to make corrections for continuity.[1] The test was carried out in the same manner each time, so it will be sufficient to describe one in detail.

TABLE 3.4.

Distribution of Sample I[2] - X^2 Test.

	Fo	Total	Fe	Fo-Fe	$(Fo-Fe)^2/Fe$.
West	3	1810	7.91	- 4.41	2.46
Rest	17	2769	12.09	4.41	1.61
Total	20	4579	20.00	0.00	4.07

In table 3.4 Fo denotes the observed frequencies; Fe the expected frequencies; $(Fo-Fe)^2/Fe$ is X^2.

1. The correction was made in the manner described by Snedecor (1956), pp.217-9.

2. The six samples of 20 schools each will henceforth be designated samples 1,2 ... 6 to show that they are samples of type 1, 2 .... 6 respectively.

TABLE 3.5

Geographical Distribution of Samples 1 to 5.

Values of X^2.

	X^2	Degrees of Freedom
Sample 1	4.07	1
" 2	.529	1
" 3	1.40	1
" 4	0.00	1
" 5	6.53	1

With one degree of freedom X^2s $\geqq$ 3.84, 5.02 and 6.63 are significant at the .05, .025 and .01 levels of probability respectively. Thus the hypothesis of random distribution may reasonably be retained in the case of sample 2,3 and 4; and it may reasonably be rejected in the case of samples 1 and 5. By referring to table 3.3 we see that the departures from random distribution are in these directions; fewer schools of sample 1 in the West and more in the Rest than 'expected'; more schools of sample 5 in the West and fewer in the Rest than 'expected'.

Mr. Tomás Ó Domhnalláin, an inspector with wide experience in both the West and the Rest, was consulted about findings, and he observed that the counties in the West are not only those which have Irish-speaking districts but are also the counties with a tradition of the keenest interest in education, partly with a view to securing good positions in later life. To understand the relevance of the observation the reader must know that Irish is the only compulsory subject for the Leaving Certificate; that it carries 200 marks more than any other subject except honours mathematics in that examination; that a bonus of 10% is awarded to candidates who answer any paper, English excepted, in Irish; and that entry to many careers, such as primary teaching, is competitive on the basis of an aggregate of Leaving Certificate marks. Consequently a student who wishes to compete for many salaried positions which do not require a university degree is influenced not only to pay great attention to Irish, but to study other subjects through Irish. It is quite probable that the influence stretches down into the primary school.

Mr. Ó Domhnalláin and others who were consulted observed that another factor might well be operative in producing the observed differences between West and East. The West sends forward a very high proportion of the trainees for primary teaching, probably a result of the interest there in financial advancement through education; and schools in the western counties are staffed mainly by teachers from the counties in which they teach, who, being reared in the tradition of the county, work to perpetuate the conditions which enabled them to 'get on' themselves. On the other hand counties such as Leitrim, Offaly, Kildare and Monaghan which have particularly few schools teaching through Irish, send forward few for training as teachers; and their teachers being largely from outside the counties where they teach may not press so hard to enable children to 'get on' as they would if they were teaching in their native counties.

Many teachers and inspectors also remarked that, in the effort to revive Irish, teachers in the English-speaking districts of counties which have Irish-speaking districts have been urged more strongly than others to achieve a high standard of Irish and to teach other subjects through Irish. The idea seems to have been that the language revival must spread from the Irish-speaking districts through neighbouring English-speaking districts to counties where no Irish is spoken.

At all events there is a distinct possibility that the West and Rest differ systematically in educational attainments, and since schools of types 1 and 5 are not randomly distributed between them, we shall have to pay particular attention to the location of schools when we come to analyse our test scores.

Many research workers[1] have found rural children

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1. Notably Emmett (1950), Barr (1959), Pidgeon (1960). This topic will be raised again and discussed in greater detail in Chapter 8.

inferior to urban ones in tests of both attainments and reasoning ability. Though the differences between the two areas in these respects do not appear to be very great, the proportion of urban to rural schools in the sample was compared with that in the country. The X^2 test is appropriate to test the hypothesis that the sample does not differ significantly from the country in this respect. Since there is only one degree of freedom it is necessary to use Yates' correction for continuity. There were 344 schools within the County Boroughs of Dublin, Cork, Limerick and Waterford in 1959; there were 4,534 in the remainder of the country[1]. The sample contains 9 County Borough schools as compared with 111 in the remainder of the country. The test yield $X^2 = .00018$, which falls far short of significance at the .05 level[2].

Of the 9 urban schools in the sample, 4 are in sample 2 and 5 in sample 3. If urban schools are distributed at random through the six types of school, the probability of drawing an urban school is 1 in 13.2 (or more precisely 344 in 4,534); and the probability of drawing 9 such in a

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1. Department of Education (1960), p.49. These are the only County Boroughs in the country.

2. With one degrees of freedom, $X^2 \geqq 3.841$ is significant at the .05 level.

sample of 40 is $\left(\frac{40!}{9!\ 31!}\right)\left(\frac{1}{13.2}\right)^{9}\left(\frac{12.2}{13.2}\right)^{31}$, which works out to be some figure less than .0001, which is a very small probability indeed. We take it as established then that the proportion of urban to rural schools in types 2 and 3 combined is greater than in the country as a whole, and that the six samples differ significantly in this respect.

The Department supplied the following information about each of the schools selected: the total number of pupils, number of boys, number of girls, number of rooms, number and qualifications of teachers. The six samples were compared with each other and, where possible, with the entire body of Irish schools in each of these respects.

Taking first the number of teachers in each school, as being a variable which is likely to bear a relationship with scholastic attainments, we indicate the composition of the samples in that respect in table 3.6.

Since the expected frequencies (3, 11, 3, 3) for a single sample are small, the hypothesis that samples do not differ significantly from one another or from the total body of schools in their teacher-school composition cannot be tested

TABLE 3.6

Number of 1-, 2-, 3-, and more-than-3-Teacher, Schools

	Sample						Total 6 Samples	Total[1] Country	'Expected' Total 6 Samples
	1	2	3	4	5	6			
1-Teacher	3	1	1	-	4	4	13	755	18.57
2-Teacher	13	9	7	14	12	13	68	2,648	65.14
3-Teacher	3	6	5	4	3	2	23	782	19.24
More-than-3-Teacher	1	4	7	2	1	1	16	693	17.05
Total	20	20	20	20	20	20	120	4,878	120.00

by means of the X^2 test in the manner outlined above. However inspection suggests that there are important differences between them. The reason for differences between samples in their number of 1-teacher schools is not far to seek. The teacher in such schools must supervise all classes at once, and probably elects to teach them all through the medium of one language, Irish or English. This probably explains why

1. Department of Education (1960) p.51.

samples 2, 3 and 4, which presuppose a change in language, have fewer 1-teacher schools than 'expected'. The same cause has probably reduced the number of 2-teacher schools in sample 3, (through Irish to 1st standard, through English from 2nd) since the teacher of the junior half of a 2-teacher school usually teaches all classes up to 3rd standard. The other interesting feature of table 3.6 is the large number of more-than-3-teacher schools in sample 3, but we shall find other unexpected facets of this sample which will throw light on the anomaly.

Totals for the 6 samples given in table 3.6 may be compared with 'expected' totals by means of a X^2 test, to ascertain whether the former are equivalent to a random selection from Irish schools as a whole. In this test, with three degrees of freedom, $X^2 = 2.597$, which falls far short of significance at the .05 level.[1] Thus the 6 samples combined can safely be regarded as representative of Irish schools in their teacher-school composition. This combined conformity with the expected pattern however cloaks quite large differences between the individual samples which, despite the result of the test just noted, were not considered suitable

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1. With 3 degrees of freedom a $X^2 \geq 7.815$ is significant at the .05 level.

for the purpose of the survey in the important respect under discussion. As we shall see, steps were taken to equate samples in the matter.

TABLE 3.7.

Average number of Children on Rolls in each Sample.

Sample	1	2	3	4	5	6	N expected[1] for 20 schools.
N	1271	2125	5940	1555	1547	1104	2018.5

Table 3.7 makes it clear that there are marked differences between samples in the average number of children on rolls, and that some samples differ markedly from the 'expected' number of children on rolls.[2] The two smallest samples are 1 and 6, which we remember from table 3.6 had only one school of more than 3 teachers apiece. So it would appear that schools of these two types tend to be small. Sample 3 has very much the largest number of pupils, which no doubt is because, as noted in table 3.6, it includes no fewer than 7 large schools: 2 of the 7 have over 1,000 children and over 20 teachers each, a 3rd has 800 children and 19 teachers, a 4th has 600 children and 13 teachers, a 5th has 500 children

1. See Department of Education (1960), p.57.

2. So great are the differences, in fact, that there is no need to test their significance by statistical procedures.

and 10 teachers. Since there are only 20[1] schools in the entire country with 19 or more teachers, and since in sample 3 we have 3 of them, it is clear that there is a preponderance of such schools among those of type 3.

There are also differences between samples in the proportion of boys to girls, which are relevant to the point we are discussing.

TABLE 3.8

Number of Boys and Girls in Schools Selected.

Group	1	2	3	4	5	6	Total
Boys	607	898	1746	786	717	558	5312
Girls	663	1226	4194	796	829	547	8228

In the country as a whole there are slightly more boys than girls, the average numbers enrolled in 1959 being 247,963 and 244,352 respectively.[2] In table 3.8 we see that there are more girls than boys in four samples, the difference being

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1. Department of Education (1960) p.51. The probability of drawing 3 such schools when selecting 20 from 4,878 schools is

$$\frac{20!}{3!\ 17!}\left(\frac{1}{243.9}\right)^{3}\left(\frac{242.9}{243.9}\right)^{17},$$

if we assume that schools of this size are distributed at random throughout the different types of school. This expression is approximately equal to .00008; which means that on our assumption such an occurrence might be expected only once in 12,500 samples, so we abandon the assumption for the belief that sample 3 comprises a preponderance of large schools.

2. Loc. Cit. p.59.

greatest in sample3. The difference in sample 3 would be even greater still if we omitted about 700 boys from 4 of the large schools which only take boys at the infant and 1st standard levels after which they are transferred to boys' schools[1].

TABLE 3.9

Number of Boys', Girls' and Mixed Schools in Sample.

Group	1	2	3	4	5	6	Total
Boys	-	6	3	2	4	1	16
Girls	-	3	7	2	4	1	17
Mixed	20	11	10	16	12	18	87
TOTAL:	20	20	20	20	20	20	120

Table 3.9 throws some light on the situation for it shows that sample 3 contains 7 girls' and only 3 boys' schools. These 7 girls' schools are the 7 large schools mentioned when discussing table 3.8; from which it is apparent that the preponderance noted there is not so much one of large schools as one of large girls' schools.

The 6 boys' schools in sample 2 are all small, and the preponderance of girls is due to the presence in the sample of 2 girls' schools of over 250 pupils apiece. It is

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1. Again, the differences between samples are so great that there is no need of statistics to test their significance.

interesting to notice in passing that there are no boys' or girls' schools in sample 1, and only one of each in sample 6; we shall be in a better position to comment on this fact when we have drawn the second sample.

Girls are in the majority by over 300 in sample 2, but the difference can be explained by the presence of one girls' school with 290 girls; so probably there is no evidence here of a general tendency for girls rather than boys to be taught through Irish in infants. None of the lesser differences between the numbers of boys and girls in Table 3.8 need detain us.

TABLE 3.10

Teacher-Pupil Ratio in each Sample.

	1	2	3	4	5	6	Country[1]
1 teacher to	29.56	38.63	46.05	31.73	35.99	27.61	34.59

To test the hypothesis that teacher-pupil ratios do not differ significantly among samples, an analysis of variance was carried out. The mean number of children per teacher forms the measure for each school.

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1. Department of Education (1960), pp.57 and 63. The figure, 34.59 is obtained by dividing the average number of children on rolls, 492,315, by the number of teachers 14,233. In the Department's lists it is the average number of pupils on rolls that is given.

TABLE 3.11

Analysis of Variance - Teacher-Pupil Ratio.

Source	DF	SS	MS	F
Among Samples	5	970.86	194.17	2.01 (5,114) Not significant.
Within Sample	114	10991.82	96.42	

The variance ratio, F, falls short of significance at the .05 level, (with 5 and 120 degrees of freedom an $F \geqq 2.29$ is significant at the .05 level).

The hypothesis that the mean teacher-pupil ratio for the entire sample, which is 1 teacher to 38.80 pupils, does not differ significantly from the mean ratio for the entire country may now be tested, using MSw of the above analysis to compute the SE of the mean difference. The formula[1] used was $t = \dfrac{M_1 - M_2}{\sqrt{MSw\left(\frac{1}{N_1} + \frac{1}{N_2}\right)}}$ in which N_1 is the number of measures in the first sample (120 in this case) and N_2 is the number of measures in the second (4,878 in this case, for that is the number of national schools in the country). Since t = 4.65 (DF = 114), which is significant at the .0 level,[2] we reject the hypothesis that the sample is representative of the country as a whole

1. Lindquist (1953) p.91.
2. With more than 30 degrees of freedom, $t \geqq 1.06$ is significant at the .05 level, and $t \geqq 2.58$ is significant at the .01 level.

in its teacher-pupil ratio.

TABLE 3.12

Number of Rooms and Number of Teachers[1]

Sample	1	2	3	4	5	6
Class rooms	42	58	108	48	49	41
Teachers	43	55	119	49	43	40

Amongst the variables which could conceivably affect teaching and learning is whether a teacher has a room to himself, or must teach in the presence of one or more other teachers with their classes. It would appear from table 3.12 that no sample is at a disadvantage in this respect. However the numbers in many rural schools are falling, which has led in many schools to a fall in the number of teachers, with the result that many rural schools have vacant rooms. Consequently table 3.12 might be misleading, for entries showing approximately equal numbers of rooms and teachers in in a particular group may cloak a surplus of rooms in some schools, a shortage in others. We are interested chiefly, of course, in the number of schools where there is a shortage of rooms. However, the differences between samples in this matter are negligible, as can be seen in table 3.13.

1. Note that large schools, and sample 3 contains 7 such, are allowed to have a non-teaching principal, who does not occupy a class room.

TABLE 3.13

No. of Schools which are Short✓ of One or More Rooms.

Sample	1	2	3	4	5	6
No. short one room	2	3	3	3	-	1
No. short more than one room	-	-	-	1	1	1
TOTAL:	2	3	3	4	1	2

✓ 'Short', in the sense that two or more teachers must share a classroom.

There are no figures for the number of schools in the country which are 'short' of one or more rooms.

TEACHERS.

Though teachers of a variety of qualifications are recognised by the Department, for our present purpose teachers may be divided into two categories, trained and untrained.[1] Trained teachers are persons who have completed a two year[2] course of training in a Training College and passed the final examination.[3] Persons are recognised as

1. The Department uses this simple division - see Department of Education (1960) p.63.

2. For university graduates the course is one year.

3. Department of Education (1946) p.113.

untrained teachers, if, while satisfying the requirements for entry to training, they have not in fact been trained, or failed to pass their final examination.[1]

Table 3.14 gives the status of teachers in the 120 schools first selected.

TABLE 3.14

Sample	1	2	3	4	5	6	Country[2]
Trained	34	51	99	39	37	22	11,092
Untrained	9	6	20	10	6	18	3,141
TOTAL:	43	57	119	49	43	40	14,233

We may test the 'null hypothesis' that the proportion of trained to untrained teachers in each sample does not differ from the proportion in the entire body of teachers by the X^2 test. As there is only one degree of freedom in each test, Yates' correction for continuity was employed.

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1. Department of Education (1946) p.52. This is a simplification, but it is accurate enough for our purpose.

2. Department of Education (1959) p.63 - figures given under this heading are obtained by adding the totals given in two tables: teachers 'in the service' and 'supernumerary teachers'.

TABLE 3.15

Ratio of Trained to Untrained Teachers.

Values of X^2.

Sample	X^2	DF
1	.00022	1
2	3.730	1
3	1.580	1
4	.009	1
5	1.187	1
6	11.027	1

Accepting a $X^2 \geqq 3.841$ as significant (the .05 level) we observe in table 3.15 that sample 6 alone differs significantly from the body of teachers as a whole in the proportion of trained to untrained teachers. It is clear from table 3.14 that the significant difference is due to the presence of a smaller number of trained and a larger number of untrained teachers than the 'null hypothesis' can support. The reason is possibly that schools in this sample, (Irish-speaking districts), which are for the most part small[1] ones situated in remote places along the west coast, do not attract trained teachers to the same extent as schools in other parts of the country. A high proportion of untrained teachers might well affect the mean

1. See tables 3.6 and 3.7.

attainments of a sample, so this factor must be borne in mind.

The proportion of trained to untrained teachers in the 6 samples combined was compared with the proportion 'expected' in the teaching body as a whole. In this comparison there was one degree of freedom, so Yates' correction for continuity was employed. $X^2 = 1.050$ (DF = 1), which is not significant at the .05 level[1].

First Sample: Summary

At this juncture the reader may find a summary of the foregoing study of the first sample of 120 schools helpful.

(i) The schools of samples 1 and 5 are not distributed at random between West and Rest - the departures from random distribution are likely to be associated with low attainments in sample 1 and high attainments in sample 5.

The schools of sample 6 (Irish-speaking districts) are not distributed at random throughout the counties of the Republic.

(ii) Although the entire sample of 120 schools does not differ significantly from Irish schools generally in the proportion of urban to rural schools, samples 2 and 3 contain a higher proportion of urban schools than the country as a whole. This probably favours those two samples slightly in scholastic attainments.

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1. A $X^2 \geq 3.841$ is significant at the .05 level in a test with 1 degree of freedom.

(iii) In sample 3, more-than-3-teacher schools are more numerous, and 1-teacher and 2-teacher schools less numerous, proportionately than among Irish Schools as a whole. In samples 2, 3, and 4, 1-teacher schools, and in samples 1, 5, and 6, more-than-3-teacher schools, are less numerous proportionately than among Irish schools as a whole.

(iv) The number of children varies widely from sample to sample; samples 1 and 6 have each fewer than the national average for 20 schools, while sample 3 has more.

(v) Sample 3 comprises a great many more girls than boys, due to the presence in the sample of 7 large girls' schools. A preponderance of girls would probably augment the sample's mean in language tests and depress it in arithmetic tests.

(vi) The six samples do not differ significantly from one another in teacher-pupil ratio; though there are more pupils per teacher in the six samples combined than in Irish schools as a whole.

(vii) The six samples do not differ significantly from one another in classroom accommodation.

(viii) Alone amongst the six samples, No.6 differs significantly from Irish schools generally in the proportion of trained to untrained teachers; its proportion of untrained teachers is significantly higher than that of Irish schools generally.

Second Sample of Schools:- Controlled

The samples of schools first selected were considered unsatisfactory for the purpose either of making comparisons between samples or of forming a representative sample of Irish schools; so a second selection was made with the aim of removing the disparities noted in the previous pages. As our main purpose is to compare groups[1], it was thought, by controlling the number of 1-, 2-, 3-, and more-than-3-teacher schools in each group, for this would control the size of school, the number of teachers and the teacher-pupil ratio. An attempt was also made to have approximately equal number of boys and girls in each group. Thus we have called the second sample 'the controlled[2] sample'.

It was not possible to find any 1-teacher schools of types 1 or 4, and it was only after a great number of type 6 had been drawn at random that a more-than-3-teacher school was found. It was impossible, then, to match groups and have them representative of the country as a whole in teacher school composition, so it was determined to aim at the following proportions:-

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1. Where in discussing the first selection we referred to samples 1, 2, etc., in discussing the second we shall refer to groups 1, 2, etc., in order to distinguish between them.

2. The word 'controlled' is used in the sense defined by Lindquist (1940) p.5: 'A controlled sample is one in which the selection is not left to chance, or not entirely to chance, but in which the distribution of some selected characteristic is made to conform to some pre-determined proportion.'

Category of School	Chosen Proportion	Country as a Whole
1-Teacher	1	3
2-Teacher	13	11
3-Teacher	4	3
More-than-3-Teacher	2	3
TOTAL:	20	20

Groups were controlled by rejecting from each of the first six samples the schools last selected which gave the sample more schools of a particular category than were required under the new arrangement, and by drawing at random again to make good deficiencies in the other categories. Thus, for example, the last five of group 3's more-than-3-teacher schools were rejected to make room for five extra 2-teacher schools. At the same time, as the numbers of boys and girls were to be kept approximately equal, one of the very large girls' schools in this group was rejected to be replaced by a smaller school with the required number of teachers, which happened to be a 2-teacher school. In the original sample 6 there were two remote island schools which were replaced by comparable schools on the mainland. A further six schools of various types which had fewer than three children in 5th standard were replaced by larger schools having the same number of teachers; for it was thought that at least three children would have to be tested to justify an inspector's visit to and day in a school, and to give the school mean some reliability. Finally, from time to time the Department discovered that a small nymber of the schools actually selected for the sample were unsuitable (one such, for example, had lost their school building in a fire) or had been misplaced in the lists of types, and these were replaced of course by other schools of the required description. In all this, the replacements were selected at random (random numbers), the first suitable school to appear in the second selection replacing a rejected school.

Needless to say, the second selection was largely a matter of trial and error. It had to be completed by the beginning of January 1961, when the inspectors were requested to visit all the schools in the sample, check the number of children in 5th standard, find out who had taught them over the past five years, and the language in which they had been taught. Even at this stage one or two schools had to be replaced on receiving the inspectors reports. And yet after all this, the groups are not as closely matched as we should have wished.

We shall examine the second sample in the same manner as the first, beginning with the geographical distribution.

TABLE 3.16 †

Number of Schools by Group and County.

County	Group 1	2	3	4	5	6	No. of Schools excluding Irish-speaking districts.
Carlow							62
Cavan		3					197
Clare (G)		2	1	1	4		164
Cork (G)	1	1	2	2	3		495
Donegal (G)				4		7	281
Dublin		1	1		1		386
Galway (G)	1		4	3	3	7	258
Kerry (G)		2	1	1	2	3	222
Kildare							99
Kilkenny		2	1		1		140
Laois					1		98
Leitrim		1	2	1			128
Limerick	1	1	1	2	1		213
Longford							73
Louth			1				84
Mayo (G)	1	3		1	1	2	287
Meath	1			2			121
Monaghan	3						143
Offaly	3						102
Roscommon	2	1	2				163
Sligo		1	1		1		147
Tipperary	3		1				247
Waterford (G)			1			1	103
Westmeath				1	1		105
Wexford	4	1	1				147
Wicklow		1		2			114
Total:	20	20	20	20	19‡	20	4,579

† Notation as in table 3.3

‡ When the testing had been carried out it was discovered that one school in group 5 was not of the right type; hence the total of 19 instead of 20.

The X^2 tests was employed to determine whether the schools of each group (except group 6) are distributed at random between West and Rest, calculating 'expected' frequencies with the aid of the column on the extreme right of table 3.16. Yates' correction for continuity was used in each test since there is only one degree of freedom. Table 3.17 shows the results. Entering the table of X^2s with one degree of freedom

TABLE 3.17.

Geographical Distribution of Schools

Values of X^2.

Group	X^2	DF
1	4.07	1
2	0.00	1
3	.073	1
4	2.70	1
5	5.49	1

we find that X^2s of 3.84, 5.02 and 6.63 are significant at the .5, .025 and .01 levels respectively; so groups 1 and 5 are not distributed at random. Table 3.16 shows that the departures from random distribution here are in the same directions as in the first sample: i.e. fewer schools of group 1 in the West and more in the Rest than 'expected'; and more schools of group 5 in the West and fewer in the Rest than 'expected'.

Because groups 1 to 5 combined will be required to represent Ireland when we compare Irish and British attainment levels in English, the hypothesis that the schools of groups 1 to 5 combined are randomly distributed between West and Rest was tested. The test yielded $X^2 = 1.22$ (DF = 1), which falls well short of significance.

The next hypothesis tested is that the proportions of urban to rural schools in groups 1 to 5 combined and in the country as a whole (excluding Irish-speaking districts) do not differ significantly. There are 4 County Borough schools in the five groups and 344 in the country. The test yielded a non-significant $X^2 = 1.26$ (DF = 1). ~~which is not significant.~~ The four urban schools are distributed within the sample thus: two in group 2, one in group 3 and one in group 5.

TABLE 3.18

Number of 1-, 2-, 3-, and More-than-3-Teacher, Schools.

Category of School	Group 1	2	3	4	5	6	Total 6 Groups	Total Country	'Expected' Total 6 Groups
1-Teacher	-	1	1	-	1	2	5	755	18.418
2-Teacher	14	12	13	14	12	13	78	2,648	64.599
3-Teacher	4	5	4	4	4	4	25	782	19.077
More-than-3-Teacher	2	2	2	2	2	1	11	693	16.906
TOTAL:	20	20	20	20	19	20	119	4,878	119.000

Table 3.18 shows that disparities between groups in the

proportions of 1-, 2-, 3-, and more-than-3-teacher, schools, though less than those between samples (table 3.6), have not been removed completely.

Totals for the 6 groups in table 3.18 were compared with the totals 'expected', (given at the extreme righthand side of the table) by means of a X^2 test with 3 degrees of freedom, to ascertain whether the former are equivalent to a random selection from Irish schools as a whole. This test yields $X^2 = 16.457$, which is significant well beyond the .05 level.[1] Comparing this finding with the corresponding one for the first sample, we notice that while groups in the second sample are better matched with one another, they are less representative of the country when combined together. This result was to be expected from the manner in which the sampling was controlled, and it will have to be borne in mind when we come to compare Irish children, represented by those in our sample, with British.

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1. With 3 degrees of freedom, $X^2 \geqq 7.815$ is significant at the .05 level, and $X^2 \geqq 16.268$ is significant at the .01 level.

TABLE 3.19.

Average Numbers of Children on Rolls.

	Group						Total	N. 'expected' in 119 schools
	1	2	3	4	5	6		
Boys	739.4	899.2	993.9	788.6	849.8	687.7	4,958.6	6,049.1
Girls	777.7	898.4	869.8	788.3	834.5	696.1	4,864.8	5,961.1
TOTAL:	1517.1	1797.6	1863.7	1576.8	1684.3	1383.8	9,823.4	12,010.2[1]

Comparing table 3.19 with tables 3.7 and 3.8 we observe that the second sample is more homogeneous than the first both in the total numbers in groups and in the proportions of boys and girls; further, the total for the 6 groups combined does not differ so much from the total expected on the basis of published figures for the country as a whole. We shall return to this topic shortly when discussing the number of children actually tested, but for the moment we shall continue to analyse the second sample along the lines of our analysis of the first.

Table 3.20 does not differ greatly from table 3.9, the corresponding one for the first sample. Groups 1, 4, 5 and 6

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1. This figure is calculated from the following:

No. of schools	=	4,878
Average No. of pupils on Rolls	=	492,315

See Department of Education (1960) p.57.

TABLE 3.20.

Number of Boys', Girls', and Mixed, Schools (Second Sample)

Group	1	2	3	4	5	6	Total
Boys	-	2	3	2	4	1	12
Girls	-	1	1	4	3	1	10
Mixed	20	17	16	14	12	18	97
TOTAL:	20	20	20	20	19	20	119

are more or less unchanged; but in order to match groups 2 and 3 with the others in their proportions of 1-, 2-, 3-, and more-than-3-teacher, schools, and to ensure that they contained approximately equal numbers of boys and girls, it was necessary to replace many of the large boys' or girls' schools by smaller ones which more often than not were mixed schools.

Because of the small numbers of boys' schools in each group, rendering the direct use of the X^2 test inadvisable, the hypothesis that the numbers of schools other than boys' schools do not differ significantly among groups was tested by means of that test. The computation involved can be followed in table 3.21.

TABLE 3.21

Proportions of Schools other than Boys' Schools.

X^2 test.

	No. of Schools	Non-Boys' Schools (Fo)	Fe	Fo-Fe	$(Fo-Fe)^2/Fe$
1	20	20	17.98	2.02	.227
2	20	18	17.98	.02	.000
3	20	17	17.98	- .98	.053
4	20	18	17.98	.02	.000
5	19	15	17.08	-2.08	.252
6	20	19	17.98	1.02	.058
Total	119	107	106.98	.02	$.590 = X^2$

The value of X^2 obtained, .590(DF = 5), is far below the level of significance.[1] A similar test carried out for schools other than girls' schools yielded a $X^2 = .636$ (DF=5) which is also non-significant; while a further test of the hypothesis that the proportions of mixed schools(made with the numbers of those schools as they stand) yielded $X^2 = 2.17$ (DF = 5) which is also non-significant. Thus the proportions of schools other than boys' schools, other than girls' schools, and the proportions of mixed schools, do not vary significantly from group to group. Figures are not available to compare the

1. With 5 degrees of freedom, $X^2 \geqq 11.07$ is significant at the .05 level.

sample in these respects with the country as a whole.

TABLE 3.22

Teacher-Pupil Ratio (Second Sample)

Group	1	2	3	4	5	6	Average 6 Groups	Average Country
1 Teacher to	30.96	36.69	35.17	32.19	35.84	31.45	33.75	34.59

Table 3.22, corresponding to table 3.10, shows that the range of teacher-pupil ratios in the second sample is less than in the first. However to determine whether or not the ratios in table 3.22 differ significantly from group to group an analysis of variance, similar to the one reported earlier was carried out.[1] The variance ratio this time is 1.11 (DF = 5 and 113) which falls well short of significance at the .05 level.

Next we test the hypothesis that the mean teacher-pupil ratio for the sample differs by chance only from the mean ratio for the country. The manner of testing this is similar to that described above on page 127, using the MSw calculated for the first sample as 'error' because it is a better estimate of the 'population' variance than that obtained in the second sample,

1. The figures on which the test was carried out are given in Appendix 1.1 .

2. With 5 and 120 degrees of freedom an $F \geqq 2.29$ is significant at the .05 level.

since fewer restrictions were imposed in drawing the first sample. In this case $t = 1.93$ (DF = 114), which falls short of significance at the .05 level.[1]

TABLE 3.23

Number of Rooms and Number of Teachers (Second Sample)

Group	1	2	3	4	5	6
Rooms	45	51	51	48	53	44
Teachers	49	49	53	49	47	44

Table 3.23 shows that the groups are closely matched in numbers of rooms and numbers of teachers, but if we wish to learn the number of teachers who have not a school room to themselves we must turn to table 3.24.

TABLE 3.24

Number of Schools which are Short of 1 or more Rooms (Second Sample)

Group	1	2	3	4	5	6
Short 1 room	4	2	2	1	1	2
Short more than 1 room	-	-	-	-	-	-

1. With 114 degrees of freedom $t \geqq 1.96$ is significant at the .05 level.

It is not advisable, because the numbers entered in table 3.24 are small, to test the hypothesis that groups do not differ significantly in number of schools which are 'short' of a classroom; but the complementary hypothesis, that groups do not differ significantly in number of schools which can provide a separate classroom for each teacher, may be tested. The test of the latter hypothesis yields $X^2 = .315$ (DF = 5) which is not significant[1]; so the groups may be considered equal in classroom accommodation.

Teachers

TABLE 3.25

Status of Teachers (Second Sample)

Group	1	2	3	4	5	6	Total	Country as whole.
Trained	38	44	46	40	45	32	245	11,092
Untrained	11	5	7	9	2	12	46	3,141
TOTALS:	49	49	53	49	47	44	291	14,233

The total numbers of teachers in groups given in table 3.25 do not vary as widely among groups or from the 'expected' totals as the corresponding totals in table 3.14 (first sample).

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1. With 5 degrees of freedom $X^2 \geqq 11.07$ is significant at the .05 level of probability. This test was carried out in a manner similar to that outlined in table 3.21.

The X^2 test of the hypothesis that differences between observed and 'expected' group totals are not significant, deriving expected totals from the fact that there are 14,233 teachers in 4, 878 schools in the country as a whole, yields $X^2 = 9.80$ (DF = 5). This is not significant[1], so we retain the hypothesis.

The next test was carried out to determine whether the sample as a whole differs significantly from the body of primary teachers in the proportion of trained to untrained teachers. This test yielded $X^2 = 6.27$ (DF = 1) which is significant far beyond the .05 level[2]. The significant X^2 is due to the presente in the sample of more trained and fewer untrained teachers than 'expected'. Finally, the hypothesis that each group does not differ significantly in its proportion of trained to untrained teachers from the body of primary teachers was tested. The results, given in table 3.26, show that only group 5 yields a significant X^2. Table 3.25 reveals that in this group there are more trained and fewer untrained teachers than 'expected'. Thus the first and second samples differ appreciably in the proportion of trained to untrained teachers. In the first sample only

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1. With 5 degrees of freedom a $X^2 \geqq 11.07$ is significant at the .05 level. The test was made in a manner similar to that outlined in table 3.21.

2. With 1 degree of freedom a $X^2 \geqq 3.84$ is significant at the .05 level, $X^2 \geqq 5.41$ is significant at the .o2 level and $X^2 \geqq 6.64$ at the .01 level.

sample 6, which contained fewer trained and more untrained teachers than 'expected', yielded a significant X^2.

TABLE 3.26

Proportion of trained to untrained teachers.

Values of X^2.

Group	X^2	DF[1].
1	.012	1
2	3.351	1
3	1.931	1
4	.205	1
5	7.667	1 significant
6	.423	1

Though the schools of group 6 are situated in what are officially termed Irish-speaking districts, not all the children who attend them speak Irish at home. It was possible to find out the numbers who do, because each year Roinn na Gaeltachta[2] gives a grant of £5 to the parents of each child at a national school (whose age lies between 7 and 17 years inclusive), who generally speaks Irish at home, and has a fluent

1. Since in each test there is only one degree of freedom, Yates' correction for continuity was employed. For this reason the sum of X^2s in table 3.26 should not be used to test the hypothesis that the proportions of trained to untrained teachers in the sample as a whole and the country as a whole do not differ significantly.
2. The government department which deals with Irish-speaking districts.

command of the language. The grants are given only on the recommendation of inspectors who test the children individually, and consult their teachers and school manager. Roinn na Gaeltachta kindly informed the writer of the number of children in each of the 20 schools for whom grants were given in 1960. Unfortunately Roinn na Gaeltachta were unable to supply figures for each standard separately, but the disadvantage is slight, because it is most unlikely that the percentage of children receiving grants in 5th standard differs significantly from the percentage receiving grants in all standards taken together as a whole. The percentage of eligible children who received grants in individual schools varies from about 18% to 100%[1]; the overall figure is 93%. But although appreciable numbers in some schools did not receive grants, most of the 5th standard children who did not would have had a fair command of Irish, obtained both outside and inside school.

The writer was advised that the £5 grants afford the most reliable index to what has been termed in the preceding chapter 'degree of bilingualism'. The very existence of these grants renders the use of a questionnaire inadvisable, because the hope of gaining, or fear of losing, grants would be likely to affect statements about linguistic home background obtained from parents or children.

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1. The standard deviation of these percentages is approximately 28.

Summary

Before proceeding to study the children actually tested, (5th standard children of the schools we have been examining) we shall summarise those findings about the schools in the second sample which indicate systematic differences between groups or significant deviations from Irish schools as a whole:

(1) The schools of groups 1 and 5 are not distributed at random between West and Rest - the departures from random distribution are likely to be associated with lower attainments in group 1, and higher attainments in group 5.
Schools in group 6 (Irish-speaking districts) are not distributed at random throughout the counties of Éire.

(11) Though the 6 groups are fairly closely matched with one another in the numbers of 1-, 2-, 3-, and more-than-3-teacher, schools in each, the second sample as a whole differs from Irish schools as a whole in the proportions of such schools which it contains.

(111) The sample as a whole contains more trained and fewer untrained teachers than 'expected' - so too does group 5.

Fifth Standard - Numbers Tested

Not all 5th standard children in the second sample of schools were tested, because they were not all in school on the day when the testing was carried out. And a number of those who were present were not tested. Thus in one school of group 5, in which there were 83 5th standard girls divided into two streams, every alternate child was selected from the roll for testing; but only 40 of these were actually tested, because two who were selected were absent. The inspectors sent back the test booklets of four children with a note attached to say that these children were mentally defective and had not been asked to take the tests. Two children fell ill during the course of testing, and their scores on the tests which they had completed were not used in the statistical analysis. Three children for some reason did not take the non-verbal reasoning test, so their scores on the other tests are also omitted. All other scores were used in the statistical analysis; the numbers of children involved can be seen in table 3.27.

TABLE 3.27.

Numbers of children enrolled in 5th standard and Numbers whose scores were used in Statistical Analysis.
(Second Sample)

Group	1	2	3	4	5	6	Total
Number Enrolled	200	217	238	202	261	195	1313
Number whose scores were used	160	188	215	170	196	155	1084

An analysis of variance, in which the number of children in a particular school[1] whose scores were used was the individual measure, was carried out to ascertain whether or not the mean number of children in one school differs significantly from group to group. There were 5 degrees of freedom for the between-groups variance, and 113 degrees of freedom for the schools-within-groups variance. The ratio of these two variances (F) is .707 (DF = 5 and 113), which is not significant.

The schools-within-groups variance, which is an estimate of the variance in size of 5th standard for the entire country, may be employed to test whether the mean size of 5th standard classes in the sample, 9.109, differs significantly from the mean size of 5th standard classes in the entire country, 9.934[2]. The critical ratio[3] is

$$\frac{9.933 - 9.109}{\sqrt{43.030\left(\frac{1}{119} + \frac{1}{4,878}\right)}}$$

where 43.030 is the schools-within-groups variance, 119 is the

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1. The figures are given in Appendix 1.5. Henceforth when speaking of the numbers in groups, the number of children whose scores were used in the main statistical analysis will be intended unless the total number enrolled is explicitly mentioned.

2. The figure 9.934 is an estimate of the mean size of 5th standard in the country, derived as follows: the total on rolls on June 30th, 1959, was 505,363 (4,878 schools) and the average number of daily attendances was 424,594; the total on rolls in 5th standard on June 30th was 57,668, and we estimate the average number of daily attendances at 48,451. 48,451 attendances in 4,878 schools gives us a mean of 9.934 attendances per school. As the figure 9.109 is the mean number of children in the sample present on one day, we naturally compare it with the mean attendance for the country, rather than the mean number on rolls. Vide Department of Education (1960) pp.57 and 62.

3. Critical ratio is the ratio of the mean difference to the standard error of that difference. With 113 degrees of freedom, $t \geq 1.96$ is significant at the .05 level.

number of schools used to calculate the mean for the sample, and 4,878 the number used to calculate the mean for the country. The above expression is equal to 1.354 (DF = 113), which is not significant at the .05 level.

Summary - Chapter 3

A random sample of 20 schools was drawn from each of the following types of schools:-

1- arithmetic taught through Irish to no class.
2- " " " " to infants.
3- " " " " up to 1st standard
4- " " " " up to 3rd standard
5- " " " " up to 5th standard or beyond.
6- schools in Irish-speaking districts (all subjects, English excepted, taught through Irish to all classes).

These samples were considered unsuitable for the purpose of inter sample comparisons because of differences between them, particularly in number of children, proportion of boys to girls, and in numbers of 1-, 2-, 3-, and more-than-3-teacher, schools.

These differences between samples were considerably reduced by replacing some schools in each sample by others of the required type drawn at random. As a result of this procedure the groups (so called to distinguish them from the original samples) are fairly closely matched in numbers of 1-, 2-, 3-, and more-than-3-teacher, schools, but taken together they differ significantly in this respect from Irish schools as a whole. In particular there are fewer 1-teacher schools in the 6 groups, proportionately, than in the country. The number of 5th standard children (whose scores were used in the main statistical analysis) dpes not vary significantly from group to group; neither does the proportion of boys to girls (5th standard), though the number of boys', girls' and mixed schools varies slightly from group to group.

Fewer schools of group 1 and more schools of group 5 than 'expected' are situated in the West (i.e. the English-speaking districts of counties which contain Irish-speaking districts); schools in groups 2, 3, and 4, are distributed between West and Rest in approximately the same proportions as Irish schools as a whole. The schools of group 6 (Irish-speaking districts) are not distributed at random throughout the counties of Éire. The attainments of children in the West are likely to be superior to those of children in the Rest. The six groups as a whole do not differ significantly from Irish schools generally in the ratio of urban to rural schools; the six groups do not differ significantly from one another in this respect. The six groups taken together comprise more trained and fewer untrained teachers than 'expected'; group 5 has a particularly high proportion (45/47) of trained teachers. The teacher-pupil ratio for the second sample as a whole does not differ significantly from that for the country; the groups do not differ significantly among themselves in teacher-pupil ratio or in classroom accommodation.

In general, therefore, the sample is satisfactory for the purpose of making comparisons between groups in scholastic attainments, but group 5 would appear to have some advantage on the others because (i) a large proportion of its schools are situated in counties which traditionally take a keen interest in education and in competitive examinations; (ii) because it comprises a greater proportion of trained to untrained teachers than other groups.

The sample as a whole, or rather the 99 schools in groups 1 to 5 would appear to represent the country well: however, they contain (i) too small a number of 1-teacher schools and (ii) too large a number of trained, too small a number of untrained teachers to be strictly representative of Irish national schools - both departures from the norms for Irish schools are likely to result in slightly higher mean attainment scores than if the sample had been drawn entirely at random.

CHAPTER 4.

INSTRUMENTS OF INVESTIGATION.

The instruments employed in the present investigation fall into three classes:-

(a) Tests -

(I) Schonell, Fred J., The Essential Problem Arithmetic Test (Form A).

(II) Schonell, Fred J., The Essential Mechanical Arithmetic Test (Form A).

(III) Moray House English Test 14.

(IV) Macnamara, J., Triail Ghaeilge (a test of Irish).

(V) Jenkins, J.W., Non-Verbal Test 1. (A scale of non-verbal mental ability; Procedure 1, i.e., without preliminary practice test).

(b) Questionnaire - about home and father's occupation, filled in by the children.

(c) Rating Scale - a five-point scale on which the skill of teachers as teachers was rated by inspectors.

Because these seven instruments are basic in our work we shall discuss each in turn.

The Arithmetic Tests

The norms for the Essential Mechanical Arithmetic and Essential Problem Arithmetic Tests[1] cover the chronological

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1. Henceforth, where convenient, these tests will be designated SMA (Schonell Mechanical Arithmetic) and SPA (Schonell Problem Arithmetic) respectively.

age ranges, 7y - 0m to 14y - 6m and 7y -0m to 15y-0m respectively. So extensive a range is an advantage in working with 5th standard children in Irish schools. The children of our sample ranged from 9y - 11m to 15y - 0m. The time allowed for each test is 30 minutes.

SMA consists of 50 sums which are expressed in arithmetical symbols alone in so far as that is possible; whereas the 50 sums of SPA are expressed in sentences. Both tests were standardised by Schonell on the same sample of 2,100 pupils between the ages of 6 and 14, the numbers of boys and girls being approximately equal.[1] The norms assign an 'arithmetical age' (AA) to each raw score (number of sums correct). An arithmetical quotient (AQ) was calculated for each Irish child tested by using the formula $\frac{AA}{CA} \times 100$, where CA stands for chronological age. Had AQs been calculated for the children in the standardisation sample, the mean in the case of each test would have been 100. Since SPA calls upon a child's reading ability to a greater extent than SMA, it will be interesting to compare the two sets of AQs obtained by Irish children; because discrepancies between these quotients may provide an index of reading disability as well as of the influence of the language of instruction on arithmetical attainment.

Wiseman (1949), in a review of these tests, states that

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1. Details about the standardisation and reliability of the tests are taken from Schonell and Schonell (1950) and Schonell (no date), Handbook of Instructions. Neither source gives the standard deviations of arithmetic quotients obtained by using the test norms.

they are highly satisfactory; though he observes that some arithmetical skills are not adequately tested - in particular he notes that SMA contains only one item involving division of fractions - which is perhaps inevitable in a short test designed to cover an estensive age range. He also tells us that they were standardised during the World War.

Translation of Arithmetic Tests:

Irish translations of SMA and SPA were prepared for the two groups of children in our sample who had been taught arithmetic through Irish in all standards. The author of the translations[1] was Mr. R. McNally, B.A., H.Dip. in Ed., of the Education Department of St. Patrick's Training College, who has taught arithmetic through Irish for many years and published a well-known series of arithmetic books in Irish for primary schools.

There was little difficulty in translating SMA, since apart from the general instructions on the cover page there are very few words to translate. The translation of SPA on the other hand was a difficult task, complicated by the fact that in Irish there are dialectical variations in vocabulary and syntax. However, since all schools prepare children for the Primary Certificate Examination (taken by 6th standard pupils)

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1. I am grateful to Professor Schonell and to his publishers, Messrs. Oliver & Boyd, for permission to make the translation; and I am grateful to Mr. McNally for making the translation.

the Irish usage of Primary Certificate Arithmetic papers has become general for all parts of the country where arithmetic is taught through Irish. Mr. McNally followed this usage; and because Primary Certificate papers include variants for some terms, he included in brackets the variant 'céadadán' for the more usual 'céadchodán', meaning 'percentage', in question 40 of SPA.

Several of the questions in SPA are ambiguously expressed. For example, in question 35 the child is asked: 'If 3/5 of the people in a bus load of 40 people are women, how many of the people are men?' Strictly speaking the question cannot be answered, because some of the people might have been children. Ambiguities of this kind were retained in the translation.

The aim in translating SPA was to provide an idiomatic rather than a literal, Irish version of the test which would not be longer or more difficult than the original. By the length of a question we mean the number of words in it. What is more important than the number of words, of course, is the length of time children take to read and, if it is within their power, understand them. These aspects of length will be studied in comparisons of the difficulty of one version with another; but it may be of some interest to examine first the number of words in each version, since if there is a notable discrepancy, it seems likely that one version will take longer to read than the other.

The Irish version is longer than the original by 35 words in all, (0.70 words per question). The hypothesis that the two versions do not differ significantly in length was tested by means of the t-test. The first step was to subtract the number of words in the Irish version of each question from the number of words in the original to obtain a distribution of 50 differences.[1] These differences enable us to calculate the standard error of the mean difference in length per question (0.70 words). The standard error is .4182, and the ratio (t) between the mean difference and its standard error is 1.674 (DF = 49), which is not significant at the 5% level of probability.[2] On the evidence of this test then, it seems reasonable to disregard the difference between the two versions in mean number of words per question.

In order to avoid unnecessary expense, before printing the Irish translation of SPA, mimeographed copies of the translation were administered to 33 5th standard boys in a Dublin school[3], (a) to discover the extent to which their scores

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1. For details on this type of test see Fisher (1960), p.36 sq.
2. A critical ratio (t) $\geq$ 1.960 is significant at the 5% level in a test with 49 degrees of freedom.
3. Arithmetic was at the time taught through Irish to all standards in the school.

might be increased if a more generous time allowance than 30 minutes were assigned, and (b) to discover difficulties which the children might experience with the Irish. The reason for investigating (a) is that several people, on seeing the extent to which arithmetic scores of children taught through Irish fell below those of children taught through English in a pilot study[1] of arithmetical attainments, suggested that a more generous time allowance might have resulted in closer agreement.

The effect of the time limit was studied by having the 33 boys use pencils for the first 30 minutes (the time allowed by Schonell) and thereafter pens until they had done all the sums they could. The average number of correct answers obtained during the first 30 minutes was 23.03, with a standard deviation of 5.8 approximately. This mean may be converted roughly to a mean AA of 10y - 6m, showing that the group is about average for Ireland in problem arithmetic, since the entire sample of Irish children tested in the present survey obtained a mean AA of about 10y - 5m. The mean CAs of the class of 33 boys and of the Irish sample 12y - 1m and 12y - 2m respectively. The average number of correct answers obtained during the entire time was 1.79; with a standard deviation of 1.8 approximately. We may take it, therefore, that the time allowance of 30 minutes is satisfactory.

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1. Macnamara (1959).

An item analysis was made of the work done by the boys during the entire time at their disposal, and the results were shown to their teacher. He was surprised to find that many of them failed to solve certain of the problems which he thought well within the range of what they had been taught. Thus fearing that some of the Irish expressions used in these particular problems, though seemingly quite common, were unfamiliar to the boys, the writer saw individually 6 of the boys (chosen at random from the roll) and set them several extremely easy problems couched in those Irish expressions which the writer thought might have proved troublesome. These expressions were: (i) 'Tá 6 órlach agam ar mo chara', q.17; (ii) 'a 4 oiread san ar fhaid', q.27; (iii) 'sa bhreis', q.27 and 30 originally; (iv) 'sochar' qq. 43, 45 and 48; (v) 'céadchodán' q.40. The number of boys who gave the correct answers to the original problems in which these expressions occur was as follows:-

Question	Correct Responses	N
17	14	33
27	1	33
30	8	33
40	0	33
43	3	33
45	3	33
48	0	33

The type of question asked in this supplementary study was: 'I am 5'6" tall and James is 6" taller than I, - Tá 6 órlach ag Seamus orm, similar to (i) above - what height is James? The number of correct answers to the five questions set to test the expressions, following the order given above, were: 4, 6, 3, 6,6. It would appear, then, that these expressions alone do not account for the great number of failures in the Schonell problems in which they were encountered. Thus expression (ii) was understood by all the 6 boys seen individually, while problem 27 in which it occurs was solved by only one.

It was possible to employ alternative expressions, roughly equal in length to the ones they replaced, in 3 of the problems, Nos. 17, 27 and 30, which had proved too difficult for a surprising number of boys. After a lapse of several months, which included the summer holidays, these 3 problems were presented to the new 5th standard in the same school as well as to the boys who had previously worked the test, now in 6th standard. The standards were divided at random into numerically equal groups by taking alternate names on the roll. To one half was given the old version of the 3 problems to the other half was given the new version. The time allowed was 6 minutes. The number of correct answers is given below:

TABLE 4.1

Numbers of Correct Answers in Test of Difficulty of Irish Expressions.

	Problem 17	27	30	N
Old Version	21	10	7	41
New "	23	2	14	41

X^2 tests carried out on the figures for each problem[1] yielded X^2s = .022, 4.08, and 1.714, respectively, (DF = 1 in each test). The only one of these values which is significant at the .05 level is the second. Thus the 'old' versions of problems 17 and 27 were retained; but the new version of problem 30 (i.e. substituting níos mó for sa bhreis - see (iii) above) appeared to be a little easier than the 'old' - though the test yielded a non-significant X^2 - so it was incorporated in the printed form of the test.

The Irish translations of SPA and SMA were printed in Gaelic type which is almost always used instead of Roman type in the printing of school books; and care was taken that the Irish versions should correspond as closely as possible with the originals in size of print and in spacing.

A series of experiments and tests were then undertaken to test the hypothesis that the mean AQ of children who had been taught arithmetic through Irish is unaffected by whether they are tested with the original or the Irish translation of SPA. The first experiment was the testing of 96 children[2] (48 boys and 48 girls) in 6 different schools. Two of these are mixed

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1. Since in each test there was only one degree of freedom, Yates' correction for continuity was employed. X^2s = 3.84 and 5.02 are significant at the .05 and the .02 levels respectively.

2. More than 96 children were tested, but because the numbers varied a little from school to school, a few scores were omitted (at random) to reduce each sub-group to the number 6. The statistical procedure made equal numbers highly desirable.

schools in Co. Donegal, one of them being in a bilingual area[1]. The other four are Dublin schools falling readily into two pairs of schools, a boys', and a girls' school in each pair. The two schools in one such pair are in the same grounds; while the other two, though not in the same grounds, are quite close to one another and are alike, in that both enjoy special privileges under the Department as 'Irish' schools, in that they are staffed by enthusiasts for the revival of Irish, and draw their pupils from roughly the same sections of the community. For the purpose of the analysis which follows each pair of Dublin schools will be treated as a single school. All the children who were tested had been taught arithmetic solely through Irish, and all were in 5th standard at the time.

In each school the boys and/or girls were assigned at random to groups equal in number and each group was tested either with the English or the Irish version of SPA. Scores were converted to quotients[2] by means of the published norms and the quotients were analysed as indicated in table 4.2.

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1. I had been told in error that both were in bilingual areas.
2. There is an advantage in analysing quotients rather than raw scores. Analysis of variance presupposes that the measures analysed are points on an equal interval scale - the scale in this case being a scale of difficulty. One of the purposes of a table of norms is to convert raw scores obtained by the standardisation sample, however distributed, into a normal distribution of quotients, thereby constructing, it seems reasonable to assume, an equal interval scale. Whether the scale so constructed is an equal interval one or not depends on the unproven but reasonable assumption that the ability being tested - arithmetic ability in this case - is normally distributed in the population.

That is, the observed difference in difficulty was assessed by analysis of variance in relation to differences between sexes, between schools, and in relation to the various interactions between these variables. The aim was to see whether a significant difference in difficulty between the two versions could be detected.

TABLE 4.2

Relative Difficulty of Versions of SPA.

Source	DF	SS	MS	F
Language (L)	1	94.0	94.0	Not significant
Sex (S)	1	931.3	931.3	
School (Sc)	3	3904.4	1301.47	
L x S	1	.5	.50	Not significant
L x Sc	3	356.6	118.87	Not significant
S x Sc	3	2338.1	779.37	2.799 (DF = 3.80) Significant at 5% level
L x S x Sc	3	71.5	23.83	Not significant
Within	80	22433.9	280.424	
TOTAL:	95	30130.3		

Since the L x S x Sc interaction is not significant (when tested against MSw) it is permissible to test each of the remaining three interactions against MSw[1]. The interactions L x S and L x Sc are not significant, but the interaction of Sex and School (S x Sc) is significant at the 5% level of probability[2]. Since the difference between the sexes is a 'fixed component' it is reasonable to suppose that the significant S x Sc interaction is due to variations in mean differences between boys and girls in different schools or pairs of schools. An examination of the means bears out this interpretation; the significant interaction comes from the fact that the boys and girls in the second pair of Dublin schools are not as closely matched as those in the other pair of Dublin schools or in the Donegal mixed schools. However, since neither Sex nor School gives rise to a significant interaction involving Language, MSL is unbiassed by any interaction; so MSL may be tested by MSL/MSw, the denominator being itself unbiassed by Language, Sex or School influences. The ratio MSL/MSw, since it is less than unity, falls far short of significance.

In this first experiment of the series referred to above there is no evidence which would lead us to reject the

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1. It is preferable to employ MSw rather than MS.L x S x Sc as error term when testing the significance of the other interaction terms, because though both of the former are estimates of the 'population' variance MSw is the more reliable of the two. MS.L x S x Sc appears to underestimate (by chance) the population variance considerably.
2. Where there are 3 and 80 degrees of freedom $F \geq 2.72$ is significant at the 5% level.

'null hypothesis'. In other words, the difference of 1.979 between the 'English' mean of 94.792 and the 'Irish' mean of 92.813 may well be due to chance. Bearing this in mind let us return for a moment to MS.L x Sc.

The hypothesis tested in relation to MS.L x Sc is that if there is a difference between 'Irish' and 'English' means, the difference does not vary significantly from school to school. Now one of the Donegal schools is on the fringe of an Irish-speaking area. Irish is the home language of nearly half[1] the children in the school, while every child speaks some Irish outside school hours. It is likely then that these children are better able to speak and read[2] Irish than children in the other three schools which are situated in English-speaking areas. Now the absence of a significant L x Sc interaction indicates that this better command of Irish has not given the children of the Donegal school an advantage over the children of the other schools in answering the Irish

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1. The government makes a grant of £5 per annum per child to the parents of children whose home language is Irish. In 1960, the last year for which figures are available, grants were given for 43% of the children in this school. (I am grateful to Roinn na Gaeltachta for this figure). Figures are not available for the number of children in 5th standard who obtained grants. I am grateful to the Principal Teacher for a more general description of the use of Irish and English in the locality of his school.

2. The supposition is supported by the fact that in the survey of Irish attainments, children whose mother tongue is Irish obtained a higher mean score than any of the groups of children whose mother tongue is English.

version of SPA. In other words all the children knew Irish, and English, well enough for the purpose of the experiment. The absence of a significant L x Sc interaction then lends support to our interpretation of the non-significant language mean-square, i.e., that if children have been taught arithmetic through Irish up to 5th standard, they do not find the Irish version of SPA more difficult to understand than the English one, or vice versa.

It was not convenient to follow up the first experiment by retesting the Donegal children, but the Dublin children were all retested, this time in a different language. Children in one pair of schools (a boys' school and a girls' school) were retested two days after the first testing, those in the other pair of schools were retested after an interval of three months. Thus two scores (quotients) were obtained for each child. Each child's first score was next subtracted from his second score to yield a 'difference' score (d). In all, 28 such d-scores were obtained for boys and 28 for girls[1], 14 in each group of 28 representing one language sequence and 14 representing the other. Figures in table 4.3 represent

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1. The reason why in this experiment N = 56, and not 48, is that certain scores are included here, which were omitted in the first analysis of variance in order to keep n constant from sub-group to sub-group. In one pair of Dublin schools 24 children were tested; 32 were tested in the other pair.

Σd for the 14 children in each quarter. English-Irish means English first, Irish second; and Irish-English means Irish first, English second.

TABLE 4.3

	English-Irish	Irish-English	Total
Boys	9	161	170
Girls	37	66	103
TOTAL:	46	227	

It is not advisable to carry out an analysis of variance of d-scores by Language Sequence and Sex for there is heterogeneity of variance from subdistribution to subdistribution. Bartlett's test for homogeneity[1] yielded $X^2 = 11.7407$, (DF = 3). which is significant well beyond the .05 level.[2] The subdistribution variances are:-

TABLE 4.4

	English-Irish	Irish-English
Boys	132.25	33.96
Girls	25.55	25.76

From table 4.4 we learn that heterogeneity of variance

1. See Lindquist (1953), pp.87-8.

2. With 3 degrees of freedom, $X2 \geqq 11.345$ is significant at the .ol level of probability.

can be avoided by analysing girls' scores only[1]. So an analysis of variance by Language Sequence and Schools, (2 schools are involved), was carried out to test the hypothesis that girls' d-scores are not affected by varying Language Sequence.

TABLE 4.5

Analysis of Differences - Girls.

Source	DF	SS	MS	F
Language Sequence (LS)	1	30.036	30.036	1.357 (DF = 1.24) not significant.
School (S)	1	97.503	97.503	
LS x S	1	39.360	39.360	1.778 (DF = 1.24) not significant.
Within	24	531.208	22.134	
TOTAL:	27	698.107		

The ratio MS.L x S/MSw shows that the interaction is not significant[2]; so the effect of Language Sequence on d-scores does not vary significantly from school to school, and we can test the significance of MS.L against MSw. The latter ratio falls well short of significance at the 5% level of probability.

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1. As to the cause of the heterogeneity of variance, there is no obvious explanation. It does not seem to be connected with the difference in interval between tests in the two pairs of of schools, since girls as well as boys are included (in equal numbers) in each pair of schools.

2. With 1 and 24 degrees of freedom, $F \geqq 4.26$ is significant at the 5% level of probability.

It is reasonable, therefore, to attribute to random fluctuation the mean difference of 2.1 points between sets of d-scores obtained with the two Language Sequences[1].

The heterogeneity of variance already noted is to be found in the boys' d-scores, so these cannot be analysed in the same manner as the girls' scores. The boys AQs were investigated by means of Bartlett's test which yielded a non-significant[2] X^2. It is permissible, therefore, to carry out an analysis of variance of boys' AQs by Langu-age, Occasion[3] and School. The purpose of this analysis is to test the hypothesis that the mean AQ obtained with the Irish version of SPA does not differ significantly from that obtained with the English version. Such an analysis is quite sensitive because all the boys contribute to both means. But it is not as sensitive as the one carried out of girls' d-scores, for in this case the effect of differences in arithmetical ability on AQs was largely eliminated, with the result that the error term was greatly reduced.

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1. For a note on the differential effects of practice in an experiment such as this, see below, p. 204, Note 1.

2. X^2 is less than 3.802 (DF = 7). With 7 degrees of freedom X^2 = 14.067 is significant at the 5% level.

3. 'Occasion' is used to designate a period of testing of which there were two.

TABLE 4.6

Analysis of AQs - Boys.

Source	DF	SS	MS	F
School (S)	1	2086.1	2086.1	9.197 (1,48) significant
Occasion (O)	1	591.5	591.5	2.608 (1,48) not significant.
Language (L)	1	370.2	370.2	1.632 not significant.
S x O	1	74.6	74.6	not significant
S x L	1	170.0	170.0	" "
O x L	1	330.3	330.3	1.456 (1,48) not significant.
S x O x L	1	418.0	418.0	1.843 (1,48) not significant.
Within	48	10887.2	226.817	
Total:	55	14927.9		

With 1 and 48 degrees of freedom, $F \geq 4.04$ is significant at the 5% level, and $F \geq 7.19$ at the 1% level of probability. Thus MS.S x O x L is not significant when compared with MSw; and so each of the other interactions may be tested by comparison with MSw. None of the interactions proving significant, as noted in the table 4.6, Language (of test) may be regarded as exercising a constant influence, if any, on both Occasions and in both Schools. To put it the other way round, the Language component may be regarded as independent of School and Occasion. It is permissible, therefore, to test the significance of MS.L by comparing it with MSw which is itself independent of Language, Occasion, and

School, influences. The test yields an $F = 1.632$ which is far short of significance.

This finding indicates that the boys tested found the Irish version of SPA as easy (or difficult) to understand as the original English.

All our tests then, lead to the conclusion that the Irish translation of SPA is satisfactory. This is important, for in the survey which formed the main part of our study two groups of children (39 schools) who had been taught arithmetic through Irish in all standards were tested with the Irish version of the test, while the remaining four groups (80 schools) were tested with the English version. The work described above indicates that comparisons of group means are not upset by the fact that all groups were not tested with the same version.

The work described above does not reveal whether children who had been taught arithmetic through Irish are better or worse at arithmetic than children who have been taught through English. All the children who took part in these experiments had been taught arithmetic through Irish.

The English Test.

Moray House English Test No.14[1] was the particular test chosen to test English. The published norms for this

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1. Henceforth, where convenient, this test will be referred to as MHE14.

test were based on complete year groups of children in 12 Education Authority areas (urban and rural) in various parts of England and Scotland, A total of 12,937 children in all with approximately equal numbers of boys and girls. In constructing the norms, the raw scores (i.e., the number of correct responses made by each child) of these children were converted to English Quotients (EQs) having a mean of 100 and a standard deviation of 15. The table of norms makes an age allowance for children between 10 - 0 and 12-0 based on the regression of raw score on age.[1]

There are 120 questions in MHE14 of which the greater part are tests of English comprehension, but spelling, punctuation, vocabulary, pronunciation (tested by the ability to pick out words which rhyme with one another), the use of capitals, the formation of adjectives from nouns, and syntax, are also tested. Perhaps British children would find three of the questions, Nos. 76, 90, 91, a little easier to answer than Irish children. No. 76 asks the child to form an adjective from the noun, 'Britain'; No. 90 tests his ability to recognise the use of capitals in the writing of 'London policeman'; No. 91 is a similar test in the case of 'Newcastle-on-Tyne'. In Ireland there are no 'policemen', there are 'civic guards'. However, experienced teachers

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1. For the above details see the 'Manual of Instructions' (no date) p.9.

inform the writer that these three questions would not present any particular difficulty to Irish children. The time allowed for the test is 40 minutes.

On the cover page of the test booklet there are general instructions to be read aloud by the supervisor. These were read as they stood in English in all areas, including Irish-speaking ones. In the test itself there are several sets of instructions explaining how the next set of questions must be answered. These the child must read for himself, assisted by one or two worked examples. It is here particularly that the Irish child's inexperience is likely to tell, since he is unfamiliar with any sort of pencil-and-paper test whatsoever. The British child on the other hand, recognises more quickly the type of question of which the instructions speak; he may not have to read the instructions at all if he can identify the question type simply by looking at the worked example.

Since one of the aims of the present study is to compare the attainment level in English of the Irish children tested with that of British children, a test standardised on a large and representative sample of British children, such as MHE14, was required. The comparison can be made by using the table of norms to convert Irish children's raw scores into EQs, and comparing the mean of such EQs with the standardisation sample's mean of 100. Since MHE14 was standardised on scores obtained during the war in the years 1941-44 the comparison will be made first between Irish children in 1961 and British children during the war. We must turn now to the reason for choosing a test standardised in war time.

The reason is connected with a study made by the present writer[1] which included administering MHE32 (standardised on scores obtained in the years 1958-60) to about 200 5th standard boys in four Dublin schools which have the reputation of being above average at all subjects. Their mean English quotient was some 14 points below the British mean as contained in the test norms; and it is likely that had a sample more representative of Irish children as a whole been tested the mean would have been lower still. The fact that Irish children, unlike British children, are quite unfamiliar with tests such as MHE tests was suggested as part of the reason for the finding. So the writer became doubly anxious to conteract the influence of coaching and practice on British children's performance in English by choosing a test standardised during the 1940s, because that influence has possibly increased over the past ten years. He was also interested to discover whether British children were able to achieve so great a superiority during a world war. These matters will come up for discussion in Chapter 8 when we come to compare British and Irish children's attainments in English.

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1. Macnamara (1959).

The Irish Test.

Since no satisfactory group test of Irish existed it was necessary to construct one. The Department of Education willingly agreed to co-operate, and three inspectors, Messrs. O. Lynch, T. Callanan and S. Burke, at the Department's request, undertook to compose some 70 items each, from which it was hoped a 30 minute test comprising some 70 to 80 items might be compiled. To help the inspectors with their work each was given copies of a MHE test and the Schonell Silent Reading Tests. When the 210 items were ready they were divided into two sections (A and B) of approximately equal lengths, for it was feared that 210 items would be too much for a primary school child at a single sitting. A and B were then mimeographed for preliminary trials.

Two boys' and two girls' schools which had some 50 children apiece in 5th standard agreed to co-operate in the preliminary trials. The schools selected comprised, in the opinion on their inspectors, a pair (boys' and girls') which were above and a pair which were below average. They thus provide a fairly representative cross section of Dublin national schools.

The children in each school were divided at random (alternate names in the roll book) into numerically equal groups; one to take A and the other to take B. When they had heard the nature of the study, they worked their way through the items at their own pace, enough time being allowed for each child to attempt all the items he wished to attempt. The writer supervised their work.

When the papers were corrected each group was divided into three lots: No.1 contained the third of the group which answered most questions correctly; No.3 contained the third which answered fewest correctly; No.2 contained the remaining third. Next, the numbers of children in lots 1 and 3 who answered each question correctly were noted; and the number in lot 3 was deducted from that in lot 1 and the remainder divided by 3. This operation may be expressed by the formula:

$$E1 - 3 = \frac{\text{lot } 1 - \text{lot } 3.}{3}$$

If an item has perfect discriminatory power E1 - 3 = + 1[1], while an item which has none yields E1 - 3 = 0.

The proportion of children (P) who answered each question correctly was also calculated.

In making a selection of items for inclusion in the final test, values of P lying between .25 and .75, and values of E1 - 3 lying at or above .5, were accepted. The number of questions qualifying for inclusion in the test on those terms was 55, and of these 39 were based on the comprehension of prose passages. In order to augment

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1. Items yielding a negative E1 - 3 are clearly pulling in the wrong direction.

the total number and increase variety the writer altered some items which had proved too difficult and composed some more, 42 in all. These were then set to about 100 children, (not the ones who had worked A and B). P. and E_{1-3} were calculated for each question as before, and 22 were found to measure up to the required specifications, and were all included in the test. From A and B, 48 questions were chosen; 7 answering to the specifications, but based on the comprehension of prose passages, were omitted for the sake of increasing variety. The very first question in the final test is an exception, having a P of .9 and an E_{1-3} of .25, included to give an easy start.

The questions included in the test can be divided into a number of types: spelling items, items concerning adjectives, prepositions, vocabulary and comprehension of prose passages. Questions of a type were grouped together to form sets, for each of which the mean P was calculated and used as an index of the set's difficulty. In arranging sets, the order of difficulty was followed in so far as it was consistent with variety. The finished test may be examined in Appendix 2.4.[1]

Mimeographed copies of the test were worked by 29 5th standard boys in a Dublin national school which has a high standing in Irish. In the class were a few very clever boys from Irish-speaking homes, one of whom completed the test in just over 25 minutes. As his speed was

1. Values of P and E_{1-3} are given in Appendix 2.4_a.

exceptional, a time of 25 minutes was settled upon for the test. The teacher was asked to rank the class in order of Irish attainments, and his order correlated highly, $r = .81$ with the raw scores obtained by them on the test. Since the class, as is the school's practice, were selected on the basis of ability when coming to the school initially, this correlation is satisfactorily high, and provides valuable evidence that the test is a valid test of Irish.

Finally, the test was printed in Gaelic script. Instructions, modelled on the instructions for the MHE Tests, were printed in Irish on the cover page.

General Remarks on Independent Variates.

The main purpose of our survey is to assess some effects of teaching children from English-speaking homes through the medium of Irish for varying lengths of time by comparing them with similar children taught through the medium of English. Briefly then the experimental variable is a linguistic one. The comparison extends over English, Irish, and arithmetic, as measured by the tests already discussed in this chapter, at the end of the 5th standard of primary schooling. It was not possible to assign children and teachers to different teaching media at random[1].

1. Had this procedure been possible there would have been no need of independent variates - cf. Fisher (1960), pp.17 sq.

Instead groups of schools employing the different media were selected at random from the 'populations' of schools employing those media, and the 5th standard children in them were tested. Though this procedure may not be entirely satisfactory, subsequent steps were taken to explore what appeared to be the most likely sources of bias, (i.e., differences between groups which if they were not eliminated would obscure the influence of the experimental variable), and to eliminate any bias that could be detected. The most likely sources of bias are as follows: the children in one group might have greater aptitude for learning English, Irish, or arithmetic, than the children in another, either because they are better endowed by nature or because they come from homes more favourable to progress in one or all of these subjects; or they might simply have better teachers. The instruments used to explore for bias were Jenkins' Scale of Non-Verbal Reasoning[1], a questionnaire about socio-economic status, and a rating scale of teaching skill.

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1. Henceforth, where convenient, this test will be designated N-VR, (Non-Verbal Reasoning).

   It should be noted that in the selection of schools, described in chapter 3, precautions were taken to guard against bias; but one could not hope to eliminate all bias no matter how carefully one selected schools - hence the need for the instruments mentioned in the text.

Before going further we shall consider these possible sources of bias and the effectiveness of the instruments mentioned in helping us to reach a fair conclusion.

We do not wish to adjust attainment scores in such a way as to eliminate all differences between groups; we wish to eliminate the effect of bias only. Where differences result from the teaching medium, they ought not to be eliminated. Thus, for example, if children's interest in arithmetic were lessened because they had been taught arithmetic through Irish rather than English, and if as a result their confidence that they could master arithmetical concepts were impaired, they could be said to have less aptitude for arithmetic than similar children who had been taught through English. Let us suppose that we could obtain measures, other than arithmetic scores, of such children's interest in arithmetic, or measures which were influenced by their interest (or lack of it); then we ought not to employ those measures to adjust differences between the two types of children's arithmetic scores, for the adjustment would alter differences which result from varying the medium of instruction, differences, that is, which are the main object of our study. Similarly we ought not to adjust Irish or English scores for differences between groups in interest in those subjects[1]. We must be on our guard, then, to see that our instruments for revealing initial bias are independent of the teaching medium.

Where bias was revealed by N-VR, the socio-economic questionnaire, or the rating scale, (the independent variates, in statistical language), its influence on attainment scores was eliminated by means of the statistical procedures known as regression analysis and analysis of covariance[2]. The

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1. Several studies (Gardner & Lambert 1959; Gardner 1960; Anisfeld & Lambert 1961; Lambert, Gardner, Barik and Tunstall 1961) carried out in Montreal show the importance of a favourable attitude to the second language and the culture of which it is the vehicle for success in learning that language. But the French saying, '<u>l'appétit vient en mangeant</u>', reminds us that there is such a thing as mutual interaction; and it is difficult to know which causes which, interest or the learning of the second language. For this reason there seemed to be little to gain by attempting to measure the interests of 5th standard children. Alternatively, the interests of parents might have been studied; but here again, apart from the immense labour involved, the prospects did not appear encouraging. The revival of Irish is so thorny and so politically loaded a question that many people are not prepared to reveal their minds about it. Finally, of the 119 schools in the sample, only 4 are urban. Now in rural areas and country towns few parents have a choice of schools for their children; and even where there is a choice, it is likely to be decided on grounds other than teaching medium. Thus it is unlikely that the parents of children who attend Irish medium schools in English-speaking districts differ in their attitudes towards Irish, or English, from the generality of Irish parents - except in so far as the former's attitudes are affected by having their children at Irish schools.

2. For an exposition of regression analysis and analysis of covariance see Fisher (1958), pp. 270 sq. and Snedecor (1956), chapter 13 and 14.

length of time for which children were taught through Irish was treated as a quantitative variable, and the regression of each set of attainment scores on this variable was calculated. In calculating the regression allowance was made for the regression of attainment scores on each of the independent variates, the extent of the allowance being determined in part by the regressions of the independent variates upon one another. Provided the latter measure bias, and are not influenced by the teaching medium the procedure is valid; and they measure bias if the regression of attainment scores on them is significant and if they (independent variates) are not influenced by the teaching medium. Thus, it is not necessary to know precisely in psychological terms or in the language of factor analysis what the independent variates measure. This is important because of the number of rival forms of factor analysis, and because of the difficulty of determining the psychological realities which underlie the quantitative factors to which any method of factor analysis leads. We can safely entrust our statistical procedures with the task of determining whether there are significant relationships between independent variates and attainment scores, but the discussion of the relationships between the former and the experimental variable occupies a large part of the remainder of this chapter.

N-VR and Language Skills.

Evidence that N-VR scores are not influenced by differences in command of language is available from two sources, factor analysis of the test and studies of bilingualism.

Emmett (1949) found that N-VR is almost entirely free of 'v' loading while it has a high 'g' loading.[1] The absence of the former is particularly important, because it suggests that the N-VR scores were un-affected by variations in linguistic skills.

Emmett also found a substantial loading (29% of the total test variance) which is specific to the test and which probably reduces its effectiveness somewhat for the purpose of the present study. The study however was based on scores obtained from British children; it does not necessarily follow that Irish children's scores, if analysed, would show the same loadings. It is possible that differences between Irish children in ability to read and comprehend written instructions (there are five short legends in N-VR) might yield a significant

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1. These findings were arrived at by group-factor analysis, which like any form of factor analysis yields numerical coefficients, not psychological entities. Sir Godfrey Thomson (1951, pp.49-58) warns us of the danger of 'reifying', that is treating as psychological realities, the ability or abilities which are sometimes defined by means of these coefficients. To avoid pitfalls we have adopted the general practice of designating factors by letters; but we may cautiously associate 'g' with reasoning ability and 'v' with verbal ability which seems to include many linguistic skills - See Vernon (1961) passim, but particularly chapter 4.

'v' loading; but the findings of the above mentioned study make this rather unlikely. The matter was not pursued further, since in any case the results of a factor analysis can hardly be considered as conclusive.

The evidence from studies in bilingualism that performance on N-VR is not influenced by differences in command of language is more convincing. One of the major conclusions from our survey of the literature on bilingualism (chapter 1) is that monoglot children excel bilinguals by and large in a great many linguistic skills. Now the two types of children have very often been compared for performance on verbal tests of 'intelligence', such as, the Stanford-Binet Scales and in the great majority of comparisons monoglots have obtained significantly higher IQs than bilingual children[1]. The superiority of monoglots in IQ is almost certainly confined to verbal tests, however, and may be attributed to their superior mastery of the language of the test; for in the majority of studies where non-verbal reasoning tests were used no significant difference between the two groups was observed.[2] Where differences have been observed between well matched groups of monoglot and bilingual children in performance on non-verbal reasoning tests, the most likely cause is that

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1. See Darcy (1953). She surveyed over 100 studies. Our survey of literature did not include these studies.

2. Darcy (1953).

those tests involved the use of language - either in the reading or following of instructions, or in the problem solving thought of the subject, - to such an extent that the monoglots' superior command of language enabled them to obtain higher scores than bilinguals. Colvin and Allen (1923) wisely remark that some non-verbal reasoning tests may involve the use of language to a greater extent than a cursory perusal of their contents would suggest. And although factorial analysis supports the view that N-VR does not differentiate between children of varying linguistic ability, thorough procedure demands that we examine those studies in bilingualism where N-VR was employed to see what light they throw on this matter.

N-VR has been administered as part of five pieces of research[1] in Wales to children aged about 11 years. Four of these have been reviewed in chapter 3, (Jones 1952, 1953, 1955 and 1959)[2]; the fifth is Jones and Stewart's (1951) based on N-VR scores obtained from 326 monoglots from a predominantly English-speaking rural area, and 518 bilinguals (Welsh translation of test) from predominantly Welsh-speaking rural areas. The children also filled up 'simple sociological and linguistic' questionnaires, and their replies to the

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1. In passing it may interest the reader to learn that all five support our previous generalisation that the monoglot has a grasp of language superior to that of the bilingual child.

2. Descriptions of these studies are to be found above, pp .

sociological questions seemed to show that 'the environment of both monoglot and bilingual groups was similar'. Monoglots' scores on N-VR were significantly higher than those obtained by bilinguals.

In Jones (1953) the difference between monoglots and bilinguals proved non-significant, but in the other four studies the former excelled the latter to a significant extent. However Jones (1959) analysed a second time the N-VR scores which he had previously analysed in his 1955 paper, this time classifying the children into twelve groups on the basis of parental occupation. The classification was based on information gathered at the time of the survey by the school welfare officers 'in accordance with explicit explanatory notes which had been prepared for their guidance'. Jones now studied his linguistic groups for differences in parental occupation as well as differences in mean N-VR score. He found that significant differences in the latter were always accompanied by significant differences in mean rating of parental occupation, whereas those sections of his material which did not reveal significant differences between linguistic groups in mean rating of parental occupation did not reveal significant differences in mean N-VR scores either. He concludes: 'the findings .... suggest that the significant differences in non-verbal test (N-VR) scores observed between the four linguistic groups .... arise from occupational rather than linguistic variations between the groups'.

Jones (1959 and 1960) states that socio-economic variations had not been adequately controlled in any of his comparisons except the one just mentioned. Taking into account Darcy's (1953) conclusions, based on over a hundred studies, it seems most probable that the conclusion just quoted from Jones (1959) is the correct one. It is contested however by D.G. Lewis (1959) who re-analysed some of the N-VR scores obtained in the 1954 Welsh Joint Education Committee survey[1]. Lewis took the scores of children in the 'Welsh' and 'English' linguistic groups only, but from the former he excluded all who spoke some English at home, and from the latter all who knew some Welsh. He found a significant mean difference between his two groups of about 7.7 raw score units in favour of the 'English' one. To explain it he made three suggestions which we must examine in turn since they have a bearing on our own work:

(a) the fact that the test is a timed one,

(b) a small 'v' factor in N-VR,

(c) a difference in the ratio of urban to rural children in the two groups.

(a) Smith and Lawley (1948) show that bilingual (Gaelic and English being the two languages) children on the isle of

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1. See Jones et al. (1957) and Jones (1959). The four linguistic classifications 'Welsh, Welsh-English, English-Welsh and English' were employed in these two papers.

Lewis obtained a mean IQ with Cattell's Non-Verbal Intelligence Test, Scale 1, which was below the mean expected[1] for that test by the equivalent of about 15 Binet IQ points. They attribute their sample's low mean quotient in part to the test's time limit, suggesting that Lewis children, being accustomed to the island's slow pace of working and living, will not hurry through a test in the way American children, or British children on the mainland, will. The authors, however, do not attempt to prove this point, nor do they discuss the socio-economic status of their Ss. IQ is almost certainly related to socio-economic status more closely than to tempo of life, (though there may well be a relationship between these two aspects of life), so we are doubtful as to the value of their suggestion.

Morgan (1957) had published research results which, he suggests, show that scores obtained with an untimed test are more 'independent of Welsh linguistic background' than those obtained with a timed test[2]. Now one of the groups of children tested in our own survey lived in the Irish-speaking districts on the western seaboard where the pace of working and

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1. By 'mean expected' is intended the mean obtained by the standardisation group tested by Cattell - a group of American children.

2. Since Morgan took no account of socio-economic variation, his conclusion begs the question in assuming a direct - it would appear - relationship between linguistic background and IQs obtained with any of the three tests.

living may be a little slower than in other parts of the country, and all these children know some English for it is taught in school. They are probably more 'bilingual' than the children in the other groups; they certainly know Irish better and, due to the pervasive influence of English, they are probably more familiar with English than the children in other groups are with Irish. If, then, we are to use N-VR (a timed test) scores as independent variate we should like to know if there is a likelihood that they reflect mean differences in pace of living. We must, therefore, examine Morgan's evidence carefully.

Morgan administered Raven's Progressive Matrices, Daniels' Figure Reasoning Test and Non-Verbal Test No.2 of the National Foundation for Educational Research to 648 children between the ages of 10y - 0m and 12y - 0m inclusive. The first of these tests is untimed, the last two are timed; all three are similar non-verbal reasoning tests. Morgan's Ss were selected at random from the children of Mid and South Wales. They were divided into 10 categories which are defined by range of scores on the Welsh Linguistic Background Scale. In the case of all 3 tests a small but significant correlation between linguistic background (quantified by position on the above mentioned scale) and test score was observed; 'there was a tendency for scores in the three tests to decrease with increasing Welsh linguistic background.' However, differences between the 3 correlation coefficients[1] were not statistically significant. The author goes on to say that:

'there was a significant positive correlation between test scores and performance times[2], which indicates a tendency for higher scores to be related to longer performance times. More opportunity is given for this tendency to operate in a "power test" (i.e., one without a time limit) such as Raven's Progressive Matrices than in "speed" tests like Daniels' Figure Reasoning Test and Non-Verbal test No.2. This finding appears to be Lewis' main reason for suggesting that the time limit in N-VR might explain the difference in mean N-VR score between his 'Welsh' and his 'English' group. But it is impossible to show how Morgan's work supports Lewis' (and Morgan's) interpretation of it, for Morgan does not explore the relationship between varying linguistic background and the correlation he obtained between performance time and test score. To prove that the time limit of a test influences the different linguistic groups differently, it is not enough to show that the time spent in working at a test by the children of <u>all linguistic groups taken together</u> is related to their test scores, not even

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1. Though Morgan does not say so, these appear to be over all, not within-group, correlation coefficients.

2. Morgan does not explain what is meant by 'performance time'. It would appear to be the length of time spent by each child working on a test. Many children do not work on a timed test for the full time allowed them, so, even in the case of a timed test, time is a variable which can be correlated with test score.

when one has shown independently that test score is also related to the language backgrounds by which the linguistic groups are distinguished.

Morgan claims further that scores obtained with Raven's Progressive Matrices are more independent of variations in language background than scores obtained with either of the other tests. His evidence is that critical ratios[1] obtained in order to compare linguistic group means on Raven's test are not significant and are smaller than the corresponding critical ratios obtained with the other two tests, a few of the latter (i.e. those between groups occupying the extremes of the linguistic background scale) being statistically significant. However, several aspects of the procedure call for comment. No over all test (analysis of variance) of the significance of mean differences obtained with each non-verbal reasoning test was made; and as a result the danger of a Type I error (cf. Lindquist 1953, p.66) in interpreting a series of t-tests is great. But leaving aside the dangers which are involved in a series of t-tests, Morgan seems to have fallen into a Type II error, (cf. loc. cit.), because he had already shown that there was a significant

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1. A critical ratio is the ratio between (a) the difference between two means and (b) the standard error of those means. The linguistic groups of these comparisons are not the same as those mentioned in the preceding paragraph; in the second part of his work Morgan combines his original groups to form three major groups. It is likely that his second set of findings are a function of this re-arrangement of groups.

correlation between linguistic background and score on Raven's Progressive Matrices. Therefore he would be better advised to reject the hypothesis that linguistic group means on that test do not differ significantly. If this hypothesis is to be rejected, then the only part of his argument which remains is that critical ratios associated with Raven's test are smaller than those obtained with the other two tests. But the argument lacks force because, not knowing the standard deviation of critical ratios, we cannot tell whether or not two critical ratios differ significantly. Finally, even if the author had obtained his findings by more rigorous statistical procedures, his conclusions would still be open to question; for he does not appear to have controlled socio-economic variation or the effect of practice in taking the three tests, while he does not show that the three tests are similar in all relevant ways, time allowance excepted.

(b) The second suggestion offered by Lewis to explain the difference in mean N-VR score between his 'Welsh' and his 'English' groups is 'the small but appreciable loading of the test (N-VR) with the "v" factor of Emmett's analysis. We have already seen that this loading is not significant, and that it was identified by Emmett as "v" tentatively only. We may, then, discount this explanation.

(c) Lewis' third suggestion is a difference in the proportion of rural to urban children in the two groups. He was led to examine the proportion of rural to urban children because 'a comparison of parental occupation revealed no difference between groups in socio-economic status, (though of course a more thorough analysis of the socio-economic factor might have revealed some differences)'. He gives no further information about the 'comparison of parental occupation'; though in a note (Lewis 1960) he says that by 'more thorough analysis of socio-economic status' he means an analysis which includes variables other than parental occupation.

Now Jones (1960), who had analysed the data used by Lewis, considers the latter's 'treatment of the socio-economic factor not only unsatisfactory but also difficult to understand in view of the fact that precise information concerning parental occupations was available to the author in the case of each pupil .... '; and he adds that 'one would expect to find occupational as well as broad urban-rural differences ... in Lewis's analysis.' Of course we must not presume to judge between two scholars who have studied the data; but it is strange that Lewis failed to find a difference in parental occupation between his groups seeing that (i) Jones (1959) found a significant difference in this respect between similar groups, - admittedly in an earlier survey; and (ii) Barr (1959) has published evidence which goes a long way towards showing that in Britain the factor operative in producing differences in IQ between rural and urban children resolves on closer analysis into a factor associated with parental occupation. Barr writes: ' A comparison of the urban and rural professional groups reveals that the difference between their mean scores is negligible; a similar comparison of rural and urban manual groups likewise shows little significant difference. However when the mean score of the combined urban and rural professional groups is compared with that of those employed in manual occupations, there appears a significant difference with the former achieving the higher mean score'. It thus appears that Lewis' third suggestion is the correct one, though we are inclined to interpret the differences between 'Welsh' and 'English' groups in the proportions of urban and rural children, as differences in socio-economic status.

To sum up this review of studies employing N-VR: there is sound evidence from factor analysis and studies in bilingualism to show that N-VR scores in Britain are not influenced by differences in linguistic skills. Findings which appear at first sight to lead to the opposite conclusion do so because they were arrived at without due regard to variations in socio-economic status. There is little likelihood that the test's time allowance affects the scores obtained by children from different linguistic backgrounds differently. It is with some confidence then that we employ N-VR as independent variate to help in isolating the effect of the experimental variable.

The Irish Translation of N-VR.

N-VR consists of 85 problems set in diagrammatic form which are divided into five separately timed sections, each with its own set of instructions printed at the head of the section. For the entire test 30 minutes are allowed. Procedure 1 was followed, that is, without preliminary tests, the S reading the instructions for himself. This seemed to be the most satisfactory procedure, for, as Vernon (1960) indicates, the benefit of a short period of preliminary testing is very slight, while the difficulty of maintaining uniformity of administration would be increased if, as is required in Prodedure II, the inspectors who administered the test had been obliged to read aloud the instructions at the head of each section. Further, while the norms for Procedure I appear firm, the norms for Procedure II are provisional, being based on the scores of urban children only.

On the front page general instructions are printed which the supervisor reads aloud while the Ss follow in their booklets.

As one of the groups which worked the test (group 6) was composed of native Irish-speakers, an Irish translation was provided[1]. A translation was printed in Irish characters

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1. The writer is indebted to the National Foundation for Educational Research in England and Wales for permission to make the translation, and to Mr. Séamus Ó Mordha and Dr. Gearóid MacEoin, lecturers in Irish at St. Patrick's Training College, for help with the translation.

of the same size as the originals on slips of paper which were then gummed in position. This, the first translation, proved too difficult for children in two Dublin national schools who had been taught through the medium of Irish in all classes. The 5th standard children in these schools had previously worked the Irish test and had been ranked for proficiency in Irish on the scores they obtained. The 20 best at Irish in each school were placed in rank order and divided into two equal groups by assigning the children alternately to each group, one group in each school to take the Irish version and one the original. As one was a boys' and one a girls' school, 10 boys and 10 girls took each version. Results were compared by analysis of variance which revealed that 'Irish' groups scored significantly lower than 'English'[1] ones. From an analysis of scores on each section of the test it transpired that some sets of instructions were too difficult in the Irish version, so these were simplified and reprinted. The new version was tried out in three schools, two being boys' schools in Dublin[2], the third a mixed school

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1. In this connection we may recall that Jones and Stewart (1951) gave no proof that their Welsh version of Jenkins' test was equal to the original in difficulty. As it was this translation which was used in subsequent surveys, we have no guarantee that the differences between linguistic groups on the version are not due in part to differences in difficulty between the versions.

2. Not including the school in which the first version was tested.

on the fringe of Donegal's Irish-speaking area. All the children tested had been taught all subjects (English excepted) in Irish from the time they went to school. The Dublin boys were native English-speakers, while about half the children in the Donegal school spoke Irish in their homes, though all had learned English before going to school[1]. The 40 boys of the Dublin schools and the 12 boys and 12 girls of the Donegal school were divided (by taking alternate names from the roll-book) in each case into two groups, one 'Irish' and one 'English', according to the version they worked. The raw score means were:

	Irish	n	English	n
Boys (Dublin)	16.55	20	18.25	20
Boys (Donegal)	9.17	6	14.00	6
Girls (Donegal)	8.33	6	12.67	6

An analysis of variance of raw scores[2] by Language of Test and Sex was carried out with the following results:

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1. This is the Donegal school which took part in the research on the Irish translation of the arithmetic test (SPA) - cf.note 1, p. 169.

2. Raw scores (i.e. number of items answered correctly) were analysed in this case because as we shall see (Chapter 6) the published norms are pitched too high to be used as they stand in allotting IQs for many Irish children. The difficulty in using raw scores is the assumption, entailed in the statistical procedure, that they derive fron an equal interval scale. This assumption is not entirely justified, but the danger of error on that account is not very great.

TABLE 4.8

Analysis of Variance - English and Irish Versions of N-VR.

Source	DF	SS	MS	F
Language of Test	1	310.64	310.64	1.139 (1 and 60 degrees of freedom)
Sex	1	3484.21	3484.21	12.771 (" " ")
Language x Sex	1	4.24	4.24	.0155(" " ")
Error	60	16369.64	272.83	
TOTAL:	63	20168.73		

The variance ratios for both interaction and Language of Test fall far short of significance[1]. Thus the hypothesis that the two versions are equal in difficulty for children similar to those tested is not refuted, even though the English groups' mean in every case is slightly higher than the Irish group's. This discrepancy in mean score, always in the same direction, caused some misgivings, however, particularly since the above test is based on a relatively small number of cases. So the test was repeated, after an interval of four

1. $F \geqq 4.00$ (DF = 1, and 60) is significant at 5% level;
$F \geqq 11.97$ " = 1, and 60) " " .1% "

The significant sex mean square is principally due to the fact that all the girls were in an ordinary rural school whereas most of the boys were in a rather select Dublin school. Very probably, then, socio-economic status of boys as a whole was higher than that of girls.

months, in one of the Dublin boys' schools. A "cross-over" design was adopted: those boys who had previously taken the Irish version now took the English one and vice versa. (Owing to the expense of printing the Irish version and the fact that after the testing described above there were only about 10 Irish copies to spare, this supplementary experiment was not extended to other schools). The two groups of boys may be conveniently termed 'Irish-English' (Irish first, English second) and 'English-Irish' (English first, Irish second).

The difference between a boys first and second scores may be attributed to four causes: (1) change with age in the ability tested, (2) practice at the test, (3) change of language, (4) chance. Speaking now in terms of average differences, we can say that the influence of (1) must be nearly equal in each of the two groups; differences in its effect may be attributed to chance. Similarly, if the two versions are equal in difficulty, the influence of (2) will be nearly equal in each group, variations in the effect it produces arising from chance only. But if the effect produced by (2) varies from group to group more than can be explained by chance alone, it is because the versions vary in difficulty[1]. Thus, whether the versions vary in difficulty or not, our measurement of (3), the effect of change in language, remains undisturbed. Change in language, the third possible cause of difference between first and second mean scores, is of course the experimental variable, whose effect we have set out to study. Statistical analysis will reveal whether the fourth factor, chance, can explain differences between the groups in mean increase from first to second occasion.

A statistical analysis of the results obtained in the manner described above was carried out in the following way. Each boy's first score was subtracted from his second[2] to yield a difference score, 'd'.

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1. If the versions differ significantly in difficulty it can be shown that practice effects may vary in the two groups. Let us suppose that the English version is easier than the Irish one; then on the first occasion 'English-Irish' will have solved more items than 'Irish-English'. Assuming a practice effect, 'English-Irish' can maintain its advantage over 'Irish-English' on the second occasion only if each of the two groups solve an equal number of extra items. Now items in N-VR have been arranged in order of difficulty and the difficulty gradient from item to item is quite steep. Because of their later position in the test the extra items to be solved by 'English-Irish', if it is to maintain its advantage, are more difficult than the extra items to be solved by 'Irish-English'. In short the task of increasing the mean score is more difficult for one group than the other. As a result the effect of practice on the mean increase from first to second occasion is likely to be smaller in one group than in the other. The extent of such variation in the effect of practice, however, will be in proportion to the difference in difficulty between the versions, since the former is due to the latter. Therefore, variation in practice effect will not disturb the measurement of the effect of change language, which measurement is our principal object.
2. By 'score' here is intended raw score.

Means for d are:

	'Irish-English'	English-Irish'
Mean d	14.6	8.5

The t-test was employed to test the hypothesis that such a difference between means can be attributed to chance fluctuations alone. The test yielded $t = 4.006$ which, with 18 degrees of freedom, is significant well beyond the 5% level[1]. Thus we conclude that the 20 boys tested found the Irish version of N-VR more difficult than the English version. Before concluding this section, however, let us remind ourselves that the boys tested are native English-speakers, while the Irish version is for the use of native Irish-speakers only. Even for the majority of native English-speakers tested the difference in difficulty between versions is so slight that it was not shown up in the first experiment described. It is unlikely then that the Irish version would present greater difficulty than the English one to children who had an equal command of Irish and English; though it will be as well to bear this last experiment in mind.

1. With 18 degrees of freedom, $t \geqq 2.86$ is significant at the 1% level.

Questionnaire.

A questionnaire about socio-economic status was adapted from that of Dr. Seth Arsenian (1937). It consists of 10 questions in all, 5 about the subject's father, 2 about siblings, and 3 about the home itself, all to be answered by the children with their teachers' help where necessary. Arsenian claims a reliability coefficient of .832 $\pm$ .0084 for his questionnaire, and while the figure cannot be applied directly to the new form, there is reason to think that the latter's reliability is not substantially lower. Since the information obtained by means of the questionnaire is to be used in analysis of co-variance, there is no danger of error even if the reliability is lower, because the extent of the adjustment to be made to attainment scores will depend on the correlation between them and socio-economic rating. There are more questions in the questionnaire than were needed for the purpose of the treatise.

As one of the groups is composed of native Irish-speakers, some of whom know little English, the questionnaire was translated into Irish by the present writer with the help of Dr. Gearóid MacEoin, lecturer in Irish at St. Patrick's Training College. Copies of both versions may be seen in Appendix 2.

The object of the questionnaire was to place each child on a 7 point scale of socio-economic status. The scale was drawn up with the assistance of Mr. Knaggs of the Central Statistics Office who works on social classification in the National Census. He very kindly supplied detailed lists of the occupations included in different social classes for purposes of the National Census. He also suggested how these classes might be arranged so as to form a scale, for they are not so arranged by the Central Statistics Office. His advice was followed, but neither he nor the writer claims high scientific validity for the scale.

The following is a brief description of the scale:

1. <u>Unskilled</u> - agricultural labourer, dairyman, roadworker, van or lorry driver, railway employee (other than station master or engine driver), private in army (or unspecified rank).

2. <u>Semiskilled</u> - most factory hands, bulldozer operator, mechanical shovel operator, engine driver, busdriver and busconductor, sergeant or corporal in army, helper of skilled worker, crofter, postman, road ganger.

3. <u>Skilled</u> - foreman in factory, machineman in factory, mechanic, fitter, baker, plumber, tailor, carpenter, painter, decorator, printer, plasterer, cobbler.

4. Small shop owner, farmer, shop assistant, barman.

5. Clerical - civic guards, insurance agents, salaried employees, traveller for small firm, stationmaster.

6. Managerial - managers of hotels, large businesses, etc.; owner of large shop in the country; owner of business not large enough to be included in 7, but too large for 4; traveller for large firm.

7. Professional - members of the professions, army officer, 'gentleman' farmer (employing 4 men or more), employers of a large number of persons.

Ratings on such a scale as this are likely[1] to show a significant positive correlation with non-verbal IQ; but regression analysis, yielding partial regression coefficients, ensures that adjustments made to scholastic attainment means in covariance analysis procedure are unaffected by correlations between independent variates.

It is scarcely necessary to point out that socio-economic ratings are independent of teaching medium, the experimental variable, - parents' socio-economic status is not altered by the extent to which Irish is used to teach their children.

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1. See Eells et al. (1951), pp.15 and 137. In the present study socio-economic status and N-VR quotients yield r = .20 for boys and r = .13 for girls. Both coefficients are significant; and both are 'simple' as opposed to partial correlation coefficients - see Snedecor (1956), p.429.

Rating-Scale: Teachers.

As already indicated our aim is to obtain the regression of Irish, English and arithmetic scores on the length of time during which children were taught through Irish. This regression is to be corrected for the regression of attainment scores on each of three independent variates, one of which is a rating of teachers' skill as teachers. There is a possibility that there are systematic[1] differences between groups (distinguished by length of time during which Irish has been the medium of instruction) in quality of teaching. It has been said that a principal teacher will not undertake to have all subjects taught through Irish to all classes unless he has a particularly good staff. It is necessary, therefore, to seek for bias in quality of teaching and to eliminate it should it be discovered.

The Department of Education agreed to obtain the ratings of teachers. Plans for the work were drawn up by Mr. Seán Ó Conchobhair, Principal Officer of the Primary Branch, and the writer. The preliminaries agreed upon were that inspectors would be approached for the ratings, since the Department's information about teachers was not sufficiently

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1. 'Systematic' differences are differences which are other than random - See Lindquist (1940), p.4.

detailed. Secondly, detailed information obtained from inspectors would not be communicated directly to the writer. He would receive, instead, a rating for each school based on the detailed information. Neither would the detailed information be communicated to the Department officially nor used for any purpose other than the present research. Thirdly, all teachers who had ever taught the classes which were tested would be rated, (since no-one knows[1] whether a teacher exercises a greater influence on children at one stage of their school career than at another). Finally, a five point scale on which to rate teachers was composed and judged suitable for the purpose by two inspectors.

Each district inspector then received a letter requesting him to find out the names of all teachers who had taught the classes which were to be tested in his district, and to rate them on the scale if they had inspected their work. The letter explained that ratings should estimate teachers' ability to arouse children's interest and assist them effectively with their school work. It also advised the inspectors to bear in mind that the mean rating of teachers for the country should lie on the middle point of the scale, and that they need not hesitate to rate a

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1. It would be possible to carry out a regression analysis of the data obtained in the present survey using ratings of individual teachers rather than of schools which would throw light on the question, but so far it has not been done.

teacher at the lowest point, explaining the use that would be made of ratings. If an inspector had not inspected some of the teachers in his district, their names were sent to an inspector who had, and he was asked for ratings. The next step was to have a panel of three experienced divisional inspectors check district inspectors' ratings to help keep a common standard throughout the country. In fact the panel modified only a very small number of ratings. The writer is deeply indebted to Mr. Ó Conchobhair for his patience and diligence in this tedious work, and to the inspectors for their co-operation.

When all returns were in and checked Mr. Ó Conchobhair assigned a number to each rating, 5 high and 1 low. The number of years during which a teacher taught a class was recognised by weighting his rating by that number. Thus, in effect, 6 ratings were obtained for each school, covering the years 1955-61, and their sum constituted the school's rating. The maximum rating possible for a school is 30, the minimum is 6, and the mean is 18.

The Department and its inspectors have fostered Irish and teaching through Irish for many years; so it is difficult to know whether or not inspectors' ratings of teachers are independent of the teaching medium. On the one hand inspectors might be inclined to rate a teacher high simply because, complying with Department policy, he taught a number of subjects through Irish; while on the other hand, if teaching arithmetic, say, through Irish has a detrimental effect on English-speaking children's arithmetical attainments, it is conceivable that inspectors might rate a teacher low, simply because he taught arithmetic through Irish. If either tendency is present in inspectors' judgments, their ratings are not independent variates. Partly to guard against such tendencies inspectors were informed of the purpose of the survey, but no other steps to maintain the 'independence' of ratings were, or it seems could have been, taken. In effect, as we shall see in chapter 7, there seems to have been a tendency for inspectors to rate highly teachers who engender a high standard of Irish, more than any other subject, in their pupils. However, this tendency may not indicate lack of 'independence' in ratings, because nearly twice as much time[1] is given to Irish as to any other subject in national schools, and because in the opinion of inspectors and teachers who were consulted, the teaching of Irish (so-called direct method) requires greater skill than the teaching of any other subject if it (teaching of Irish) is to be successful. Moreover adjustments to scholastic attainment scores for differences between groups

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1. See below, pp. 279-80.

in ratings of teachers were in all cases small; so error in these adjustments, if it exists, is most probably slight. Further discussion of the difficulties attached to using these ratings as independent variates must be left over until in chapter 7 we set out the main findings of the survey.

CHAPTER 5.

Testing Procedure.

The tests which were described in the preceding chapter were administered by the inspectors in 116 of the 120 schools in the fortnight previous to the Easter holidays, i.e., between the 13th and 24th March 1961.
Circumstances prevented the tests from being administered in 4 schools within that fortnight; but they were administered in those immediately after the Easter break.

The simplest way of describing how the testing was carried out is to give a translation of the relevant portions of the letter which the inspectors received to guide them in their work. The letter first listed the schools (the maximum number for any one inspector was 5) in which the recipient had agreed to administer the tests, and specified the linguistic category in which each school belonged. The letter then continued:

III.A. Tests.

' The following tests should be administered in the order in which they are given:

P1. Jenkins' Non-Verbal Test 1.
P2. Moray House English Test 14.
P3. The Essential Problem Arithmetic Test (Schonell).
P4. Triail Ghaeilge.
P5. The Essential Mechanical Arithmetic Test (Schonell).

Please follow this order exactly in every school because it has been established that fatigue and practice affect a child's score. (Henceforth the tests will be referred to by the symbols prefixed above, P1 - P5.)

III.B. Language of Test.

' Tests P1, P3 and P5 have been translated into Irish; there is therefore an English and an Irish version of each.

P1 - The English version is to be administered in all schools outside the Fíor-Ghaeltacht. The Irish version is to be administered in all Fíor-Ghaeltacht schools (group 6).

P2 - is to be administered as it stands in all schools.

P3 - the Irish version is to be administered in all schools in the Fíor Ghaeltacht, (group 6), and also in all schools in the Galltacht[1] where arithmetic is taught through Irish up to 5th standard (group 5). The English version is to be administered in all other schools.

P4 - is to be administered as it stands in all schools.

P5 - the Irish version is to be administered to all schools in the Fíor Ghaeltacht, (group 6), and also in all schools in the Galltacht where arithmetic is taught through Irish

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1. English-speaking districts.

up to 5th standard (group 5). The English version is to be administered in all other schools.

III.C. Test Instructions.

' Each test has its own set of instructions; these will be sent to you separately. Please read them carefully and follow them closely, especially in regard to what you are permitted to say while conducting the test. Speak calmly to the children so that they will attend without being made to feel uneasy, especially when starting the first test in the morning.

The instructions tell you the number of minutes allowed for each test. Since not so much as a second can be added to or deducted from this, a watch with a second hand will be essential.

III.D. Time for Starting the Tests.

' It is not my intention to set down an exact time for the beginning of each test, because it might not be opportune in every school; instead it is preferable to give general directives and to leave to you to determine times which are suitable for each school - but it is most important to adhere to the order of tests laid out above.

P1 - Early in the morning when the children have settled down.

P2 - Ten minutes after completing P1.

P3 - Half an hour before lunch break.

p4 - Shortly after lunch break.

After this allow a break of 15 minutes during which the children should be sent out into the open air.

P5 - After the 15 minute break.

III.E. The Language in which to Address the Children.

' Since you must address the children before each test and announce the time to them at certain intervals during tests, it is necessary to determine the language in which to address them.

<u>General Rule I:</u> Before the beginning of a test, when you are explaining what is to be done, use the language of the version about to be worked. Thus, before the children begin on P1, speak in English to all classes outside the Galltacht. Similarly, speak in English to all classes before P2, and in Irish to all classes before P4. For P3 and P5, follow the language of the version to be administered to the class.

In the above General Rule I only that speech is intended which is prescribed by the test rules. If you are directing a class to spread themselves out, for example, speak in the language you consider most suitable, but please avoid disturbing children by saying things they cannot understand.

General Rule II: If you are announcing the time or telling the children to stop, use the language most commonly used in the locality of the school.

IV. The Pupils.

IVA. 5th Standard.

' It is highly desirable that all - if possible - 5th standard children should be present for the tests, and be actually tested. No-one should be omitted because he is stupid. In order to set their minds at rest, you might tell the children that they are being asked to take part in a piece of educational research, and that we are all grateful to them for their co-operation; that their school will not be compared with any other individual school; and that the test results will not be used to determine which pupils are to be promoted at the end of the year.

IVB. To Start a Test.

' 1. Separate the children from one another as best you can. Copying in these tests is easy.

2. See that each child has a pencil. It would be wise to bring a few pencils with you for fear any child should break

the point of his pencil.

3. Do not allow a rubber or a ruler (even a book) on top of the desk, because these waste time. Some children are excessively careful.

4. Certain facts have to be entered by the children on the front page of each test. It is quite in order for you or the teacher to help the child with them. Since these facts are almost the same in every test, more help will be required with the first test than with later ones. Neither you nor the teacher should answer any question or give any help while the test is in progress.

5. Take a note of the time to the minure and second when you give the word to begin. Correct timing is essential.

IV.C. The Questionnaire.

' A questionnaire on the social and economic status of the children's families has been prepared. There is a great deal of evidence, as you are well aware, that progress at school is closely related to the type of home a child comes from. Additionally, many problems in genetics can be examined if we obtain information about the home. At any rate, such information is vital to the reliability of conclusions based on the results obtained with the above tests.

' There is an Irish as well as an English version of the questionnaire. All children outside the Fíor Ghaeltacht (groups 1-5) should be given the English version; the Irish version is for children in the Fíor Ghaeltacht (group 6).

' I am afraid that duller children will have difficulty answering the questionnaire, so please invite the teacher to help them, and please give the children all the help you can youself.

' The most important thing in the questionnaire is the father's present occupation, if he is alive, or the occupation he had, if he is dead. Please ask the teacher to check the answers for this item at least and to correct them if he knows they are wrong.

' It would be wise to inquire of the teacher beforehand whether there is an illegitimate child in the class. If there is one, the best thing is to allow the teacher make his own arrangements. He will hit upon some plan to meet the situation; for example, he might send the illegitimate child away on some message and ask the others to fill up the questionnaire while he is gone. It is not necessary to have them filled in on the day when you visit the school; you can arrange for the teacher to forward them by post. If they are to be filled in during your visit, they should be left until after P5.'

The test programme was a heavy one. For that reason MHE14 was placed second in the morning when it was hoped children would have grown accustomed to the idea of these sorts of tests through sitting N-VR and when they would not be too tired to give of their best. It was important that they should sit MHE14 at a good time of the day, because their EQs are to be compared with those of British children who would not have had as heavy a day's testing when they sat MHE14.

Data from the other tests are chiefly for the purpose of inter group comparisons, and as long as all groups took the tests in the same order there was little danger that those comparisons would be affected by fatigue or practice. Note that SPA came last in the morning and SMA last in the afternoon, which probably means that the children were fresher when they took the former than the latter.

CHAPTER 6.

TWO PRELIMINARIES TO THE MAIN STATISTICAL ANALYSIS.

Two issues must be raised and settled before the main findings of the present survey are presented:

(a) the conversion of Irish, English, and N-VR, raw scores to quotients;

(b) the complication that in two linguistic groups arithmetic was taught bilingually (Irish and English) for some years - see above, p. 112, note 1.

(a) Raw scores to quotients.

Generally it is desirable to convert raw test scores (i.e. number of items answered correctly) to quotients before proceeding to statistical analysis. The reason is that otherwise one may not be dealing with scores which lie on an equal internal scale. In the present study Irish, English, and N-VR, raw scores were converted to quotients which, in accordance with customary practice, are normally distributed about a mean of 100 with a standard deviation of 15, and incorporate an age allowance. On the assumption that the ability tested by each of the three tests is normally distributed in the standardisation sample, one thus obtains with each a set of scores (quotients) which are appropriate for statistical analysis. Certain difficulties, however, attended the conversion of Irish, English, and N-VR, raw scores to quotients, so we shall discuss each set in turn.

Irish:

To facilitate the conversion of raw scores to quotients a conversion table is generally constructed from which the appropriate quotient for each raw score at each age level can be read. Because the Irish test is a new one, an Irish conversion table had to be constructed. Beforehand, each group's results were examined separately, and it was discovered that children between the ages of 11y - 0m and 12y - 11m in groups 1 to 4 obtained mean raw scores which are somewhat lower than those obtained by children of the same age in groups 5 and 6. The median raw score for groups 1 to 4 combined is 16; for groups 5 and 6 combined it is 20. There are 523 children between the ages specified in groups 1 to 4 and for these the regression of raw scores on age, calculated according to the method outlined by Lawley (1950), is - .0709. If this coefficient were used in converting raw scores to quotients with a standard deviation of 15, the regression of such quotients on age would be -.5319 (= 15 x - .0709). Thus there is a marked tendency for quotients to decrease as age increases, roughly equal to that for quotients to increase as age increases as instanced in

Moray House and many other conversion tables. The reason for the difference in sign is that Moray House conversion tables are based on scores obtained from complete age groups of children, whereas the Irish regression coefficient is based on those obtained from children in one particular standard. The wide range of ages to be found in any standard in Ireland indicates a marked tendency for bright children to be promoted rapidly and for dull children to be held back. In any standard the old children are likely to be duller than the younger ones; hence the negative correlation.

Clearly common sense would be violated if a negative age allowance were incorporated in a conversion table, since the point of an age allowance is to compensate the younger child in quotient points for the fact that he has not had as long to mature and to learn as an older child. Furthermore, the observed negative regression results merely from the manner in which the sample of Irish children was selected. The difficulty was met by estimating an age allowance from those which had been calculated elsewhere. In Moray House conversion tables, whether verbal reasoning, English, or arithmetic, the age allowance is invariably close to .5 of a quotient point per month, and the age allowance in the N-VR table is also about .5 points per month between the ages of 10y - 0m and 10y - 11m.

For these reasons an allowance was made in the Irish norms of .5 points per month over the age range 10y - 0m to

10y - 11m. From there on it was thought best to adhere to the age allowance of the N-VR norms rather than the Moray House ones because of the former's wider age range; so from 11y-0m to 11y-11m the allowance was reduced to about .33 points per month, and from 12y-0m to 12y-11m to about .25 points per month, as was done in the N-VR norms for raw score 20[1]. Over the age range 13y-0m to 13y-11m (N-VR norms extend no further than 12y-11m) the age allowance was further reduced to about .17 points per month; but from 14y-0m forward no further allowance was made, the appropriate quotient at age 13y-11m being allotted[2]. Needless to say, all of this is to some extent arbitrary, but two points may be made in its support. (i) So closely do conversion tables which were examined agree in their age allowances that there is good reason to believe that even had a large and representative age group of Irish children been tested, the age allowance

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1. The age allowance in the N-VR norms varies slightly with raw score. Seeing that the imposition of the N-VR age allowance on the Irish conversion table was arbitrary, it seemed pointless to follow those fluctuations; so the allowance at N-VR raw score 20 was adopted, as 20 was the median of the Irish raw scores upon which the Irish conversion table was based.

2. Such a reduction in age allowance towards the table's upper age limit and beyond it is quite reasonable. When children of an age close to that limit are tested, their scores are found to cluster together more closely than those of younger children, the reason being that the test problems are not difficult enough to discriminate between children of varying ability at this age as finely as at a lower age. Consequently, the increase in score per month is less for older than for younger children.

derived from their scores would not differ greatly from the one imposed on the Irish table, at least between ages 10y-0m and 13y-0m which includes about 84% of the present sample of children. (ii) Though the differences in mean age between groups are significant they are not very great in terms of months[1]; so an age allowance which may be slightly in error introduces only a minute error into mean differences between groups in Irish quotients, an error which is almost certainly very much smaller than the error which would exist if mean differences in age were ignored.

The Irish conversion table was based on the scores obtained by the 241 children between the ages 11y-0m and 12y-11m in groups 5 and 6, because their median score was 20, whereas that obtained by the other four linguistic groups was 16. The difference of 4 points suggested a somewhat wider range and more normal distribution of raw scores in groups 5 and 6 than in the other four groups; a suggestion which was confirmed by comparing scattergrams for the two sets of scores. It is an advantage that the scores on which the conversion table is based should be as widely scattered as possible, without a great concentration of scores in any part of the distribution. The advantage may be grasped by imagining the difficulty of forming a normal distribution of quotients from a set of raw scores which are scattered

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1. See below table 6.1.

between 0 and 50, but with 90% of scores between 0 - 5; a small increase in raw score would correspond to a large increase in quotient at the lower end of the distribution. In fact at the lower end of the Irish conversion table an increase of 1 in raw score corresponds to an increase of 3 in quotient, even though the table is based on the more suitable set of raw scores. Admittedly the procedure which was adopted employed only about a quarter of the available raw scores, and probably that quarter which was least representative of the country as a whole; but the writer believed that the advantage (albeit slight) of the wider scatter of raw scores in groups 5 and 6 outweighed the disadvantages mentioned. These disadvantages are also slight, because the need for large numbers was not so great when an age allowance was not to be calculated from them; and as we shall see, groups 5 and 6 are fairly representative of the sample as a whole.

The Irish conversion table[1] was constructed, age allowance apart, according to Lawley's (1950) method, and was used to convert all Irish raw scores to the quotients which were analysed statistically; these have a mean of 97.6 and a standard deviation of 17.0.

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1. This and the other conversion tables mentioned in this chapter are to be found in Appendix 3.

English.

The conversion table for MHE14, embodying the national norms for the test, provides for children between the ages of 10y-0m and 12y-0m. But these age limits are altogether too narrow for Irish 5th standard children whose ages were found to vary from 9y-11m to 15y-0m. Hence the choice presented itself of: (a) confining the analysis to children whose ages lay between 10y-0m and 12y-6m[1]. (b) extrapolating from the table to include all the children tested, (c) constructing a new conversion table based on the raw scores obtained by Irish children. To choose (a) would be to reject 32% of the sample. Moreover, an analysis of variance carried out to test the hypothesis that the mean

TABLE 6.1

Mean Age in Months above 12.0 years.

Linguistic Group	1	2	3	4	5	6
Boys	4.94	3.20	1.97	5.16	-0.06	0.12
Girls	3.39	0.87	-0.17	-0.65	-0.56	-1.76
Total	4.14	1.95	1.00	2.49	-0.32	-0.96

1. The Manual of Instructions, p.12, states that there is little danger of error in extrapolating up to age 12y-6m, but it adds: 'Extrapolation in this manner should not be carried beyond age 12y-6m'. The 'in this manner' means employing the same age allowance as that which is used throughout the table when extrapolating.

ages of boys (table 6.1) do not differ significantly among linguistic groups, yielded F = 3.50 (DF = 5 and 530); which being significant[1] led to the rejection of the hypothesis. The test of the corresponding hypothesis in the case of girls yielded F = 2.49 (DF = 5 and 542), which being also significant led to the rejection of this hypothesis too. Finally a t-test, using the method of paired (mean) differences[2], yielded t = 3.25 (DF=5) which is significant and implies that in 5th standard boys tend to be older than girls (see table 6.1). These three findings all go to show that if (a) were chosen, the results obtained would be biased in accordance with the tendencies[3] which the findings reveal. Additionally, sound procedure demands not only that children be selected as far as possible at random, but also that all the children selected if at all possible be represented in the analysis of data.

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1. With 5 and 400 degrees of freedom Fs $\geq$ 2.23 and 3.06 are significant at the 5% and 1% levels respectively.

2. See Fisher (1960), pp.36 sq. With 5 degrees of freedom ts $\geq$ 2.57 and 4.03 are significant at the 5% and 1% levels respectively. For details of these tests see Appendix 2 .

3. The reasons for these tendencies do not concern us directly here, but in passing we may remark that in the Rest (counties which have no Irish-speaking districts - see above pp. sq.) the use of Irish as medium of instruction is associated significantly with high marks in Irish; and since Irish occupies the most important position in the primary school curriculum (almost twice as much time devoted to Irish as to any other subject - see below, pp. 350 sq.) we expect to find that more rapid progress in Irish is associated with more rapid promotion from class to class. If our argument is correct, and it seems to be, it explains the tendency for age to decrease from group to group as the use of Irish as teaching medium increases. The fact that girls are younger than boys may be connected with the fact that girls acquire linguistic skills more rapidly than boys - see McCarthy (1954) pp. 577 sq.

For these reasons (a) was rejected.

The decision to obtain EQs for all the children tested involved its own drawbacks. It was found that the printed conversion table, if used to convert raw scores to quotients, gave a distribution of EQs which was positively skewed to a marked degree and therefore unsuited to relevant forms of statistical analysis. Moreover, 38 children obtained raw scores of zero, while a great number obtained raw scores which were so low that EQs could not be assigned to them without extrapolating below 70, the lowest EQ in the table. These difficulties prompted the decision to draw up a new conversion table (alternative c), based on Irish children's raw scores, to be used in converting these into quotients having a mean of 100 and standard deviation of 15. These EQs were used in comparisons of groups for attainment in English.

The new conversion table, constructed by Lawley's (1950) method, is based on all 1083 raw scores obtained in the present survey. The age allowance which was used in constructing the Irish conversion table was built into the new English table.

N-VR:

Difficulties were encountered in the use of N-VR similar to those encountered in the use of MHE14. Though the N-VR conversion table encompasses a larger age range than the MHE14 table, it is still not wide enough for Irish 5th standard pupils. Moreover the distribution of IQs obtained by using the printed conversion table was positively skewed to a marked extent, just as was the distribution of EQs obtained by means of the MHE14 table. For those reasons a new conversion table based on the raw scores obtained by 1083 Irish children was drawn up. The age allowance in the new table, like that of the Irish and new English tables, corresponds closely with the age allowance of the original N-VR table. The new table however, like the Irish and English ones, has an age range of from 10y-0m to 13y-11m, the age allowance above the age 12y-11m being treated in the same manner as in the Irish table. Quotients derived by means of the new table have a mean of approximately 100 and a standard deviation of approximately 15. These are the quotients which are employed in the analysis of regression to be described in the next chapter.

There remains one vexing problem in the treatment of three sets of raw scores which we have been discussing, what to do with raw scores of zero? The problem exists only in connection with the Irish, MHE14 and N-VR tests, since there were no zero scores in arithmetic. At first, an attempt was made to match children from each of the six linguistic groups who obtained zero scores in order to omit them, but that proved impossible because apart from the fact that the number of zero scores in English, Irish and N-VR varies appreciably from one group to another (see table 6.2), the children who obtained them could not be matched for age, sex, school-type (whether 1-teacher, 2-teacher, 3-teacher, or m-teacher) and geographical region.

TABLE 6.2

No. of Zero Scores.

Linguistic Group	1	2	3	4	5	6	Total
MHE 14	3	0	10	3	3	19	38
Irish	2	3	6	6	1	3	21
N-VR	2	1	5	7	1	6	22

It was then decided to allot a quotient to each zero score, but the question was, what size of quotient? Should the same quotient be allotted to a zero score regardless of the age of the child who obtained it? Or to put it another way, is a child of 10y-0m as weak at English as a child of 13y-6m if both obtain a raw score of zero? No conclusive answer can be given, though a case can be made for allotting a higher quotient to the first child than to the second on the grounds that a score of 1 at the age of 10y-0m is better than a score of 1 at the age of 13y-6m; and a score of 1 is not much better than a score of zero. So it seemed sensible to replace each score of zero by a quotient 2 points less than the quotient which would be assigned if the child had obtained a score of 1. Thus the two children instanced above would be assigned English quotients of 84 and 70 respectively, since the corresponding English quotients to be assigned for raw scores of 1 at these ages are 86 and 72.

Raw scores of zero were included in preparing conversion tables for each of the three tests, Irish, MHE14 and N-VR.

(b) Bilingual Teaching of Arithmetic.

In chapter 3 it was noted that by a regrettable error the lists from which the schools of groups 3 and 4 were selected contained many schools which, though they taught arithmetic through Irish to the required levels (1st and 3rd standards respectively), did not completely replace Irish by English in the more advanced classes but used the two languages side by side as teaching media. Unfortunately, however, it is not possible to determine precisely the extent to which each of the two languages was used. Probably there was considerable variation between schools; but at least some schools have in common the fact that they describe themselves as teaching arithmetic 'bilingually' at the levels specified.

The effect of bilingual teaching on attainment level in problem arithmetic was studied by comparing the AQs of the two types of children in group 3, those who had been taught arithmetic bilingually and those who had been taught through the medium of English alone from 2nd to 5th standards. Problem arithmetic was chosen rather than mechanical as being more likely to reveal any effects of varying the language of instruction. Group 3 was chosen in preference to group 4 because the two methods of instruction had been employed over a longer period of time (two years longer) with group 3 than with group 4, and consequently any difference in arithmetical attainments which resulted from them should be more apparent in the former than in the latter group. Two analyses of covariance were carried out, one for boys' and one for girls' AQs; each was a two-component analysis taking into account besides differences of a linguistic nature, differences between West and Rest.[1] N-VR was the only independent variate employed. The main reason for the separate analyses is that numbers in sub-groups vary disproportionately[2] and on that account adjustments to allow for the disproportionality must be made to each component of the total sum of squares. Calculating these adjustments involves solving simultaneous equations and

1. For the connotations of the terms 'West' and 'Rest' see pp. 114 sq. The data for these tests are given in Appendix 3 .

2. Federer (1957) describes how analysis of covariance may be carried out when numbers are disproportionate.
The 'subgroups' are of course those who have been taught '<u>bilingually</u>' or in <u>English</u> - either in the <u>West</u> or in the <u>Rest</u>; i.e. four subgroups.

much additional labour besides. In each of the present analyses there are two sets of simultaneous equations with three unknowns per set; whereas if boys' and girls' AQs had been analysed together there would have been four unknowns in each set, and though there would be only two sets the labour of solving them would be greater than that of solving the four smaller sets. It is doubtful whether the increased sensitivity of the analysis would repay the extra labour. Moreover, tables 6.3 and 6.4 suggest that at least one condition for the single analysis, homogeneous variance, was not satisfied; cf. the 'error' terms in those two tables.

TABLE 6.3

Table of Analysis of Covariance - Boys.

Source	DF	MS	F
Treatments	1	3.0059	not significant
Regions	1	84.6459	"
Interaction	1	92.2141	"
Error	108	417.373	"

TABLE 6.4

Table of Analysis of Covariance - Girls.

Source	DF	MS	F
Treatments	1	28.343	not significant
Regions	1	490.943	4.626 (d.f. = 1,86) significant at 5% level.
Interaction	1	10.857	not significant
Error	86	106.131	

Tables 6.3 and 6.4 show that in neither set of AQs is the mean square for interaction of Region and Treatment significant, and that in neither is the mean square for treatments significant. Thus it is reasonable to disregard differences in mean problem arithmetic quotient between schools where arithmetic has been taught bilingually and those where it has been taught through English alone. These findings are in agreement with the views of some inspectors who were consulted, namely that schools which describe themselves as teaching a subject bilingually in fact use English nearly all the time, Irish only very little. All schools then in groups 3 and 4 will be regarded as schools which teach arithmetic through the medium of English after they cease to teach it through the medium of Irish.

With DF = 1 and 80 an $F \geq 3.96$ is significant at the 5% level ($F \geq 6.96$ at the 1% level), and so the mean square for regions in table 6.4 is significant. It is curious that this mean square should be significant, but not the corresponding one for boys in table 6.3 - but having noted the facts we must leave their fuller discussion over to the following chapter, number seven.

CHAPTER 7.

COMPARISONS AMONG LINGUISTIC GROUPS - RESULTS 1.

In the following analyses each of four dependent variates (Y) is analysed in turn together with five other variates (Xs).

Dependent Variates. i.e. sets of scores obtained with each of these tests:-

SPA (problem arithmetic	Ys.
SMA (mechanical arithmetic)	
Irish	
MHE14.	

Independent Variates: scores or assessments obtained under these headings:

N-VR (non-verbal reasoning = X_1

Socio-economic status = X_2

Rating of teaching skill = X_3

Experimental Variates

Extent of teaching through Irish = X_4

Step-function = X_5

X_5 which is included to test a particular hypothesis about the regression of each Y on X_4 is discussed below (pp. 248sq.);

the other variates have been discussed at length in chapters 3 and 4.

When the present investigation was planned the statistical treatment envisaged was analysis of covariance in which X_1, X_2, and X_3, were to be the only Xs. X_4 was then to be treated as a qualitative variate consisting of the six linguistic groups described in chapter 3. As work progressed the number of qualitative divisions of Ss which appeared to be important increased, as we have already seen in chapter 3. Eventually, within each of the six groups measures obtained in the West were separated from those obtained in the Rest[1]; within each region measures for boys and girls were separated; within each of the sub-subgroups thus determined, measures for 1-teacher, 2-teacher, 3-teacher, and more-than-3-teacher, schools were separated. This meant 96 sub- sub- subgroups in all. So many subdivisions, coupled with the fact that numbers in subdivisions vary disproportionately, rendered analysis of covariance of the type originally envisaged impracticable, because analysis of co-variance in those circumstances would require the solution of simultaneous equations with an unmanageably large

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1. For the meaning of the terms 'West' and 'Rest' see above pp. 114 sq.

number of unknowns and much labour in making appropriate adjustments for disproportionate subgroup numbers.

Some method of reducing the number of qualitative subdivisions was required, and Mr. Frank O'Carroll, head of the statistics department of The Irish Institute for Agricultural Research, suggested that X_4 be treated as a quantitative variate and that the analysis be confined to the elementary among, and within, group pattern. X_4 was assigned the value 0 for each child in linguistic group 1, the value 1 for each child in linguistic group 2 ...., the value 4 for each child in linguistic group 5. Instead of separating the values of X_4 by units over the five groups, those values might have been fixed at 0, 1, 2, 4, 6 which would be to separate them by the differences between groups in the number of years during which arithmetic was taught through Irish. If the latter alternative had been adopted, significant linear regression coefficients of Ys on X_4 could have been interpreted as the loss or gain of so many points of Y per year of teaching arithmetic through Irish; the first alternative yields coefficients which must be interpreted, if significant and linear, as the loss or gain of so many points of Y from one group to the next. There is little to choose between the two alternatives; the writer chose the first because the arithmetic involved was somewhat simpler. Of course the alternatives would yield different sets of coefficients, but the difference between the sets would almost certainly be very slight.

Group 6, which is composed of native speakers of Irish was omitted from the main analyses, because it could not be placed anywhere on the X_4 scale, group 5 (all subjects - English excepted - taught through Irish at all levels) already occupying the only position in which it might have been placed[1]. However, the data for group 6 were analysed separately. Data from 1-teacher schools were also omitted from the main analyses, the number of children in groups 1 to 5 in such schools, 9 children in all, being quite inadequate for the type of statistical treatment which was carried out.

The majority of analyses carried out consisted of two principal steps, (1) multiple regression analysis and (11) analysis of covariance. The former consists essentially in calculating partial regression coefficients to measure the regression of Y on each X (i.e. the regression of Y on each X 'independent' of the other Xs)[2]. For example,

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1. A further reason for not including group 6 in the main analysis was the fact that, Irish apart, the group obtained very low mean scores and mean ratings on all scales - see below, table 7.4. If the value 5 for X_4 had been assigned to the group it is likely that the regression of Ys on that variable would have become too difficult to deal with.

2. See S edecor (1956), chap.14, which was used extensively for the work of the present chapter. For the particular point made in the text see particularly op. cit. pp.413-4.

the effect of the other four X variates was eliminated from the coefficient calculated to measure the regression of EQ on X_4; thus this coefficient is the best means available to us of determining whether the teaching of arithmetic through Irish has an effect on EQ, and if it has, the extent of the effect.

Where, as in the present study, the total body of data has been divided into subgroups[1], regression analysis may be carried out in two basic ways:

1. Regression coefficient may be calculated from the 'total' sums of squares and 'total'[2] sums of products, which means that subdivisions of the data are ignored;

2. subdivisions may be recognised by calculating from the sums of squares and sums of products 'within'[2] subgroups a set of regression coefficients each of which is the average of the corresponding coefficients for subgroups.

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1. In what follows 'subgroup' will be used to designate a division of children composed of either boys or girls, from either the West or the Rest, who attend a 2-teacher, a 3-teacher, or a more-than-3-teacher school; thus there are twelve subgroups in all.

2. For a definition of these terms as used in analysis of variance - they are used in the same sense here - see Lindquist (1953), pp.54-55. See also op.cit. pp.320-21.

The statistically minded reader will recognize that the procedure is in fact part of what one does in covariance analysis with more than one independent variate.
For convenience sake we shall use the terms 'coefficient-T' and 'coefficient-W' to signify regression coefficients of types 1 and 2 respectively.

In the preceding paragraph regression coefficients based on 'among' subgroup sums of squares and sums of products were not mentioned because they would be unlikely to prove useful in our work. The reason why can be understood if we consider the case where there are two groups, one of boys and one of girls for example, and a single set of criterion scores (Y) and a single set of independent scores (X) have been obtained for all Ss.
Then b_{yx} based on 'among' subgroup sums of squares and sums of products is simply the regression of Y means on X means. If sex differences do not affect Y means and X means to the same extent, and if any unmeasured bias does not affect those means to the same extent, then this coefficient is a biased extimate of the parameter involved.
For the reason that regression coefficients-T include differences between groups, they too are likely to be to some extent biased. Those differences have been eliminated from coefficients-W which are simply the averages of corresponding regressions within the various subgroups,

and for that reason coefficients-W are the least biased estimates of the parameters in question. Where possible we have calculated regression coefficients-W; but apart from the fact that we have had to be satisfied in certain analyses with coefficients-T, for reasons which will be made clear in the appropriate places, coefficients-T as well as coefficients-W were calculated in most analyses because both are required in covariance analysis.

In many cases after multiple regression analysis had been carried out it was followed up by covariance analysis[1] to test the significance of differences between subgroups in Y means. The assumptions[2] which underlie the form of multiple regression analysis and covariance analysis carried out are the same; they are as follows:-

(i) The regression of Y on each X is linear. This condition underlies analysis leading to either coefficients-T or -W as well as covariance analysis; but in the two last mentioned procedures the condition must be satisfied in each subgroup. (Where the condition is not satisfied, linear

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1. The appropriate methods are described by Snedecor (1956), pp. 420 sq.

2. The statement of these assumptions is derived from Snedecor (1956), pp.127 sq. and p.423 and from Lindquist (1953), pp.323 sq.

regression may sometimes be replaced by curvilinear regression, but it was not found necessary to do so in the present inquiry.)

The next three assumptions concern coefficients-W and analysis of covariance.

(ii) The regression of Y on each X is constant from sub group to sub group.

(iii) The variance of Ys adjusted by means of the multiple regression equation is homogeneous throughout sub groups. This assumption underlies tests of the significance of a regression coefficient-W or of the difference between adjusted Y-means; it has no bearing on the calculation or use of coefficients-W.

(iv) The distribution of adjusted Ys in each sub-group is normal. This condition is involved only if the tests mentioned in (iii) are to be carried out.

Apart from assumptions (i) to (iv) which concern the validity of the procedures employed, there are two other assumptions - discussed in chapters 3 and 4 - which must be justified if the analysis is to yield evidence which can form the basis for conclusions about the interrelationships of the variates being studied.

(v) Ss in each subgroup were drawn at random from the same parent population; <u>or</u> initial bias in the selection of subgroups can be controlled by means of independent variates, - which requires that the selection was random with reference to all factors not controlled as qualitative variables or by means of X-measures.

(vi) Independent variates are not affected by differences in 'treatment', i.e., in this case, by the extent to which Irish is used as teaching medium.

It is unlikely that condition (i) has not been satisfied in the regression of Ys on each of the first 3 Xs. Macnamara (1959) in a study preliminary to the present one examined the correlation[1] between the attainment (English and arithmetic) and X_1 scores (N-VR) obtained by some 200 Dublin boys. He divided the data into four numerically equal sections, each representing a quarter of the X_1 distribution, and calculated correlation coefficients

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1. It should be noted that r_{xy} is closely related to the regression of Y on X; r_{xy} is the geometric mean of b_{yx} and b_{xy}. See Snedecor (1956) p.167.

for each quarter. He discovered no significant differences between the coefficients for different quarters, and while it is not valid, strictly speaking, to reason from the linearity of the correlation between two variates to the linearity of the regression of one on the other, the 1959 test does suggest that marked departure from linearity of regression of Ys on X_1 in the present investigation is unlikely. Correlations between measures of attainments and measures such as X_2 (socio-economic status) are usually found to be so small[1] that there is scarcely any purpose in investigating whether the corresponding regression is best treated as linear or as curvilinear. The accompanying scattergram (Fig.7.1) which illustrates the relationship between EQs and X_2 in group 4 shows that departure from linearity in the regression of either of these variables on the other is most unlikely to be significant, so great is the scatter of EQs for each value

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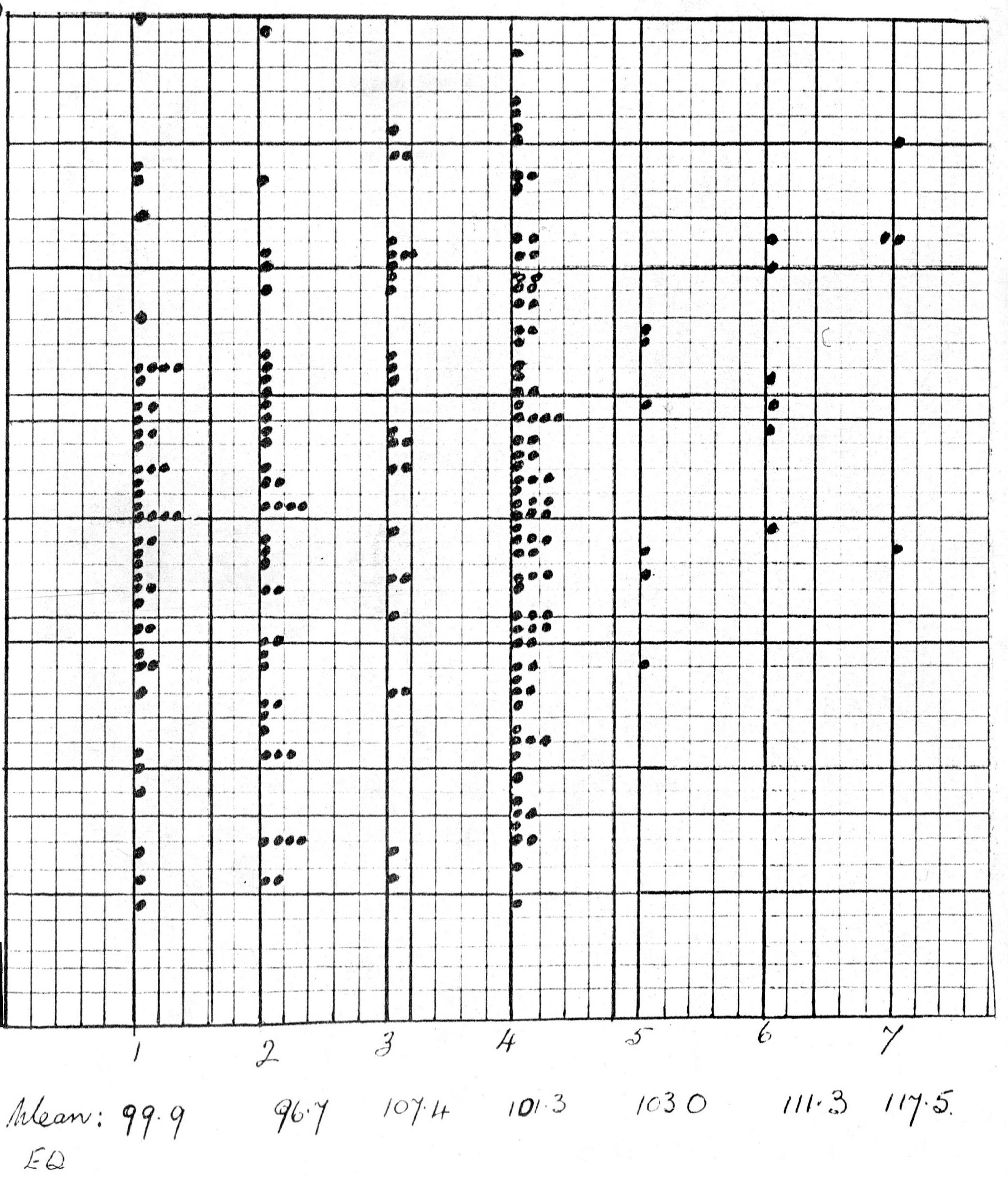
1. Vernon, M.D. (1958, pp.154 sq.) cites a few studies in which correlations of the order of .3 were found between ability to read and socio-economic status. McCarthy (1954) cites several studies in which small correlations were found between measures of language development and socio-economic status. In the present study the 'simple' correlation coefficients (see Snedecor 1956, p.409) between English and socio-economic status and between Irish and socio-economic status, fluctuate slightly about .2. The simple correlation coefficients between arithmetic and socio-economic status range from .22 to .30.
   Curry (1962) presents some evidence that the relationship between attainment scores and socio-economic status is not the same at different levels of IQ. However, his statistical analysis is not very rigorous and does not determine whether or not there are significant differences between the correlations at different IQ levels.

Fig. 7.1

Scatter Diagram
EQ and Socio-Econ. Rating
Linguistic Group 3



of X_2. This scattergram is not untypical of what was observed of the relationships between other Ys and X_2. The relationships between Ys and X_3 (ratings of teaching skill) are also likely to be slight[1] if only because X_3 is a rather subjective and unreliable measure. Special steps were taken to test the hypothesis that the regressions of attainments on X_4 (extent of teaching through Irish) is linear, because X_4 is the experimental variable.

Let us remind ourselves of the distinctions between the five linguistic groups of schools included in the regression analysis. Groups 1 to 4 are distinguished by the varying number of years during which arithmetic was taught through Irish; group 5 differs from the other four not only because Irish was its medium of instruction in arithmetic over a greater number of years than any other group, but also because, unlike the other four groups, Irish was its medium of instruction in all subjects (English excepted)

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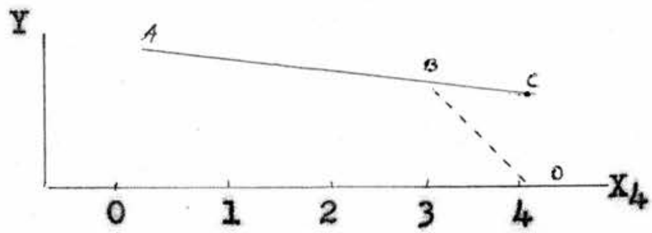
1. The simple (for the meaning of the word in this context see Snedecor, 1956, p.429) correlation coefficients between measures of attainmenta and ratings of teaching skill in the present survey were curious.

	MHE14	IRISH	SPA	SMA	N-VR	N (schools)
Boys	.16	.26	.09	.14	-.07	106
Girls	.52	.52	.25	.30	.08	106

Regression analysis, however, reveals that the regression of SPA quotients and GQs (Irish) on X_3 are the only significant ones.

at all age levels. (Group 6 is omitted from the main regression analyses). If, then, the regression of any Y on X_4 is not linear, it is likely that the departure from linearity should occur at $X_4 = 3$ (i.e., at group 4). The point may be made clear by means of a graph:

FIGURE 7.2



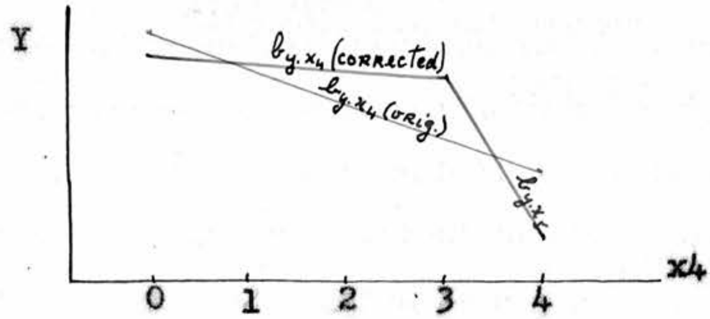
In Figure 7.2 line AC represents the first alternative, i.e., linear regression; lines AB and BD represent the second alternative, i.e., the regression departs from linearity at the point where $X_4 = 3$. The reason for believing that regressions may be represented by one or other of these alternatives is the constitution of the groups; because if one result of teaching native English-speakers arithmetic through Irish is to diminish arithmetical attainments, the extent of the diminution, probably, will either be revealed by a constant drop in arithmetic score from group to group, or the drop from group 4 to group 5 will be significantly greater than that between other successive pairs of groups. Mr. Frank O'Carroll suggested a simple method of testing which of the above-mentioned alternatives best represents the data. The method is to include in the matrix[1] which contains sums of squares and sums of products for Xs an extra set of sums of squares and sums of products for a new variate, X_5, which has the following values:

$$X_5 = 0 \text{ when } X_4 = 0 \text{ to } 3$$

$$X_5 = 1 \text{ when } X_4 = 4.$$

The elements of the inverted matrix are used to calculate the values of bs (regression coefficients) which provide the best fitting multiple regression equation and the smallest sum of squared deviations from regression which the data warrant. The effect of including X_5 where regression departs from linearity in the manner described may be illustrated graphically:

FIGURE 7.3



1. See Snedecor (1956) p.438 sq.

By including X_5 the coefficient b_{yx4} may be altered appreciably, and b_{yx5} may have a significantly greater negative value than the new b_{yx4}; if both possibilities are realised the blue line of Fig. 7.3 represents the relationship in question better than the red one. The significance of b_{yx5} is tested in the usual way (Snedecor 1956, p.440); it will be significant only if the inclusion of X_5 has been a significant improvement to the multiple regression equation, or to put it another way, if the inclusion of X_5 has significantly reduced the sum of squared deviations from regression.

The 'null-hypothesis' that regression is homogeneous over all subgroups, where the data is divided into subgroups, may be tested by an extension[1] of the method by Lindquist (1953, pp. 330 sq.) for the case where there is only one independent variate. Lindquist shows that the sum of squared deviations from regression based on coefficients-W ($SS_W y$) may be analysed into two components, (i) the sum of squared deviations from regression based on coefficients calculated for each group (SS dev. fr. grp. regr.) and (ii) the sum of squares for differences among group regressions (SS among grp. regr.). A similar division of $SS_W y$ may be

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1. I am grateful to Mr. Dermot Harrington of the Statistics Department at the Agricultural Institute for guidance in this matter.

made where there are several independent variates, and a similar test of significance to the one described by Lindquist may be applied. Where there is more than one X however, the rules given by Lindquist for calculating the degrees of freedom to be associated with each component require adjustment. If there are N sets of observations for N subjects, each set comprising v observations, then the degrees of freedom (DF) associated with the total variance of adjusted Ys are N-v; where Ss are divided into a subgroups and $SS_{w}y$ is calculated on the basis of coefficients-W, DFw = N-v-(a - 1). In order to calculate SS dev. fr. grp. regr., mean Y and v-1 regression coefficients must be calculated for each subgroup (i.e. v constants are required for each subgroup) and since there are a subgroups, there are N-av degrees of freedom associated with SS dev. fr. grp. regr. DF for SS among grp. regr. are (a - 1)(v - 1). Thus, for example, if we were to test whether the regression of Y on five Xs is homogeneous over all of our twelve subgroups comprising 1083 children in total -

DF (total)	= 1083-6	= 1077
DFw	= 1077-11	= 1066
DF (dev.fr.grp.regr.)	= 1083-12 x 6	= 1011
DF (among grp. regr.)	= 11 x 5	= 55

Many tests of the hypothesis that regression is homogeneous in various sections of the data were carried out which revealed that the hypothesis must be rejected in many cases, but before presenting the results in detail it will be well to note some points about the third and fourth conditions mentioned above.

The third condition is that the variance of adjusted Ys should be homogeneous throughout subgroups, the fourth is that each distribution of adjusted Ys should be normal; these two conditions are involved only when t-tests or F-tests are to be applied. Lindquist (1953, pp. 78 sq.) cites strong evidence that such tests[1] can be carried out with very little loss of reliability even when these two conditions are not fulfilled.[2] However condition (iii) has an important bearing on the present work since it is closely connected with condition (ii). A little reflection will show that one of the reasons why condition (ii) is not satisfied in any set of data might well be heterogenous variance either in the Ys or in any of the Xs. The following figures illustrate the point:

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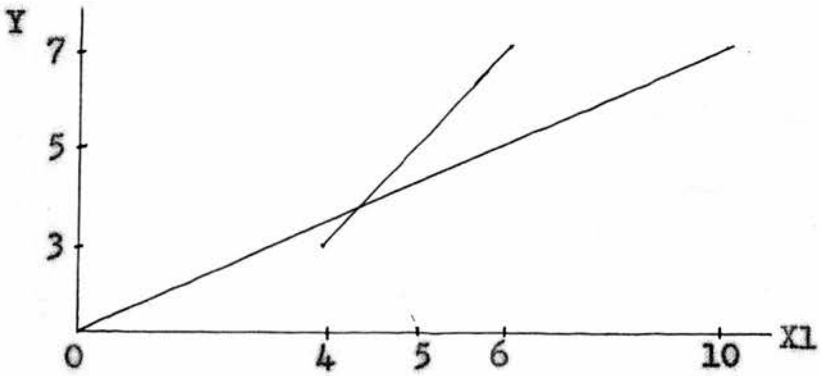
1. Lindquist speaks only of F-tests, but the arguments he uses apply also to t-tests.
2. Cochran (1957) writes: 'although the effects of failures of these assumptions on the analysis of covariance do not appear to have been investigated, much of the related work on the analysis of variance carries over - for instance, that on the effects of non-normality or inhomogeneity of variance ... ' p.278. His remarks need not be confined to analysis of covariance; they apply with equal force to multiple regression analysis which in key respects is related to analysis of covariance.

Group I		Group II	
Y	X_{11}	Y	X_{12}
7	6	7	10
5	5	5	5
3	4	3	0

Here the variance of Ys is homogeneous while that of Xs is heterogeneous.

If the two lines are plotted on a graph it is immediately apparent that the variances have an effect on the slope of the lines and consequently on the regression coefficient b_{yx}.

FIGURE 7.4



Numerous tests of the hypothesis that variance is homogeneous throughout subgroups in various sections of the data were carried out. These tests have a twofold value:

(i) they throw light on the source of heterogeneous regression; (ii) they reveal when one of the assumptions underlying t-tests and F-tests is not justified. When that assumption is not justified by the data on which such tests are carried out a slightly higher level of probability

TABLE 7.1

Results of Tests of Departure from Homogeneity of Regression and Variance.

Variate		B + G (W & R)	B & G (W)	B & G (R)	B (W.& R)	G (W& R)	B (W)	B (R)	G (W)	G (R)
SPA	(Reg.	HS		HS		HS				HS
	(Var.	HS	HS	S	S		HS	HS		
SMA	(Reg.	HS	HS	HS		HS			S	HS
	(Var.	HS	S	HS	HS	S		HS	S	
Irish	(Reg.	HS	S	HS	HS	HS	HS			HS
	(Var.	HS	HS	HS	HS		HS	HS		
English	(Reg.									
	(Var.	HS	HS		HS					
X_1	Var.	HS	S	S		HS			S	HS
X_2	Var.	HS	S	HS	(S)	(S)		HS		S
X_3	Var.	HS	HS	HS	(S)	(S)	HS	HS	HS	HS
X_4	Var.	HS	HS	HS	(S)	(S)	HS		HS	S
X_5	Var.	HS	HS	HS	(S)	(S)	HS	HS		HS

NOTES: S = departure from homogeneity - significant at 5% level.
HS = " " " - " " 1% "

No entry shows that the tests revealed no significant departure from homogeneity.

NOTES: (Contd.) B = boys, G = girls, W = West, R = Rest.

Under each B and G at least three subgroups are included, namely, 2-teacher, 3-teacher, and more-than-3-teacher, schools. Under the heading B & G (W & R) all twelve subgroups are included.

Y variates - have not been adjusted by means of multiple regression equations.

is required for significance[1]. The findings of the tests for homogeneity of regression and homogeneity of variance are summarised in a single table, 7.1.

One conclusion which emerges from all these tests is that heterogeneity of regression in every instance may well be due to heterogeneity of variance, since the former never occurs without the latter. Another conclusion is that the populations of children in the three different types of schools, 2-teacher, 3-teacher, and more-than-3-teacher, schools differ appreciably. It is not easy to see precisely what the differences are because the numbers of observations on which subgroup variances are based vary very much, and where n is small, variance is subject to large random fluctuations. It must be added that Bartlett's test for homogeneity of variance makes an allowance for variations in n so that they do not affect the validity of the test.

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1. Lindquist (1953, p.83).

At this point of our thinking the following hypothesis to explain why populations vary suggested itself. By and large 2-teacher schools are found in more sparsely populated areas than 3-teacher schools, and the latter in more sparsely populated areas than schools which have more than three teachers (m-teacher schools). And by and large there are fewer middle class families in sparsely populated areas than in thickly populated ones. Indeed Barr (1959) has shown that many of the differences in scholastic attainments between rural and urban areas can be explained by differences between the two regions in the proportion of people at each socio-economic level. In the present analysis each set of attainment quotients, Y, and also X_1, correlates positively with socio-economic status as indicated by parental occupation. Therefore the dispersion of each Y and X_1 might be expected to vary with the dispersion of measures of socio-economic status (X_2).

The hypothesis may be examined in table 7.2. The first point to be observed about table 7.2 is that the pattern of variances for X_2 does not support the hypothesis just stated. In the West the variance of X_2 is homogeneous, but in the Rest it is heterogeneous, among subgroups. Secondly, in the Rest, there is a distinct tendency for the variance of X_2 in 3-teacher schools to be larger than those of either

TABLE 7.2

Subgroup Variances. ≠

	WEST						REST					
	BOYS			GIRLS			BOYS			GIRLS		
Type of School	2-t	3-t	m-t	2-t	3-t	m-t	2-t	3-t	m-t	2-t	3-t	m-t
n	89	76	85	89	47	25	144	61	10	121	50	122
SPA	569	277	309	180	177	198	311	276	44	293	274	216
SMA	274	292	293	154	291	173	268	232	19	290	231	229
GQ	275	353	160	259	256	131	268	393	45	239	284	227
EQ	377	328	257	185	185	298	180	279	91	181	252	183
(X_1)	192	244	292	324	188	151	228	332	102	163	284	277
(X_2)	1.9	2.9	2.2	1.4	1.8	2.7	2.4	4.5	1.3	1.6	2.9	2.3
(X_3)	12.7	5.1	1.7	10.7	5.3	.84	22.3	4.2	0.0	10.5	5.0	6.7
(X_4)	1.7	1.4	0.64	1.6	1.9	0.21	1.6	2.5	0.0	1.9	1.2	2.4
(X_5)	0.25	0.19	0.06	0.20	0.20	0.21	0.06	0.20	0.0	0.11	0.0	0.22

≠ 't' stands for teacher, 'm-t' for schools in which there are more than 3 teachers.

There is heterogeneous variance among subgroups for each of the variables named on the left of the table. By referring back to table 7.1 the reader can remind himself in which sections of the table variance is heterogeneous.

2-teacher or m-teacher schools. Looking next at the variances for Ys, the same patterns as those just noted for X_2 are observed: no consistent pattern in the West; a distinct tendency for those of 3-teacher schools to be the largest. Let us first consider the second half the table, marked Rest. In the Rest there are six m-teacher schools, and of these two are Dublin schools, a third is situated in a town of over 10,000 people, (there are only fourteen such in Ireland), the remaining three in towns which are large by Irish standards.

TABLE 7.3

Means for X_2

	WEST						REST					
	Boys			Girls			Boys			Girls		
	2-t	3-t	m-t	2-t	3-t	m-t	2-t	3-t	m-t	2-t	3-t	m-t
Mean X_2	3.3	3.3	3.1	3.2	3.4	2.8	2.9	3.8	2.8	3.6	2.7	2.5
"	89	76	85	89	47	25	144	61	10	121	50	122

In Dublin and the town of over 10,000 there are private schools to which middle class parents generally prefer to send their children rather than to the national schools, while in rural areas there is generally speaking no alternative to the national school. As all 2-teacher and, with one exception, all 3-teacher schools are rural, their pupils form a sample which from the socio-economic point of view is representative of the local communities, whereas the pupils in m-teacher schools are less representative of the local communities, since they do not include the correct proportion of middle class children. This could explain why contrary to our prediction the variance for m-teacher schools is smaller than that for 3-teacher schools in the second half of table 7.2. It is more difficult to explain why the prediction is not verified in the first half of the table unless, perhaps, the reason is, that in the West differences in density of population between the areas served by the three sorts of school are not as marked as those between corresponding areas in the Rest. Only one of the four m-teacher schools in the West, for example, is situated in an area where there is also a private primary school.

The above observations may explain why in the West subgroup variances in X_2 do not differ significantly one from another, and why no pattern is observable in the differences between subgroup variances for Ys and X_1; but they hardly explain why the latter differences are in certain sections (West) of the data heterogeneous. However since the correlations between X_2 on the one hand and X_1 and the different Ys on the other are low, it would be futile to attempt to explain fully in terms of X_2 all anomalies in X_1 and in Ys. We must rest content with the partial explanation of heterogeneous variances offered because the evidence to hand does not permit of a fuller one.

The fact that condition (ii)[1] is not satisfied in numerous sections of the data poses two problems which can

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1. See above, p. 245.

be solved only by examining what heterogeneous regression involves. The first is whether a number of subgroups showing heterogeneous regression can be combined into a single group for the purpose of regression analysis or whether the data for each subgroup must be analysed separately.

In considering this problem some points about the samples of children concerned must be borne in mind. Each group approximates to a random sample of all the children who are taught in the particular manner which characterises that group. One of the limitations imposed on each sample was that it should be representative of all the national schools in the country in the proportion of boys and girls, and in size of school as indicated by number of teachers. The suggestion has been made above that in dividing groups into 2-teacher, 3-teacher and m-teacher schools, the entire sample has been divided into heterogeneous subpopulations whose heterogeneity is revealed by heterogeneous regression. But almost any population can be broken down into heterogeneous subpopulations. For example, the population of 11 year old Dublin boys can be divided into those who have spent the last twelve months in hospital and those who have not; each of these subgroups can be divided into the sons of professional class people and the sons of people who are not professional class. If an English test and a non-verbal reasoning test were administered to all these boys it would be reasonable to expect marked differences between the various types of boys not only in mean EQ, but also in the subgroup variances[1] of EQs and IQs. It would also be reasonable to expect that the regression of EQ on non-verbal IQ would vary significantly from subgroup to subgroup. All this does not mean that 11 year old Dublin boys may not be considered as a single population; what it means is that any population in which there are differences between individuals can be broken down into quite heterogeneous subpopulations. What has happened in the present investigation seems to be just that. In separating children into subgroups which are characterised by a particular number of teachers per school, heterogeneous subpopulations have been determined. The first problem posed by the discovery of heterogeneous regression amongst subgroups was whether such subgroups might be combined into a single large group for the purpose of regression analysis. We maintain that the answer is yes.

There remains the further problem; whether it is better to combine these subgroups into a single group or to take account of differences between subgroups; or to

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1. Bernstein (1961) reports such a difference in variance between working class and public school youth: the verbal IQs of the former were not as widely spread as those of the latter.

put it another way, whether coefficients-T represent the regressions of Ys on Xs better than coefficients-W? Coefficients-W, we remind ourselves, measure regression based on lines which are parallel in each subgroup; coefficients-T measure regression which is baded on only one set of lines (one line for each X) for the entire sample. The former, which take into account differences between groups in mean Ys and mean Xs, are more accurate than the latter which ignore such differences; unless mean Ys and mean Xs coincide, in which case the two sets of coefficients are identical. For this reason the analyses to be described in the following pages are where possible baed on coefficients-W.

Results: Groups I to 5.

The most important hypotheses tested in the various analyses reported in this section are that the regression of Ys on X_4 and on X_5 are not significantly greater than zero: these are the hypotheses which state that when allowance has been made for differences in the first three independent variates, the extent of teaching through the medium of Irish has no significant bearing on attainments in each of the four subjects investigated. These hypotheses will be considered first.

TABLE 7.4

Linguistic Group Means (Unadjusted).

Group	1	2	3	4	5	6
n≠	160	188	215	170	196	155
SPA	87.2	87.9	87.3	88.3	83.0	78.6
SMA	95.0	94.4	95.5	94.5	96.3	87.7
Irish	93.1	94.1	95.4	98.0	102.6	102.7
English	101.2	102.6	101.7	100.8	102.9	91.9
X_1	101.3	102.0	99.4	98.4	101.8	99.4
X_2	2.56	3.01	2.96	2.89	3.72	2.25
X_3	17.2	18.5	17.3	18.5	20.2	17.4

≠ Note: these means are for the entire sample, including children in 1-teacher schools.

In the tables which follow b_1 signifies the partial regression of an attainment quotient on X_1; b_2 signifies the partial regression of an attainment quotient on X_2 etc. A single asterisk is used to mark a coefficient which is significant at the 5%, two asterisks to mark a coefficient which is significant at the 1% level of probability. After each coefficient its standard error is given in brackets.

Commentary on table 7.5 will be recorded under the four subject headings.

TABLE 7.5

Regression Coefficients-W : Groups 1 to 5.

	SPA	SMA	Irish	MHE14[x]
b1	.600**(.029)	.541**(.028)	.523**(.029)	.611**(.025)
b2	1.602**(.304)	1.730**(.290)	.642* (.297)	.629* (.253)
b3	.330* (.150)	.098 (.143)	.568**(.147)	.080 (.125)
b4	.699 (.511)	.586 (.486)	1.728**(.499)	.539 (.425)
b5	-8.849**(1.718)	-2.455 (1.634)	.596 (1.678)	-.517 (1.430)

N = 919

x The only one of these four analyses in which the condition of homogeneous regression is satisfied is the analysis of MHE14 quotients.

Problem Arithmetic (SPA):

Since b_4 is not significant, X_4 has not reduced the regression sum of squares significantly, though it can be expected to have somewhat disturbed each of the other regression coefficients. The significant b_s become better estimates of the corresponding parameters when they have been corrected for disturbance due to the influence of X_4. The method which Snedecor (1956, pp. 444-5) outlines for 'deleting an independent variable' when the inverse matrix has been calculated was followed. When X_4 has been deleted, b_5 becomes -7.696 (SE = 1.676), which is significant at the 1%

level of probability. Thus the findings of regression analysis are that group 5 obtained problem arithmetic quotients which are significantly below those obtained by the other four groups on an average by about 8 points, and that these other groups do not differ significantly among themselves in mean problem arithmetic quotient.

The coefficient of multiple correlation[1], which measures the extent to which variation in Y (within subgroups) has been accounted for by means of the Xs, in this analysis is .61. Thus, much of the variation in Y has not been accounted for. If more of the variation had been accounted for, by the introduction of further Xs for example, there is no knowing to what extent the observed bs would have been affected, but it is very likely that they would have been affected to some extent. Thus, conclusions from the above analysis are less secure than we should wish. However, it is highly probable that the difference between group 5 and the other four groups in the use of Irish as teaching medium has resulted in a significant difference in mean SPA quotient in favour of the four groups.

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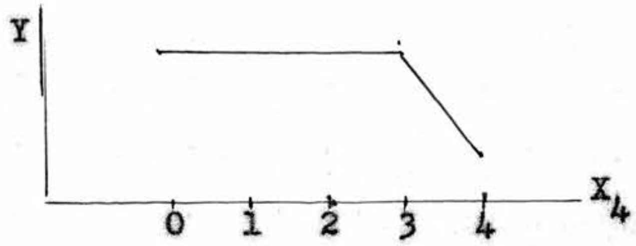
1. Snedecor (1956) p.420 gives the formula for this coefficient, which is symbolised by R, as

$$\sqrt{\Sigma \hat{y}.1234^2 / \Sigma y^2}.$$

See also op.cit. p.438.

The findings for problem arithmetic may be represented on a graph.

FIGURE 7.5



These findings, however, raise a theoretical difficulty. If the teaching of English-speaking children through the medium of Irish is the cause of a sharp drop in problem arithmetic quotient between groups 4 and 5, it seems strange that there should be no drop at all between groups 1 and 4, since one would expect to find some drop associated with increases in the length of time during which arithmetic was taught in Irish. Figure 7.5 however does not accord with this expectancy; though the findings do not exclude it.

The advice of an experienced national school teacher was sought about the difficulty, and he suggested that it might be solved as follows. By and large there is very little work done in problem arithmetic in national schools before 3rd standard; in particular, he thought, children are seldom set written problems before they come to 3rd standard and even in this standard they do not get a lot of such work. Thus of the children in the first four linguistic groups, only those in group 4 would have had experience of written problems in Irish, and their experience was most likely quite limited. Hence the absence in our findings of a drop in mean problem arithmetic quotient from group to group over the first four groups.

It is of interest that the findings for problem arithmetic recorded here are in general agreement with the conclusion arrived at as a result of our review of the relevant studies in bilingualism, (see above pp. 101 sq.).

Mechanical Arithmetic (SMA):

Apart from b_1 and b_2, none of the other 3 coefficients calculated for SMA is significant. Neither b_4 nor b_5 becomes significant if any one or any pair of the variates which is failing significantly to reduce the sum of squares due to regression is deleted. Thus we shall retain the hypothesis that length of teaching through the medium of Irish exerts no appreciable influence on attainment in mechanical arithmetic. Again this finding is in harmony with our conclusion about the effect of bilingualism on mechanical arithmetic arrived at as a result of our survey of the relevant studies.

For this analysis, $R = .59$.

Irish (GQ):

When X_5 is eliminated, b_5 falling short of significance, b_4 becomes 1.85 (S.E. = .356) which is also significant at the 1% level. This means that there is a significant tendency for Irish quotients to increase as the use of Irish as teaching medium increases. However, the analysis does not yield any evidence that group 5 excels group 4 by any more than group 4 excels group 3 etc. The non-significant b_5 is surprising because it seems to indicate that group 5's advantage in GQ over group 4, which appears to result from the former's being taught all subjects through Irish throughout their school lives, is no greater than that of group 4 over group 3, which appears to result from group 4's having been taught arithmetic alone through Irish for two years longer than group 3. This may arise from the fact that apart from English and Irish there is very little else on the curriculum of Irish national schools except arithmetic[1]; which means that the difference between teaching all subjects (English excepted) through Irish and teaching just arithmetic through Irish is not very great. However we shall have more to say on this point when we take the findings for West and Rest separately.

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1. These three subjects occupy some 88% of a national school child's time - see below, pp. 352 sq.

R in this analysis is .57.

English (MHE14):

Since b_3, b_4, and b_5 all fall short of significance the effect on b_4 and b_5 of eliminating X_3 was tested, also the effect on b_4 of eliminating X_5 and on b_5 of eliminating X_4. The effect on b_5 of eliminating X_3 and X_4 and on b_4 of eliminating X_3 and X_5 was also tested. Neither b_4 nor b_5 was found significant in any of these tests. In short no tendency for mean EQ to be related to either X_4 or X_5 is revealed.

R = .66 in this analysis.

Mean differences between subgroups:

In an analysis of regression where the condition of homogeneous regression has not been satisfied the hypothesis that subgroup means adjusted by analysis of covariance procedure do not differ significantly may still be tested. The effect of heterogeneity of regression on the F-test, like the effect of heterogeneity of variance, is probably slight, tending to make a mean difference appear significant when in fact it is not. The hypothesis was tested[1] for each of the Ys, and the values of F noted in table 7.6 were obtained.

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1. Snedecor (1956) pp.420 sq. outlines a test of this hypothesis suitable for the case where there are more Xs than one. The test entails calculating coefficients-T as well as coefficients-W. For details of these tests, see Appendix 6 .

In each test twelve subgroups were recognised (Boys and girls, from <u>West</u> and <u>Rest</u>, who attend one of the three types of school, 2-teacher, 3-teacher, or more-than-3 teacher), but as the analysis was only one dimensional (not three dimensional) no interaction components were obtained. Because numbers varied disproportionately among subgroups, the labour of a three dimensional analysis would have been too heavy.

<u>TABLE 7.6</u>

Variance Ratios in Tests of Mean Differences Between Subgroups.

Y variates	$F^{\dagger}$	DF
SPA	.231	11 and 902
SMA	1.639	11 and 902
Irish	10.24**	11 and 902
MHE14	11.84**	11 and 902

$\dagger$ $F \geq 1.80$ is significant at the 5% and $F \geq 2.26$ at the 1% level of probability.

N = 919.

Though the regression of GQs on independent variates is heterogeneous among subgroups, so large an F as that for Irish in table 7.6 must be accepted as sufficient evidence to overthrow the null hypothesis. The regression of EQs

Table 7.7

Means: Original and Adjusted.

	West						Rest					
	Boys			Girls			Boys			Girls		
	2-t	3-t	m-t	2-t	3-t	m-t	2-t	3-t	m-t	2-t	3-t	m-t
N	89	76	85	89	47	25	144	61	10	121	50	122
	-	-	-	-	-	-	-	-	-	-	-	-
SPA (Orig.	86.6	88.9	90.2	85.6	86.8	82.1	87.3	88.1	91.9	86.2	86.4	83.3
(Adjust	88.5	89.3	86.6	86.3	85.9	86.2	88.1	89.7	89.8	85.8	87.0	81.7
SMA((Orig.	94.6	95.7	97.2	94.1	98.9	97.8	92.3	95.1	101.3	96.3	96.3	94.9
(Adjust.	94.1	95.6	95.2	94.1	97.7	101.2	94.0	95.8	101.5	96.8	98.2	92.9
Irish(Orig.	97.3	101.2	94.8	102.7	106.8	92.0	91.9	95.0	76.2	99.8	97.4	93.0
(Adjust	96.1	100.5	92.2	102.2	105.7	92.6	94.7	96.7	78.8	100.5	100.5	90.5
Eng- (Orig.	98.3	103.5	104.1	101.2	108.1	94.0	99.7	101.4	88.6	104.9	102.8	103.4
lish (Adjust	98.0	103.0	102.0	101.5	107.3	97.4	101.3	103.3	88.5	105.4	104.7	100.4
X_1	100.9	99.6	104.1	101.1	101.7	95.4	98.2	96.8	101.2	100.0	97.8	106.2
X_2	3.27	3.33	3.12	3.24	3.43	2.76	2.87	3.84	2.80	2.99	2.74	2.51
X_3	17.5	18.7	19.2	18.1	18.9	18.6	17.7	18.2	20.0	19.0	17.9	18.3
X_4	2.85	2.58	2.20	2.55	2.06	3.28	1.45	1.98	0.00	1.64	1.36	2.03
X_5	.48	.25	.06	.28	.28	.28	.06	.28	.00	.12	.00	.32

on independent variates is homogeneous among subgroups. Unadjusted and adjusted subgroup means are given in Table 7.7.

In order to help sort out which of the factors associated with the classifications of subgroups (i.e. sex, region, and size of school) caused the significant Fs in table 7.6, a further analysis of covariance was undertaken. This was made with sums of squares and sums of products 'within', recognising only two subdivisions, namely, West and Rest, and with sums of squares and sums of products 'total', enabling us to test the hypothesis that West and Rest do not differ significantly in mean attainment quotient. These tests yielded $F = 6.858$ for GQs (DF = 1 and 912) and $F = 2.066$ for EQs (DF = 1 and 912). Since values of $F \geq 3.85$ and 6.66 are significant at the 5% and 1% levels of probability respectively, the null hypothesis is rejected in the case of GQs but not in the case of EQs. Thus it is only in Irish that children of West and Rest differ significantly, the former excelling.

Inspectors and teachers who were consulted were generally of the opinion that the higher GQs of children in the West are to be explained mainly by the fact that the Department requires a higher standard of Irish in counties where there are Irish-speaking areas (West) than in other counties (Rest). Some were also of the opinion that the finding might be explained partly by the tradition[1] in the West, more than in the Rest, of looking on 'education' as a means to secure covetted positions; and since greater prominence is given to Irish than to any other subject in national schools, children in the West may be expected to excel at Irish. However, this argument loses some of its force because the differences in arithmetic and English between regions are not significant; and while these subjects are not given as much prominence as Irish they are far from being regarded as unimportant. A final suggestion to explain the significant difference in mean GQ is that in the West spoken English is more influenced by the syntax and phonetics of Irish than the English of other parts, and as a result children in the West learn Irish with greater ease than those in the Rest. This is certainly a reasonable suggestion, though if it were true we should perhaps expect to find that the Rest excelled the West in English; but we do not find this.

Heterogeneous regression of Y on independent variates among subgroup means that bs differ among subgroups and consequently that the multiple regression equation differs among subgroups. However, it is maintained here that such

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1. See above, pp. 117.

heterogeneity arises from the particular manner in which the sample of children tested have been divided into subgroups, and that a single multiple regression equation may be employed to represent the sample regression of Y on Xs. Assuming that the argument is correct, it is permissible to use this multiple regression equation (employing coefficients-W) to adjust mean Ys. This was done for subgroup means in the four Y tests (though the problem of heterogeneous regression did not arise in the case of English), and the results were set out in table 7.7. For purposes of comparison the unadjusted, or original, subgroup means are also given.

It is not possible without a great deal of labour to test the significance of the difference between pairs of means for any given Y in table 7.7; but apart from the difficulty, the wisdom of making such a series of tests is open to question. Even when an overall test has revealed no significant differences among a number of means, a pair of means can generally be selected from among them which when tested appear to differ significantly. We shall, therefore, be content to seek for general tendencies.

It would appear that the significant F for mean differences in GQ is due not only to a significant difference between West and Rest but also to a difference

between boys and girls. There also seems to be a tendency for 3-teacher schools to obtain higher mean GQs than 2-teacher schools, and for m-teacher schools to obtain the lowest means of all. Though the difference between West and Rest in mean EQ is not significant, the other tendencies noted in mean GQs seem to be present also, though not to the same extent, in adjusted mean EQs. It is easy to understand why the advantage of an extra teacher should raise the mean GQs and mean EQs of 3-teacher above those of 2-teacher schools, but it is difficult to explain why the advantage of more than three teachers should not raise these means still further. Schools classed under m-teacher differ from the other two types of schools in a number of ways:
(i) 10 of the 99 schools in groups 1 to 5 are m-teacher schools and of the 10 only 2 are mixed schools whereas 78 of the remaining 89 are mixed; (ii) the ratio of boys to girls in m-teacher schools, 95/147, is smaller than in the other 2 types of school combined, 370/307 ; (iii) m-teacher schools are mostly situated in or near the larger centres of population; four are in cities, one is in a town of over 10,000 and one in a town of over 5,000 people - in the entire country there are only 32 towns with a population of over 5000. Perhaps the tendency for m-teacher schools to obtain lower GQs and EQs than other schools is to be explained by the third point. In the larger centres of population there are private schools to which middle class parents generally prefer to send their

children rather than to national schools, while in rural areas there is generally no alternative to the national school. This point has already been made in connection with table 7.2, but it seems relevant here also, since the absence of an appreciable number of middle class children would tend to reduce mean scores, particularly in language tests[1] such as Irish or MHE14. While X_2 helps to make an adjustment for socio-economic differences between subgroups it may not succeed in eliminating completely the effect of socio-economic differences. However, whatever the truth of this reasoning, it is hardly sufficient to explain the large differences in mean GQ and EQ between m-teacher and other schools, and indeed these differences cannot be adequately explained by the information available about the different types of school.

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1. The work of Nisbet (1953) and Bernstein (1958) suggesting that one of the main reasons why social classes differ in scholastic attainments is that they differ in knowledge and command of language.
   Eells et al. (1951) had previously noted that: 'practically all items which show unusually small differences (between social classes) are non-verbal in symbolism or are expressed in relatively simple everyday vocabulary and deal with concepts which are probably equally familiar, or equally unfamiliar, to pupils at both status levels', p. 357.

Summary:

The results so far presented may be summarised as follows:

No loss or gain in mean mechanical arithmetic or English quotient appears to be associated with teaching children from English-speaking homes through the medium of Irish. A loss of about 8 points in mean SPA quotient was found in the schools of group 5 by comparison with those of the other four groups; this difference may be expressed as a difference of about 11 months[1] in mean arithmetic age. An increase in the length of time during which Irish is used as the medium for teaching arithmetic to children from English-speaking homes appears to be accompanied by an increase in mean GQ; the difference between successive groups is about 1.85 points which is equivalent to 3.70 months of "Irish age" if one month is taken as equivalent to .5 of a GQ point, as was done in preparing the Irish

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1. Arithmetic quotients (AQ) are calculated by means of the formula $AQ = \frac{AA}{CA} \times 100$ in which AA = arithmetic age and CA = chronological age. The formula may also be used to calculate the difference in AA implied by a difference of 8 points in AQ. The 5 groups' mean CA is 12.17 months; the mean AQ for groups 1 to 4 is 87.60. The difference in mean AA thus obtained must be regarded as no more than an approximation to the 'real' or 'true' difference in AA which cannot be calculated since adequate information for the purpose is not provided in the test manual.

conversion table. From this line of reasoning it follows that the difference between linguistic groups 1 and 5 in mean Irish age is about 14 months, the difference being in favour of the latter.

Differences between subgroup means are not significant in problem and in mechanical arithmetic; but they are significant in Irish and English. Only in Irish is there a significant difference between West and Rest, the former being superior. This difference is most likely due to the fact that the Department requires a higher standard of Irish in the West, but other explanations were also considered. There is a general tendency for Irish and English means for 3-teacher schools to be larger than those for either 2-teacher or m-teacher schools. Differences in socio-economic status between the children who attend the three different sizes of schools were suggested to help to explain this tendency; but for the most part the tendency is unexplained.

Coefficients, b_1, b_2, b_3.

In all four analyses b_1 and b_2 were significant, showing that the inclusion of X_1 and X_2 has contributed in each case to the sensitivity of tests dealing with the relationship of attainment with extent of teaching through Irish. Nothing further about the first 2 Xs need be added except to note that no purpose would be served by comparing the corresponding coefficients from the different analyses, for example, b_2 in the analysis of SPA quotients and b_2 in the analysis of English quotients; such a comparison would be without meaning since the variance of the former is not the same as that of the latter.

The most interesting of the first three regression coefficients is b_3 which measures the regression of attainment quotients on inspectors' ratings of teachers. Only two of the b_3s are significant, namely, those obtained in the analysis of problem arithmetic and Irish quotients. That b_3 in the analysis of Irish quotients is significant might have been anticipated, since Irish is given more prominence than any other subject in national schools. It would also appear that inspectors attach greater importance to problem arithmetic than to mechanical arithmetic or to English; or perhaps that good teaching is rewarded to a greater extent in problem arithmetic. That there should be a significant regression of SPA quotients but not of SMA quotients, on X_3 is understandable, since mechanical arithmetic sums can be worked out successfully by children who have been drilled in a more or less mechanical fashion, whereas problem arithmetic sums are more likely to prove troublesome to children who do not understand the arithmetical procedures which they have been taught or who have not been encouraged to analyse problems before attempting to solve them. Excellence in teaching is likely to be more amply revealed in the way children progress in problem than in mechanical arithmetic. But the non-significant regression of English quotients on X_3 is extremely puzzling. Perhaps it is to be attributed to the placing of the revival of Irish first amongst the aims of primary education with the result that attention has been withdrawn from English. However, we must bear in mind that R in this analysis is only .66.

Supplementary Analyses.

The supplementary analyses whose results are now to be presented are of arithmetic and Irish quotients; no further analysis of English quotients was necessary since the regression of EQs on Xs is homogeneous among subgroups. Indeed, these further analyses were carried out precisely because the regression of arithmetic and Irish quotients on Xs was in each case heterogeneous - see table 7.1.

Table 7.1 shows that the regression of SPA on Xs does not vary significantly among subgroups of boys and girls in the West or among the six subgroups of boys; the same table also shows that the regression of SMA on Xs does not vary significantly among the six subgroups of boys. An analysis was carried out for each of these sections of the data and for each of the remaining sections of three subgroups each. The results are presented in tables 7.8, 7.9, and 7.10. By referring to table 7.1 the reader can remind himself in which sections the condition of homogeneous regression is satisfied.

Coefficients in the left hand and centre columns of table 7.8 are similar to the corresponding ones in table 7.5, but b_4 and b_5 in the right hand column, for girls in the Rest, are rather different.

TABLE 7.8≠

Regression Coefficients: SPA.

	WEST	WEST AND REST	REST
	Boys and Girls	Boys	Girls[x]
b_1	.527** (.049)	.620** (.047)	.700**(044)
b_2	1.636** (.535)	1.898** (.477)	1.526**(.462)
b_3	.394 (.302)	.308 (.221)	.341 (.237)
b_4	.813 (1.021)	-.056 (.818)	2.107**(.711)
b_5	-8.865**(2.762)	-7.467**(2.742)	-14.181**(2.581)

≠ Symbols used in this table are used with the same meaning as in table 7.5.

x In this section regression is markedly heterogeneous among the 3 subgroups.

(The coefficients for the separate subgroups of girls in the West may be compared in Appendix 7 , where it will be noticed that there are enormous differences between these sets of coefficients for girls of which those given in table 7.8 are the averages.)

The highly significant and positive b_4 in conjunction with a highly significant and negative b_5 seems to show that there is some important source of variance which is not controlled by the independent variates. Otherwise it is almost impossible to explain how the teaching of arithmetic through Irish appears to produce one effect on linguistic group 5 and the opposite effect on the first four linguistic groups. In the latter case the effect seems to be: the longer the period of teaching through Irish, the higher the arithmetic score. Though $R = .73$ in this set of data, which is slightly higher than in most other sections where $R = .6$ approximately, it is still sufficiently small to permit of considerable increase through the improvement of the existing independent variates or the introduction of new ones. For this reason it is interesting to note in passing that b_3 is not significant in any of the three analyses of table 7.8, though it was significant in table 7.5. It is quite possible, if the general belief that teachers vary a great deal in their ability to develop arithmetical skills and powers in children is true, that X_3 is not a sufficiently sensitive measure to control variations of this sort.

TABLE 7.9.[x]

Regression Coefficients: SMA.

	West and Rest Boys	West Girls	Rest Girls
b_1	.594**(.039)	337** (.065)	.575** (.051)
b_2	1.676**(.400)	1.502 (.782)	1.912** (.529)
b_3	.142 (.185)	.624 (.425)	-.242 (.270)
b_4	.126 (.686)	-.322 (1.330)	1.895* (.812)
b_5	1.329 (2.300)	.144 (3.619)	-12.666**(3.06)

x Symbols in this table are used with the same significante as in table 7.5.

Coefficients in table 7.9, with the exception of those for girls in the Rest, do not differ greatly from the corresponding ones in table 7.5. Coefficients for girls from the Rest in table 7.9 resemble the corresponding ones in table 7.8, for in both tables b_4 is significant and positive, b_5 is significant and negative. Neither b_4 nor b_5 is significant in any other analysis of SMA quotients. Such a similarity between tables 7.8 and

7.9 is not surprising since both tables deal with arithmetic quotients. However, this particular similarity is further evidence that some uncontrolled or poorly controlled factor is affecting quotients. The negative, though not significant, b_3 for these girls reinforces the suggestion, made above, that this poorly controlled factor may be differences between teachers or schools.

Table 7.10 contains coefficients obtained from four analyses of GQs. (Regression was not homogeneous over any two of these sections.) The table suggests that the use of Irish as medium of instruction has no effect on children's GQs in the West. In the Rest, increases in the length of time during which arithmetic was taught through Irish to girls are associated with increases in mean GQ; while only the very extensive use of Irish as teaching medium which characterises group 5 is associated with higher GQs for boys. Why should teaching through Irish produce different effects in the West and in the Rest? The answer given by the majority of inspectors and teachers who were asked this question is that greater pressure has been brought to bear on schools in the English-speaking parts of Gaeltacht counties

(West) to teach through Irish, than on schools in other counties[1].

TABLE 7.10[x].

Regression Coefficients: Irish.

	WEST		REST	
	Boys	Girls	Boys	Girls
b_1	.561**(.055)	.458**(.066)	.532**(.105)	.487**(.052)
b_2	1.250* (.578)	.981 (.792)	.371 (.610)	-.0864(.543)
b_3	.948**(.335)	1.460**(.430)	.580* (.238)	.119 (.278)
b_4	.786 (1.172)	.112 (1.347)	1.382 (.920)	1.962*(.837)
b_5	-2.984 (3.175)	-2.16 (3.664)	.578*(4.122)	4.558 (3.161)

x Symbols in this table have the same significance as in table 7. .

The effect of this difference in policy has been that teachers who teach through Irish in the West and in the Rest differ; in the Rest teachers who do so are for the most part more enthusiastic for the Irish language movement and possibly possessed of a better knowledge of Irish than those who do not, while in the West many teachersteach through

1. See above pp. 117 sq. where it is noted that the proportion of schools teaching through Irish is greater in the West than in the Rest. Note the interesting parallel between the suggestion offered by Irish teachers and that offered to McConkey (1951) by teachers in S. Africa - cf. above p. 19.

Irish who have little interest in the language movement and possibly no greater knowledge of Irish than those who do not teach through Irish. Teachers and inspectors who were consulted, then, were of the opinion that the reason why teaching through Irish is associated with higher mean GQs in the Rest is that the teachers who teach through Irish there are better teachers of Irish than those who do not teach through Irish; whereas the same could not be said of teachers who taught through Irish in the West. Thus the higher mean GQs associated with teaching through Irish in the Rest are not, it seems, the result of teaching through Irish. All this would appear to be further confirmation that X_3, which is a general rating of teaching skill, does not adequately control differences between teachers in the quality of their teaching of individual subjects.

No explanation could be found of why in the Rest b_5 for boys and b_4 for girls are significant, while b_4 for boys and b_5 for girls are not significant.

In Table 7.10, b_3 tends to be larger in the West than in the Rest. This seems to be further evidence of a difference in emphasis on Irish between the two regions; for when inspectors rate teachers they seem to pay more attention to Irish in the West than in the Rest.

Summary of Supplementary Analyses.

Supplementary analyses made of sections of the data yield conclusions which like those of the main analysis presented earlier in this chapter are of a somewhat tentative nature in as much as R is small in each. The most consistent finding throughout is that linguistic group 5 and its subgroups obtain mean SPA quotients which are lower than those obtained by other groups - a finding which might have been anticipated from our review of the literature on bilingualism. The difference in mean quotient is estimated as the equivalent of a difference of 11 months in arithmetical age. A further finding, also of considerable interest, is that higher mean GQs are associated with teaching through Irish in the Rest but not in the West. The best explanation of this difference which can be found is that the teachers who teach through Irish in the Rest are better teachers of Irish than those who do not teach through Irish; whereas there is probably no such distinction between teachers who teach through Irish and those who do not in the West. There are several indications in the findings that differences between teachers and between schools have not been adequately controlled by X_3, and this weakness has been suggested to explain certain anomalies in the results, such as the coefficients for girls' AQs in the Rest.

Native-Speakers of Irish.

Group 6, which is composed of native speakers of Irish, was not included with the other five linguistic groups in the analyses already reported since the only position which it might have occupied on the scale X_4 (length of time during which Irish was used as medium of instruction) was already occupied by group 5. However the data for group 6 was analysed separately, each of the 4 Ys in conjunction with X_1, X_2, and X_3.

TABLE 7.11†.

Coefficients: Native-speakers of Irish.

	SPA	SMA	IRISH	ENGLISH
b_1	.472**(.071)	.559** (.068)	.495**(.081)	.577**(.040)
b_2	1.392 (1.102)	1.160 (1.016)	1.450 (1.266)	1.030 (.626)
b_3	1.754**(.375)	2.154**(.362)	1.609**(.431)	1.638**(.213)
R	.52	.60	.48	.78

† Symbols in this table have the same significance as those in table 7.5. The coefficients are coefficients-T.
N = 155.

Table 7.11 contains the coefficients-T obtained for group 6 analysed as a single group. The number of children in the group, 155, is rather too small to divide into subgroups as was done in previous analyses.

The principal differences between table 7.11 and table 7.5 are: (i) b_2 is significant in none of the analyses represented in the former while it is significant in all four of the latter; (ii) b_3 is significant in all four analyses of the latter whereas in table 7.5 it was significant in the analyses of SPA quotients and GQs only. The reason for (i) would appear to be that the variance of X_2 in group 6 is very small, 1.05; smaller, in fact, that any of the variances for X_2 given in table 7.2. The reason for this is that the very great majority of fathers of children in group 6 are what in Scotland would be called crofters, and nearly all the children received a socio-economic rating of 2. The effect of the small variation in X_2 on b_2 may be clearly realised by imagining what happens to b_2 in the extreme case where the variance of X_2 becomes zero; then b_2 becomes zero also. Thus it is not surprising that b_2 in the analyses of data for group 6 should be non-significant; particularly if one bears in mind that even in those sections of the data where the variance of X_2 is larger, b_2 is invariably quite small.

Perhaps the reason why b_3 in contrast is significant in all four analyses of data from group 6 is that teachers of these children were rated by a very much smaller number of inspectors than the teachers of other linguistic groups. Irish-speaking areas are very small today by comparison with the rest of the country and some three or four inspectors between them supervise all the schools of these areas. This fact probably leads to greater consistency in the rating of teachers in group 6 than in other groups. Hence, perhaps, the significance of b_3 in table 7.11, and hence, too, the tendency for b_3 to be much larger in this table than in previous ones.

Though the data for group 6 was not included in the main analysis, it is possible to make a fairly accurate test of the hypothesis that children in group 6 do not differ significantly from those in other groups in mean attainment quotients. Multiple regression analyses was carried out using X_1, X_2, and X_3, for all children in the six linguistic groups, and coefficients-T[1] were calculated for each Y in turn.

TABLE 7.12†.

Coefficients-T: Entire Sample.

	SPA	SMA	IRISH	ENGLISH
b_1	.540**(.027)	.509**(.026	.483**(.029)	.583**(.023)
b_2	1.724**(.293)	1.948**(.275)	1.005**(.305)	1.119**(.246)
b_3	.494**(.136)	.483**(.127)	.681**(.142)	.503**(.114)
R	.56	.57	.50	.64

† Symbols in this table have the same significance as in table 7.5. N= 1083.

These coefficients were used to adjust attainment means, whereupon

1. Coefficients-W could not have been calculated without a great deal of labour which would hardly be repaid since neither X_4 nor X_5 could be included in the analysis. The small number of children from 1-teacher schools previously omitted from analyses are included in the analysis recorded in the text.

the standard error of a differencebetween adjusted means was calculated[1].

In problem arithmetic the adjusted means[2] for the first five linguistic groups combined and for group 6 are 86.22 and 80.90 respectively; the mean difference of 5.32 (SE = 1.26) is significant. The adjusted mean for group 5 (which took the Irish version of SPA) is 79.77; the difference of 1.13 (SE = 1.62) between it and the adjusted mean for group 6 is not significant. From these findings we conclude that children from Irish-speaking areas and children in group 5 fall behind those in group 1 to 4 in problem arithmetic score by about the same amount; i.e., by about 11 months arithmetic age.

In mechanical arithmetic the adjusted means for the first five linguistic groups combined and for group 6 are 94.14 and 89.44 respectively; the mean difference of 4.70 (SE = 1.18) is significant. This difference in quotient is equivalent to a difference of about 7 months arithmetic age.

In Irish the adjusted mean for the first five

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1. The formula given by Snedecor (1956) p.423 was expanded for 3 Xs and used to calculate the standard error. The expanded formula is:

$$S_d^2 = Sy.123^2 \left[\frac{1}{n1} + \frac{1}{n2} + C11\,(\bar{x}_{11} - \bar{x}_{12})^2 + C_{22}(\bar{x}_{21} - \bar{x}_{22})^2 + C_{33}(\bar{x}_{31} - \bar{x}_{32})^2 + 2C_{12}(\bar{x}_{11} - \bar{x}_{12})(\bar{x}_{21} - \bar{x}_{22}) + 2C_{13}(\bar{x}_{11} - \bar{x}_{12})(\bar{x}_{31} - \bar{x}_{32}) + 2C_{23}(\bar{x}_{21} - \bar{x}_{22})(\bar{x}_{31} - \bar{x}_{32}) \right]$$

2. The unadjusted or original means for each of the six linguistic groups are given in table 7.4.

linguistic groups combined is 96.42; for group 6 it is 104.57. The difference of 8.15 (SE = 1.31) is significant. The adjusted mean for group 5 is 99.60 which falls short of that for group 6 by 4.97 (SE = 1.69) which is also significant. Allowing .5 of a point per month, the former difference is equivalent to about 16 months, the latter to about 10 months of "Irish age".

The adjusted mean EQs for groups 1 to 5 combined and for group 6 are 101.68 and 93.79 respectively. The difference of 7.89 (SE = 1.08) which is significant, is equivalent to a difference of about 13 months in English age.

To sum up, the overall picture is that children whose mother tongue is Irish fall behind other children in Ireland whose mother tongue is English in mechanical arithmetic and in English; that though on a level with the children of group 5 in problem arithmetic, they fall behind the children of groups 1 to 4; and that they are better than all other children in Irish. In fact group 6 excelled the other five groups combined in Irish by roughly the same amount as the five groups excelled group 6 in English. This is hardly surprising. It is surprising however that group 6 should fall so far behind the other children in arithmetic, though they, unlike the children of the other groups except group 1, had always been taught arithmetic through the medium of their mother tongue. Probably the explanation is to be sought in some uncontrolled source of variance whose nature is not even hinted at in our data.

Note

It must be observed that neither the Irish test not MHT14 was designed to yield an attainment age in the way that the two arithmetic tests were. Nevertheless the conversion tables of the former two tests contain an age allowance. It is not unreasonable to use that allowance to convert mean differences from quotients to attainment ages - as we have done in the text above.

CHAPTER 8.

LEVELS OF ATTAINMENT IN ENGLISH - BRITAIN AND IRELAND.

Two tasks confront us in this chapter: (i) to compare British and Irish children's levels of attainment in English; (ii) to find reasons for any differences which are discovered.

The Irish children tested in our investigation achieved very low English scores in comparison with the British children on whose scores MHE14 was standardised. So low, in fact, were these scores that the quotients with which the British conversion table replaces them were unsuitable for regression analysis[1] and a new conversion table was constructed which would replace raw scores with a more manageable distribution of quotients. A good idea of the level of Irish children's performance is gained from their mean raw score which was 22.2. This is the mean for children in linguistic groups 1 to 5 combined whose mother tongue is English; children in group 6, whose mother tongue is Irish, obtained a mean raw score of 11.7. The mean age of children in the five combined groups

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1. See above pp. 222 sq.

is 12y-2m, that of children in group 6 is 11y-11m. The British conversion table does not extend beyond the age of 12y-0m, but permissible extrapolation shows that in Great Britain the expected mean raw score at age 12y-2m is 64. We read directly from the table that the expected mean raw score at age 11y-11m is 61 or 62 (an EQ = 100 is allotted to either raw score at that age). Thus children in Great Britain on whose scores the norms were based answered about three times as many questions correctly as Irish children whose mother tongue is English

These differences in raw score result in considerable differences between the two conversion tables. The reader may remember from chapter 7 that the Irish conversion table, based on Irish children's raw scores (including those from group 6) replaces Irish children's raw scores by quotients which have a mean of 100 and standard deviation of 15. This table can therefore be compared with the British table, which also replaces raw scores in the standardisation sample by quotients having a mean of 100 and standard deviation of 15. Table 8.1, showing how the two tables differ at the mean age of the entire sample of Irish children, 12y-1m, indicates the extent of differences between the two countries in English attainment. As at the mean Irish raw score there is a difference of 23 EQ points between the two tables, at the mean British raw score there is a difference

TABLE 8.1

EQ at certain Raw Score Levels:

British and Irish Conversion Tables: Age 12y-1m.

Raw Score	1	10	17	20	30	40	50	60	63
Published Table*	-	72	77	79	85	90	94	98	100
New Table	76	91	100	103	111	117	122	127	128
Mean Difference	-	19	23	24	26	27	28	29	28

* It was necessary to extrapolate slightly from the published table to obtain these quotients.

of 28 points. Somewhat smaller differences would of course have been obtained if the data from group 6 (native-speakers of Irish) had been excluded from the Irish standardisation; but it is clear that there is a difference of some 20 EQ points[1] or more between Irish children whose mother tongue is English and the children on whose scores the British norms are based.

Knowing only the mean raw score and the mean age of a group of children one cannot in general accurately compute the corresponding mean EQ - i.e., the mean EQ which

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1. We note in fact that the mean of EQs derived from the British conversion table for children in groups 1 to 5 combined is 79.0. In deriving these IQs however it was frequently necessary to extrapolate a long way below 70 EQ and above age 12y-0m, the upper age limit of the table - Irish children ranged in age from 9y-11m to 15y-0m. These quotients, therefore, scarcely make possible an accurate comparison between the English attainments of Irish and British children.

would be obtained if the individual EQs were known. The reason is that rate of increase of EQ with increase in raw score is different at different levels of raw score. Thus the correct mean EQ is a function not only of mean raw score and mean age, but also of the distribution of raw scores. However, mean raw score and mean age may be used to estimate mean EQ with sufficient accuracy for our purpose. Estimated thus the mean EQ for groups 1 to 5 combined (mean raw score = 22, mean age = 12y-2m) is 80. This is further evidence of a difference of some 20 EQ points between Irish children whose mother tongue is English and the children of the standardisation sample.

Yet another method of comparing Irish and British children is to select only those Irish children whose ages lie within the range for which the published conversion table caters, namely, 10y-0m to 12y-6m[1], and allot them EQs from that table and average these EQs. This is to select the brighter children by and large, since there is a marked tendency for older children to be duller than younger ones[2]. Some 50 of the 605 children so selected in groups 1 to 5

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1. Though the upper age limit of the table is 12y-0m, extrapolation to age 12y-6m is considered reasonably reliable by the test constructors - see Manual of Instructions, p.12.

2. See above pp. 223 sq.

combined obtained raw scores so low that the table did not cater for them; all such were allotted EQs = 70, the lowest EQ in the table. The mean EQ obtained by children in the bove age range is 85.21. The children who obtained this are about 65% of all the children in linguistic groups 1 to 5; they have been separated from the older and duller section; they have been allotted no quotient below 70, though 50 (8.3%) of them obtained raw scores lower than those which correspond to EQ = 70 - yet their performance is below the level of the standardisation sample by about 15 quotient points. For this reason in estimating the difference in level of performance between all the children of groups 1 to 5 and the standardisation sample at about 20 quotient points it is quite unlikely that we have been ungenerous to the former.

In chapter 3, when describing the method of selecting schools for the present survey, it was pointed out that steps were taken to ensure that each group of schools should be representative of Irish national schools in the proportion of boys and girls and in the number of schools of different sizes (as indicated by the number of teachers in a school). In chapter 7 it was recorded that regression analysis discovered no significant tendency for a linguistic group's mean EQ to be related to the extent to which Irish was used as medium of instruction, and that covariance analysis discovered no significant difference in mean EQ between children from the West and those from the Rest. There is good reason therefore for regarding groups 1 to 5 combined as a fairly representative or unbiased sample of 5th standard national school children whose mother tongue is English.

The words of the constructors of MHE14 indicate the extent to which the norms of that test were thought to be valid for Great Britain at the time when the test was standardised:

> 'Norms in an attainment test must always be of a somewhat tentative nature. Performance in the test will depend on the syllabus in vogue in any particular area, and on the time devoted in schools to the subject. For this reason we should not like to claim that the conversion table given is necessarily valid for the population of Great Britain as a whole, based as it is on only six administrative areas. However, these areas are fair samples of what one may expect others to be, and show good agreement amongst themselves. We feel, therefore, that the norms here presented may be used with considerable confidence in other districts'[1].

Later in this chapter (pp. 305 sq.) an experiment on the gains which Irish children may be expected to make with practice at Moray House English tests will be described. The experiment was designed to make possible comparisons in

1. Manual of Instructions p.9.

difficulty level between MHE14 and more recent tests. It was found that while difficulty level varied but little from one test to the next, there was a significant tendency for difficulty level to increase between the extremes so that some 2.5 points must be added to quotients obtained with MHE14 (standardised on data obtained between 1941 and 1944) to make them directly comparable with quotients obtained with MHE32 (standardised on data obtained between 1958 and 1960). The rise in difficulty level, as we shall see, is attributed principally to a raising of the standards of English during the years since the war rather than to any increase in children's test sophistication[1], though the evidence for this explanation is not conclusive. These findings are of twofold importance here: (i) they support the claim of those who constructed and standardised MHE14 that the test norms might be taken 'with considerable confidence' to represent the level of performance in Great Britain as a whole, since the norms for different MHE tests vary but little; (ii) some 2.5 points must be added to the difference of 20 EQ points which has been discovered between Irish children tested in 1961 and British children tested in the years 1941 to 1944. The estimate of that difference, then, is 22.5 EQ points.

We now come to our second task: to seek out the reason or reasons for the observed difference in mean level of

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1. See below, p. 314.

English attainment between the children of Ireland and those of Great Britain. This is a formidable undertaking, so we shall take the various possible reasons one by one beginning with Irish children's lack of test sophistication.

(1) Test-sophistication:

The Irish children tested in the present investigation had never previously taken pencil-and-paper tests of any description, whereas children in the 11 + age group in Great Britain have almost invariably had much practice at, and coaching for, such tests. This difference between the children of the two countries[1] is one of the most obvious reasons why they should differ in mean EQ.

To avoid confusion when speaking of the effects of coaching and practice on attainment tests two sorts of coaching and practice must be distinguished. The main business of teacher and pupils during the English lesson (at other times too, but particularly during the English lesson) is to develop pupils' command of English, and as English tests are composed to test command of English, it follows that English lessons influence scores on English tests. If English lessons, developing pupil's command of English, are conducted to some extent for the purpose of helping children to obtain higher marks in an English test,

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1. The writer begs leave, without intending to offend Englishmen, Welshmen or Scots, to refer to Great Britain as a 'country' - for the sake of brevity.

to that extent they may be regarded as coaching or practice for the test. This is the first sort of coaching and practice. There is another sort which results not in an improved command of English but in what is sometimes called 'test sophistication'. If the test is an 'objective' test and a timed one (MHE14 is both) such coaching and practice will consist in familiarising children with the format of questions, in teaching them to interpret instructions, in training them to make the best use of the time allowed. It is this second sort of coaching and practice that concerns us particularly when we employ a British set of norms as a basis for comparing the English attainments of Irish and British children, and it is in this sense the words will be used in what follows.

Although MHE14 is a comparatively early test (norms compiled 1941-44) its norms were undoubtedly affected by coaching and practice. This is clear from W.S. James (1953) who, speaking from experience, observes that coaching for intelligence tests was 'rampant' as long ago as the early 1930s wherever they were used to help decide which children should have scholarships to grammar schools; for it is likely that coaching for attainment tests has always been even more intensive when they were used for the same purpose[1]. Since the norms of all Moray House tests are based on scores

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1. Vernon (Ed. 1957), p. 57.

obtained by candidates for scholarships, they are all pitched rather high as a result of coaching and practice. Thus, they may lead to a falsely high picture of the level of English attainments at the time when the tests were standardised.

A priori, however, it would appear that the norms of an early test, such as, MHE14, are less affected by coaching and practice than those of more recent tests; in fact this was one of the main reasons for choosing MHE14 for the present investigation. In the early 1950s, as a result of several studies[1] with verbal reasoning tests, teachers and psychologists came to realise how great were the gains in score which could be obtained through coaching and practice. As a result coaching and practice for all tests used in the 11 + examinations became more widespread. Many local authorities actually introduced practice testing in verbal reasoning as a preliminary to their allocation procedures. The effect of all this on performance level in Moray House verbal reasoning tests has been studied by Pilliner et al. (1960), who found a rise in mean performance level since 1950 equivalent to about 6 quotient points which they attribute mainly to increased 'test sophistication' due to increased coaching and practice. There has also been a rise in performance level in English which, though not so

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1. See particularly Vernon (1951, [illegible] 1954), Dempster (1954), Peel (1952 and 1953), Yates (1953) Wiseman (1954), Watts et al. (1952).

marked as in the case of verbal reasoning tests, must be examined.

In a study[1] of data held in the Department of Education of the University of Edinburgh, Dr. T. Renshaw found a slight mean rise in the mean level of attainment in English in those areas of Britain where Moray House Tests have been used over the years 1942-55. It is to be regretted that no data were available for MHE14, but fortunately there were data for MHE15 which was constructed a year later; it seems most unlikely that it and MHE14 differ to any appreciable extent. His findings are summarised in table 8.2 where each entry indicates the number of points which must be added to quotients obtained with the test indicated on the top of the table to make them comparable with quotients obtained with MHE15.

TABLE 8.2.

Zero Error in MHE Tests.

Test	MHE15	MHE20	MHE21	MHE22	MHE23	MHE24	MHE25
Norms Compiled	1942-46	1947-50	1948-51	1951-52	1951-53	1952-54	1953-55
Mean difference in quotient	0	0	2	2	1	1	2

1. Made at the request of the present writer who would wish to record his gratitude.

Although these figures are based on a comparatively small number of children's scores, approximately 40 pupils in each of six paired comparisons, they appear to be reliable estimates of the parameters involved for they are supported in a general way by the present writer's findings in an experiment designed primarily to study the influence of practice at Moray House English tests on Irish children's EQs.

This experiment was conducted in two Dublin schools, one boys', one girls'. The children tested were chosen at random from the 5th standard children in their schools, 48 boys and 48 girls in all who sat two tests each week for three weeks. If a child was absent at the time when the others were tested, he sat the test he had missed when he next came to school. In order that their interest might be maintained throughout the experiment, the children in each school were told that they were competing with those in another school and that they would be told the results; they were also told that they would hear how they comoared with children in Britain. In each school the children were divided at random into 6 groups of 8 each; and in each school each group of 8 sat the 6 tests in a different order from other groups in the same school. This arrangement of 6 groups taking 6 tests in varing orders is the familiar 'Latin square' design, which enables us to isolate the effects of repeated testing, of differences between tests in difficulty level, and of differences between the groups in a school. Replicating the design with boys and girls also enables us to isolate differences in score arising from differences between schools, which are partly sex differences. The 6 tests are MHE Nos. 14, 18, 23, 24, 29 and 32.

By the procedure outlined above 576 EQs were obtained. Now in an experimental design, such as the present one the sensitivity of statistical tests can be increased by analysing the 'total' sum of squares into 'between Ss' and 'within Ss' components[1], each of which can be further analysed as noted in table 4.8. It should be observed that differences between groups, and the many interactions between groups and the three main components mentioned in table 4.8, are confounded with components which are associated with Tests or Occasions or both.

The appropriate term to use in testing mean squares in each section of this table is the mean square designated 'error'. Since none of the ratios between error and interaction terms is significant, and since the mean square for schools is not significant, being less than unity, it is reasonable to disregard fluctuations which are associated with these sources. We may then combine boys' and girls'

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1. For a description of this method of analysis see Lindquist (1953) pp. 285-8. The 'between Ss' components (see Table 4.8) are calculated without reference to the fact that each child took several tests; while in calculating the 'within Ss' components this fact is recognised.

scores to obtain a more reliable estimate of the mean for each test, and make a more effective study of differences between these means.

TABLE 8.3.

Practice Effect and Zero Error - MHE Tests.

Source	DF	SS	MS	F
Between Ss	95	64956.8		
Schools	1	154	154	not significant
Occasions≠ x Test (b)	5	5962	1192	1.759 (DF = 5,84) Not significant
Occasions x Tests x Schools (b)	5	1917	383.4	Not significant
Error (b)	84	56923.8	677.7	
Within Ss	480	8197		
Occasions	5	2389	477.8	5.049 (DF = 5,420) Significant.
Tests	5	1099	219.8	2.322 (DF = 5,420) Significant.
Occasions x Tests (w)	20	189	9.45	Not significant
Occasions x Schools	5	342	68.4	Not significant
Tests x Schools	5	19	3.8	Not significant
Occasions x Tests x Schools (w)	20	184	9.2	Not significant
Error (w)	420	3975	94.64	
TOTAL:	575	73154		

≠ By 'Occasion' is meant a period of testing of which there were 6 in each school. Differences between mean scores for the different occasions reveal whether there is a practice effect or not.

The significant[1] mean square for Tests in the table of analysis of variance shows that the tests differ significantly in difficulty level.

TABLE 8.4.

MHE Test Means.

Test	MHE14	MHE18	MHE23	MHE25	MHE29	MHE32
Norms compiled	1941-44	1945-48	1951-53	1953-55	1956-58	1958-60
Mean EQ	94.50	95.97	94.28	94.50	92.19	92.06

The mean increase in difficulty level results in a drop of 2.44 quotient points from MHE14 to MHE32. The increase, however, is less than half that for verbal reasoning tests. It is difficult to see why there should be such a difference between results obtained with the two sorts of test. It is also difficult to know whether to attribute the rise in performance level in English to solidly improved standards in English or to increased test suphistication; for, apart from more widespread and perhaps more intensive practice and coaching for all tests, there are indications that

1. With 5 and 420 degrees of freedom $F \geq 2.23$ is significant at the 5% level of probability.
" " " " " $F \geq 4.6$ is significant at the 1% level of probability.

standards in English at the age of eleven, as revealed by national surveys of reading ability, have been rising steadily since the war when there was a loss in standard equivalent to about one year's progress[1]. But we shall be in a better position to make a decision on these matters when we have examined the rest of the table of analysis.

Table 8.3 also contains the quantities necessary to test the 'null hypothesis' that performance level does not increase with practice. The mean square for Occasions (practice effect) is highly significant, so we reject that hypothesis. And since the increases do not differ significantly for boys and girls, (the 'Occasion x Schools' interaction falling short of significance), we may combine the two sets of scores to obtain mean quotients for the different occasions.

TABLE 8.5.

Effects of Practice.

Occasion	1	2	3	4	5	6
Mean EQ	90.09	92.70	94.31	94.51	95.76	96.13

There is a mean increase of about 6 points from the first to the sixth Occasion.

1. Ministry of Education (1950 and 1957). The indications are that about half the loss sustained during the war had been regained by 1956. A rise in standard was also observed between the wars. In the light of what we shall have to say about coaching and practice in the following pages, it seems likely that this rise in performance level since the war was due to improved standards rather than to more intensive coaching and practice.

This finding is in remarkably close agreement with the findings of similar studies in Britain dealing with the gains in verbal reasoning quotient which follow upon the taking of several practice tests. Professor Vernon (1960, p.131) sums up the British studies in the following words: 'Thus under present conditions, where the majority of British children (at least in urban areas) are to some extent 'test wise', the total average gain from taking two practice tests + a few hours of interspersed coaching is not 5 or 15 but about 9 points. This is confirmed, not just by small-scale experiments but by practice trials including complete 11-year age-groups in large boroughs. With similar children, a single practice test gives about 3 - 4 points, and several practices 5 - 6 points. Thus coaching does add something, but remarkably little, and obviously far less than teaching does in the case of ordinary school examinations'. Following close upon the passage quoted, Professor Vernon goes on to say: 'In most Education Areas there will be some children (e.g., from private or from remote rural schools) who have no previous experience of tests at all, and they are likely to be handicapped[1] much more seriously - by an average of 12 or

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1. 'Handicapped', presumably, in their attempts to obtain grammar school places.

more points - in comparison with fully coached children'. But Vernon (1951) has shown that bright children gain more from practice than duller ones and Emmett (1954) has shown that children in private schools are on an average far brighter than children in other schools. So if, as Vernon suggests, children in private schools are able to increase their scores by 3 points more than those in Local Authority schools as a result of coaching and practice, the reason is probably not an initial difference in familiarity with tests but a difference in verbal reasoning ability. The present writer has come across no evidence that children in remote rural schools obtain greater increases in verbal reasoning quotients than urban children of comparable ability[1]. Now all this is relevant in the present case because the Dublin children were not 'test-wise' at all, while in the opinion of their inspectors they were above average in intelligence. Thus, if practice has the same influence on EQs as it has on Moray House IQs - it certainly appears to have - a mean increase of about 6 EQ points is as much as can be hoped for as a result of practice alone for any representative group of children either in Britain or Ireland.

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1. Barr (1959) found no tendency for rural children to gain more from a single practice test than urban children.

We might expect to find a mean gain of about 9 points if coaching were combined with practice.

Unfortunately not much research has been carried out on the effect of coaching and practice on MHE quotients; however the one piece of research which can be cited supports the present writer's conclusions on the subject. Watts et al. (1952) report an experiment in which a number of children each sat 10 complete MH verbal reasoning tests, 10 complete MHE tests, and 10 complete MH arithmetic tests. The children took one of each type of test each week and received some coaching in between tests. A control group of children took only the first and last test of each type and received no coaching. The results are given in table 8.6.

TABLE 8.6.

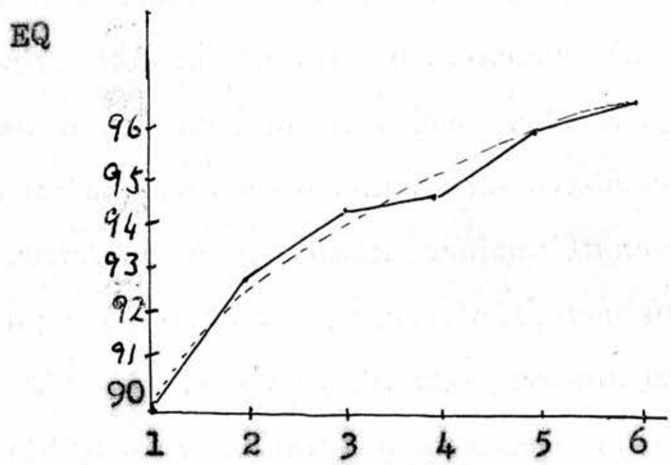
Test Means:- Watts et al. (1952)

	Coached Group			Control Group		
	Initial Test	Final	Gain	Initial	Final	Gain
MHT	108.06	116.26	8.20	104.97	108,19	3.22
MHA	94.03	104.14	12.11	102.22	106.09	3.87
MHE	98.29	107.91	9.62	97.28	101.19	3.91

The fact that gains in EQ are slightly greater than gains in IQ is probably explained by differences in initial mean quotients for verbal reasoning and English.

The regression of Dublin children's mean EQ on Occasion may be represented in the form of a graph.

FIGURE 4.1.



The graph reveals a tendency for gains to be largest after the early periods of testing and to diminish as the experiment progressed. The tendency can be seen more clearly by following the broken line which represents an attempt at smoothing the regression. Indeed the children appear to have come to the peak of their performance by the sixth Occasion. We may, then, take the mean increase of about 6 points from first to sixth Occasion to be the maximum that the children could obtain by practice alone. Watts et al. (1952), who combined coaching with practice, also found that the maximum gain in EQ was obtained by about the fifth or sixth Occasion, and that further periods of testing did not add anything[1]. Thus the maximum gain is obtained relatively quickly. Now it is highly probable that children have always been prepared more thoroughly for English and arithmetic tests than for verbal reasoning ones[2]. This would explain why the difficulty level of English tests has not risen so much in the period studied as that of verbal reasoning tests: children were probably more 'test-sophisticated' at the beginning of the period in relation to English tests. Indeed it is probably true that children were gaining the maximum, or almost the maximum, increases in EQ from coaching and practice many years before they did in IQ. Thus the present writer is strongly inclined to attribute most of the increase of between 2 and 3 points in difficulty level from MHE14 to MHE32 to a rise in the standard of English attainment rather than to be an increase in

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1. There are several papers which report a similar tendency in the case of verbal reasoning tests - e.g., Peel (1952), Dempster (1954). Watts et al. (1952) also observed this tendency in IQ gains.

2. Vernon (Ed. 1957) cites evidence that this was the case in the early 1950s. It is even more likely to be true of earlier periods when many people believed that verbal reasoning quotients could not be increased by coaching and practice.

coaching and practice. It is noteworthy that the extent of this increase in difficulty corresponds closely to the extent of the improvement since the war in reading standards. The age allowance in the tables of norms for MHE tests is about ½ a quotient point per month; thus 2.44, the observed difference between MHE14 and MHE32, corresponds roughly to a gain of 5 months. We have already seen that the rise in reading standards in Britain between the end of the war and 1956 has been estimated as equivalent to the average improvement in reading over a period of six months.

In comparing Irish and British children in English attainment level by means of quotients derived from MHE14 and its norms, we shall take it as established that the former's level is under-rated by some 9 points (coaching and practice); while we shall assume, with a certain degree of confidence, that the latter's level is under-rated by some 2.5 points[1] (improved standard in English).

(11) <u>Motivation:</u> Another possible reason for the difference in mean EQ between British and Irish children is that the test was administered under widely differing conditions in the two countries. Norms for Moray House Tests are based on scores obtained in the competitive 11 + examination. There is little need to emphasise that British children, or at any rate the brighter ones among them, are on this account

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1. See above, p. 308.

strongly motivated to obtain high scores. The Irish children, on the other hand were tested in far less competitive circumstances: their local inspectors who supervised the testing, explained to them that they were taking part in a piece of educational research, and that their test results would not be used to determine which pupils would be promoted to the next class at the end of the year. Hence the Irish children were probably more relaxed during testing than children in Britain usually are when they sit the 11 + examination.

Before pursuing this discussion further, it is necessary to distinguish between (i) motivation to obtain high test scores and (ii) anxiety or fear of failure. Even though it may be difficult to decide whether a particular child is strongly motivated, or over-anxious, or both, during a test, the distinction is useful; for there is surely a difference between a determination to work hard and well in a test (i) and an 'attack of nerves' (ii) which, occasioned by the importance of a test, may reduce a person's capacity for sustained and thoughtful work.

Anastasi (1961) pp. 48 sq. cites several studies which show that children's scores in attainment tests may be influenced by increasing the incentive to succeed. These scores may be increased or decreased, depending on the kind of incentive and on the particular children concerned. In general, it would appear that factors which increase a person's desire to succeed and to excel, such as, praise or money prizes, tend to improve children's performance, while factors which cause or increase anxiety tend to lower their performance; in each case the effect is likely to be only temporary. However, this general statement needs qualification. It seems that incentives which stimulate some children to greater and more successful efforts may heighten a nervous or poorly adjusted child's fear of failure, and many situations which cause anxiety in some children have little effect on others.

There can be no doubt that children in Britain who feel they have a chance[1] of obtaining grammar (or senior secondary) school places are powerfully motivated in their 11 + tests; and there can be no doubt that 11 +

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1. Burt and Williams (1962) noted 'an attitude of careless boredom' in the duller children who felt that they stood to gain nothing by the 11+ tests. Eells et al. (1951 p.552) noted a similar attitude amongst lower-class children when they were set speed tests. These children, the authors argue, endeavoured to shorten the period of discomfort occasioned by a test, which they had decided was beyond them, by rushing through it. One or two inspectors remarked that they thought some Irish children behaved in a similar manner.

tests cause anxiety in many children[1] simply because the tests play a part in selection. For the Irish children who took part in this survey on the other hand there was no such intense motivation, but neither was there any cause for great anxiety. Probably for them the most important feature associated with the testing was that it was conducted by their local inspector whose visits are not to be taken lightly. Furthermore, the inspectors attempted to reduce anxiety by explaining the purposes of the tests. Accordingly one would expect that the general atmosphere was favourable to good work. On the other hand there is some evidence that children achieve higher quotients in the 11+ examination than at other times. Burt and Williams (1962) give results of verbal reasoning tests administered to the same children, (i) in the 11+ examination, (ii) at other times, before or after the 11+

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1. For a discussion of the extent of the anxiety which accompanies the 11+ examination see Vernon (ed. 1957, pp. 57-62). The general tenor of this discussion is that while very many children must experience anxiety in the 11+ tests, the anxiety is not as great or as crippling as has frequently been claimed. Sarnoff et al. (1959) who had previously discovered negative and significant correlations ($r = -.23$) between scores on a Test Anxiety Scale and IQs obtained in elementary schools in America under more everyday circumstances, found no significant correlation ($r = -.068$) between scores on the same scale and the IQs which 152 English children obtained in their 11+ tests. However, the authors point out that the absence of a significant correlation could be due to a universal anxiety making nearly all children equally anxious just as readily as to a universal sang froid which enabled English children to set at naught the fear of failure.

examination[1]. Analysis of variance, taking account of differences between tests used, differences in the order of situations (whether the subsidiary tests came before or after the 11+), and differences between the groups into which the 284 children tested were divided, revealed a significant difference between mean quotients for the two situations. IQs obtained in the 11+ examination were on an average about three points higher than those obtained at other times, The authors go on to say that much research is needed to determine more precisely the extent of the difference to be expected between results obtained in the two sorts of situation, and the extent to which this difference is a function of such factors as the personality and official status of the person who administers the test. Their experience was that the highest scores were obtained when tests were administered by either the children's teacher or 'by a psychologist who was a member of the school inspectorate'; but when 'tests were administered by an outside research student, particularly if he had no teaching experience or adopted a conspicuously unfamiliar approach (e.g., a student with marked overseas accent or a typical "Oxford-and-Cambridge manner") - in such cases the reliability, validity and level of performance were liable

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1. Here only what the authors term the '4th Series' of results are given, as these appear to be the most relevant and the best controlled.

to drop to a remarkable degree'[1]. It is difficult to assess the likely effect of the fact that the tests were administered to the Irish children by their local inspectors; but it is true that all primary school inspectors have considerable experience of children (almost all have been primary school teachers), and that the 'conspicuously unfamiliar approach' which is 'typical' of the 'Oxford-and-Cambridge manner' is conspicuously un-Irish. It is likely then that Irish inspectors resemble the persons with whom the children appeared to work well rather than the outside research-student with whom they appeared to work badly.

While Burt and Williams' work is important in that it directs attention to the motivation-anxiety aspects of testing[2], it is doubtful whether their findings are of

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1. Burt and Williams (1962), pp. 133-4.

2. Probably these findings lose little of their relevance for us from the fact that the authors confined their work to tests of reasoning, verbal and non-verbal, and in the '4th Series' to Moray House Verbal Reasoning Tests, since the findings for MHE tests appear to match those for Moray House Verbal Reasoning tests very closely - see above pp. . Sutherland (1951) found that, after entering secondary schools, Scottish children's scores in arithmetic fall appreciably below the scores they obtained in their transfer examination for as many as two or three years. He is inclined to attribute the falling off to causes other than those mentioned by Burt and Williams, though he does consider that children's performance level in the transfer examinations is raised by their being keyed up, and that 'after the examination the child slips back to his normal level of performance'.

assistance to us because almost certainly the Irish children's attitudes to being tested were different from those of British children taking additional tests either before or after their 11+ examination. For the latter the 11+ examination is so important that any other tests which they take either just before or just after their 11+ tests must shrink in significance. For the Irish children, on the other hand there was nothing equivalent to the 11+ test in the recent past or near future. So the Irish children probably took their tests more seriously than British children would take additional tests around the time of their 11+ tests.[1]

Taking one thing with another it is unlikely that differences in the circumstances of testing account for more than 1 or 2 points of the difference in mean EQ between the two countries.

(111) Proportion of Urban to Rural Inhabitants:

The proportion of urban to rural inhabitants in Ireland is very different to what it is in Great Britain. A simple and fairly satisfactory way of revealing the difference is to quote the percentage of the gainfully

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1. This is something which can be investigated easily, but so far the present writer has not had an opportunity to do so.

employed population above the age of fourteen engaged in agricultural occupations in each. Census years coincide for Great Britain and Ireland, the last census for which figures are available being the census of 1951. In that year 47.0% of males[1] gainfully employed in Ireland were engaged in agriculture; the corresponding figure for England and Wales is 5.9%[2].

The relevance to our present purpose of knowing the proportion of urban to rural inhabitants is that the latter have in Britain been consistently found to excel the former slightly in mean test score. The Ministry of Education (1950 and 1957) pamphlets give evidence that at the age of eleven children in urban schools obtain reading ages which are some six months in advance of those obtained by children in rural schools. The work of Morris (1959) in Kent confirms the finding that urban children obtain higher

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1. Central Statistics Office (1960), p.47, there are grounds for believing that the percentage has dropped since 1951; see ibid. p. 46.

2. General Register Office (1956). The number of males above the age of 15 years recorded for agriculture and allied occupations at the time of the 1951 census is 961,300, from which must be deducted the figure 128,689 which is the number of persons who had been in these occupations but had retired before 1951. The total number of males in England and Wales aged 15 + gainfully employed in 1951 is 14,063,542.

scores on a reading test than rural ones[1]; but it is difficult to estimate the size of the difference in reading age, because she quotes correlation coefficients only. Bristol Institute of Education (1952) found a difference of 1.7 EQ points[2] between urban and rural children tested with Moray House tests in their 11+ examination. Pidgeon (1960) reports findings from a 'national survey of ability and attainments of children at three age levels' of which only those for the 10+ age group, which comprised about 3200 in a large number of areas, concern us here. Non-verbal reasoning, reading, mechanical, and problem arithmetic tests were set. The reading test is described as a '60-item reading comprehension test'. Table 8.7, which contains the mean standardised test scores, shows a significant difference of approximately 3.8 points in favour of urban children. The author does not give the regression of standardised

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1. So we read in the text, p.44 et passim, but in table 4.1, p.43, we notice that when a significant coefficient of .36 is 'adjusted for intelligence' it becomes .26 which is not entered as significant. Morris tested children aged 7 to 11 in 51 schools.

2. Urban children obtained a mean EQ of 100.23, rural children a mean EQ of 98.58 - cited in Barr (1959). If we allow .5 of a month per quotient point, the difference may be interpreted as a difference of some three months in English age. In this connection it must be observed that MHE and similar tests were not designed for the purpose of determining 'English ages' - though it is legitimate to employ the means expected at a particular age and the age allowance to calculate what are equivalent to 'English ages'.

score on age, but if we take it as .5 of a point per month we obtain a difference in reading age of about 7 months between the two groups of children; a difference which is closely in harmony with the Ministry of Education findings given above. Finally, Moreton and Butcher (1963), who

TABLE 8.7.

Urban and Rural Mean Scores, 10+ Age Group - Pidgeon (1960).

Test	Urban	Rural	Urban-Rural with S.Es.
Non-Verbal	100.91	98.06	2.85 (1.54)
Reading	100.61	96.85	3.76 (1.55)
Mechanical Arithmetic	100.84	97.47	3.37 (1.45)
Problem Arithmetic	100.90	97.56	3.34 (1.44)

report mean EQs obtained by 297 urban (Manchester) and 274 rural children (Westmoreland) in their 11+ examination with an NFER test, find that urban children excel rural children by a significant 2.12 points.

It is possible that the differences quoted above are to be attributed in considerable part to differences in IQ[1]. McIntosh (1959) found no significant difference

1. This view assumes that IQ is less dependent on environment than EQ and that IQ is a measure of ability to succeed in the study of English. The latter assumption is supported by the many studies, including the present one (see above pp.   ), which report a significant positive regression of EQs on IQs; the former assumption is supported by work reported in Burt and Howard (1956 and 1957).

in mean EQ between pupils from 1-, 2-, and 3-teacher, rural schools and those from urban schools in Fife when IQ was held constant[1]. Barr (1959) however attributes mean differences between urban and rural children whether in IQ or in attainments to socio-economic factors, since in an analysis of data collected by the NFER Population Investigation Committee these differences were found to lose their significance when socio-economic status was held constant. These apparantly conflicting reports can be reconciled by certain findings of the 1947 Scottish Mental Survey[2] which indicate (a) that families with high socio-economic status tend to change their place of residence more frequently than those with a lower socio-economic status, and (b) that children who migrate to cities tend to have higher IQs than urban or rural children who have never migrated, and higher, too, than children who migrate from cities or to the country. Selective migration may well be at the root of the differences between urban and rural children in IQ and attainments; and since IQ is positively correlated with socio-economic status, McIntosh in holding IQ, and Barr in holding socio-economic status, constant may have achieved roughly the same result,

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1. Op. cit. p. 95.

2. Scottish Council for Research in Education (1953), pp.178-85.

namely, negativing the effects of selective migration. It must be added, however, that the authors of the 1947 Scottish Mental Survey report consider[1] socio-economic status, rather than IQ, to be the main factor influencing migration; which, presumably, means that a difference in socio-economic status is the root cause of the difference between urban and rural children in mean EQ.

To say that differences in mean EQ between urban and rural children are closely associated with differences between them in socio-economic status is to make the interpretation of the estimated mean difference in EQ between Irish and British children very difficult for the following reasons. Unfortunately, in order to obtain a socio-economic

TABLE 8.8.

Percentage at Each Socio-Economic Level* - Groups 1 to 5.

Socio-Economic Level	1	2	3	4	5	6	7
Percentage	23.5	16.8	10.2	40.2	2.8	3.1	3.3

* For the interpretation of these levels, see above p. . Level 7 = professional, Level, 1 = unskilled labourers. N = 928.

scale which would be valuable in educational research it was

1. Op. cit., p.184. Their reason, presumably, is the fact that tendency (a) recorded in the text above appears to be more marked than tendency (b). We should like to observe, however that there is no evidence in the work referred to which contradicts an alternative interpretation: the superiority of urban children results from life in a city, and the superiority of children who migrate to a city results from migrating to a city.

necessary to redistribute the occupational classes of the Irish 1951 Census report. Thus while the report classified farmers under seven heads, depending on size of farm, the present writer classified them under three heads depending on the number of men they employed and geographical area. Such changes, apart from being sensible simplifications, were necessitated by the fact that the basis of classification was children's responses to a questionnaire: but the changes mean that the figures in table 8.8 are not diredtly comparable with figures from the Irish census of 1951[1]. Neither are the figures of table 8.8 directly comparable with those of the British census of 1951; and what is more, most figures for occupational classes in Ireland and Britain cannot be compared validly without an immense amount of re-interpretation of classifications and sub-classifications. Thus a direct attempt to adjust the difference in mean EQ between the two countries for differences in the socio-economic structure of the two societies seems destined to failure. This being so, it is best to base the adjustment on the proportion of urban to rural dwellers in the populations. Here again there are difficulties since whether

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1. The figure for socio-economic level 1, unskilled labourer, is probably an exception. By adding the figures for all male unskilled labourers, and expressing the resultant total as a percentage of the total number of males gainfully employed, the figure 24.3% is obtained, which does not differ a great deal from 23.5%, the corresponding figure in table 8.8. The corresponding figure for Britain in 1951 is 13%.

a town is to be called a city is decided on grounds other than size of population; hence the word 'urban' bears different connotations in the two countries. Furthermore, the British Registrar General recognises four types of area, County and Municipal Boroughs, Urban and Rural Districts; the nearest terms in the Irish census report are County and County Borough, Urban and Rural district. And although detailed figures are available for the population of each of these areas in Ireland and in Britain, a comparable figures for the ratio of urban to rural dwellers cannot be obtained without very much reinterpretation and computation, which is beyond the scope of the present work. Probably the best plan is to base the adjustment on the figures given in the first paragraph of the present section, i.e. the proportions of persons engaged in agriculture and allied occupations. For although the numbers of persons so engaged is not the same as the number of persons who live or work in the country, the difference between Britain and Ireland in the proportions of persons so engaged is surely a reasonably reliable index of the differences between the two countries in the proportion of urban to rural dwellers. The relevant figures are 47.0% in Ireland, 5.9% in England and Wales[1].

The best estimates of the difference in mean level of English attainment between urban and rural children in England and Wales are those of the Ministry of Education (1957) pamphlet and Pidgeon (1960), since both were obtained in national surveys; the former reports a difference in reading age of six months, the latter a difference of 3.8 standardised score points (which we have suggested, is probably equivalent to about seven to eight months in reading age). Unfortunately both these estimates were obtained with reading tests, which means that they may not be entirely applicable to MHE tests. The Bristol Institute of Education (1952) report would suggest that six to eight months is an overestimate[2] for the latter type of test; so

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1. In accepting these figures and applying them to school children we are making the assumption that the proportion of children in each social class is equal to the proportion of the adult population in each social class. We have no means of assessing whether in Ireland emigration and a marked difference between social classes in mean age of marriage invalidate this assumption. Similarly in applying to Ireland figures for the difference in English performance level between urban and rural children in Britain, we are making the assumption that this difference is the same in both countries. The assumption appears reasonable, but it is unverified by research findings.

2. Emmett (1954) gives 1.76 as the difference in mean verbal IQ (Moray House test) between children in rural districts and those in Metropolitan Boroughs and Urban Districts combined (N=98,902). Moray House verbal reasoning and English tests are very similar, and usually factors which affedt one affect the other almost equally (see table 8.6 for the effects on IQ and EQ of coaching and practice). Working with NFER tests Moreton and Butcher (1963) found that at the age of 11+ the difference between urban and rural children in mean verbal reasoning quotient is very close to the difference between them in mean EQ; 2.28 points in the former case, 2.12 points in the latter. Emmett's findings then, suggest that the estimate of mean difference in EQ at 3 points (six months) is not an underestimate.

we shall base the adjustment on the lower extreme of the suggested range, i.e., six months or 3 EQ points.

Now that we have figures, it remains to calculate the adjustment. Taking 5.9% of the population of England and Wales and 47.0% of the population of Ireland as rural, the mean percentage difference in rural population is 41.1. And if 3 points is taken as the mean difference in EQ between urban and rural children, we estimate that a mean difference of 41.1 in the percentage of the populations which is rural could account for a mean difference of 1.23 (= .03 x 41.1) EQ points.

In offering 1.23 points as the estimate of the extent to which the observed mean difference in EQ between Irish and British children has been enlarged by the difference between the proportions of urban to rural dwellers in the two countries, we are extremely conscious of the number of assumptions upon which it rests. There is one source of confidence, however: it seems most probable that the adjustment to be made for urban/rural (socio-economic) differences is small, and that any error in the estimate of that adjustment must as a result be small.

(IV) Teaching Methods:

Performance in an English test may depend on the teaching method, and, as the Manual of Instructions for MHE14 points out, on the syllabus[1], in vogue in a particular area. Our knowledge of the influence of either variable on mean EQ or of the extent to which Irish and British schools differ in these two respects, is very limited. Apart from the amount of time devoted to English lessons, which will be discussed in a later section in connection with the effect of the national programme for reviving Irish on the work of Irish national schools, we know very little about the types of syllabus fpr English courses in Irish or British schools; we know nothing at all about the effect o mean EQ of varying the syllabus. A little more is known about methods of teaching reading and their effects, and since reading comprehension is a major component of a MHE test we can, from a discussion of these methods, set rough limits to the effects which they are likely to have on EQ.

For the methods of teaching reading in vogue in Britain we consulted Morris (1959) who records the extent to which the 'alphabetic, phonic, whole-word and sentence method' were in use in the 60 schools in Kent: 4 schools used a combination of all four methods, 47 used a combination

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1. By syllabus in this section is intended the school course in English excluding such coaching and practice for 11+ English tests as leads to test sophistication rather than to increased knowledge and command of English - see above pp. 301-2.

of phonic, whole-word and sentence methods, 9 used a combination of phonic and whole-word methods.[1] We do not know whether Kent is typical of Britain in this respect, but it is likely that throughout Britain the alphabetic method is out of favour in the majority of schools, which employ instead some one of the other methods or a combination of them. Though there are no figures, the reverse is probably true of Ireland, at least during the years when the children who were tested in 1961 were being introduced to reading[2]. It seems that the alphabetic method supplemented by phonic drill was in vogue in most national schools in the middle 1950s.

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1. Pp.55 sq. The terms alphabetic, phonic etc., can give rise to some confusion since different teaching methods are sometimes designated by one of these terms and different terms sometimes designate the same method. Dr. Morris defines these terms as follows:- (pp.56-7)? alphabetic method - names and shapes of letters are taught, and on these the teaching of reading is based; phonic method - sounds replace the names of letters as used in the alphabetic method; whole-word method - the 'length and shape of different word patterns' are taught, and the pupil depends on these rather than upon letters or phonic elements to learn to read; sentence method - the sentence is the basic unit and 'stress is laid on reading for meaning'. Though these definitions allow room for considerable variations they show a fundamental division in reading methods between those that start with the elements of words (letters or phonic elements) which are then combined to form words, and those that do not break words into elements (whole-word and sentence) but rely on shapes or patterns.

2. This is the opinion of some inspectors who were consulted, though they were not sure that the position had not altered appreciably in the last few years.

The evidence about the relative merits of the four methods of teaching reading which have been mentioned is not conclusive, as the many controversies[1] on the subject testify. Some recent studies[2] in Britain suggest that the phonic method or some adaptation of it leads to better progress in reading than methods based on visual patterns (whole-word and sentence methods). The authors of one such study, Daniels and Diack, cite the findings of a large-scale experiment conducted in Queensland to decide the relative merits of three variations of the whole-word method and 'the traditional phonic approach in use in the Queensland schools'[3]. Children taught by the traditional phonic method, which is probably not unlike the one which was most used in Irish schools a decade ago, proved superior to those taught by whole-word methods in three out of four tests administered about three years after the start of the experiment: the former obtained higher scores than the others

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1. For a brief but authoritative discussion of the evidence see Vernon, M.D. (1957) pp. 159-172.

2. Daniels and Diack (1956) and Morris (1959).

3. Op. cit., p.25. Elsewhere, Diack describes this method as a 'rather old fashioned phonic method' - Diack (1960) p.141.

in tests of word recognition, reading comprehension and the ability to 'attack'[1] new words; one of the experimental groups excelled in speed of reading[2]. But it is not possible to measure the advantage, if any, which Irish children had in being taught to read by an alphabetic-phonic method over British children, many of whom were taught to read solely or partly by whole-word or sentence methods. And if the Irish children had the advantage in method, it was probably offset by the lack of books in Irish national schools in which school libraries are rare (though some County Councils do valuable work in supplying books suitable for children to teachers who wish to avail of them for their pupils); whereas to judge from the schools of Kent[3], school libraries are extremely common in Britain (though much seems to depend on the L.E.A.).

The only reasonable conclusion to this section is that the quantitative effects of differences between the two countries in the use of methods of teaching reading cannot be assessed. Our discussion suggests however that neither country gained an appreciable advantage in mean EQ because of such differences.

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1. By 'attack' is meant, presumably, 'attempt to pronounce'.
2. Diack (1960), p.141.
3. Morris (1959) pp. 85 sq. See also Library Association (1962), pp.30-31.

(V) British Character of MHE14: Type of English spoken in Ireland:

The discussion of teaching methods raises two related issues: (1) MHE14 was composed in Britain for use in Britain and hence it may not suit Irish children as well as it suits[1] British; (11) dissimilarities between the types of English spoken in Britain and that spoken in Ireland, apart from their influence on the suitability of a British test for use in Ireland, might explain to some extent, a difference in performance level between the children of the two countries.

Inspection of MHE14 reveals four items which a child in Britain might possibly find easier to answer than an Irish child for reasons other than command of English, Nos. 62, 76, 90 and 91[2]. Number 62 requires the child to spell the word 'marriage' which is indicated thus: 'The mar____ge of James IV and Margaret Tudor was a great occasion'. Five per cent of Irish children[3] spelled the word correctly; but the percentages who spelled the five preceding words correctly (tobacco, handkerchief, character, therefore, plaque) are 16, 8, 2, 6 and 5 respectively.

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1. See Anastasi (1958) p.533 and Anastasi (1961) pp.255 sq.

2. See Appendix 2 for a copy of MHE14 and Appendix 8 for the proportion of Irish children in groups 1 to 5 to answer each item correctly.

3. Irish children whose mother tongue is English - linguistic groups 1 to 5.

An index of the relative difficulty experienced by British children with the same items is provided by the following figures[1] derived from the work of a random sample (N = 254) of children in one L.E.A. area; 30%, 37%, 18%. 31%, 28% and 28% answered correctly questions 57 to 62 respectively. Thus it is apparent that question 62 did not present any particular difficulty, because of its 'British' character, to Irish children. The second question, No.76, which we have singled out requires the child to fill the gap in the sentence 'We are .... people' with an adjective from the noun, 'Britain'. Seventeen per cent of Irish children gave the correct answer. The following five items which are similar in type (courage, hope, body, fire, man) were answered correctly by 2%, 7%, 10%, 2% and 4% of Irish children. The corresponding figures for British children, starting with question 76, are: 63%, 19%, 26%, 18%, 11%, 27%. Once again we see that, proportionately, question 76 was not especially difficult for Irish children. Finally, question 90 which requires the child to recognise the correct use of capital letters in the words 'Friday' and 'London policeman' was answered correctly by 8% of Irish children; question 91, a similar item in which the words are 'James Brown' and 'Newcastle-on-Tyne', was answered correctly by 8%

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1. The writer is grateful to Dr. T. Renshaw of Edinburgh University, Department of Education, for these figures.

of Irish children also. The Irish figures for questions 89, 92 (usage), 93 (capitals in 'English' and 'foreign visitor'), and 94 (usage), are 6%, 5%, 3%, and 8%, respectively. The corresponding British figures for questions 89 to 94 are: 43%, 41%, 48%. 23%, 22%, 24%. Thus it is highly unlikely that the 'British' character of any of the four items singled out at the beginning of the paragraph presented Irish children with a difficulty. Moreover, questions 90 and 91 occur so late in the test that the great majority of Irish children never reached them, as the reader can see for himself by a glance at Appendix 8.

Items which appear prima facie to be easier for Irish than for British children appear so because they test vocabulary[1] which is probably more familiar to rural than to urban children. These items have already been dealt with in principle when we discussed the allowance in mean EQ to be made for the fact that a higher proportion of Irish than British children are rural.

The second point mentioned at the beginning of this section (dissimilarities between the type of English spoken in Ireland and in England) is more general than the first since it raises the whole question of Irish people's command of the English language. Though Irish people are generally

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1. See item No.32 which requires that the testee know that cattle 'bellow' rather than 'roar' or 'bray' etc.

credited with the gift of fluent speech, we must recall that the gift has survived a change of language in the course of the past 200[1] years. And some of the teachers and inspectors who were consulted on the mean difference in EQ between British and Irish children said that Irish people generally, but particularly the working classes, do not possess as sound a command of English as the British for the very reason that the English language is so new to the Irish people. It is true that traces of Irish phonetics and syntax are apparent in the English spoken in Ireland, particularly in country places and amongst the working classes. But the point must not be pressed too far since English has been the language of the great majority of those families from which the children in linguistic groups 1 to 5 come for at least 100 years[2]. Furthermore, it is the spoken English of Ireland that bears the signs of interference[3] from Irish rather than the English of the school books and

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1. According to the most reliable estimates, two thirds of the inhabitants of Ireland used Irish as their ordinary language in 1731. The census of 1851 (the first to give the number of Irish speakers) records that 4.8% of the population could speak Irish only; the corresponding figure for 1901 is .47%. See O Cuiv (1951) and Census of Ireland 1901, General Report, p.575 in H.M.S.O. (1902).

2. The census of 1851, which recorded the proportion of persons who knew Irish only as 4.8% of the population recorded the proportion of bilingual Irish and English speakers as 23%.

3. For a discussion of linguistic interference see above pp. 81 sq.

the English which the children are required to write. Therefore, since MHE14 is a printed test of English reading and usage rather than a test of spoken English the point loses a great deal of its force. Moreover there are marked regional variations in spoken English in Britain, particularly among the working classes; while in any region there are great differences between the language of the school books and the spoken language. And although nothing is known of the influence of regional variations in spoken English on MHE scores, there is no reason to believe that Irish children, because of their speech, labour under a greater difficulty in a MHE test than the children of Yorkshire or Nottingham. This argument receives some support from the fact, noted in chapter 7, that the difference in mean EQ between children whose mother tongue is English in counties which still retain Irish-speaking areas and those in counties which speak English only is not significant, despite the fact that the families of the former by and large learned English more recently than the families of the latter.

No allowance, therefore, will be made for the points raised in section (v) when we finally come to assess the significance of the observed mean difference in EQ between British and Irish children.

(VI) IQ:

While Irish children obtained a very low mean EQ, they obtained a correspondingly low mean IQ. Now since MHE14 and

N-VR both test reasoning ability, the low mean IQ would very largely explain the low mean EQ if the former indicated that Irish children are very much inferior to British children in reasoning ability.

Irish children in all six linguistic groups (mean age 12y-1m) obtained a mean N-VR raw score of 17; the British conversion table shows that in Britain the mean raw score expected at that age is 48. Thus British children may be expected to respond correctly to about three times as many items as Irish children, excelling the latter by the same proportion of successes as in the English test. At age 12y-1m a raw score of 17 is allotted an IQ of 75 in the British conversion table; in the Irish conversion table[1] at the same age a raw score of 48 is allotted an IQ of 130. By referring to table 8.1 the reader will see that the mean difference in IQ is of about the same size as the mean difference in EQ[2], or possibly larger by a point or two. In fact the difference in mean IQ is probably greater than appears from the above figures;

1. For a description of this table see chaper 6. For a discussion of the difficulties of comparing Irish and British levels of performance in a British test see the beginning of this chapter - the methods used to compare the two in mean IQ are the same as those which were used previously for comparing them in mean EQ.

2. The figures quoted here for mean difference in IQ are directly comparable with those given in table 8.1 since both sets are based on results obtained from the children of all six linguistic groups.

for Watts and Slater (1951, p.29) give figures which suggest that the British norms underrate the performance of children in England and Wales by some 5 points of quotient[1].

Undoubtedly[2] the mean non-verbal IQ of Irish children is underrated in the figures given above for the reasons already discussed in connection with the English test. However, as we shall shortly see, the main reason for the very low Irish mean IQ is most probably lack of test sophistication[3]; that is assuming that social class for social class the general level of non-verbal reasoning

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1. This conclusion is based on the assumption that the norms of MHT39, which was administered to the same children as N-VR, are representative of the level of British performance. Watts and Slater found the mean N-VR quotient higher than the mean Moray House IQ by some 5 points of quotient. However the authors do not reveal which test was administered first and so we do not know if part of the 5 points is due to practice.

2. In support of this see particularly the high mean quotients for mechanical arithmetic obtained by Irish children - above p. 264.

3. Dr. J.W. Jenkins, who constructed N-VR, was killed in an air tragedy. In a personal communication, Mr. D.A. Pidgeon of NFER informs me that the data on which the norms for the test were based have unfortunately been lost. These data were collected in the late 1940s from children aged between 10y-0m and 12y-11m; presumably these children would have by then been familiar with the types of test used in the 11+ examination.

ability[1] is the same in Ireland as it is in Britain. The assumption would seem to be supported by the similarity between the two types of culture, British and Irish, the largest difference between the two (at least so far as children are concerned) being that Irish children devote 42% of their school lives to learning Irish. But since the general conclusion from the many studies on the subject is that bilingualism does not affect level of performance in non-verbal reasoning tests, the assumption seems quite legitimate.

As against this assumption it has been suggested that selective emigration from Ireland might have impoverished the native stock, that is, if the tendency through the years was for those who emigrated to be on an average superior

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1. What is intended here is a general level of ability to reason about non-linguistic reality, an ability which is a function at once of 'innate potential', (which Hebb, 1949, p.294, has called intelligence A), of mental development, and of environmental conditions. The scope of this ability is far wider than can be encompassed in a single test of non-verbal reasoning; and there are circumstances, some given in the text above, which make a non-verbal IQ a poor estimate of the level of ability in one community relative to its level in another. However, we realise that in speaking of a 'general' level of an ability which is a function of experience we have to do with an ill-defined quantity, for only a part of any person's experience can have been shared by others of the same community.
We may add, in passing, that if we are correct in interpreting differences between urban and rural areas in mean EQ as the result of social differences, we have made an adjustment for socio-economic differences between the two countries in making an adjustment for the difference in the proportion of urban to rural inhabitants.

in IQ to those who remained. Unfortunately, evidence from Ireland on this most important point is lacking[1]; but if emigration from Ireland followed even roughly the same pattern as that which migration from rural to urban areas over the past 150 years followed in Great Britain, (in Ireland emigration was mostly from rural areas), then emigration can be called upon to account for only a small fraction of the very large difference between Irish and British children in mean IQ. Migration in Britain, if it is the cause, has produced only a very small difference between urban and rural areas in mean IQ (cf. above p. 329).

The value of our suggestion that the low Irish IQ is to be explained principally by the difference between Irish and British children in test-sophistication hinges on whether there is a transference of the effects of coaching and practice in verbal material to non-verbal material, since British children's sophistication is developed by means of verbal material. Now much of the work on the transference in

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1. The questionnaire employed in the present investigation included questions, the answers to which may throw light on the question, but unfortunately these answers have not yet been analysed.

question was done with British children during their final year at junior school, at a time when they are already highly test-sophisticated. This probably explains the discrepancy which we find between results obtained in these experiments and those obtained with children who were less test-sophisticated. The first type of experiment is represented by that of Navathe reported in an unpublished thesis, but summarised by Vernon (1951). In that experiment no transference of coaching effect was observed, but a transference of practice effect was. Working with eleven year old British children Watts et al. (1952) obtained results very similar to those obtained by Navathe. Later, Dempster (1954) found no transference of either coaching or practice effects in the scores of eleven year old girls, though boys' scores showed transference of both types of effect amounting to about 2 and 4½ points respectively.

There are indications however that the size of the increase in non-verbal IQ to be expected from coaching or practice depends on the initial degree of test sophistication and that if children are not test sophisticated at all to begin with, their gains in non-verbal IQ will be very much greater than in verbal IQ. Smith and Lawley (1948), who report results obtained with the two forms of Cattell's Non-Verbal Intelligence test (Scale I) in the Hebrides found that gains from form A to form B were about twice as large on an average as Cattell's norms predict. The Hebridean children were not test-sophisticated to the same extent as children on the mainland[1]. Lloyd and Pidgeon (1961) report the findings of an experiment in South Africa on the effect of coaching European, African, and Indian children, who were initially quite unfamiliar with standardised tests of any sort, in the principles involved in a NFET non-verbal reasoning test. Each ethnic group comprising about 280 children was divided into an experimental and a control group, of which only the experimental group was coached. All children however were set two NFER non-verbal reasoning tests, the interval between them being three weeks during which the experimental groups were coached twice for a period of half an hour each time. The order in which the two tests were set was varied so that differences between orders do not affect the main results[2], which are summarised in table 8.9.

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1. See Smith & Lawley (1948) p.27. Though there is mention on p.10 of tests previously administered 'in the schools of Gaelic-speaking communities'. Thus Hebridean children had probably heard of timed tests of the Moray House type and on that account they were more test-sophisticated than Irish children who in all probability had never heard of such tests.

2. Europeans obtained an initial mean IQ some 16 points higher than Africans and Indians; the reason most probably being that the Europeans were mostly of the professional classes while the other children were almost all/of the working classes.

TABLE 8.9.

Gains Made Between Initial and Final Tests by Groups of European, African and Indian Children:- Lloyd & Pidgeon (1961).

Group	European	African	Indian
Experimental	10.60	14.55	6.10
Control	7.39	6.95	5.65

The first interesting feature in table 8.9 is that gains made by the control group after a single practice test are about twice as large as those which have been generally found with verbal reasoning tests[1]. Secondly the gains made by Europeans and African children in the experimental groups are more than twice as large as those which have been found in Britain with verbal-reasoning tests after similar amounts of coaching and practice. The authors suggest cultural influences to explain the smaller gains of the Indian experimental group. Now since the Irish children who were tested in the present survey were quite unfamiliar with any type of standardised test (N-VR was the first test administered), we might expect very large

1. See above p. 310 sq.

gains from practice alone[1], or practice and coaching combined, in non-verbal material: much larger than those to be expected with verbal reasoning or standardised English tests.

It is important to observe however that the point at issue here is that Irish children's non-verbal IQs would have been very much higher if they had been accustomed to the idea of timed tests and had had some practice at reading standardised test instructions. In other words our contention is that a large transference of practice and coaching effects from standardised verbal tests, whether verbal reasoning or English, to non-verbal reasoning tests is to be expected with children who are not at all test sophisticated. The first three studies cited do not greatly support this contention, but neither do they gainsay it because, it has been suggested, they were made with already highly test-sophisticated children; the last two studies cited do not deal with transference from verbal to non-verbal reasoning

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1. In comparing the Irish translation of N-VR with the original, the test was administered to 20 Dublin school boys a second time the language being changed so that those who took the Irish version to begin with took the English on the second time and vice versa. (For details see above pp. 203 sq.) The mean gain in IQ (published norms) from first to second testing four months later is 8.1 points; which, though the number of boys is small and different versions of the same test rather than different tests were administered, seems to bear out the conclusion given in the text above.

tests since they were conducted with the latter type of test alone. However the last two studies are relevant since they show that non-verbal IQs in the case of children who are not test-sophisticated can be increased by coaching and practice to a much greater extent than verbal IQs[1], and that such gains are obtained very quickly and easily in comparison with gains in Verbal IQs. It is not unreasonable to conclude, therefore, that sophistication in verbal reasoning tests transfers to non-verbal reasoning tests to a far greater extent than experiments in present day Britain reveal.

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1. As evidence of this, two studies may be quoted: (i) Watts et al. (1952, p.37) indicating that the gains to be expected from coaching and practice in verbal IQ and EQ in Britain are almost equal; (ii) our own study conducted in Dublin indicating that gains in EQ from practice in Ireland (with children unfamiliar with standardised tests) and Britain are of the same order. Thus it seems highly probable that Irish children who are totally unsophisticated in new type tests would gain no more in verbal IQ from coaching and practice than IQ+ children in Britain.
The second study has been used to suggest that the results of coaching would also be of the same order in Ireland and Britain. The reason for the difference between verbal and non-verbal reasoning tests in susceptibility to coaching and practice effects has not, to our knowledge, been investigated, but probably it lies in the initial unfamiliarity of the non-verbal test material and in the absence in most non-verbal reasoning items (unlike verbal reasoning ones) of any indication of how the item is to be tackled, throwing great weight on a brief instruction. Moreover a child who has never heard of an 'intelligence test' might not consider a non-verbal test as anything more than a strange new sort of game and not really apply himself to it; whereas the child who is test-sophisticated would recognise it as a type of intelligence test and attempt to acquit himself well. After the first test the former child will probably learn what the test was and make greater efforts the next time.

There is one further consideration. The reader will by now have concluded that in primary schools the standard of English is lower in Ireland than in Britain. This almost certainly means that Irish children are far behind British in English reading[1]. Now there are five legends in N-VR and it is quite likely that Irish children would have far greater difficulty than British in reading and comprehending them, not only because the Irish children have neither practice nor coaching in interpreting test instructions but also because they are poorer at reading. Moreover, lack of test sophistication probably meant that Irish children obtained less information than British children about how to solve sets of items from the worked example which illustrate each legend, with the result that they were more dependent on the legends. Thus, even though the legends are quite brief, they may in fact have played a large part in depressing Irish children's IQs.

In conclusion, taking all things into account, it is quite legitimate to assume that the low mean non-verbal IQ obtained by Irish children is not due to a lack of ability to reason about non-verbal materials. And consequently the Irish children's low non-verbal IQ will not be invoked to explain their low mean EQ.

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1. This probably explains to a great extent why Irish children's mean problem arithmetic quotient fell far below their mean mechanical arithmetic quotient (by some 10 points of quotient).

(VII) Time Devoted to Irish and English in Irish National Schools:

We come now to what is probably the most important factor giving rise to the large difference in EQ between Irish and British children, namely a difference in the amount of time spent at 'English'[1] in Irish and British schools.

Irish is a compulsory subject at all levels in Irish national schools; English is compulsory in 2nd standard and all higher standards[2]. For some twenty years prior to 1948 the teaching of English to infants was forbidden, but in that year permission was granted to teach them English for half an hour per day[3]. English has been for many years and still is optional in 1st standard.

The above is a brief outline of the regulations about Irish and English governing national schools; but in order to learn how they are put into practice, the schools in which the survey was carried out were asked for their time tables for

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1. By 'English' in this context is meant English reading, writing, grammar, pronunciation and any other activities which have as one of their main aims the increasing of children's knowledge or command of English, such as story-telling or drama.

2. For particulars of the programme in Irish national schools see Department of Education (1946) pp. 46 sq. and Department of Education (1956).

3. Department of Education (1954) p. 70.

the year 1960-61, the year when the tests were administered[1]. The tables, which were received from 99 of the 119 schools, show that 58% of schools do not avail of the permission to teach English to infants while all but 5% teach English to 1st standard.

TABLE 8.10.

Classes in Irish National Schools in which English is Not Taught.

Group	No. of Schools	Infants	1st Standard
1	17	5	
2	17	10	1
3	15	10	
4	17	9	
5	19	10	1
6	14	7	3
Total:	99	51	5

Table 8.10 indicates a marked difference between Ireland and

1. It is quite impossible to obtain the time-tables for the five years previous to 1960-61, though obviously these would have been very interesting since if we had all six sets it would be possible to estimate more accurately the amount of time spent at each subject by the children who were tested.

Britain not only in the amount of time devoted to teaching English, but also in attitude to the importance of English, which may in turn affect the quality of English teaching.

TABLE 8.11.

Mean Number of Hours per Week Given to Irish, English and Arithmetic: And Mean Number of Hours as Percentage of Total* Number of Hours.

Group	No. of Schools	Irish		English		Arithmetic**	
		Mean Hours	% of Total	Mean Hours	% of Total	Mean Hours	% of Total
1	17	45.4	40	26.4	24	25.8	23
2	17	46.4	43	22.7	21	27.0	25
3	15	46.5	42	26.0	23	25.5	23
4	16	46.6	42	22.9	21	27.5	25
5	17	48.8	44	25.9	23	24.4	22
6	14	43.5	39	23.5	21	29.6	26
TOTAL:	96	46.3	42	24.6	22	26.5	24

* Excluding 2½ hours per week per class devoted to Religious Knowledge. The three subjects fill some 88% of the time devoted to secular subjects.

** The figures for arithmetic in mixed schools are those for boys, who in many schools devote the time spent by girls at sewing and knitting to arithmetic - hence these figures slightly over-estimate the time spent by girls at arithmetic.

Though it must be confessed that nothing is known of how the two countries compare in these respects. Differences between the two countries are even more clearly seen in

Table 8.11 where the mean number of hours per week[1] spent at Irish, English, and arithmetic are set out. Those figures were obtained by averaging the number of hours spent per week in 96[2] schools at each of the three subjects in each class from infants [3] to 5th standard.

It is difficult to obtain comparable figures for Britain, but Morris (1959, p. 95) gives the ratio of time

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1. The principal teacher in each school draws up a time table for the whole school each year setting down the number of hours per week to be devoted to each subject in each class. The time tables which the author obtained are copies of the school time tables. Naturally teachers do not adhere rigidly to the time table, but by and large the tables give a reasonably reliable estimate of the amount of time spent at each subject. Because the tables were operative in the school year 1960-61 only, they do not give the amount of time spent at each subject by the children who were tested during the five years previous to 1960-61, but the writer has been assured that the averages for linguistic groups of schools, and a fortiori for all 96 schools, are unlikely to err much on that account.

2. Figures from two schools which have no infant department were omitted in order that the figures which were averaged might be directly comparable. Figures from another school which is about to close are also omitted because there are no children left in the junior classes, and consequently no time table for junior classes was drawn up.

3. The figures in table 8.7 probably underestimate the average time spent at Irish because many children spend more than one year in infants, while the table allows only one year in infants.

spent at 'reading and allied activities'[1] to time spent at arithmetic for a large number of schools in Kent. Table 8.12 is derived from her book.

TABLE 8.12.

The Ratio of Time Spent at Reading and 'Allied' Activities to Time Spent at Arithmetic in Some Schools in Kent: Morris (1959)

Ratio (Reading etc. placed first)	5½/1	5/1	4½/1	4/1	3½/1	3/1	2½/1	2/1	1½/1	1/1
Junior Departments*	0	1	1	4	4	11	8	14	2	2**
Infant Departments	3	1	2	4	4	5	3	18	0	1**

* Junior Departments include from 1st to 4th year - see loc. cit. p. 137.

** The figures for these schools do not include 'allied' activities.

The average time per day devoted to arithmetic in these schools in Kent was between 40 and 45 minutes; in the Irish schools it was about 53 minutes. Thus it is apparent that in Kent most primary school children spend more than twice as much time as Irish children at English. This is

1. Dr. Morris writes: 'Reading and "allied" activities such as stories, discussions, drama, poetry and writing' p.94. Thus it would appear that what she intends by these words is almost the same as what we have called 'English'.

an obvious source of difference in mean EQ between Ireland and Britain - if the schools of Kent may be taken as typical of British schools in the amount of time they devote to English, and one feels sure they can. Moreover, the very fact that almost twice as much time is devoted to Irish as to English in Irish national schools would seem to denote that English comes a long way behind Irish in importance. All this helps to explain the finding reported in chapter 7, that the regression of GQs on inspectors' ratings of teachers is significant while the regression of EQs on these ratings is not significant. Taking one thing with another it seems clear that Irish schools are much less interested in English attainments than British ones (one feels sure that the schools of Kent are not singular in this matter). Here perhaps is the main source of the difference in mean EQ.

Does the time devoted to learning Irish in any way affect an Irish child's capacity for learning English? Psychologists have established that different fields of learning (school subjects for example) are not sealed off from one another in the memory, but that by a process known as retroactive inhibition, what a person has learned in one field may make learning in another field more difficult. McGeoch and McDonald's (1951) work shows that the more closely these fields are related, conceptually at least, the greater the interference. Now Irish and English are both languages and it is quite possible that the learning of linguistic skills in Irish affects the learning of similar skills in English. For example, learning to read in Irish may interfere with a child's learning to read in English, all the more so for the fact that though Irish and English are similar to one another, eight letters are written somewhat differently in Irish from the corresponding letters in English. Moreover many letters and letter combinations have different phonic values in the two languages. And finally the same combinations of letters usually have quite different meanings in the two languages[1]. Of course, there is also the possibility of positive transference making the learning of linguistic skills in English easier for having learned similar ones in Irish, but as neither effect has been studied in Ireland, it is perhaps best to be content for the moment with raising both without

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1. As examples of this take 'do' and 'go' which besides being pronounced differently in Irish and English have quite different meanings in the two languages - in Irish they mean 'your' and 'to' respectively. The Irish and English words are occasionally confused by young children in word recognition tests in English.

   In a slightly different connection, the author has experienced the influence of a mental set caused by the teaching of Irish which confused some young children to whom he was administering the Termon and Merrill test. When asked 'what is an orange?' etc., they responded by giving, as far as they could, the Irish equivalents for these words. But perhaps the phenomenon is curious rather than important.

attempting to assess the importance of either.

Summary and Conclusion.

The difference in mean EQ obtained with MHE14 between Irish children (whose mother tongue is English) in 1961 and British children during the war years is estimated at about 20 points. Since British children in more recent years are expected to obtain EQs with MHE14 some 2.5 points of quotient higher than those obtained by British children during the war, the mean difference in EQ in 1961 is estimated at about 22.5 points. From this figure 9 points must be deducted because the Irish children were not test-sophisticated whereas the British children on whom MHE14 was standardised were. A further 2 points may reasonably be deducted because the Irish children did not have such a strong incentive to do well at the test as the British children; a further 1.2 points may be deducted because of the higher proportion of rural children in the Irish sample of children than in the British one. No points will be deducted because of differences between the two countries in quality and method of teaching, because the test was constructed for use in Britain rather than in Ireland, or because Irish children obtained non-verbal reasoning quotients which are very much lower than those which British children obtain with the same test. The total number of points to be deducted from the mean difference of 22.5 is 12.2; which leaves a mean difference of 10.3 points still to be accounted for. This difference, if translated into months of "English age", allowing .6 points per month, may be taken as equivalent to about 17 months.

The conclusion of the present chaper is that Irish children by comparison with British children are retarded on an average by about 17 months English age, chiefly because of the fact that Irish national schools devote very much less time (probably less than half as much) than British ones to teaching English.

CHAPTER 9.

ITEM ANALYSIS AND SUPPLEMENTARY INVESTIGATIONS - RESULTS III.

In an attempt to throw light on the findings reported in the two previous chapters, the proportions of children[1] in each linguistic group, or in various combinations of these, who responded correctly to each item in SPA, SMA, Irish, and MHE14, were studied. Only those linguistic groups which have been shown to differ significantly from other groups in overall mean test score have been singled out for separate consideration; in fact item analyses were made chiefly to account at least in part, for these differences. Differences between the sexes and between schools were ignored in the item analysis, not because they were unimportant, but because numbers in subdivisions of Ss would be exceedingly small if they were taken into account.

A number of investigations, supplementary to the main one reported in chapter 7, were also undertaken. Again the aim was to throw light on some of the findings

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1. Tables showing these proportions are given in Appendix 8 .

of the main investigation. We shall begin however with the item analysis of the two arithmetic tests, taking them together.

Item-Analysis: Arithmetic

The arithmetic tests differ radically from the other two criterion tests in the unit of measurement which they employ; for they were designed to yield an arithmetic age for each child, that age being simply the median[1] chronological age of children in the standardisation sample who obtained the same number of correct answers. The scale of measurement is graduated in months. The Irish and English tests, in contrast, were designed to compare the attainments of children whose ages are equal[2]; the scale of measurement is graduated in units of normalised score. In constructing the arithmetic tests it was necessary to determine the mean performance of children of

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1. Presumably, though the author of the test does not say so.

2. Observe that though arithmetic scores are converted to arithmetic ages, these ages were in the present work converted to arithmetic quotients. And though the unit of measure in Irish and English is normalised score, or quotient, an age allowance was made to adjust the deviation of an individual child's quotient from the mean quotient for deviation of his age from the mean age of children with whom he was compared. Nonetheless the statements about units of measurement in the text stand.

widely differing ages, so each test includes items which differ widely in difficulty[1]. Tests such as MHE14 (the Irish test is similar in this respect) are standardised over a comparatively narrow age range, and the items they contain are not so widely different from one another in difficulty.

Items in the arithmetic tests are arranged in order of ascending difficulty, the difficulty gradient being quite steep as we have just pointed out. The early items are very elementary, calling for little from a 5th standard child but accuracy in computing. Later in the tests money sums, sums involving weights, measures, decimals, percentages etc., are introduced. Thus some information can be obtained by dividing each arithmetic test into five sections of ten items each and calculating the mean proportion of children who responded correctly to the items in each section. These proportions for linguistic group 6 (mother tongue Irish) and for the other five groups taken together[2] (mother tongue English) in the five sections of SMA are given in table 9.1.

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1. Difficulty is defined for our present purpose by the proportion of children, at some age about the middle of the age range catered for by the test, who give the correct response to an item.

2. Group 6 differs significantly from the other groups, which do not differ significantly from one another, in mean SMA score.

TABLE 9.1

Mean Proportion of Children who Obtained the Correct Answers to Items in SMA - Items Taken in Sections of 10.

Item	1 - 10	11 - 20	21 - 30	31 - 40	41 - 50	n
Groups 1 to 5	.93	.83	.62	.29	.10	928
Group 6.	.84	.73	.41	.16	.06	155

Though groups 1 to 5 excel in all sections, their superiority is greatest in the third section, Nos. 21 - 30. All except four of the items in the first two sections test nothing except ability to apply the four rules accurately; and though group 6 falls behind the other groups in these sections, its weakness is more apparent, relatively, in the later sections which involve more complex arithmetical operations. In the last section Nos 41-50, the arithmetic proved too difficult[1] for most of the children and consequently the difference between the proportions is slight.

Our analysis yields more precise information if instead of combining the items of SMA in sections of ten, we group them according to type, i.e., money sums, fractions,

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1. In Appendix 8 it will be seen that a high proportion of children obtained the correct answer to No.49, suggesting that a very large number had sufficient time to complete the test.

long[1] division, long multiplication, etc.

TABLE 9.2.

Mean Proportions of Children who Solved Various Types of Item in SMA.

Type of Item	Item Nos.	Groups 1 to 5	Group 6.
1. Long multiplication and long division.	31-32	.45	.27
2. Money Sums	17-26,33-36	.70	.42
3. Weights and Measures	27-29	.54	.29
4. Fradtions	37-42	.19	.13
5. Decimals	44-48	.12	.06

The mean proportion of native English-speakers and native Irish-speakers answering correctly five such types of item, which include nearly all items in the test apart from the first 16 (elementary computations), are given in table 9.2, where in general differences tend to be greater than in table 9.1. Children in group 6 appear to be much weaker, in comparison with children in the other groups, at sums which involve change of units, such as

1. 'Long' is used here in the traditional sense to indicate that the divisor (multiplier in multiplication) is greater than 12. The multiplication and division sums amongst the first 20 items are all 'short' (i.e., multiplier or divisor an integer less than 13).

money sums and weights and measures, than at elementary computation. The difference between the two mean proportions for sums involving fractions is surprisingly small; but this is very probably due to the late position in the test of these sums.

The findings of the item analysis of SPA may be presented in much the same manner as those of SMA. However, group 5 (arithmetic taught through Irish at all levels) and group 6 were found to differ significantly in mean SPA quotient from groups 1 to 4, which did not differ significantly amongst themselves; so three sets of figures are presented from the SPA item analysis: one set for groups 1 to 4, a second for group 5, and a third for group 6.

SPA was divided into five sections of ten items each and the mean proportion of children who obtained the correct solution in each section was calculated. These proportions are given in table 9.3, where it will be seen that group 6 consistently obtains a lower figure than the other groups except in the last section where the problems appear to have been too difficult to distinguish between groups. It is surprising that group 6 should fall as far behind the first four groups in section 1 (Nos 1-10) as in section 2 (Nos 11-20) and further than in section 3 (Nos. 21-30); but the figures for these two divisions of

TABLE 9.3.

Mean Proportions of Children Who Solved SPA Problems - Problems Taken in Sections of 10.

Items	1-10	11-20	21-30	31-40	41-50	n
Groups 1 to 4	.85	.61	.33	.07	.02	733
Group 5	.72	.50	.26	.06	.01	195
Group 6	.65	.42	.15	.02	.01	155

the children drop so rapidly from section to section, (more rapidly than the corresponding figures in table 9.1), that one receives the impression that the increase in difficulty of the problem tends to lessen differences between the divisions, and to obscure the effect of those factors which differentiate them in the earlier sections. Clearly if the problems became so difficult that none of the children could solve them, no differences at all would be observed between the divisions. The figures for group 5 come in magnitude between those for groups 1 to 4 on the one hand and group 6 on the other. Differences between the figures for group 5 and those for groups 1 to 4 are affected by the increase in difficulty of problems in much the same way as those between group 6 and groups 1 to 4.

Many types of problem can be distinguished in SPA, but since several problems involve two or more arithmetical processes, such as the calculation of a percentage and the conversion of pounds to ounces (No.40), and since there is only one example of other types, for instance the calculation of a mean (No.32), there seemed to be little point in breaking up the test for the purpose of further analysis into any more than five types of problem, comprising in all 32 items. The nature of each type and the mean proportions of children solving the examples of each are given in table 9.4.

TABLE 9.4.

Mean Proportions of Children Solving Various Types of Arithmetic Problems.

Type of Item	Nos.	Groups 1 - 4	5	6
Elementary Computation	1-7, 9, 12, 16	.84	.74	.66
Simple Money Sums	8,11,13-15,21,22,24	.62	.51	.40
Weights and Measures	17,23,27,30	.23	.14	.09
Fractions	25,35	.26	.24	.08
Ratio[1]	26,31,33,37,41,43,45	.13	.08	.04

This further analysis brings little new to light, but it confirms the impression of general weakness in preblem

1. 'Ratio' is used here to denote problems involving the use of ratio, (No.26) or the calculation of proportion, or the use of the unitary method (No.33) which is simply a method of dealing with proportion.

arithmetic on the part of group 6 compared with groups 1 - 4. Surprisingly, table 9.4 does not show this weakness to be greater in relation to sums involving change of unit than sums involving no more than elementary computation[1]; but the reason is probably the one already given, namely, the rapid increase in difficulty of problems through the test. Group 6 falls further behind the main body of Irish children in the number of problems involving fractions than in the number of mechanical sums involving fractions which they solved. This fact, taken together with similar findings for items involving elementary computation only, seems to suggest that in comparison with Irish children generally the children of group 6 are relatively weaker at problem, than at mechanical, arithmetic.

Children in groups 1 - 4 excel those in group 5 at all types of problems except those which involve fractions, where the difference is negligible. But since there are only two problems involving fractions, this scarcely leads one to doubt the conclusion that the advantage of groups 1 - 4 in problem arithmetic is a general one. It is noteworthy, as we shall see, that, by contrast, group 5 does not differ from the first four groups in mean mechanical arithmetic quotient.

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1. See tables 9.1 and 9.2.

Supplementary Investigation I:-

Irish-Arithmetic Investigation:.

When setting arithmetic problems orally or correcting those in test papers the present writer sometimes noticed that children in English-speaking areas who had been taught arithmetic through Irish and were being examined in Irish failed to solve problems even when, he believed, they must have been capable of understanding the Irish and of coping with the arithmetic. It was as though the tasks of understanding the language and of dealing with the arithmetic taken together were too much for them, though they might have managed either task alone. As the observation was not without its relevance both to the teaching of arithmetic through Irish to such children and to the examination of their progress, the author decided to investigate the matter further. He would like to add, however, that up to the present his investigations have not progressed beyond the 'pilot' stage, and though promising, the findings must be viewed with caution. The investigation was conducted in the following manner.

The author selected some eight expressions from the Irish version of SPA which he thought, from his work in comparing the difficulty levels of the Irish and English versions, might cause children to fail with a problem, though they knew well enough what the expressions meant[1]. It is only natural that children who are native English-speakers should find some Irish words and phrases 'hard', even though they are the normal means of expressing certain concepts or relationships. Next, two sets of problems were composed, the first consisting of eight simple problems each containing one of the expressions, the second consisting of ten more complex problems each again containing one of the expressions. Apart from the eight expressions the Irish throughout is very simple, and the problems of the second section are the same in arithmetical type as those of the first; the intention being that the main difference between the first and second sections would be in the complexity of the arithmetic. The eighteen problems were then translated as simply as possible into English, and copies[2] of both versions mimeographed.

Fifth and sixth standard children who had been taught arithmetic through Irish at all levels in two Dublin

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1. The reader is referred to p. 163 above where five of these expressions are dealt with in detail. In addition to the five expressions mentioned there, i.e., tá x ag A ar B', 'a 4 oiread san', 'sa bhreis', 'sochar', 'céadchodán', the following three were chosen: 'roinn' (divide), 'meachain iomlán' (total weight), 'ar an meán' (on the average). Since constructing the test (2 years ago) the author has come to believe that the last four expressions given here were altogether too simple for his purpose.

2. Copies of both versions may be examined in Appendix 8. Unfortunately no tests were carried out to determine whether 'balanced' bilinguals would experience equal difficulty with the two versions.

schools took the test. The schools, one a boys' and one a girls' school, are situated in the same grounds and in general draw their pupils from the same sections of the community; they are believed to achieve a particularly high standard in Irish. Each class was divided at random into two numerically equal groups, one taking the Irish, one the English version. The total number of children tested was 122, 54 boys and 68 girls. No time limit was fixed, each child being allowed to finish the test in his own time.

Our expectancy was that the 'Irish' group would cope fairly well with section 1 (easy arithmetic, difficult Irish), but not with section 2 (difficult arithmetic and Irish). The 'English' group were a control group. We shall begin by studying scores[1] (number of problems solved by each child) for section 1. Since numbers in classes varied disproportionately, 12 scores were omitted at random from one class, 6 from another (an equal number from Irish and English groups in each class) to reduce the number in each to 28; in order to increase the number in a third to 28, one score equal in value to the mean for the English group

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1. Since we are working with measures which have not been normalised we have no guarantee that they are distributed along an equal interval scale. This is an added reason for treating the findings of the present investigation with caution.

and one equal in value to the mean for the Irish group in the class were added[1]. This procedure secured 28 scores for each class, the total being 112; however the total degrees of freedom are 110, since none are gained by adding scores equal in value to the mean. The scores were submitted to analysis of variance in which account was taken of differences between Schools (in part a sex component), Classes, and Languages. The analysed components of the total sum of squares are given in table 9.5.

The triple interaction component falls short of significance when tested against MSw; so the latter was then employed to test the significance of the other interaction components[2]. Of these only MSsc reaches significance; but since School and Sex differences are confounded in it, we shall not attempt to give the causes of its significance. However, neither of the interactions involving Language is significant, so the Language mean square is free from Class and School influences. Tested against MSw, it was found to be significant. Thus, we reject the hypothesis that the difference between the English group's mean of 6.01

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1. This procedure is advocated by Lindquist (1953), p.148, where the number of 'missing' observations is very small.

2. Because of the greater number of DF associated with it, and because MSscl is, by chance, smaller than it.

TABLE 9.5.

Analysis of Variance

Section I: Irish-Arithmetic Investigation.

Source	DF	SS	MS	F†
Schools (S)	1	31.93	31.93	
Classes (C)	1	44.00	44.00	
Languages (L)	1	7.61	7.61	5.47* (DF = 1 & 102)
S x C	1	8.41	8.41	5.86**(DF = 1 & 102)
S x L	1	.42	.42	not significant
C x L	1	.21	.21	not significant
S x C x L	1	.69	.69	not significant
Within	102	141.64	1.39	
Total:	109	234.64		

† A single asterisk after a variance ratio indicates significance at the 5% level, where $F \geq 3.94$ is significant; a double asterisk indicates significance at the 1% level, where $F \geq 6.90$ is significant.

and the Irish group's mean of 5.49 is due to chance. The English version is somewhat easier for the children tested than the Irish one.

Despite the fact that our expectancy as regards section 1 is not fully realised we were able to proceed to the second and principal part of our investigation, which is to determine whether the same difficult Irish will prove a still greater handicap in the more difficult arithmetic of section 2. In order to eliminate the variance due to the fact that the Irish version of section 1 is more difficult than the English one, and at the same time reduce the variance due to differences between the children in arithmetical ability, each child's score for the second section was deducted from his score

TABLE 9.6.

Analysis of Variance: d-Scores. Irish-Arithmetic Investigation.

Source	DF	SS	MS	F †
Schools (S)	1	4.81	4.81	
Classes (C)	1	13.44	13.44	
Languages (L)	1	15.90	15.90	5.88* (DF = 1 & 102)
S x C	1	19.55	19.55	7.23**(DF = 1 & 102)
S x L	1	.93	.93	.344 (DF = 1 & 102)
C x L	1	3.50	3.50	1.29 (DF = 1 & 102)
S x C x L	1	5.06	5.06	1.87 (DF = 1 & 102)
Within	102	275.86	2.705	
TOTAL:	109	339.05		

† A single asterisk after a variance ratio indicates significance at the 5% level, where $F \geq 3.94$ is significant; a double asterisk indicates significance at the 1% level, where $F \geq 6.90$ is significant.

for the first section to yield a single score which we shall call '<u>d</u>'. The 112 ds were analysed[1] in the same manner

1. Once again the reader is reminded that we do not know whether our measures (d_s) are distributed along an equal interval scale.

as the scores for section 1; Table 9.6 contains the analysed components.

MSw was employed as error term to test the significance of the triple interaction component; and the latter falling short of significance MSw was employed in preference to it, because of the larger number of degrees of freedom, to test the significance of each of the other three interaction terms. Of these the only one which reaches significance is the School x Class interaction, implying that the difference in mean d-score between classes varies from one school to the other. But as we have previously remarked, in connection with the corresponding component in the analysis of scores for section 1, Sex and School differences are confounded, so it is futile to attempt a detailed explanation of the significant MSsc.

Because the Language mean square of table 9.6 is free from Class and Sex influences and from the influence of any interaction it was tested against MSw and found to be significant. Thus we reject the hypothesis that the difference of .76 between the mean d-scores of 3.21 for the Irish and 2.45 for the English groups is due to chance. May it be attributed to the combined difficulty of Irish and arithmetic, a difficulty which is greater for the type of child tested, it is suggested, than the difficulty of either the Irish or the arithmetic taken separately?

Whether it may nor may not depends on a number of assumptions which regrettably have not been substantiated experimentally:
(i) that the Irish of the second section is neither easier nor more difficult to the children tested than the Irish of the first section; (ii) that the English of the two sections does not vary in difficulty;
(iii) that the arithmetic in the two sections involves the same types of operation, but that in the second section these are more complex than in the first. Inspection of the test alone[1] can be offered in support of these assumptions. However it probably lends them enough weight to enable us to conclude tentatively that the combination of difficult Irish and difficult arithmetic placed an appreciable number of problems beyond the powers of the children tested in Irish, even though they were able to understand the Irish and would have been able to solve the problems had they been expressed in English. The conclusion is probably quite general in its application, even though it is not based on the work of a random sample of

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1. It seems unlikely that sufficient support for these assumptions could be obtained from the interaction components of table 9.6. The absence of a significant Language x Sex interaction for instance proves nothing because the Sex component is also a School component; and also because even if the Irish of the second section is more difficult than that of the first, it could have happened that girls compensated for greater difficulty than boys with the more complex arithmetic of the second section by greater facility than boys with the more difficult Irish. In this case the Language x School interaction might also fall short of significance.

children[1] who were taught arithmetic through Irish, because those on whose work it is based almost certainly had a command of Irish above the average for native speakers of English in Irish national schools.

The experiment just described contributes to our understanding of the difficulties experienced by children from English-speaking homes with arithmetic problems set in Irish. But before discussing its contribution we must recall firstly that several investigations failed to reveal a significant difference in difficulty between the two versions of SPA for children who had been taught arithmetic through Irish. Secondly, analysis of covariance failed to reveal a significant difference between the first five linguistic groups in mean SMA quotient, while it did establish that the first four linguistic groups were significantly superior to group 5 in mean SPA quotient. Thirdly, item analysis led to the conclusion that the superiority of groups 1 to 4 in problem arithmetic was general, and not confined to the more difficult problems. All this indicates that the children of group 5 failed to achieve as high a standard of problem arithmetic in general

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1. The author hopes to repeat the experiment employing a more representative group of children, a better validated test, and a verbal reasoning test - it would be particularly interesting to learn whether the effect studied varies with level of reasoning ability.

as the children of groups 1 to 4; or to put it another way, the general superiority of groups 1 to 4 is not a function of the version of SPA which they took. Now since most of the problems in SPA are expressed in simple Irish, the third point mentioned above is of particular importance; for it seems to imply that the findings of the Irish-arithmetic investigation apply to even <u>simple Irish.</u> Here we seem to have an explanation of why the children of group 5 became retarded in problem arithmetic: Irish, even when it is simple, and when they understand it, makes problem arithmetic more difficult for these children than it would be if the problems were in English. The added difficulty of Irish might conceivably bring about a retardation in either of two ways:

(i) it might prevent children from gaining competence and skill in solving problems which involve the arithmetical operations which have been taught. In view of the fact that group 5 did not differ significantly from the first four groups in mean SMA quotient, the second alternative is more likely to be true[1]. However we shall return to this problem later.

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1. Moreover the Department of Education lays down a programme of work for each year, and it is likely that the majority of schools cover that programme in the space of the year.

Supplementary Investigation II: Three-term Relations:

The Irish-arithmetic investigation was carried out to study how well children whose mother tongue is English but whose schooling has been conducted in Irish can solve complex arithmetic problems set in rather difficult Irish. A second investigation was carried out to study how well these children can solve unfamiliar problems set in simple Irish. The purpose in studying this aspect of problem solving in Irish is to determine whether the unfamiliarity of the operations involved had the same effect as complexity appears to have had in the Irish-arithmetic operation. It is important to know the answer to this question because of necessity much of children's work in problem arithmetic involves newly learned and therefore relatively unfamiliar operations. No doubt some of the problems in SPA were new to most of the children in group 5, but it is very likely that when children of that age are faced with sums of an unfamiliar type they do not attempt them at all. So there is little purpose in examining their work in the test to learn how they fared with unfamiliar problems even if we could determine which ones were unfamiliar to which children, which we cannot do. The matter might have been broached by introducing classes of children similar to those in group 5 to a new arithmetical operation and then dividing each class at random into two groups, the one to take a test consisting of problems involving the new operation set in Irish, the other to take an English version of the same test. But this procedure would have taken more time than the writer has so far been able to afford.

As an alternative it was decided to employ problems involving three-term relations of the type 'A is greater than B, but smaller than C; which is the smallest?' Such problems are not unlike sums involving ratio since both involve mainly the logic of relations, while they possess two advantages for our purpose over such sums:

(i) they are unfamiliar to 5th standard children, but not, as the event proved, too difficult for them;
(ii) they can be expressed in such simple language that the problem of equating an English and Irish version in difficulty hardly arises. Indeed if that problem were to arise it would probably mark the extent to which a teacher who wished to present any new matter in Irish to a class whose mother tongue was English would be hampered by language difficulties.

Twelve problems were composed in Irish to form a test which was then translated into English[1]. The type

1. Copies of the two versions may be seen in Appendix 8 .

or relation varies from problem to problem, but all are simple such as, 'taller than', 'prettier than', 'to the left of'. The form of problem varies too; there are four types and three examples of each.

Problems 1 - 3 take the form 'A > B: B > C; which is the greates A, B or C?' 4 - 6 take the form A > B, C < B; which is the greatest A, B or C?' 7 - 9 take the form 'A > B: B > C; which is the smalles A, B or C?' 10 - 12 take the form A > B, C > A; which is the greatest A, B or C?'

The test was administered to the children in the two Dublin schools who had previously taken part in the Irish-arithmetic investigation. The Irish version of the test was administered to the children who had taken the Irish version of the arithmetic test, the English version to those who had taken the English version of the arithmetic test. Twelve minutes were allowed in which to complete the three-term relations test. Afterwards the number of problems which each child had solved counted and recorded as his score[1]. The number of scores in each of the four classes was made equal to 28 in exactly the same manner as the number of scores in the Irish-arithmetic investigation; and these scores were submitted to analysis

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1. These scores may not be distributed along an equal interval scale, and so the results obtained by analysis of variance are somewhat tentative.

of variance in which account was taken of differences between Schools, Classes and Languages. The components of the total sum of squares are given in table 9.7.

TABLE 9.7.

Analysed Mean Squares: Three-term Relations

Source	DF	SS	MS	F †
Schools (S)	1	2.6	2.6	
Classes (C)	1	35.5	35.5	
Languages (L)	1	40.1	40.1	
S x C	1	.7	.7	.099 (DF = 1 and 102)
S x L	1	52.2	52.2	7.36** " " "
C x L	1	3.9	3.9	.55 " " "
S x C x L	1	8.9	8.9	1.26 " " "
Within	102	723.4	7.09	
TOTAL:	109	867.3		

† A double asterisk after a variance ratio indicates that it is significant at the 1% level where $F \geq 6.90$ is significant; $F \geq 3.95$ is significant at the 5% level of probability.

Since the triple interaction, tested against MSw is not significant, the other three interaction components were also tested against MSw in preference to MSscl because of the greater number of DF. Only the interaction of

School and Language proved significant, and that highly so. The four mean scores involved in this interaction are as follows:-

School	English	Irish
Boys' School	10.32	7.82
Girls' "	8.71	8.82

The standard error of the difference between any pair of these means is .712[1], which shows that the difference within the girls' school is not significant, whereas that within the boys' school is highly significant[2]. These findings seem to show clearly that Irish caused considerable trouble to the boys but scarcely any to the girls[3]. The fact that girls fared equally well with the

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1. Obtained by replacing MS error in the formula

   $$SE = \sqrt{MS\ error\ \left(\frac{1}{n_1} + \frac{1}{n_2}\right)}$$ by MSw from table 9.7.

   Cf. Lindquist (1953) p.243.

2. $t = 3.51$, d.f. $= 102$. A $t \geq 2.58$ is significant at the 1% level of probability in this test.

3. Another way of looking at the means is to compare boys with girls; this brings out the fact that boys and girls do not differ significantly in mean score obtained with the Irish version, while the mean score obtained by boys with the English version is significantly greater than that obtained by girls. Thus the findings might be interpreted as indicating that boys were better able to deal with 3-term relations than girls, and girls had the better command of Irish.

two versions lends some support to our contention at the outset that the language of each is simple and familiar; thus the difference between boys' mean scores may be attributed with greater confidence to a difference in their command of the two languages. There is nothing surprising of course in finding that girls develop competence in a second language more quickly than boys, since it is most likely that they do so in the mother tongue[1]. These

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1. McCarthy (1954), p.577 summarises the evidence for a sex difference in linguistic development in these words: 'One of the most consistent findings to emerge from the mass of data accumulated on language development in American white children seems to be a slight difference in favour of girls in nearly all aspects of language that have been studied'. Towards the end of her section on sex differences Dr. McCarthy mentions the especially interesting work of Seidl (1937) in the following words: 'An unpublished study by Seidl (1937) showed that the Stanford-Binet scores of bilingual girls are apparently more depressed in comparison with their scores on the Arthur Point Scale of Performance Tests owing to their bilingualism than are the scores of a similarly selected group of bilingual boys'. These words seem to indicate that Seidl's findings are the opposite of our own. Actually, Seidl is at pains to show that the correlation between Stanford-Binet and Arthur IQs is low (see Seidl, p.73); therefore little can be inferred from the relative levels of mean IQs (verbal and non-verbal) obtained by bilingual boys and girls, and particularly little can be inferred about the linguistic skills of such boys and girls since the Stanford-Binet test is not primarily a test of language. Moreover Seidl found that girls' mean Stanford-Binet IQs in both monoglot and bilingual groups (N = 240) exceeded the corresponding mean IQs obtained by boys; suggesting, if anything, that both monoglot and bilingual girls had a better command of English than monoglot and bilingual boys respectively. However, Seidl's study touches on linguistic skill only incidentally, and it is best to treat its findings in that connection with extreme caution.

findings however do not indicate that the girls tested would have been as well able in Irish as in English to deal with a wide range of materials and relationships, but only with a very narrow one. Even over this narrow range the boys were less competent in Irish.

One interesting fact emerged from an item analysis of the children's work. The difference between the number of boys who solved problems presented in Irish and those who solved them when presented in English increases as we progress through the test; this was not true of girls. The fact can best be shown by summing numbers for each of the four forms of problem and comparing the results, which are set out in table 9.8[1]. The decrease in number as we go down the column for boys who took the test in Irish might be due to either of two possible factors - (i) to an increase in complexity of problem or (ii) to a slower pace of working on the part of the boys, which would have the effect that fewer of them than of the corresponding group of girls attempted the later problems. On balance the second is the more likely since no consistent

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1. The item analysis was carried out on the test sheets of all the children tested, 58 boys and 68 girls; hence the discrepancy in numbers between table 9.8 and table 9.7.

TABLE 9.8.

Three-term Relations: Item Analysis - by Sections.

Problem Nos.	BOYS			GIRLS		
	English	Irish	Eng-Irish*	English	Irish	Eng-Irish*
1-3	75	65	10	75	73	2
4-6	80	68	12	86	79	7
7-9	77	56	21	72	77	-5
10-12	81	55	26	70	72	-2
N**	29	29		34	34	

* Eng-Irish = the total in the English group minus the total in the Irish one.

** N = the number of children in each group who took the test. If we multiply this number by 3 we obtain the maximum number possible for any set of 3 problems.

tendency is observed for numbers to fall off in the other groups[1]. And if the main effect of Irish on these boys was

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1. At this point it is helpful to recall that the School x Language interaction in the Irish - arithmetic investigation fell far short of significance, indicating that the effect of increasing the complexity of the arithmetic in that test was the same for girls as for boys. Admittedly the tests are not quite parallel, but still if increasing complexity were a necessary and sufficient condition of the phenomenon we are discussing, we should expect it to have an observable effect on the number of girls taking the test in Irish who were successful.

to slow them down appreciably, it is reasonable to conclude that the speed with which they can solve problems involving any newly taught and still unfamiliar operation in arithmetic is reduced by the use of Irish, no matter how simple. Since it is extremely doubtful whether children can be set problems in a new operation, such as the use of the unitary method, in Irish as simple as that used in the three-term relation test, it is quite likely that the speed at which boys, at least, understand and solve these problems is reduced by Irish even more than their speed of understanding and solving the three-term relation problems. It seems likely, too, that if the speed at which children can understand problems is reduced by Irish, they do in fact experience greater difficulty in understanding them than if the problems were set in English; so we are brought back to the conclusion of the Irish-arithmetic investigation, i.e., the 'combined' difficulties of a second language and of arithmetic are greater than the difficulty of either 'on its own'. In short, the reduction of speed of understanding due to Irish, and the increase of difficulty due to Irish, may be merely different facets of the same phenomenon.

Supplementary Investigation III - Language of Thought.

Because of the evidence that the boys whose mother tongue was English solved problems set in Irish more slowly than if they had been set in English, the author attempted to discover whether such children translated the problem into English or thought it out in Irish. For the purpose, the 5th standard children in two Dublin schools, one a boys', the other a girls' school, were chosen. These two schools resemble those in which the first two supplementary investigations were conducted in that they are both situated in the same grounds and teach all subjects (English excepted) at all levels through the medium of Irish; but they differ from the previous two in that a higher proportion of their children come from the middle classes. The present writer took each of the 12 boys and 12 girls thus selected one by one, and set them three problems in Irish from the three-term relations test. When each had finished with the problems he was asked in Irish whether he had thought about them in English, or Irish, or partly in English and partly in Irish. Most of them seemed surprised by the questioh and all except one replied without hesitation that they had thought about them in Irish; the child who hesitated said he was not sure, but that he believed he thought about them in Irish. Moreover the investigator noticed that those of the children who muttered to themselves when working out the problems muttered in Irish. While this examination is simple in the extreme it is probably as effective as any which could be undertaken conveniently; and the writer sees no reason to doubt the children's word. Thus he is of the opinion that if children whose mother tongue is English have been taught through the medium of Irish for six years, many of them will have learned to think in Irish when presented a problem in Irish. Consequently if boys of this type solve problems presented in Irish more slowly than if they had been presented in English, the reason, he is inclined to believe, is not that they translate the problem into English and translate the answer back into Irish.

Supplementary Investigation IV: Fluency.

Still seeking a reason why boys should solve problems more slowly in Irish than in English, the author decided to compare the speed at which Irish and English words come to native-English speakers whose schooling has been through the medium of English. The test chosen is simply the one which occurs in the Stanford-Binet scale, i.e., the naming of as many words as possible within the space of one minute. As there is clearly a connection between the ability (or abilities, since the test was given in both languages) thus tested and Thurstone's primary mental ability of 'word fluency', the term fluency has been adopted to describe this ability. However, the author does not consider that this ability should be identified with the ability which Thurstone called 'word fluency', or with any of the subdivisions of word fluency proposed by such psychologists as John B. Carroll or J.P. Guilford.[1]

The children whose fluency was tested are those who were tested in supplementary investigation No. III. For the purpose of comparing these children's fluency with that of other 5th standard children whose schooling had not been through the medium of Irish, a further 24 boys[2] in a Dublin national school of the required type were tested. Each child was seen individually and asked to name all the

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1. There would appear to be a fair measure of agreement between the subdivisions proposed by these two authors. Carroll (1961), p.101, describes three as follows:- (i) fluency of expression = 'the ability of the individual to supply responses rapidly from among a series of possible alternative responses', (ii) ideational fluency = 'the ability to give a series of ideas rapidly', (iii) naming ability = 'the ability to name objects rapidly'. Since in the present writer's test, the stimuli or examples, given in the instructions, were all nouns, the children tested confined themselves to nouns for the most part; hence the ability which was tested would appear to approach closest to the third of Carroll's abilities, i.e., naming ability. However the two should not be identified because the present writer's test did not place any restriction whatever, explicitly at least, on the type of words to be named, whereas Carroll seems to have done so; and because there is no assurance that the ability used by a child to name words in one language is the same as the ability that he uses to name words in a second language, (that is if it does make sense to speak of 'the ability used by a child to name words').

2. These boys were selected at random from a 5th standard class which numbered 31 boys.

words he could think of in one of the languages, then after a pause he was given the same length of time to name all the words he could think of in the second language. In order to randomise the effects of practice and fatigue the language order was reversed from one child to the next, children coming to be tested in the order in which their names were entered in the roll. Instructions[1] were given orally in the language of the test which followed immediately and were repeated in translation before the second test. When the instructions had been repeated the child was told that he could name the 'same' or 'different' words in the second language. One mark was allotted for each word not named previously in the same langugage, and two scores were obtained for each child, i.e., the number of marks gained in Irish and the number gained in English. These scores were submitted to analyses of variance, account being taken of differences between <u>Schools</u>, <u>Languages</u> and <u>Language Sequences</u>, to test the hypothesis that children of the type who were tested are able to name as many words in one language as in the other in a given time. Table 9.9 contains the analysed mean squares.

The triple interaction component proving non-significant when tested against MSw, each of the other inter-

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1. The English version ran: 'I want to see how many words you can name in a minute. You must say them out loud so that I can count them. Any words at all will do, like 'window', 'table', 'pen', Ready? Begin'.

TABLE 9.9.

Analysed Mean Squares: Fluency.

Source	DF	SS	MS	F[x]
Schools (S)	2	571	285.5	7.71** (DF = 2,84)
Languages (L)	1	1060	1060.0	28.62** (DF = 1,84)
Language Sequences (LS)	1	75	75.0	2.02 (DF = 1,84)
S x L	2	8	4.0	.11 (DF = 2,84)
S x LS	2	97	48.5	1.31 (DF = 2,84)
L x LS	1	2	2.0	.05 (DF = 1,84)
S x L x LS	2	2	1.0	.03 (DF = 2,84)
Within	84	3111	37.04	
TOTAL:	95	4926		

x A double asterisk attached to a variance ratio signifies significance at the 1% level, a single asterisk signifies significance at the 5% level of probability. With 1 and 84 DF, Fs ≐ 3.96 and 6.96 are significant at the 5% and 1% levels respectively; with 2 and 84 DF, Fs ≐ 3.11 and 4.88 levels respectively.

action terms was also tested against MSw[1], and all proved non-significant. The absence of a significant Schools x Languages interaction is particularly interesting since it indicates that the ration of Irish to English scores

1. The use of MSw in these tests is preferable to the use of the triple interaction component not only because of the greate number of degrees of freedom which it affords but also because the latter term, which with MSw estimates the population variance, is so much smaller than the former, - being to that extent a less reliable estimate than the former.

does not vary between the three schools. One might have expected that Irish words would form a greater porportion of the total number of words named by children who have been taught all subjects (English excepted) through the medium of Irish than by children who have been taught Irish as a subject only; but such is not the case.

The mean square for Schools is highly significant when tested against MSw showing that the mean total number of words, Irish and English, varies from school to school. The school means are as follows:-

Schools	Boys* 1	Boys* 2	Girls
n	24	12	12
Irish	17.2	22.4	22.7
English	24.3	28.2	29.3

* Boys 1 = boys who have not been taught through the medium of Irish.

Boys 2 = boys who have been taught through the medium of Irish.

Clearly the reason for the significant mean square is the difference between the school denoted Boys 1 on the one hand and the schools denoted Boys 2 and Girls on the other. The latter pair of schools are situated in the same grounds and draw their pupils almost exclusively from the middle classes, whereas the proportion of middle class children in the former school is much smaller. Perhaps the significant mean square for schools should therefore be attributed in part to socio-economic differences.

The Languages mean square is also significant when tested against MSw, while the Language Sequences mean square falls far short of significance. Thus we may disregard any observed differences between scores obtained with the two language sequences in interpreting the significant Languages mean square[1]. The means for Irish and English are 19.9 and 26.5 respectively, showing that on the average the children named Irish and English words in the ratio of 3 to 4 approximately.

If a child obtained a higher English than Irish score, immediately after the test he was asked if he could explain the difference. The majority said that they did not know the reason, but three children said that they sometimes failed to remember the Irish word for things which they noticed about them during the test. For instance one girl said that she could not remember the Irish word for 'ashtray' and 'fireplace', giving the Irish words as she spoke. Asked whether they had translated

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1. It is interesting to note that Johnson (1953) had similar findings when he tested 30 Spanish-English bilinguals (ages 9 to 12) in the USA in a manner similar to ours, except that he allowed 5 minutes in which to name words in each of the two languages. Varying the language sequences made no difference to the results.

English words into Irish during the test, all the children said they had not. Such evidence as can be gleaned from the children's introspections therefore suggests that the Language difference came about simply because English words came to them more rapidly than Irish ones.

In view of the fact that the relative fluencies (in our sense of the word fluency) of bilingual children in their two languages has been so little studied[1] it is difficult to interpret the significance of our findings precisely in psychological terms. Nonetheless it does seem likely that even when children have been educated through the medium of Irish for six years, English still comes more readily to them than Irish. Thus if they are using Irish in their thinking they probably think more slowly than if they were to use English, since the words come to them more slowly. Moreover for the same reason they probably express themselves, whether orally or in writing, with greater difficulty in Irish than in English. We have little evidence about the relative speeds at which they comprehend Irish and English, but it seems probable that they comprehend English more rapidly.

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1. Lambert (1956) used a similar procedure to ours with English-French bilinguals in Canada, and he found that the number of words named in the second language increases with the experience people have in using that language.

The findings of the fluency test help to explain some of the previous findings. For instance, part of the reason why the children of linguistic group 5 are weaker at problem arithmetic than children in groups 1 to 4 is probably that they think out problems more slowly, not only during arithmetic tests but at all times. If we are correct in extending the conclusion of the fluency test to the comprehension of language, the children of group 5 follow their teacher and the language of arithmetic problems more slowly since Irish is the language used. One elderly teacher, who had taught arithmetic in English for some years before he was persuaded to teach it in Irish, remarked to the writer that in his experience the difficulty of children whose home language is English in following arithmetic problems presented orally in Irish and in discussing them in Irish is so great that problem arithmetic tends to be neglected and mechanical arithmetic emphasised when arithmetic is taught in Irish. Though he did not mention speed either of comprehension or of expression, it seems clear that a slow rate of either or of both in Irish would impede the work of teacher and pupil alike[1].

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1. Other factors might also make their work more difficult, such as, lack of Irish vocabulary or poor command of Irish syntax, but up to the present, the writer has not had an opportunity to investigate these aspects in a satisfactory manner. But see note 1 on p. 402 below.

The significant Languages mean square in the fluency test arises when comparing children's Irish and English scores; and if a child's English score may be taken as an indication of the normal speed at which words come to him, the difference between his Irish and English scores indicates the extent to which he is slowed down when recalling Irish words. The slowing down may be a symptom that the child is experiencing a general increase of difficulty in expressing himself in Irish as compared with English, and that he is devoting more of his attention to language and less to the arithmetic problem than if he were using English. This may partly explain why the children in linguistic group 5 are weaker at problem arithmetic than those in the first four groups. It may also be part of the reason why in the Irish - arithmetic investigation an increase of difficulty in the arithmetic was accompanied by a greater fall in the number of problems which children who took the test in Irish solved compared with the falling off in the case of those who took the test in English.

The findings of the fluency test do not, however, help to explain those of the three-term relations test. The latter were thought to show that boys could not solve the problems as quickly when they were presented in Irish as when they were presented in English; whereas girls were equally quick in either language. But the fluency test reveals no significant difference between the sexes[1], and so cannot help to explain the findings of the three-term relations investigation. Perhaps the latter findings might be due to a sex difference in the command of vocabulary or syntax, but so far these have not been adequately studied.

Summary of Findings about Arithmetic.

Item analysis has revealed that the superiority of linguistic groups 1 to 5 over group 6 in mechanical arithmetic, which was established by analysis of covariance, is not confined to any particular type of sum, but that it is more marked in sums which involve change of units (money sums and sums involving weights and measures particularly) than in sums which involve no more than elementary computation. Item analysis has also revealed that the superiority of groups 1 to 5 over group 6 in problem arithmetic - also established by analysis of covariance - is general, and probably not more marked in any one type of problem than another.

Similarly, the superiority of groups 1 to 4 over group 5 in problem arithmetic - established by analysis

1. The standard error of the mean difference between the boys' and girls' school which are situated in the same grounds is 1.76. The reader will see by referring to the means on p. 392 that neither the Irish nor the English pair of means differ significantly.

of covariance - is not confined to any particular type of problem, being as marked, apparently, in problems involving only elementary computation as in those which involve more complex arithmetical operations. The former's superiority is attributed to the fact that they had been taught arithmetic through the medium of their mother tongue[1], whereas the latter had been taught through the medium of their second language, Irish. A series of investigations was carried out to examine why teaching arithmetic through the medium of Irish should have this effect. Leaving aside difficulties with vocabulary - and there is some evidence[2] that the Irish vocabulary of children like those in group 5 is very much smaller than their English vocabulary - and syntax, some evidence was obtained that Irish, even when understood, makes problem arithmetic more difficult for the children of group 5 than it would be if it were taught in English. There is convincing evidence that these children think in Irish when presented a problem in Irish, but this may increase their all round difficulty with problems - the evidence that they are less fluent in Irish than in English is also convincing. It was

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1. Though three of the first four linguistic groups had been taught arithmetic through Irish for varying numbers of years it is important to bear in mind that by and large children in Irish national schools are not given written problems to solve before 3rd standard, so, in fact, of the four only linguistic group 4 would have had any experience of such problems in Irish.

2. See below, p. 402 note 1 .

suggested that lack of fluency may not only slow down a child's thought processes, but increase the 'amount of attention' which he must devote to language and decrease the amount he has to devote to the problem and to the necessary arithmetical operations. The three-term relations investigation, undertaken to study how children such as those of group 5 fared with an unfamiliar type of problem presented in simple Irish, showed that boys, but not girls, who took the test in Irish solved significantly fewer problems than those who took it in English. This was taken as indicating not that these girls were equally capable of solving problems whether presented in Irish or English, but that the boys were less able to solve them even when the Irish was as simple as that used in the three term relation test. There were indications that part of the reason why boys solved fewer three-term relation problems in Irish was that they worked more slowly in Irish than in English; which fits in with the findings of the fluency investigation.

These difficulties of children whose mother tongue is English with problem arithmetic taught in Irish are really difficulties for their teacher as well. Almost certainly it is more difficult for him to discuss problems with his class in Irish than in English. It is at least possible, as one teacher remarked to the writer, that he will, perhaps unconsciously, devote more of the arithmetic period to mechanical, less to problem arithmetic, than if he were teaching through the medium of English. Indeed, taking all things into consideration the surprising thing is that the children of group 5 are as good as they are at problem arithmetic.

Item-Analysis: Irish.

Each of the six linguistic groups differed significantly from the others in mean GQ. For this reason the findings of item analysis of each group's work in the Irish test will be considered here.

Questions in the Irish test fall into six types. Those of the same type were grouped together and the mean proportions of children giving the correct answers to each were calculated the better to grasp each group's strengths and weaknesses. These mean proportions are recorded in table 9.10.

The most striking feature of table 9.10 is that differences between groups 5 and 6 (mother tongue Irish) are not as great as those between groups 5 and 1. Thus, for example, the same mean proportion of children in groups 5 and 6 gave the correct responses in the vocabulary items, whereas there is a difference of .14 between groups 5 and 1. This almost certainly shows that though the test succeeds in discriminating between children's knowledge of Irish

TABLE 9.10.

Mean Proportion in Each Linguistic Group
Giving Correct Response to Questions
of 6 Types in the Irish Test.

Type of Question	Question Nos.	Group 1	2	3	4	5	6
1. Comprehension of Prose	7-11,18-23, 31-37,43-48, 52-56,65-70.	.21	.22	.22	.23	.29	.26
2. Vocabulary	1-6,15,17,38, 39,41,49-51.	.35	.37	.37	.43	.49	.49
3. Spelling	24-30	.14	.15	.14	.20	.22	.23
4. Comparatives of Adjectives	57-64	.02	.02	.02	.04	.05	.05
5. Use of Prepositions	13,14,16,40, 42.	.29	.31	.29	.38	.42	.51
6. Use of Adverbs	12.	.54	.56	.51	.71	.71	.68
N. in group		160	188	215	170	195	155

vocabulary provided they learned their Irish in school, it does not show up the superiority of children whose mother tongue is Irish[1].

Prepositions are inflected in Irish, and the figures in table 9.10 show group 6's superior grasp of the complex prepositional system; though once again the mean difference between groups 5 and 6 is not as great as that between groups 5 and 1. Surprisingly enough the mean proportion for group 5 in the Comprehension of Prose (the ability to read a passage of prose and answer questions testing knowledge of what has been read) is slightly higher than that for group 6; which shows that the former

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1. The author attempted to compare the Irish and English vocabularies of boys and girls in two Dublin schools where all subjects (English excepted) are taught in Irish at all levels, (the same children as those who took part in the fluency investigation). Each of the 12 boys and 12 girls were shown some of the Macmillan Geography Pictures, which they had never seen before, and asked to name 56 objects first in Irish, then in English. The 20 objects which were most familiar (named in English by 19 or more of the 24 children - but the same objects would have been selected had the sum of correct responses in Irish and English been the criterion) were: bridge, net (fishing), lifeboat, sea-gull, wave, whale, wire, sledge (snow), furs, shoot (verb), lamp post, log, palm tree, crane, cement (noun) traffic, crossroad, factory, airport, railing. The number of correct responses given in Irish was 147, the number in English was 430, which can be simplified by saying that the children gave about three times as many correct responses in English as in Irish. Unfortunately the test does not estimate the vocabularies of the children in the two languages very accurately (the experimenter's aim was to assess one aspect of the difficulty of teaching such children Geography through Irish) since the choice of words is for the most part arbitrary; but it does indicate that their English vocabulary is very much greater than their Irish one. It is almost certain that the Irish vocabulary of the children in linguistic group 6 is very much larger than their English one, and that their Irish vocabulary is larger than that of children in group 5. The Irish test used in the main survey failed to reveal this, but possibly the reason lies either in the particular items used or in the general style of the test.

have gained a very good reading knowledge[1] of the language. It should be noted however that nearly all the items of this type are extremely simple, as for example No.7 which runs in English, 'Who was sitting beside the lamp?', the key sentence in the prose passage being 'Dad was sitting in his own chair beside the lamp reading the paper'. The reader need but compare this item with the first set of items of the same type (Nos. 1 - 6) in MHE14[2] to appreciate that the latter are more difficult and complex. It would probably have been possible to select passages of prose and frame questions which tested comprehension of subtle idiomatic expressions which would have revealed a

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1. When interpreting the figures given for Comprehension of Prose we should bear in mind that reading items are scattered throughout the test and that the time limit reduced those figures well below what they would have been had the test been untimed. Nevertheless, the grounds for the statement in the text are not so much the absolute size of the figure obtained by group 5 as its size relative to the figure which group 6 obtained.

2. A copy of MHE14 may be seen in Appendix 2.3.

superiority on the part of group 6[1]; but such questions would have been too difficult in a test which was prepared principally for use with children whose mother tongue was English.

In general it can be said that group 5 have acquired a remarkable knowledge of Irish, equalling native speakers of that language in some of the skills tested by the Irish test. The only important difference between groups 5 and 6 which the test reveals is in command of prepositions, but even here the difference is not great. The other four linguistic groups, considering that they are all composed of native English-speakers, also compare

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1. For example, item No.35 of MHE14 asks the candidate to give the meaning of 'was as good as his word' as used in a prose passage. Lado (1961) p.196 says: 'The figures of speech formerly taught in courses of rhetoric represent some of these uses (extensions of the meaning of words etc., which should be used in language tests). The point is that we have not made sufficient use of this fact of language in foreign language tests of vocabulary'. His words apply with equal force to phrases. But the trouble with many such items is that they test reasoning ability as much as command of language.

The only items in the Irish test which approach the above item from MHE14 in subtlety are Nos. 46 and 66. The latter occurs too late in the test to be of much help to us, but the proportions of children in groups 5 and 6 who gave the correct answer in No. 46 are .14 and .19 respectively; which tends to bear out the point made in the text. Item No.46 asks for the meaning of 'Bhí an tine beagnach as' (the fire was nearly out) which extends the normal meaning of the preposition 'as' (out) to bear the same meaning as the preposition 'out' in the equivalent English expression - indeed the Irish expression appears to be an example of linguistic ~~interfeepnce~~ interference from English, and therefore not a very suitable one ~~which~~ with to test the hypothesis which we have been discussing.

favourably with group 6, though not so favourably as group 5. Finally it is necessary to add a note of warning. The Irish test does not test all linguistic skills, or even all important ones since for example it can scarcely be said to test ability to speak the language; other skills it probably does not test adequately, such as command of vocabulary. For these reasons it would be foolish to conclude from the evidence which is to hand that any of the first five linguistic groups have a native-like command of Irish.

Item-Analysis: English.

Analysis of covariance revealed no significant differences between the five linguistic groups of children whose mother tongue is English, but it revealed a significant difference between these five groups taken as a whole and group 6 (mother tongue Irish). For this reason only two sets of figures obtained by item analysis of the children's work in the English test will be presented and discussed, those for the first five linguistic groups taken as a single body and those for group 6.

Questions in MHE14 fall conveniently into eight different types. The mean proportions of children who gave the correct answers to each type was calculated in order that the relative strengths and weaknesses of native Irish and native English-speakers might be revealed more clearly.

TABLE 9.11.

Mean Proportion of Children Who Gave Correct Responses to 8 Types of Questions in MHE 14.

Type of Question	Nos. of Questions	Groups 1-5	Group 6	Britain
1. Comprehension of Prose.	1-6, 34-38, 51-56, 82-87	.25	.12	.49
2. Correct Usage[1]	7-12, 88-94	.24	.14	.50
3. Spelling	13-19, 57-62, 95-101	.13	.08	.30
4. Vocabulary	20-33, 70-75, 102-114	.18	.09	.46
5. Pronunciation[1]	39-45	.24	.15	.54
6. Abstract Nouns for Adjectives[1]	46-50, 76-81	.12	.05	.33
7. Poetry[1]	63-69	.22	.12	.56
8. Meaning of Phrases	115-120	.02	.00	.28

1. 'Correct usage'- for example item No.7 asks the child to underline the correct word in the brackets in the following sentence: 'We have spoken (to / too) long about this; there (is/are) other things to talk about'.
'Pronunciation' is tested by the ability to pick out words which rhyme with a key word.
'Abstract Nouns for Adjectives' is the name we have given to two types of closely related items those which ask the child to form an adjective from an abstract noun, e.g., 'British' from 'Britain' (No.76); those which ask him to form an abstract noun from an adjective, e.g., 'truth' from 'true' (No.46).
'Poetry' - these items test ability to select words of the correct rhythm, meaning and in some cases rhyme to fit into the lines of a poem.

The nature of each type and the figurescalculated are set out in table 9.11; the corresponding figures for the children (N = 254) of one L.E.A. in Britain who took the test in 1941 are given in the column on the extreme right.

Table 9.11 suggests that the native English speakers' (Ireland) advantage is not limited to any type of item, but there are indications that it is more marked in some types of item than in others. However the issue is somewhat confused by the fact that some of the items of a particular type occur late in what is a very long test; and if there were a difference in the speed at which the two types of children worked, it might obscure differences between them in the ability to deal with questions of a particular type. For this reason a second table, 9.12, was prepared giving the mean proportions of children who gave correct answers to each lot of questions of a particular type. This was possible because questions of a type are grouped together in the test in lots ranging in number from 5 to 14.

Table 9.12 confirms the view that the advantage of native English-speakers (Ireland) is not confined to any type of item; but it shows that although their advantage is maintained throughout the test, it is more marked towards the beginning where all the items must have been attempted by almost all the children.

TABLE 9.12.

Mean Proportions of Children Who Gave Correct Answers to each Lot of Questions of a Particular Type

Type of Item	Question Nos.	Groups 1 - 5	Group 6	Difference	Britain.
1. Comprehension of Prose	1 - 6	.42	.22	.20	.69
2. Correct Usage	7 -12	.44	.26	.18	.64
3. Spelling	13 -19	.30	.18	.12	.46
4. Vocabulary	20 -33	.30	.15	.15	.57
5. Comprehension of Prose	34 -38	.23	.11	.12	.41
6. Pronunciation	39 -45	.24	.15	.09	.54
7. Abstract Nouns for Adjectives	46 -50	.17	.08	.09	.39
8. Comprehension of Prose	51 -56	.24	.12	.12	.50
9. Spelling	57 -62	.07	.04	.03	.29
10. Poetry	63 - 69	.22	.12	.10	.56
11. Vocabulary	70 -75	.21	.09	.12	.58
12. Abstract Nouns for Adjectives	76 -81	.07	.02	.05	.27
13. Comprehension of Prose	82 -87	.09	.04	.05	.35
14. Correct Usage	88 -94	.08	.04	.04	.37
15. Spelling	95 -101	.02	.01	.01	.15
16. Vocabulary	102 -114	.04	.02	.02	.28
17. Meaning of Phrases	115 -120	.02	.00	.02	.28

For this reason we obtain from table 9.12 a better idea of the superiority of native English-speakers (Ireland) to native Irish-speakers than from table 9.11. The former's superiority seems more marked in Comprehension of Prose and Correct Usage, and less so in Spelling and Pronunciation; though the evidence for all this is slight, and may be a function to some extent of the position of these items in the test. It is interesting to recall that these findings are in general agreement with those of the majority of bilingual studies reviewed in chapter 2. Our conclusion there was that monoglots are superior to bilinguals in all the linguistic skills studied except spelling and power of expression as measured by length of response and length of phrase[1].

What we mainly discover from the item analysis is that children in Irish-speaking districts are very much weaker at all aspects of English which are tested by MHE14 than children in the English-speaking districts of Ireland, and weaker still than children in Britain. Thus native-speakers of Irish are ill-equipped indeed, by the time they come towards the end of primary school, for life in what will be for many of them an English-speaking world.

The position of children in the English-speaking

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1. See above, p. 80 .

districts of Ireland is also serious, though not so serious as that of children in Irish-speaking ones. The former's inferiority in mean EQ to British children, discussed in chapter 8, is discovered in table 9 to be a general inferiority in English attainment, though less marked in spelling than in the other aspects of English tested in MHE14. All the Irish children tested were bilinguals, so this study and the majority of studies reviewed in chapter 2 mutually support each other - bilinguals are inferior to monoglots (British children) in nearly all the linguistic skills in which they have been compared. In chapter 8 evidence was educed showing that the most likely factor producing the difference between Irish and British children in English attainments is a time one. Most British schools devote more than twice as much time as Irish schools to developing children's command of English. Here then are findings of the utmost importance in relation to the policy of reviving Irish and its influence on Irish national school children.

Chapter 10

SUMMARY AND CONCLUSIONS

The investigation which is the subject of this thesis was conducted with two main aims in mind: (i) to discover the effect on arithmetical attainments of teaching arithmetic through the medium of Irish to children from English-speaking homes; and to determine whether their attainments in Irish and English are affected by the language used in teaching arithmetic; (ii) to discover the effect of the entire official programme for reviving Irish on the level of English attainments in national schools. Investigations have frequently been carried out in other countries of the progress which bilingual children make in either or both of their languages, and of their progress in arithmetic, but none has previously been made, on a large scale, in Ireland. The bulk of the work which has been done elsewhere reveals that bilingual children, by and large, know neither of their languages as well as monoglot speakers of those languages; and that bilingual children generally are excelled in problem, but not mechanical, arithmetic by monoglots. However, the findings of research on bilingualism, like the findings of any research, can be applied to situations other than those in which they were obtained only if the condition, ceteris paribus, is satisfied. In the field of bilingualism it never is. The Report of the Central Advisory Council for Education (Wales)[1] on bilingualism in Wales indicates why the condition is unlikely to be satisfied: the age at which children are introduced to their second language varies; the attitude to the two languages, whether favourable or hostile, of persons with whom the children are in close contact varies; 'the educational, administrative, economic, political and social conditions of contact between the two languages'[2] vary; and the degree of similarity between the two languages varies, for example from Italian and Spanish which are romance languages to English and Chinese which are not even of the same linguistic stock. Thus the only way to determine the effects of bilingualism in Ireland (which incidentally is for the most part a 'scholastic bilingualism'[3] unlike the bilingualism which has most frequently been studied) is to carry out an investigation in Ireland. However, though the findings of research on bilingualism in other countries do not

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1. Ministry of Education (1953)

2. Op. cit., p.41

3. That is, bilingualism in which the second language is acquired in school only.

necessarily apply in Ireland, our own work has profited from the experience of workers in other countries. Apart from the fact that the majority of previous findings in a general way support, and are supported by, our own, previous research indicates, if only by its defects in some cases, the factors which must be controlled, and the best available means of doing so, in order to reach a fair conclusion.

The present investigation was carried out in 5th standard in national schools which is the highest standard from which a complete cross-section of national school children can be drawn. By confining the investigation to national schools, some 10% or 11% of children, those who attend private sbhools, were excluded. This was done mainly for practical reasons. Instead of a standard an age-group might have been chosen. But the disadvantage of working with an age group would have been enormous, because the eleven-plus group, for example, is scattered throughout all classes from infants to 8th standard. Admittedly children in 5th standard range in age from eight to sixteen years; but the effect of variation in age is more easily controlled than the effect of variation in class.

Twenty schools of each of the following types were selected at random from all the schools of that type:

type 1 - arithmetic taught through Irish to no class

type 2 - arithmetic taught through Irish to infants alone

type 3 - arithmetic taught through Irish up to 1st standard inclusive.

type 4 - arithmetic taught through Irish to 3rd standard inclusive

type 5 - arithmetic taught through Irish to 5th standard inclusive

type 6 - schools in Fíor-Ghaeltacht districts.

(The schools of types 1 to 5 are all in English-speaking districts).

The geographical distribution of the schools of each type selected, the numbers of boys and girls they contained, the number and qualifications of the teachers, and the class room accommodation, were studied and compared to see (i) whether the samples of the six types of school were matched in these respects and (ii) whether the schools of each type were a cross section of the national schools of the country. The disparities which were discovered between the samples of schools of each type, and between the samples taken either individually or together on the one hand and Irish national schools in general on the other, indicated that the samples were to some extent unsatisfactory for our purpose. So a second selection of schools was made with the aim of reducing, if not removing, those disparities. This was effected by rejecting from each sample the schools last selected which gave rise to the disparities, and replacing them by ones of the required description selected at random. At the conclusion of this procedure the six 'groups' were fairly closely matched. Group 5 however appears to have a slight advantage, (i) because a larger proportion of its schools are situated in counties (West) which traditionally take a keen interest in education and in competitive examinations; (ii) because it comprises a greater proportion of trained teachers than the other groups.

The sample as a whole, or rather the 99 schools in groups 1 to 5 appear to be a good cross-section of national schools. However, they contain (i) too few 1-teacher schools, and (ii) too many trained, too few untrained, teachers to be strictly representative of Irish national schools. Both of these disparities are likely to result in slightly higher mean attainment scores than if the sample had been drawn entirely at random.

The following tests were administered: Schonell's Essential Problem Arithmetic Test (SPA), his Essential Mechanical Arithmetic Test (SMA), a test of Irish, Moray House English Test 14 (MHE 14), and Jenkins' Non-Verbal Reasoning Test 1 (N-VR). Ratings were obtained for each child on a seven-point scale of socio-economic status. A common rating on a five-points scale of teachers' skill as teachers was obtained for each school. Complete sets of scores and ratings were obtained for 1083 children, i.e., all but a tiny percentage of the 5th standard children who were in school on the day just before Easter 1961 when the local inspectors came to administer the tests.

N-VR quotients (X_1), the socio-economic ratings (X2), and the ratings of teaching skill (X_3), were employed as indépendent variates in regression and covariance analyses of the data. It was hoped that any bias which might otherwise disturb inter group comparisons might thus be eliminated. Bias, or the possibility of bias, arising from uncontrolled differences in initial ability, in home background, and in schooling, has bedevelled much of the work done on bilingualism. N-VR was shown, with a fair degree of probability, to be independent of linguistic home background. It is at least equally probable that it is independent of the language used as teaching medium in school. It is almost certain that ratings on the socio-economic scale are independent of both these variables. The inspectors' ratings of teaching skill, however, may not be entirely independent of the language used by teachers in school; yet apart from explaining the purpose of the ratings to the inspectors nothing was or, it seems, could have been done to ensure the 'independence' of those ratings.

For native-speakers of Irish (group 6) Irish translations of N-VR and the socio-economic questionnaire were prepared. The Irish version of N-VR was compared for difficulty with its original in two investigations. The first of these revealed no significant difference in difficulty between the versions. The second, however, carried out with Dublin boys who had been taught all subjects, English excepted, through the medium of Irish throughout their time at school, revealed that such children are likely to find the Irish version slightly more difficult than the original. It was argued that children who had an equal command of Irish and English (the Dublin boys mentioned were native-speakers of English) would not find one version more difficult than the other.

For the children of groups 5 (all subjects, English excepted, taught through Irish at all levels) and 6, SPA and SMA were translated into Irish. The latter was easily translated because the test is almost entirely non-verbal. The translation of SPA was compared with the original in a series of investigations none of which revealed a significant difference in difficulty between the two versions.

Two obstacles had to be surmounted before the scores and ratings which we have been discussing could be analysed as required. The <u>first</u> was occasioned by the great number of very low raw scores in English and non-verbal reasoning. Because of these it was necessary to calculate new conversion tables to be used in converting raw scores to normalised quotients. In constructing these tables, and a similar one for the Irish test, the wide age range of 5th standard children presented a difficulty, which was increased by the fact that the regression of raw score on age was negative, in Irish at least, - a result of working with a standard rather than an age group. However the difficulty was overcome, successfully it is reasonable to hold, by adopting the age allowance of the British conversion table for N-VR between the ages of ten and thirteen years, by progressively reducing the allowance from thirteen to fourteen, and by making no further allowance above fourteen years of age. The second obstacle consisted in the fact that about half the schools of groups 3 and 4 registered themselves as teaching arithmetic bilingually (Irish and English) in those standards in which the other half registered themselves as teaching arithmetic through English. These two sorts of school in group 3 were compared for attainment in problem arithmetic in two analyses of covariance, one of boys' the other of girls' AQs. Non-verbal reasoning quotients were employed as independent variates. The mean difference was not found to be significant in either analysis. Now group 3 is the group, and problem arithmetic the attainment, in which a difference was most likely to be revealed between schools which taught arithmetic bilingually and those which taught it in English over the same period. So the distinction between these two sorts of school was ignored in the main analyses.

In the main analyses each of the four sets of criterion scores (SPA, SMA, Irish, MHE 14) was analysed in conjunction with non-verbal IQs (X_1), socio-economic ratings (X_2), and ratings of teaching skill (X_3). Differences between linguistic groups 1 to 5 were quantified and included in the analyses as X_4, a variate which has the value 0 for each child in group 1, the value 1 for each child in group 2, ..., the value 4 for each child in group 5. To test the linearity of the regression of each set of criterion scores (Y) on X_5, which has the value 0 for each child in groups 1 to 4, and the value 1 for each child in group 5. A significant $b_{y.x_5}$ indicates that the regression of Y on X_4 departs from linearity at the point where X_4 has the value 3; in which case $b_{y.x_4}$ measures the regression of Y on X_4 over groups 1 to 4, and $b_{y.x_5}$ measures it from group 4 to group 5. If $b_{y.x_5}$ is not significant, $b_{y.x_4}$ measures this regression over all five groups.

In all except two of the analyses of the main data group 6 (native-speakers of Irish) was omitted because group 5 already occupied the only position on the scale, X_4, which group 6 might have occupied, i.e., $X_4 = 4$. In both of these groups all subjects, English excepted, were taught through Irish to all classes. Moreover, group 6 obtained very low mean Ys in all subjects except Irish.

So even if it could have been included, by assigning X_4 the value 5 for each child in the group, the regression of Ys on X_4 would have been complicated in a way which would have been difficult to control. However the data for group 6 were analysed separately, and also in combination with the data obtained from the other children. In the second of these analyses however X_4 and X_5 were omitted.

In the analyses of data from the first five linguistic groups (N = 919) account was taken of differences between West and Rest, between boys and girls, and between 2-, 3-, and more-than-3-teacher, schools. The data from 1-teacher schools were omitted, because the number in them, 9 children in all, was too small for the type of statistical treatment which was carried out.

An examination of the data, to see whether the conditions underlying regression and covariance analysis are satisfied, revealed heterogeneity of regression in many sections. This was attributed principally to unexplained heterogeneity of variance in those sections. Thus two of the conditions are not satisfied; but, it was thought, the others most probably are. The heterogeneity of regression and variance just referred to is over the twelve subdivisions mentioned above. It was argued that its existence was for some unknown reason caused by the particular subdivisions made, and that these subdivisions might be combined again into one large group and valid analyses of the data for this group carried out. It was argued further that the sensitivity of the tests which analyses of the data as a whole make possible can be increased if differences between subdivisions are taken into account. So the data as a whole were analysed in this way. However those sections of the data in which the condition of homogeneous variance is satisfied were also analysed separately. The remaining sections were further subdivided and analyses of each subdivision were carried out. The findings of all these, and of item analyses of the 1083 children's test papers, will now be summarised under the four subject headings.

Problem Arithmetic.

The most consistent finding of regression analysis is a negative and significant $b_{y.x_5}$ for SPA quotients, which can be interpreted as indicating that the first four linguistic groups excel group 5 in problem arithmetic - by about 11 months arithmetic age on an average. As work on written problems in arithmetic does not generally begin in national schools before 3rd standard, linguistic groups 2 and 3 had probably never been given such work in Irish. Group 4 had one year's experience of it, after which they switched to English. All group 5's work in problem arithmetic, in school at least, was in Irish. The mean difference between the first four linguistic groups and group 5 is attributed to the difference in medium of instruction; though this conclusion is necessarily tentative in view of the fact that much of the variance of Y is not controlled by the Xs. However the conclusion is supported by the bulk of comparable research in other countries.

The analysis of data from all six linguistic groups showed that the first five groups combined obtained a significantly higher mean SPA quotient than group 6 (native-speakers of Irish).[1] At the present time native-speakers of Irish are nearly all bilingual (Irish and English) to a greater extent than even the children in linguistic group 5 (all subjects, English excepted, through Irish in all classes) in the sense that the former hear and speak more of the second language than the latter. Thus this comparison is between children who are more and children who are less bilingual; the finding is in keeping with that of comparisons between the first five

1. Groups 5 and 6 did not differ significantly in adjusted mean SPA quotient.

linguistic groups, and in keeping too with those of the majority of comparable investigations in other countries.

Item analysis of SPA papers discovered that group 5's weakness in problem arithmetic, compared to the first four linguistic groups, is a general one not confined to any type of problem, and scarcely more marked in one type than another. Item analysis also revealed that group 6 was weaker than group 5 at all types of problem.

Mechanical Arithmetic.

No loss or gain in mean mechanical arithmetic quotient appears to be associated with teaching children from English-speaking homes through the medium of Irish, except in the case of girls in the Rest. The coefficients for these girls show unexplained tendencies:[1] (i) for an increase in the time during which arithmetic was taught through Irish to be associated with a mean increase in SMA quotient over the first four linguistic groups; (ii) for the increase in time during which arithmetic was taught through Irish from group 4 to group 5 to be associated with a large drop (14 points) in mean SMA quotient. However the multiple regression is extremely heterogeneous over the three subdivisions of this section, and the anomaly just noted may be the result of it. In these analyses, too,

1. The coefficients for SPA show similar tendencies.

the Xs failed to control much of the variance of Y. In particular, differences between schools and teachers do not appear to have been adequately controlled.

Though they do not concern us directly, we may note the mean differences, adjusted in covariance analysis, between the twelve subdigisions of groups 1 to 5 are not significant in either problem or mechanical arithmetic.

Analysis of covariance revealed that when the SMA means for groups 1 to 5 combined and group 6 were adjusted for mean differences in X_1, X_2, and X_3, the first five groups excel group 6 by a significant 5 points of quotient approximately. Thus children who were less bilingual excelled in mechanical arithmetic children who were more so; a finding which is unusual in studies of bilingualism. However the greater part of the Y variance was not controlled by the independent variates, so we cannot confidently attribute the difference in SMA means to differences in linguistic skills.

Item analysis revealed that the superiority of groups 1 to 5 over group 6 in mechanical arithmetic is not confined to any particular type of sum, but that it is more marked in those which involve change of units (money sums, and sums involving weights and measures, especially) than in those which involve no more than elementary computation.

Irish

In the main analysis of data from groups 1 to 5 a significant tendency was observed for mean Irish quotient to increase with the number of years during which arithmetic was taught through the medium of Irish. This analysis yielded no evidence that group 5 excelled group 4 by any more than group 4 excelled group 3, etc. This is surprising because it seems to indicate that group 5's advantage in Irish, which appears to result from the former's being taught all subjects, except English, through Irish throughout their school lives, is no greater than the advantage of group 4 over group 3, which appears to result from group 4's having been taught arithmetic alone through Irish for two years longer than group 3. At first sight the findings might be attributed to the fact that apart from English and Irish there is very little else on the secular curriculum of Irish national schools. However, further analyses point to a different explanation.

Analysis of covariance showed that children in the West obtained a significantly higher mean quotient in Irish than children in the Rest. The best explanation of this which could be found is that the Department of Education requires a higher standard of Irish in the West than in the Rest. Analysis of covariance also showed that the twelve subdivisions differed significantly in mean Irish quotient. Inspection of the adjusted means suggested that, apart from the difference between West and Rest, there was a tendency for girls to score higher than boys; for children in 3-teacher schools to score higher than those in 2-teacher schools; and for children in m-teacher schools to score lowest of all. Differences in home background were suggested to explain the observed differences between children in the three sizes of school; but for the most part it is unexplained. That girls excel boys in linguistic skills is quite a common finding.

In relation to all the above findings for Irish, as for those to be outlined below, it must be noted that the major portion of the Y variance was not controlled by the independent variates, so it is particularly difficult to establish causal connections between suggested factors and the observed results.

Further regression analyses carried out with subdivisions of the data brought to light a finding of considerable interest. Higher Irish quotients, for both boys and girls, are associated with the use of Irish as teaching medium in the Rest, but not in the West. The most probable explanation of these findings is that in the Rest the teachers who teach <u>through</u> Irish are generally better teachers <u>of</u> Irish than those who do not teach through Irish. There seems to be no such distinction between teachers who teach through Irish and those who do not in the West. The reason for all this is probably that the Department of Education has brought greater pressure to bear on teachers in the West than on those in the Rest to teach through Irish; the idea being that the revival of Irish must spread from Irish-speaking districts through neighbouring English-speaking districts to other parts of the country. One result of the policy, as we noted when discussing the geographical distribution of the various types of school, is that more teachers, proportionately, teach through Irish in the West than in the Rest. And it is quite likely that the ones who do are neither more interested in Irish nor better equipped to teach it, or to teach through it, than those who do not teach through Irish. From the statistical point of view these findings indicate that differences between schools and between teachers have not been adequately controlled by X_3, (inspectors' ratings of teaching skill). It must be noted however that the control of these variables appears to have been greater in the case of Irish than of any other attainment. This reflects at once the preponderance of time devoted to teaching Irish compared to any other subject, and the importance attached by inspectors to the teaching of Irish.

Notwithstanding, variations between schools and between teachers do not appear to have been adequately controlled. This may partly explain an anomaly in the findings for Irish in the Rest. The boys in group 5 excelled those in the other linguistic groups which (groups) did not differ significantly among themselves; whereas there was a significant tendency over all five linguistic groups for girls' mean quotient to increase with the extent of teaching through Irish. In short, $b_{y.x_5}$ for boys, and $b_{y.x_4}$ for girls, in the Rest were significant, while $b_{y.x_4}$ for boys, and $b_{y.x_5}$ for girls were not. It must be added however that in the case of girls, but not of boys, the condition of homogeneous regression over subdivisions of the data was not satisfied - this, too, might have disturbed the findings.

Analysis of covariance of all the Irish quotients from the six linguistic groups showed that the adjusted mean quotient for group 6 excelled that for the other five groups combined by a significant 8 points.[1] If we allow .5 of a point per month, the difference is equivalent to about 16 months of 'Irish age'. However, item analysis revealed that the mean proportions of children in groups 5 and 6 who answered correctly questions of each type in the Irish test were for the most part roughly equal. The only type of question with which group 6 was a little

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1. The adjusted mean quotient for group 6 is significantly higher than that for group 5.

more successful was that which involved knowledge of the complex prepositional system. But against that, a slightly greater mean proportion of children in group 5 answered correctly the many questions which might be classified as 'reading comprehension'. Taking all things into account, the test does not succeed very well in revealing group 6's undoubted[1] superiority in Irish to group 5; though it did succeed fairly well in distinguishing between the first five linguistic groups. On the other hand the results might be taken as arguing that the superiority in Irish of group 6 is practically confined to the spoken language. Moreover, the Irish test is an extremely simple one, (much simpler than MHE 14 it would appear), and yet the children in group 6 answered on an average less than a third of its questions correctly. It can be argued then that they have not achieved the scholastic attainments in Irish (as opposed to proficiency in speech) which we might have

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1. The reader is referred to the attempt made to compare the English and Irish vocabularies of children in schools of type 5 - see above, p. 402, footnote 1 . It would appear that their English vocabulary is immensely superior to their Irish one. Correspondingly, the Irish vocabulary of native-speakers of that language must be superior to their English one, and superior, too, to the Irish vocabulary of children in group 5. We might extend the argument to other aspects of language - but the test results give no firm evidence of any superiority.

expected. (A random sample of children (N - 254) in one L.E.A. authority in England answered approximately 43% of the questions in MHE 14 correctly.) This interpretation of group 6's performance in Irish has much to commend it, not least that it helps to explain why the group's mean quotient (79) in problem arithmetic is so low compared to the British mean, and compared to that of any of the other five linguistic groups. SPA tests reading comprehension as well as arithmetic.

As regards the five groups of native English-speakers, the item analysis revealed that the tendency for mean Irish quotient to increase with the extent of teaching through Irish is a general one, and not confined to any particular type or types of item.

English

The regression analysis of English quotients from the first five linguistic groups showed no tendency for mean quotient to be related to the extent of teaching through Irish. However, once again attention is drawn to the fact that in this, as in all other regression analyses reported in these pages, the variance of Y is for the most part uncontrolled by the independent variates. This implies that the findings might be somewhat different if the investigation were repeated with better control of the Y variance. Differences between the twelve subdivisions in mean EQ were shown to be significant by analysis of covariance; the difference between West and Rest was not significant. Inspection of the adjusted mean EQs suggested that, apart from the difference between West and Rest, the tendencies noted in adjusted mean Irish quotients are present also, though not so marked, in adjusted mean EQs - the tendency for girls to score higher than boys; the tendency for children in 3-teacher schools to score higher than those in 2-teacher schools; the tendency for children in schools which have more than three teachers to score lowest of all. The first of these tendencies causes no surprise. The other two must remain largely unexplained, though, perhaps they might be attributed partly to uncontrolled variation in home background with greater justification than the corresponding tendencies in mean Irish quotients.

Groups 1 to 5 combined excelled group 6 in adjusted mean EQ by about 8 points of quotient, a difference which covariance analysis showed to be significant. Allowing .6 of a point per month the difference is equivalent to about 13 months of 'English age'. Item analysis showed that the first five groups' superiority extends over all types of question in MHE 14, and that it varies hardly at all from type to type.

Supplementary Investigations - Problem Arithmetic.

THough the findings of the main survey of attainments in Irish, English, and mechanical arithmetic, were not followed up, four supplementary investigations were carried out of group 5's weakness in problem arithmetic.

The first[1] of these was suggested by something which the writer noticed when setting arithmetic problems to children. It seemed to him that children such as the ones in group 5 failed more frequently to solve arithmetic problems set in Irish than in English, even when, he believed, they were capable of understanding the Irish and of coping with the arithmetic. This was particularly apparent when the Irish used was slightly complex. It seemed as though the combined tasks of understanding the Irish and dealing with the arithmetic placed a number of problems beyond their power, though they might have managed either task by itself. The results of the first investigation were interpreted, tentatively, as confirming the original observation; though the need for caution in accepting the interpretation was stressed. This finding,

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1. The investigation is too complicated to summarise here, so the reader is referred to the description of it in chapter 9, pp. 368 sq.

taken in conjunction with those of the regression analyses of the main data of this research and those of the item analysis, suggests that Irish, even simple Irish which children can understand, retards their progress in problem arithmetic. Possibly the reason is partly that they have to devote more of their attention to understanding the language in which problems are expressed when that language is Irish than they would if it were English.

The first of the four supplementary investigations was designed to study how well children such as those in group 5 can cope with problems involving complex arithmetic set in rather difficult Irish (though the findings, it was thought, applied to Irish generally). The second was designed to study how well such children can cope with unfamiliar problems set in very simple Irish. A test was composed for the purpose, consisting of twelve problems involving three-term relations of the type, 'A is greater than B, but less than C; which is the least, A, B or C?' These problems are not unlike a great many arithmetic problems such as those which involve proportions in that both involve the logic of relations; and they were unfamiliar to the boys and girls attending schools of type 5 who took the test. Besides, these problems can be expressed in very simple language. The 5th standard children of one boys' and one girls' school of type 5 were , independently in each school, divided at random into numerically equal groups. An Irish version of the test was administered to one group, and an English version to the other group in each. The time allowed was twelve minutes. Analysis of variance of scores (number of problems solved) showed that the mean difference between the two groups of girls was not significant. This was taken as indicating that the two versions of the test did not differ in difficulty. The 'English' group of boys however obtained a significantly higher mean than the 'Irish' group. Following this up an item analysis of test sheets showed that, unlike the other children tested, the boys of the Irish group solved fewer of the problems at the end of the test than of the earlier ones. This was taken to indicate that such boys, at least, solve unfamiliar problems more slowly when they are set in Irish than when they are set in English. Since much of children's work in problem arithmetic necessarily involves newly introduced and as yet unfamiliar operations, it is quite likely that boys, at least, in schools of type 5 are slowed down in their work by the use of Irish no matter how simple.

At this stage in the inquiry it occurred to the writer that the children tested in the first and second investigations might have to translate Irish problems into English, and translate the answer back into Irish, and that this might explain why the boys of the Irish group solved the three-term relation problems more slowly than the other children. To study whether this is so, twelve boys and twelve girls (5th standard) in schools of type 5 were set three of the problems from the Irish version of the three-term relations test. When each had finished he was asked (in Irish) whether he had thought about them in Irish or in English. All replied that they had thought about them in Irish. Their replies were probably correct because those of the children who muttered, while thinking about the problems, muttered in Irish. And though these children were not a random sample of 5th standard children in schools of type 5, it seems quite likely that the latter, or at least a great many of them, think in Irish about problems set in Irish. Thus translation can scarcely be invoked to explain any of the findings outlined above.

The fourth investigation was a simple test of fluency in Irish and in English. Twelve boys and twelve girls (5th standard) in Dublin national schools of type 5, and twenty four boys in a Dublin school where most subjects are taught through English, were asked to name all the Irish words they could in one minute, and all the English words they could in one minute. In order to randomise the effects of practice and fatigue the language order was reversed from one child to the next, children coming to be tested individually in the order in which their names were entered in the rolls. The number of words named by each child in each language was counted, and these numbers were submitted to analysis of variance. None of the interactions, of which there were four, was significant; but the mean number of both Irish and English words named in the schools of type 5 was significantly greater than the mean number named in the third school. The significant difference was attributed chiefly to a difference in home background. Almost all the children in the schools of type 5, but only a few of those in the third school, were from middle-class homes. It must be confessed, however, that while the difference in mean number of English words named is almost certainly due to the difference in home background, the difference in mean number of Irish words could well be due to school differences. The main finding of the fluency test however is that in all three schools the mean number of English words named was significantly greater than the mean number of Irish words; the ratio was 4 English to 3 Irish words. This was taken as showing that even after six years at a school of type 5, English words come more quickly than Irish words to children from English-speaking homes. The finding throws some light on why the children of linguistic group 5 in our main investigation were weaker at problem arithmetic than those of the first four linguistic groups. The former probably think about the problems in Irish, and thus think more slowly than if they were thinking in English. It is quite likely, too, that these children comprehend the same statement made in Irish more slowly than if it were made in English. And if we can take this slowing down of thought as indicating an increase in difficulty with language (it is reasonable to do so) we have the situation explored in the 'complex Irish - complex arithmetic' investigation. Thus it would appear that the children of group 5 are obliged to devote more time and attention to understanding and thinking about arithmetic problems expressed in Irish than they would if the problems were in English. Indeed the added difficulty of Irish may place beyond their powers a number of problems which they would have been able to solve if they had been taught arithmetic in English. The findings of the fluency test however scarcely help to explain those of the three-term relations test, because the latter reveal a sex difference while the former do not.

The difficulties which children from English-speaking homes experience with arithmetic problems in Irish are really difficulties for the teacher as well. When he speaks, even if he uses Irish words and expressions which are known to the class, he is understood more slowly and with greater difficulty, it seems, than if he were to speak in English. Moreover words[1] and expressions which the children, or at least a number of them, do not understand are bound to crop up more frequently in Irish. Further, it is almost certainly more difficult for the class to discuss problems with him in Irish. And it is at least possible, as one teacher remarked to the writer, that he will, perhaps unconsciously, devote more of the arithmetic period to mechanical, less to problem, arithmetic than if he were teaching through the medium of English.

Comparison of Irish and British Children in English

The mean EQ obtained by the first five linguistic groups is a good index to the level of English attainment

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1 See p. 402 note 1 above for the findings of a test of Irish and English vocabularies. Though the test was unsatisfactory in many ways, the observed superiority of children's (schools of type 5) English vocabulary compared to their Irish one was so great that the statement in the text above is quite justified.

achieved by native-speakers of English in Irish national schools. We have already observed that the sample of schools on which it is based comprises fewer 1-teacher schools and more trained teachers than would be expected in an entirely random sample of schools. Though these disparities are likely to result in a slightly higher mean EQ for the sample tested (N - 919) than would be obtained by a random sample, there would scarcely be any need to make allowances for them, even if we could. It may be added that since the five linguistic groups did not differ significantly in mean EQ, the fact that the proportions of schools of the various linguistic types are not what they would be in a random sample of schools, does not disturb the estimate of the mean EQ.

The difference in mean EQ between Irish children in 1961 and British children during the world war, when MHE 14 was standardised, was estimated as 20 points. It has been shown that British children in more recent years would on the average be expected to obtain EQs with MHE 14 some 2.5 points of quotient higher than those obtained by British children during the war. This amount therefore was added to the 20 points just mentioned to obtain the mean difference for 1961. The reasons for this difference of 22.5 points were then explored.

As Moray House English tests are standardised on the scores obtained by children who are thoroughly 'test-sophisticated' in scholarship examinations, whereas the Irish children tested were innocent of these, and indeed of any tests, the mean difference in EQ can be attributed in part to the difference in test-sophistication. An experiment was conducted in two Dublin national schools, one boys', one girls', to obtain an estimate of the gains which Irish 5th standard children might make with practice at taking Moray House English tests. It was found that they gained 6 points of quotient on an average from first to last over a series of six tests. Their greatest gains were made at the start of the series, and their smallest gains towards the end. These findings are in the closest agreement with those of the majority of similar experiments in Britain. Since in Britain children have been found to gain 9 points if coaching is added to practice, it was estimated that 9 points should be deducted from the 22.5 points to allow for the difference between the children of Ireland and Great Britain in test-sophistication.

Recent work by Burt & Williams (1962) indicates a second reason for the mean difference in EQ between British and Irish children. These authors observed that children (in Britain) tend to obtain a mean IQ in the eleven plus examination about 3 points higher than at other times shortly before or shortly after that examination. The difference is attributed by the authors chiefly to the greater incentives for children to obtain high scores in the eleven plus examination. This work was discussed in relation to the present comparison, and it was decided that an allowance of 2 points should be made for the fact that the estimate of Irish children's mean EQ was not obtained in a scholarship examination.

Furthermore, it has frequently been found that in Britain urban children excel rural ones in attainment tests. The relevant research was discussed and the difference between the two types of children in mean EQ estimated as 3 points of quotient. The difference between the proportions of urban and rural bhildren in Ireland and Great Britain were estimated from the proportion of the population in each employed in agriculture and allied activities. These figures were used to estimate the allowance in mean EQ which should be made for the fact that a greater proportion of the Irish than of the British population is rural. The estimate of that allowance is 1.2 points of quotient.

Differences between the methods of teaching reading commonly employed in Ireland and Great Britain were also discussed, and it was decided that no allowance should be made for these. Then followed a discussion of the fact that Irish children obtained a lower mean IQ than the children of Great Britain - the mean difference was at least as great as that in EQ. This fact was attributed chiefly to differences in test-sophistication and reading comprehension between Irish and British children, and it was assumed that social class for social class, the two peoples are equal, or nearly so, in non-verbal reasoning ability. It was therefore decided that no allowance should be made for the low non-verbal IQ. Another consideration which was brought forward was that the families of the children from whom we have obtained the Irish estimate of mean EQ learned English relatively recently, sometime between 200 and 100 years ago, according to the best available evidence. The point was discussed and the conclusion reached that no part of the mean difference in EQ between Irish and British children could be attributed to the fact that English is, historically speaking, a new language to most Irish families.

Very often attainment tests constructed in one country are unsuited to the children of another country because they contain questions which those children cannot be expected to answer correctly. MHE 14 was examined from this point of view, and four items were discovered which at first sight might appear more difficult for Irish than for British children for reasons other than command of English. However the mean proportions of Irish children who answered correctly these and the adjacent questions of the same type were compared with the corresponding mean proportions of a random sample of children in an English L.E.A. area, and it was discovered to be improbable that the four questions presented any particular difficulty to Irish children.

If all the allowances mentioned above are deducted from the mean difference of 22.5 points - namely, 9 points for lack of test-sophistication, 2 points for the difference in incentive, 1.2 points for the difference in the proportions of urban and rural children - about 10 points of quotient remain. In order to account for this the time-tables for the year 1960-61 were requested from the schools in which the main investigation was carried out, and 100 of them were obtained. An analysis of these showed that about 52% of the schools in linguistic groups 1 to 5 did not teach English to infants at all. Moreover, of the available time (religion periods excepted) in all classes from infants to 5th standard combined, about 42% is devoted to teaching Irish, 24% to teaching arithmetic, and 22% to teaching English. Thus it is clear that because of the prominence given to Irish in national schools, the time available for English is short in comparison. The figure for English was compared with the corresponding one which Morris (1959) obtained in the schools of Kent. It thus became apparent that the primary teachers of Kent, and probably those of Great Britain generally, devote more than twice as much time to teabhing English as the primary teachers of Ireland. Here, it was thought, was the chief source of the mean difference of 10 points of EQ which was not otherwise accounted for.

The reader may be helped to appreciate the extent of this difference if it is converted to 'English age'. An allowance of .6 of a point per month implies that 10 points are roughly equivalent to about 17 months of 'English age'. This is the estimate of the mean difference between the children of Great Britain and those in the Irish Republic whose mother tongue is English. To obtain an estimate of the mean difference between the children of Great Britain and those whose mother tongue is Irish a further 13 months must be added, which comes to about 30 months of 'English age'. These findings, in substance at least, are supported by those of the majority of investigations of the linguistic effects of bilingualism.

Conclusion.

The two objects of the present survey were set down at the beginning of this chapter. We are now in a position to say whether or not they have been achieved. (1) The evidence obtained goes far to establish that native-speakers of English who attend national schools where arithmetic is taught through English generally make better progress in problem, but not in mechanical, arithmetic than similar children who attend national schools where arithmetic is taught through Irish. The extent of the difference between them in problem arithmetic is estimated as 8 AQ points, or 11 months of 'arithmetic age': but this estimate is an approximate one. The difference is attributed, with probability but not with certainty, to the difference in medium of instruction. The findings indicate, again with probability but not with certainty, that attainments in Irish and in English are not affected differentially whether arithmetic is taught through Irish or through English. The evidence for this conclusion is stronger in the case of English than of Irish. (ii) The evidence that Irish national school children's scholastic attainments in English (as opposed to proficiency in speech) are poorer than those of British primary school children is fairly conclusive. The estimate which was obtained of the mean difference between them is 10 points of EQ or 17 months of 'English age' in the case of Irish children whose mother tongue is English; in the case of Irish children whose mother tongue is Irish the estimate is 18 points of EQ or 30 months of 'English age'. But once again the writer must insist that these estimates are approximate ones. The difference between British children and Irish children whose mother tongue is English is, with a high degree of probability, attributed chiefly to the fact that Irish national schools devote less than half as much time to teaching English as British primary schools. The time available for English in Irish national schools is relatively small because the teaching of Irish occupies a relatively large portion of the total time available. Thus, in attributing the mean difference in EQ to the difference in time devoted to teaching English, it is in fact attributed to the programme for reviving Irish which is operative in Irish national schools. The mean difference between British children and children whose mother tongue is Irish is attributed partly to the fact that English is only the second language of the latter group, and partly to the relatively small place of English in its school curriculum.

Assuming that the mean differences recorded above are correctly attributed to the programme for reviving Irish - the writer maintains that they are - then the effect of that programme on arithmetical attainments is serious, but not so serious as its effect on English attainment. For one thing it appears to have no effect on mechanical arithmetic scores, and for another the number of native-speakers of English who are taught problem arithmetic through the medium of Irish is relatively small. But the effect on English attainment is very grave indeed, and all Irish national school children whose mother tongue is English are involved. Many of them leave school with no more than a primary education, so it is doubtful whether they will have an opportunity to catch up on their counterparts in Great Britain whose scholastic attainment in English, after all, few would regard as satisfactory. Those of Irish national school children who go forward to various forms of secondary education are less well prepared than they might be to follow a secondary school course in which the reading of books in English will occupy a major part of their work. On the credit side, national schools appear to give a good grasp of Irish to children from English-speaking homes. This is evident when we compare their Irish attainments with those of children in Irish-speaking districts.

The position of these children in Irish-speaking districts appears to be the most serious of all; for their attainments in arithmetic and English are the poorest of all, while their scholastic attainments in Irish (as opposed to their grasp of the spoken language) are no better than those of the children in linguistic group 5 who for the most part know only what Irish they have been taught in school. For many of these children in Irish-speaking districts, the adult world, in Ireland or in England, will be an English-speaking one; and they appear to be ill-equipped indeed to live in it.

APPENDIX 1

Tables Relating to Chapter 3.

APPENDIX 1.1

Teacher/Pupil Ratio[1] (Second Sample).

School	Gr.1	Gr.2	Gr.3	Gr.4	Gr.5	Gr.6
1	23.2	27.0	14.0	34.8	33.5	17.1
2	25.6	28.3	40.0	29.5	52.9	31.0
3	36.1	31.5	47.9	27.7	20.5	30.0
4	20.3	52.9	26.7	41.1	43.4	32.9
5	36.9	40.5	44.3	21.9	51.2	21.6
6	38.4	37.5	37.3	22.9	28.7	21.5
7	29.3	41.7	20.0	18.0	26.0	32.8
8	16.3	30.5	42.7	38.0	30.0	34.3
9	35.4	47.6	32.4	25.3	26.0	37.7
10	34.0	23.0	38.9	45.0	31.8	21.2
11	34.3	36.8	34.0	36.3	27.5	19.8
12	20.0	35.5	48.5	17.9	38.5	32.0
13	30.1	29.3	35.4	29.4		32.1
14	36.9	35.5	27.5	26.9	52.0	48.6
15	31.0	26.1	16.8	40.3	29.1	34.4
16	28.7	25.7	33.0	36.5	24.5	51.4
17	18.9	32.5	19.5	23.8	36.6	18.0
18	29.0	37.3	32.4	42.3	29.6	35.5
19	30.3	42.0	23.0	19.6	32.1	27.5
20	42.3	27.1	23.5	26.5	40.2	29.5
Total:	597.0	688.3	637.8	603.7	654.1	608.9

1. Number of children to 1 teacher.

APPENDIX 1.2

Total No. of Boys and Girls[1].

School	Gr.1	Gr.2	Gr.3	Gr.4	Gr.5	Gr.6
1	18	9	43	18	17	9
2	6	8	6	17	10	3
3	20	20	10	9	17	4
4	5	18	11	18	14	8
5	10	7	6	6	39	5
6	9	8	9	5	8	6
7	7	15	5	8	6	12
8	4	14	4	5	7	7
9	6	10	7	6	10	6
10	4	5	4	7	8	7
11	4	11	10	7	7	4
12	10	4	10	6	7	8
13	9	6	7	4	13	18
14	7	10	10	4	8	5
15	3	10	6	6	3	9
16	10	5	3	6	6	8
17	3	3	7	5	5	9
18	5	6	5	6	3	15
19	7	10	15	5	8	7
20	13	9	37	22	-	5
Total:	160	188	215	170	196	155

1. Number tested whose scores are included in the statistical analysis.

APPENDIX 1.3

No. of Boys[1].

School	Gr.1	Gr.2	Gr.3	Gr.4	Gr.5	Gr.6
1	-	6	43	8	17	3
2	3	2	1	17	5	1
3	10	9	10	-	17	2
4	1	-	5	-	9	1
5	6	4	3	3	-	4
6	7	4	3	3	4	-
7	5	15	1	4	4	12
8	2	7	1	-	-	4
9	2	2	4	-	6	4
10	3	5	4	6	5	2
11	1	4	10	5	2	1
12	7	3	5	5	2	1
13	6	1	5	3	6	7
14	6	3	5	-	8	2
15	1	6	3	3	2	3
16	5	3	-	3	4	2
17	2	2	4	1	2	4
18	3	3	3	5	3	8
19	3	5	7	4	-	2
20	5	3	-	22	-	3
Total:	78	87	117	92	96	66

1. Number whose scores are included in the statistical analysis.

APPENDIX 1.4

No. of Girls[1].

School	Gr.1	Gr.2	Gr.3	Gr.4	Gr.5	Gr.6
1	18	3	-	10	-	6
2	3	6	5	-	5	2
3	10	11	-	9	-	2
4	4	18	6	18	5	7
5	4	3	3	3	39	1
6	2	4	6	2	4	6
7	2	-	4	4	2	-
8	2	7	3	5	7	3
9	4	8	3	6	4	2
10	1	-	-	1	3	5
11	3	7	-	2	5	3
12	3	1	5	1	5	7
13	3	5	2	1	7	11
14	1	7	5	4	-	3
15	2	4	3	3	1	6
16	5	2	3	3	2	6
17	1	1	3	4	3	5
18	2	3	2	1	-	7
19	4	5	8	1	8	5
20	8	6	37	-	-	2
Total:	82	101	98	78	100	89

1. Number whose scores are included in the statistical analysis.

APPENDIX 1.5

Analysis of Variance : Numbers (boys & girls) in second sample.

Source	DF	SS	MS	F
Between groups	5	152.175	30.435	.707 (DF = 5 & 113)
Within "	113	4862.405	43.030	Not significant.
Total	118	5014.580		

Analysis of Variance: Teacher/Pupil Ratio (second sample).

Source	DF	SS	MS	F
Between groups	5	432.63	86.53	1.11 (DF = 5 & 113)
Within groups	113	8797.71	77.86	not significant.
Total	118	9230.34		

APPENDIX 1.6

1. Analysis of Variance: Boys' Ages (9y-om was subtracted from each child's age).

Source	DF	SS	MS	F
Between groups	5	2191.63	638.326	3.502
Within "	530	66341.67	125.173	Significant
Total	535	68533.30		

2. Analysis of Variance: Girls' Ages (9y-om was subtracted from each child's age).

Source	DF	SS	MS	F
Between groups	5	.350.52	270.104	2.493
Within "	542	59807.38	110.346	Significant
Total	547	61157.90		

3. Test of Significance of Mean Difference in Age.

Between Boys & Girls: Method of 'Paired Differences'.

The mean age of girls in each linguistic group was subtracted from that of boys to yield a measure, d, for each group. The unit is 1 month. No. of groups = 6.

$d = 14.2171$. $d^2 = 50.0403$. $(d - d)^2 = 16.3526$.

$SE_d = .7383$.

t = 3.2544 (DF - 5), significant at 5% level of probability.

APPENDIX 2

Tests and Translations

Questionnaire and Translation

FORM A

THE ESSENTIAL PROBLEM ARITHMETIC TEST

FOR PUPILS 7+ TO 14+

Prepared by PROFESSOR FRED J. SCHONELL, PH.D., D.LIT.

Name ....

Boy or Girl ....

Your Age ....

Date of Birthday..

Class ....

School..

....

FOR THE TEACHER	
Page 1	
Page 2	
Page 3	
Page 4	
Page 5	
Page 6	
Page 7	
TOTAL SCORE . .	
Actual age in years and completed months	
Arithmetic age .	

READ THIS CAREFULLY

1. Do the sums in this booklet as carefully and as quickly as you can.
2. Some of the sums are very easy. You can work them in your head and just write the answer on the dotted line at the right of the sum.
3. If you can't do a sum in your head work it out in the space near the sum. Do all the working you want on this paper.
4. If you can't do a sum leave it and go on with the next. When you finish one page go on to the next page **without waiting.**
5. The first sums are easy, then they get harder, but no one is expected to do everything. Just do your best.
6. You have 30 minutes. **You must not ask questions.**

DO NOT TURN OVER THIS PAGE UNTIL YOU ARE TOLD TO DO SO.

OLIVER AND BOYD LTD. EDINBURGH TWEEDDALE COURT
LONDON 39A WELBECK STREET, W.1

THIRTEENTH IMPRESSION 1960

ANSWER

If you can't do a sum in your head always work it out in the space near the sum, like this :

Tom had 18 nuts and he lost 5.
How many nuts has he now ?

$$\begin{array}{r} 18 \\ 5 \\ \hline 13 \end{array}$$

13 ....

1. Jack had 4 nuts and he got 7 more. How many has he now ? ....

2. Tom is 8 years old. Peter is 15 years old. How much older is Peter than Tom ? ....

3. We have 20 hens. There are 8 white hens, 3 black hens, and the rest are brown. How many hens are brown ? ....

4. I spent 10d. and then 9d. How much did I spend altogether ? ....

5. One box holds 5 books. How many boxes will I want for 35 books ? ....

6. John had 29 stamps in his stamp book. He saved 34 more. How many has he now ? ....

7. How many sweets will be left out of 42 if 17 sweets are eaten ? ....

8. Ten boys are given 2 pennies each. How many shillings and pence is this ? ....

ANSWERS

9. There are 35 buns on a plate. 8 boys ate 4 buns each. How many buns were left ? ....

10. How many shillings would I pay for 12 cards at sixpence each ? ....

11. I have 2 half-crowns, 3 shillings, 4 sixpences and 2 threepences. How much money have I altogether ? ....

12. There are 36 girls in our class. They each have 6 books. How many books have they altogether ? ....

13. Mother gave her 4 children 5s. to share among themselves. Each child was to get the same. How much did each get ? ....

14. I spend 1s. $6\frac{1}{2}$d. on a book, $5\frac{1}{2}$d. on a pencil, and 2d. on a pen. How much have I left from 4s. ? ....

15. I buy 21 buns at 7 for 1s. How much will that cost ? ....

16. I have 156 marbles. How many dozen is this ? ....

ANSWE

17. I am 5 feet 4 inches tall. My friend is 6 inches shorter than I. How tall is she ? ....

18. My brother works from 9 o'clock in the morning until 6 o'clock in the evening, with an hour off for lunch. How long does he work each day ? ....

19. Father was 37 years old in 1945. In what year was he born ? ....

20. Teacher tells us to be in the schoolyard 10 minutes before the bell rings. In the afternoon the bell rings at 5 minutes past 1. At what time should we be in the yard ? ....

21. At our school each pupil pays 2s. 1d. for dinners and 5d. for milk every week. 32 boys take dinner and milk every week. How much money is paid altogether, every week, for all the boys ? ....

22. Apples cost 8d. per lb. and pears cost 11d. per lb. I buy 3 lbs. of each. How much more do the pears cost than the apples ? ....

23. The milkman leaves 1 pint of milk in our house every day except Sunday, when he leaves a quart. Milk costs 9d. a quart. How much is our milk bill every week ? ....

ANSWERS

24. What is the cost of a dozen paper hats at $3\frac{3}{4}$d. each ? ....

25. A draper sells $1\frac{1}{2}$ yards of linen, $2\frac{3}{4}$ yards of silk, and $\frac{3}{4}$ yard of print. How many yards of material does he sell ? ....

26. Petrol is 2s. $1\frac{1}{2}$d. per gallon. How much do I pay for petrol to travel 100 miles if my car goes 25 miles on one gallon ? ....

27. I have a piece of tape 1 yard 1 foot long, but I want a piece 4 times as long as this, and 1 foot extra. How much more tape shall I have to get ? ....

28. My suit cost $2\frac{1}{2}$ guineas. How much is this in £ s. d. ? ....

29. If 25 children sell 137 flags each, how many flags are sold altogether ? ....

30. A cake weighed 3 lbs. 12 ozs. A second cake weighed 1 lb. more than the first. Mother bought both of them. How much cake did she get ? ....

ANSW

31. A bag of shillings weighed 3 lbs. If 4 shillings weigh 1 oz., how many shillings were there in the bag ?

....

32. I work 8 hours a day on Monday, Wednesday and Friday ; 7 hours on Tuesday and Thursday, and 4 hours on Saturday. What is the average length of my working day ?

....

33. A school needs 15 cricket balls. What will they cost if 1 dozen can be bought for £2 ?

....

34. Share £1 between Bob and Bill so that Bob gets 2s. 6d. more than Bill.

....

35. If $\frac{3}{5}$ of the people in a bus load of 40 people are women, how many of the people are men ?

....

36. After spending $\frac{1}{3}$ of my money, I have 2s. 6d. left. How much did I have at first ?

....

37. How much will 3 cwt. of coal cost at £2, 10s. per ton ?

....

ANSWERS

The distance all round a square is 12 inches. What is its area ? ....

From A to B is 7·7 miles. From B to C is 4·4 miles more than from A to B. How far is it from A to C ? ....

A pot of jam contains 1 lb. of jam and the sugar in it weighs 3 ozs. What percentage of sugar is there in the jam ? ....

Jones and Smith painted a house together and were paid £16. But Jones had worked 3 times as long as Smith at the job. How should they share the £16 ? ....

A man can cycle at the rate of $10\frac{1}{2}$ miles per hour. He leaves home at 2.30 p.m. and cycles till 4 p.m.; he then has his tea and starts again at 4.30 p.m., getting home at 6.0 p.m. How far does he cycle ? ....

A man bought 6 rare stamps at 5s. each and sold them to make a profit of 4s. 6d. How much did he sell each stamp for ? ....

A leaking tap wastes $\frac{1}{2}$ pint of water in 2 minutes. How many gallons of water are wasted from 2 p.m. to 6 p.m. ? ....

ANS

45. A boy buys 100 newspapers at 1s. 4d. for 20 and he sells them at 1d. each. How much profit does he make ?

....

46. A train consists of 18 trucks, each 14 feet long. There is 3 feet space between each truck and between the engine and the first truck. Find the length of the whole train if the engine is 33 feet long.

....

47. A room is twice as long as it is wide. If it is 20 feet 6 inches long, what will be the total length of the picture rail needed for the four walls ?

....

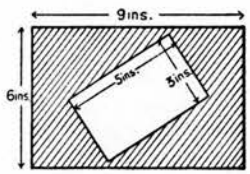
48. A sports dealer bought a bat for £1 and sold it for £2, 10s. What was his gain per cent. ?

....

49. Jim has 2s. 5d., Jack has 2s. 3d., Tom has 1s. 10d. How much must Jim and Jack each give to Tom so that they share the money equally ?

....

50. This is a sheet of metal. If the whole sheet was worth 4s. 6d., what was the value of the shaded piece ?



....

APPENDIX 2.1

Triail Uiṁríoċta

FRED J. SCHONELL, M.A., Ph.D., D.Lit.

Ainm ....

Buaċaill nó Cailín ....

Aois ....

Lá Breiṫe ....

Rang ....

Scoil ....

Ná scríoḃ anso	
Leaṫ. 1	
Leaṫ. 2	
Leaṫ. 3	
Leaṫ. 4	
Leaṫ. 5	
Leaṫ. 6	
Leaṫ. 7	
Marc Iomlán ..	
Aois i mblianta agus míosa iomlána	
Aois Uiṁríoċtúil ..	

Léiġ go cúramaċ

1. Freagair na ceisteanna san leaḃrán so ċóṁ cúramaċ agus ċóṁ tapaiḋ agus is féidir leat.
2. Tá cuid des na ceisteanna an-éasca. Is féidir leat iad d'ḟreagairt i do ċeann agus an freagra a scríoḃ ar an líne poncanna ar ḋeis na ceiste.
3. Muna mbíonn tú ábalta ceist d'ḟreagairt i do ċeann is féidir í réiteaċ san spás in aice na ceiste. Scríoḃ pé figiúirí is maiṫ leat ar an bpáipéar so.
4. Má tá ceist ar biṫ ró-ċruaiḋ duit fág í agus ar aġaiḋ leat go dtí an ċéad ċeist eile. Nuair a ṫagann tú go dtí bun leaṫanaiġ ar aġaiḋ leat **díreaċ** go dtí an ċéad leaṫanaċ eile.
5. Tá na ceisteanna tosaiġ éasca, ansan éiríonn siad níos deacra, aċ is ar éigin a ċríoċnóiḋ éinne an triail ar fad. Déan do ḋíċeall agus sin an méid.
6. Beiḋ 30 neomat agat. **Ná cuir ceist ar éinne.**

Ná hiompaiġ an leaṫanaċ so go dtí go ndéarfar leat é ḋéanaṁ.

(Leaṫanaċ a 1)

Freag

Mura féidir leat an ceist a ḋéanaṁ as do ċeann déan sa spás in aice leis an gceist i mar so :—

18	
5	
—	
13	1.

Ḃí 18 gcnó ag Tomás agus ċaill sé 5 cinn. Cé méad cnó a ḃí aige ansin? ......

1. Ḃí 4 ċnó ag Seán agus fuair sé 7 gcinn eile. Cé méad a ḃí aige ainsin? ....

2. Tá Tomás 8 mbliana d'aois. Tá Peadar 15 bliana d'aois. Cé méad bliain atá ag Peadar ar Ṫomás? ....

3. Tá 20 cearc againn. Tá 8 gcearc ḃána agus 3 ċearc ḋuḃa ann, agus tá an ċuid eile donn. Cé méad cearc donn atá ann? ....

4. Ċaiṫ mé 10d. agus ansin 9d. Cé méad a ċaiṫ mé ar fad? ....

5. Tá 5 leaḃar i mbosca. Cé méad bosca i gcóir 35 leaḃar? ....

6. Ḃí 29 stampa ag Seán ina leaḃar stampaí. Fuair sé 34 stampa. Cé méad atá aige anois? ......

7. Cé méad milseán a ḃeiḋ fágṫa as 42 taréis 17 milseán d'iṫe? ......

8. Tugaḋ 2 pingin an duine do ḋeiċniúr buaċaillí. Cé méad scilling agus pingin é sin? ......

Freagraí

Ḃí 35 ċíste ar ṗláta. D'iṫ 8 buaċaillí 4 ċíste an duine. Cé ṁéad císte a ḃí fágṫa? ....

Cé ṁéad scilling a ḋíolfainn as 12 ċárta do réir réal an ceann? ....

Tá 2 leaṫċoróin, 3 scilling, 4 réal agus 2 leaṫréal agam. Cé ṁéad airgid atá agam ar fad? ....

Tá 36 buaċaill i rang. Tá 6 leaḃar an duine acu. Cé ṁéad leaḃar atá acu ar fad? ....

. Ṫug Mamaí 5s. dá 4 páiste le roinnt eatarṫu, an méid céanna do gaċ duine. Cé ṁéad a fuair gaċ duine acu? ....

. Caiṫim 1s. 6½d. ar leaḃar, 5½d. ar ṗeannluaiḋe, agus 2d. ar ṗeann. Cé ṁéad atá fágṫa agam as 4s.? ....

. Ceannaím 21 ċíste do réir 7 gcinn ar 1s. Cé ṁéad a ċosnóiḋ siad? ....

. Tá 156 ṁirlín agam. Cé ṁéad dosaen atá agam? ....

Freaġ

17. Táim 5 ṫroiġ 4 órlaċ ar airde. Tá 6 órlaċ agam ar mo ċara. Cé'n airde í?

......

18. Oibríonn mo ḋearṫáir óna 9 ar maidin go dtí a 6 sa tráṫnóna aċ go mbíonn uair a ċloig saor ċun lóin aige. Cé'n ḟaid a oibríonn sé gaċ lá?

......

19. Ḃí Daid 37 mbliana d'aois i 1945. Cé'n ḃliain in ar rugaḋ é?

......

20. Deireann an múinteoir linn ḃeiṫ i gclós na scoile 10 nóiméad sula mbuailtear an clog. Taréis lóin buailtear an clog ar a 5 nóiméad taréis a 1. Cé'n t-am is ċóir dúinn ḃeiṫ sa ċlós?

......

21. Sa scoil seo againne díolann gaċ dalta 2s. 1d. as a ḋinnéir agus 5d. as bainne gaċ seaċtain. Ġeiḃeann 32 ḃuaċaill dinnéir agus bainne gaċ seaċtain. Cé ṁéad a ḋíolann na buaċaillí go léir sa tseaċtain?

....

22. Cosnaíonn úlla 8d. an pt. agus cosnaíonn piorraí 11d. an pt. Ceannaím 3 pt. de gaċ sórt. Cé ṁéad níos mó a ċosnaíonn na piorraí ná na h-úlla?

....

23. Fágann fear a' ḃainne 1 pionta bainne sa tiġ gaċ lá aċ amáin Dé Doṁnaiġ. Fágann sé cárt an lá sin. Cosnaíonn bainne 9d. an cárt. Cé ṁéad a ḃíonn le díol againn as bainne sa t-seaċtain?

....

Freagraí

. Cé ṁéad a ċosnaíonn dosaen hataí páipéir ar $3\frac{3}{4}$d. an ceann ? ....

. Díolann éadaiṫeoir $1\frac{1}{2}$ sl. lín éadaiġ, $2\frac{3}{4}$ sl. síoda, agus $\frac{3}{4}$ sl. muislín. Cé ṁéad slat éadaiġ ar fad a ḋíolann sé ? ....

6. Cosnaíonn peitreal 2s. $1\frac{1}{2}$d. an galún. Cé ṁéad a ḋíolfainn as peitreal ċun 100 míle slí a ċur díom im' ġluaisteán do réir 25 míle slí an galún ? ....

7. Tá píosa téide agam 1 slat 1 troiġ ar fad aċ teastaíonn píosa uaim a ḃeiḋ a 4 oiread sin ar fad agus 1 troiġ sa ḃreis. Cé ṁéad téide eile a ċaitfiḋ mé d'ḟail ? ....

8. Ċosnaiġ mo ċulaiṫ éadaiġ $2\frac{1}{2}$ ġiní. Cé ṁéad é sin i £ s. d.? ....

9. Má ḋíolann 25 páiste 137 mbrat an duine, an mó brat a díoltar ar fad? ....

0. Ḃí 3 pt. 12 ún. meáċain i gcíste amáin agus 1 pt. meáċain níos mó i gcíste eile. Ċeannaiġ Mamaí an dá ċeann. Cé'n meáċan ar fad a fuair sí ? ....

(Leaṫanaċ a 5)

Freagı

31. Ṁeá mála scilling 3 ṗt. Má ṁeánn 4 scilling 1 ún, an mó scilling a ḃí sa ṁála? ....

32. Oibrím 8 n-uaire a ċloig sa lá Dé Luain, Dé Céadaoin agus Dé hAoine; 7 n-uaire sa lá Dé Máirt agus Dé Déardaoin, agus 4 huaire Dé Saṫairn. Cé'n ḟaid a oibrím, ar an méan, in aġaiḋ an lae? ....

33. Teastaíonn 15 liaṫróid ó ṁúinteoir. Cad a ċosnóiḋ siad, má's féidir 1 dosaen díoḃ a ċeannaċ ar £2? ....

34. Roinn £1 idir Seán agus Liam i dtreo is go mbeiḋ 2s. 6d. sa ḃreis ag Seán ar Liam. ....

35. Má's mná iad $\frac{3}{5}$ de 40 duine i mbus, an mó fear atá ann? ....

36. Taréis $\frac{1}{3}$ dem ċuid airgid a ċaiteaṁ tá 2s. 6d. fágṫa agam. Cé ṁéad a ḃí agam ar dtúis? ....

37. Cé ṁéad a ċosnóiḋ 3 cdm. guail do réir £2, 10s. an tonna? ....

Freagraí

. Tá suim na gceiṫre slios i gcearnóig 12 órlaċ ar ḟaid. Faiġ a haċar.

....

. Tá 7.7 míle slí ann ó A go B. Ó B go C tá sé 4.4 míle slí níos fuide ná ó A go B. Cén ḟaid atá ann ó A go C?

....

. Tá 1 punt suiḃe i bpróca agus meánn an siúcra atá ann 3 ún. Scríoḃ meáċan an tsiúcra mar ċéadcodán (ceatadán) de ṁeáċan na suiḃe.

....

. Díolaḋ £16 le Tomás agus Pádraig le ċéile as tiġ a ṗéinteáil. Aċ ċait Tomás a 3 oiread ama ag an obair agus a ċait Pádraig. Conas ba ċóir dóiḃ an £16 a roinnt eatarṫu?

....

. Roṫaíonn fear ar luas $10\frac{1}{2}$ míle san uair. Fágann sé an baile ar a 2.30 p.m. agus roṫaíonn sé go dtí a 4 p.m.; ġeiḃeann sé té ansin agus tosnaíonn sé arís ar a 4.30 p.m. Sroiseann sé an baile ar a 6.0 p.m. Cé'n ḟaid slí a roṫaíonn sé ar fad?

....

. Ċeannaiġ fear 6 stampa ar 5s. an ceann agus ḋíol sé iad ar ṡoċar 4s. 6d. Cé ṁéad an ceann a fuair sé orṫu?

....

. Tá uisce ag sileaḋ as sconna agus cailltear $\frac{1}{2}$ ṗionta de gaċ 2 nóimeat. An mó galún uisce a cailltear óna 2 p.m. go dtí a 6 p.m.?

....

45. Ceannaíonn buacaill 100 nuacán do réir 1s. 4d. ar 20 agus díolann sé iad ar 1d. an ceann. Cé'n socar a déanann sé? ....

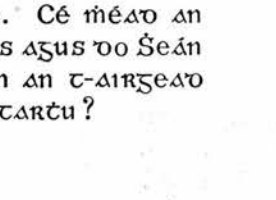
46. Tá 18 dtrucail i dtraein, gac ceann acu 14 troig ar faid. Tá 3 troig idir gac dá trucail agus idir an céad trucail agus an t-inneall. Faig faid iomlán na traenac má tá an t-inneall 33 troig ar faid. ....

47. Tá faid seomra níos mó fé dó ná a leitead. Má tá sé 20 troig 6 órlac ar faid, faig faid iomlán na ráille pictiúr ar na ceitre fallaí. ....

48. Ceannaig siopadóir liatróid peile ar £1 agus díol sé arís é ar £2 10s. Cad é an socar fén gcéad? ....

49. Tá 2s. 5d. ag Séamus, 2s. 3d. ag Seán agus 1s. 10d. ag Tomás. Cé méad an duine is ceart do Séamus agus do Seán a tabairt do Tomás cun an t-airgead a roinnt go cotrom eatartu? ....

50. Is pláta miotail é seo. Más fiú 4s. 6d. an pláta iomlán, cad is fiú an cuid dorca de? ....



APPENDIX 2.2

FORM A

THE ESSENTIAL MECHANICAL ARITHMETIC TEST

FOR PUPILS 7+ TO 12+

Prepared by PROFESSOR FRED J. SCHONELL, M.A., PH.D., D.LIT.

Name..

Boy or Girl..

Your Age..

Date of Birthday..

Class..

School..

....

FOR THE TEACHER	
Page 1	
Page 2	
Page 3	
Page 4	
Page 5	
Page 6	
TOTAL SCORE . .	
Actual age in years and completed months	
Arithmetic age	

READ THIS CAREFULLY

1. Do the sums in this booklet as carefully and as quickly as you can.
2. There are different kinds of sums. **Look for the sign to tell you what to do.**
3. Write your answers in the place left for them. Do all the working you want on this paper.
4. If you can't do a sum leave it and go on with the next. When you finish one page go on to the next page **without waiting.**
5. The first sums are easy, then they get harder, but no one is expected to do everything. Just do your best.
6. You have 30 minutes. **You must not ask questions.**

DO NOT TURN OVER THIS PAGE UNTIL YOU ARE TOLD TO DO SO.

OLIVER AND BOYD LTD. EDINBURGH - - TWEEDDALE COURT
LONDON - 39A WELBECK STREET, W.1.

Look carefully to see whether the sum is an add $+$, subtract $-$, multiply $\times$, or divide $\div$ sum. Work across the page.

1. **Add**

$3 + 8 =$

2. **Add**

$$\begin{array}{r} 44 \\ +53 \\ \hline \end{array}$$

3. **Add**

$$\begin{array}{r} 67 \\ +98 \\ \hline \end{array}$$

4. **Subtract**

$15 - 6 =$

5. **Subtract**

$$\begin{array}{r} 79 \\ -44 \\ \hline \end{array}$$

6. **Subtract**

$$\begin{array}{r} 92 \\ -47 \\ \hline \end{array}$$

7. **Multiply**

$4 \times 8 =$

8. **Multiply**

$$\begin{array}{r} 93 \\ \times 3 \\ \hline \end{array}$$

9. **Multiply**

$$\begin{array}{r} 54 \\ \times 7 \\ \hline \end{array}$$

10. **Divide**

$36 \div 4 =$

11. **Divide**

$3\overline{)63}$

12. **Divide**

$6\overline{)102}$

Work across the page

13. **Add**

$$\begin{array}{r} 4\ 2\ 6 \\ 3\ 3\ 7 \\ +\,9\ 4\ 9 \\ \hline \end{array}$$

14. **Subtract**

$$\begin{array}{r} 8\ 2\ 5 \\ -\,2\ 4\ 8 \\ \hline \end{array}$$

15. **Multiply**

$$\begin{array}{r} 3\ 5\ 7 \\ \times\,8 \\ \hline \end{array}$$

16. **Divide**

$8\,\overline{)2\ 0\ 8}$

17. **Add**

s.	d.
5	7
+ 3	8

18. **Add**

s.	d.
2	$11\frac{3}{4}$
	$4\frac{3}{4}$
1	$3\frac{1}{2}$
+ 3	$9\frac{1}{2}$

19. **Subtract**

s.	d.
10	4
− 4	9

20. **Multiply**

s.	d.
3	8
	× 5

21. **Divide**

	s.	d.
4)	4	6

22. **Divide**

	s.	d.
6)	13	6

Work across the page and put your working on the page

23. **Subtract**

£	s.	d.
6	3	5
− 4	16	$10\frac{1}{2}$

24. **Add**

£	s.	d.
3	18	$6\frac{1}{4}$
8	4	$10\frac{1}{2}$
+ 1	3	$9\frac{1}{2}$

25. **Multiply**

£	s.	d.
3	9	$7\frac{3}{4}$
		× 4

26. **Divide**

	£	s.	d.
5)	7	11	3

27. **Multiply**

weeks	days
3	6
	× 6

28. **Subtract**

lbs.	ozs.
6	13
− 2	15

29. **Divide**

	yds.	ft.
8)	34	2

30. **Divide**

12) 3 6 6 7 2

31. **Multiply**

$$\begin{array}{r} 846 \\ \times\ 79 \\ \hline \end{array}$$

Work across the page and put your working on the page

32. **Divide**

$6\overline{)69402}$

33. **Multiply**

£	s.	d.
12	16	$6\frac{1}{2}$
		$\times 14$

34. **Divide**

	£	s.	d.
17)	55	14	11

35, 36.

Pay this bill and find the change from 12s. 6d.

	£	s.	d.
3 lbs. currants at 9d. per lb. . .			
$1\frac{1}{2}$ lbs. coffee at 2s. 8d. per lb. . .			
$1\frac{3}{4}$ lbs. margarine at 1s. 4d. per lb. .			
7 eggs at 2s. 6d. per dozen . . .			
Paid			
Gave shopkeeper . .	0	12	6
Change			

Work across the page and put your working on the page

37.

Add

$\frac{2}{3} + \frac{5}{6}$

38.

Subtract

$\frac{3}{4} - \frac{2}{3}$

39.

Add

$3\frac{2}{3} + 2\frac{4}{5}$

40.

Subtract

$2\frac{1}{5} - 1\frac{5}{6}$

41.

Multiply

$\frac{3}{10} \times \frac{5}{6}$

42.

Divide

$\frac{3}{4} \div \frac{5}{6}$

43.

£ $3\frac{3}{5} + 2\frac{3}{4} - 2\frac{1}{2}$. Answer in £, s. d.

44.

Add

Add 55·5, 6·01, 19·042 and seven hundredths.

45.

Subtract

$$\begin{array}{r} 15{\cdot}1012 \\ -9{\cdot}0186 \\ \hline \end{array}$$

46.

Multiply

$$\begin{array}{r} 3{\cdot}8964 \\ \times\ {\cdot}6 \\ \hline \end{array}$$

47.

$49{\cdot}707 \div {\cdot}7$

48.

$62{\cdot}78 \div 4{\cdot}3$

49.

	s.	d.
Find 25 per cent. of	12	6

50.

	£	s.
Find 40 per cent. of	5	10

APPENDIX 2.2

Foirm A

Triail Uiṁríoċta Meicniúla

FRED J. SCHONELL, M.A., Ph.D., D.Lit.

Ainm..

Buaċaill nó Cailín..

Aois..

Lá Breiṫe..

Rang..

Scoil..

Ná scríoḃ anso	
Leaṫ. 1	
Leaṫ. 2	
Leaṫ. 3	
Leaṫ. 4	
Leaṫ. 5	
Leaṫ. 6	
Suim Iomlán ..	
Aois i mblianta agus míosa iomlána	
Aois Uiṁríoċtúil..	

Léiġ go cúramaċ

1. Freagair na ceisteanna san leaḃrán so ċóṁ cúramaċ agus ċóṁ tapaiḋ agus is féidir leat.

2. Tá saġasanna éagsúla ceist. **Taispeánfaiḋ an tsín duit cad tá le déanaṁ agat.**

3. Scríoḃ na freagraí ins na spásanna atá fágṫa ḋóiḃ. Is féidir pé obair is maiṫ leat a scríoḃ ar an bpáipéar so.

4. Má tá ceist ar biṫ ró ċruaiḋ duit fág í agus ar aġaiḋ leat go dtí an ċéad ċeann eile. Nuair a ṫagann tú go dtí bun leaṫanaiġ ar aġaiḋ leat **díreaċ** go dtí an ċéad leaṫanaċ eile.

5. Tá na ceisteanna tosaiġ éasca. Éiríonn siad níos deacra, aċ is ar éigin a ċríoċnóiḋ éinne an triail ar fad. Déan do ḋíċeall agus sin an méid.

6. Beiḋ 30 neomat agat. **Ná cuir ceist ar éinne.**

Ná h-iompaiġ an leaṫanaċ so go dtí go ndéanfar leat é ḋéanaṁ.

(Leat. 1)

Féac go cúramac ar an gceist féacaint an suimig +, dealaig —, méadaig × nó roinn ÷ atá i gceist. Lean trasna an leatanaig.

1.
Suimig
3+8=

2.
Suimig
$$\begin{array}{r} 4\ 4 \\ +\ 5\ 3 \\ \hline \\ \hline \end{array}$$

3.
Suimig
$$\begin{array}{r} 6\ 7 \\ +\ 9\ 8 \\ \hline \\ \hline \end{array}$$

4.
Dealaig
1 5—6=

5.
Dealaig
$$\begin{array}{r} 7\ 9 \\ -\ 4\ 4 \\ \hline \\ \hline \end{array}$$

6.
Dealaig
$$\begin{array}{r} 9\ 2 \\ -\ 4\ 7 \\ \hline \\ \hline \end{array}$$

7.
Méadaig
4×8=

8.
Méadaig
$$\begin{array}{r} 9\ 3 \\ \times\ \ 3 \\ \hline \\ \hline \end{array}$$

9.
Méadaig
$$\begin{array}{r} 5\ 4 \\ \times\ \ 7 \\ \hline \\ \hline \end{array}$$

10.
Roinn

3 6 ÷ 4=

11.
Roinn

$3\overline{)6\ \ 3}$

12.
Roinn

$6\overline{)1\ 0\ 2}$

Lean trasna an leatanaig

13. Suimig

$$\begin{array}{r} 4\;2\;6 \\ 3\;3\;7 \\ +9\;4\;9 \\ \hline \\ \hline \end{array}$$

14. Dealaig

$$\begin{array}{r} 8\;2\;5 \\ -2\;4\;8 \\ \hline \\ \hline \end{array}$$

15. Méadaig

$$\begin{array}{r} 3\;5\;7 \\ \times\;8 \\ \hline \\ \hline \end{array}$$

16. Roinn

$8\overline{)2\;0\;8}$

17. Suimig

s.	d.
5	7
3	8

18. Suimig

s.	d.
2	$11\frac{3}{4}$
	$4\frac{3}{4}$
1	$3\frac{1}{2}$
+3	$9\frac{1}{2}$

19. Dealaig

s.	d.
10	4
−4	9

20. Méadaig

d.

$$\begin{array}{r} 8 \\ \times 5 \\ \hline \\ \hline \end{array}$$

21. Roinn

s. d.

$4\overline{)4\quad 6}$

22. Roinn

s. d.

$6\overline{)13\quad 6}$

(Leaṫ. 3)

Lean trasna an leaṫanaiġ agus scríoḃ do obair ar an leaṫanaċ

23.

Dealaiġ

£	s.	d.
6	3	5
−4	16	10½

24.

Suimiġ

£	s.	d.
3	18	6¼
8	4	10½
+1	3	9½

25.

Méadaiġ

£	s.	d.
3	9	7¾
		×4

26.

Roinn

£	s.	d
5)7	11	3

27.

Méadaiġ

seaċtaini	laeṫe
3	6
	×6

28.

Dealaiġ

pt.	ún
6	1
−2	1

29.

Roinn

sl.	tr.
8)34	2

30.

Roinn

12)36672

31.

Méadaiġ

84
× 7

Lean trasna an leaṫanaiġ agus scríoḃ do obair ar an leaṫanaċ

32.

Roinn

$$36\overline{)69402}$$

33.

Méadaiġ

£	s.	d.
12	16	6½
		×14

34.

Roinn

	£	s.	d.
17)	55	14	11

35, 36.

Íoc an bille seo agus faiġ an briseaḋ (sóinseáil) as 12s. 6d.

		£	s.	d.
3 pt. cuirín ar 9d. an pt.	....			
1½ pt. caife ar 2s. 8d. an pt.	....			
1¾ pt. margairín ar 1s. 4d. an pt.	....			
7 uiḃeaċa ar 2s. 6d. an dosaen	....			
Íoċta	....			
Tugṫa don siopadóir	....	0	12	6
Briseaḋ (Sóinseáil)	....			

(Leaṫ. 5)

Lean trasna an leaṫanaiġ agus scríoḃ do obair ar an leaṫanaċ

37.

Suimiġ

$\frac{2}{3} + \frac{5}{6}$

38.

Dealaiġ

$\frac{3}{4} - \frac{2}{3}$

39.

Suimiġ

$3\frac{2}{3} + 2\frac{4}{5}$

40.

Dealaiġ

$2\frac{1}{5} - 1\frac{5}{6}$

41.

Méadaiġ

$\frac{3}{10} \times \frac{5}{6}$

42.

Roinn

$\frac{3}{4} \div \frac{5}{6}$

43.

£ $3\frac{3}{5} + 2\frac{3}{4} - 2\frac{1}{2}$. Freagra in £ s. d.

44.

Suimiġ 55·5, 6·01, 19·04
agus seaċt gcéadú

45.

Dealaig

$$\begin{array}{r} 15\cdot1012 \\ -\ 9\cdot0186 \\ \hline \\ \hline \end{array}$$

46.

Méadaig

$$\begin{array}{l} 3\cdot8964 \\ \times\ \cdot6 \\ \hline \\ \hline \end{array}$$

47.

$49\cdot707 \div \cdot7$

48.

$62\cdot78 \div 4\cdot3$

49.

	s.	d.
Faig 25 faoin gcéad de	12	6

50.

	£	s.
Faig 40 faoin gcéad de	5	10

APPENDIX 2.3

NOT TURN OVER OR OPEN THIS BOOK UNTIL YOU ARE TOLD

№ 29235

ENGLISH TEST 14

'l in the following particulars at once :—

-day's Date..19...........

our Surname (in capitals)..

our Christian Name(s)..

our Sex (Boy or Girl)..

ame of your School..

ass you are in..

our Age..Years

ate of your Birthday: Day..............Month..............................Year..............
(Write the month as a word)

Not to be filled in by Pupil.	
Page.	Score.
1.	
2.	
3.	
4.	
5.	
6.	
7.	
8.	
9.	
10.	
11.	
TOTAL	
Signature of Marker:	
Age in years and completed months. y. m.	
English Quotient:	

ead the following carefully :—

1. When you are told to begin, answer the questions as quickly and as carefully as you can.
2. Begin at the beginning and go straight through.
3. If after trying a question you find you cannot do it, don't waste time but go on to the next.
4. When you have to write an answer, do it in your ordinary handwriting. Don't waste time printing letters.
5. When you finish one page, go on to the next.
6. You will have 40 minutes and you will be told the time every quarter of an hour. No one is expected to do everything. Just do as much as you can.
7. Make any alterations in your answers clearly.
8. **Ask no questions at all.**

UNIVERSITY OF LONDON PRESS, LTD., LITTLE PAUL'S HOUSE, WARWICK SQUARE, LONDON, E.C.4.

l E. 14

Answer the questions in this book as quickly and as carefully as you can. Begi the beginning and go straight through. When you have finished a page, go on at c to the next without waiting to be told.

If you cannot answer any question after trying it, do not waste time on it but go to the next.

Read the following carefully.

As Margaret and Robert Holmes sat by the fire reading they could hear the rain beginn to splash on the street outside. "Mother," said Robert, "I'm glad we stopped playing came indoors." Hearing no answer, he looked up, and found, to his surprise, that they w alone.

The following questions are about what you have just read. Underline in the brac the correct answer to each.

1. Before he looked up, who did Robert think were in the room with him ?
(*Mr and Mrs Holmes* | *nobody* | *the boys he had been playing wi* *Mrs Holmes and Margaret* | *Mr Holmes and Margaret* | *the raindro*

2. Why was Robert glad they had come indoors ?
(*because he was tired of playing* | *because they would have got w* *because Margaret had wanted to come in* | *because it was dark no* *because he liked the rain* | *because his mother had told him to come*

3. What had Margaret and Robert been doing before they sat down at the fireside ?
(*playing outside* | *playing indoors* | *sitting outside and readi* *watching the rain splashing on the street* | *sleeping* | *lighting the fi*

4. Why was Robert surprised ? . . . . . (*because the room seemed so st* *because the rain came on so suddenly* | *because Margaret spoke to hi* *because Margaret had gone away* | *because he had thought his mother was in the roo* *because the rain was coming down the chimne*

5. How many people are mentioned in this story ?
(1 | 2 | 3 | 4 | 5 | 6

6. What was Margaret doing ?
(*staring into the fire* | *sewing* | *knitting* | *reading* | *sleeping* | *writi*

GO ON TO THE NEXT PAGE WITHOUT WAITING TO BE TOLD

In these questions underline the correct answer in the brackets.

'. We have spoken (*to* | *too*) long about this ; there (*is* | *are*) other things to talk about.

. He (*wont* | *w'ont* | *wo'nt* | *won't* | *wont'*) go away till we tell him.

. They put on (*there* | *they're* | *their*) coats. Then they took them (*off* | *of*) again.

. There aren't (*any* | *no*) more pencils. Someone has (*took* | *taken*) them away.

. It is the (*beautifulest* | *beautifullest* | *beautifuler* | *beautifuller* | *most beautiful* | *more beautiful*) view I have ever seen.

. I wish I had (*known* | *knowed*) that before ; then I would certainly not (*of went* | *of gone* | *have gone* | *have went*).

In each of the following sentences the word which is underlined has some letters issing. Find out what the word is, and then write it correctly spelt in the brackets.

Here is an example :

The thief was caught by a po c ma . . (................*policeman*................)

The word underlined is of course "policeman," so we have written "policeman" the brackets.

Now do these. Be sure to write the word IN THE BRACKETS. Write it clearly, d spell it correctly.

. He is too proud to y ld . . . . . . (..)

. We had a violent storm of thunder and l t ing . (..)

They spoke together in a foreign lan ge . . (..)

December 25th is C mas Day . . . (..)

I have p d my bill . . . . . . (..)

With this camera I have taken many ot gr s (..)

A native of Spain is called a Sp rd . . (..)

TURN OVER TO PAGE 3 WITHOUT WAITING TO BE TOLD

In the next questions underline in the brackets the word or phrase which mea most nearly the SAME as the word in capital letters.

Here is an example :—

Although he has done me harm, I shall PARDON him.

(*punish* | *love* | *reward* | *forgive* | *hit* | *pleas*

" Pardon " means nearly the same as " forgive," and so we have underlin " forgive " in the brackets.

Now do these.

20. He was delighted to meet his COMRADE again.
(*company* | *dog* | *brother* | *friendship* | *companion* | *travelle*

21. I was sorry to hear of your MISFORTUNE.
(*illness* | *ill-nature* | *ill-luck* | *good luck* | *mystery* | *acciden*

22. I wonder what his real PURPOSE is.
(*name* | *proposal* | *thing* | *purple* | *porpoise* | *intentio*

23. The watchman was punished for his NEGLIGENCE.
(*crime* | *theft* | *carelessness* | *wickedness* | *negative* | *informatio*

24. After a RAPID inspection of our papers, he let us through.
(*thorough* | *careful* | *rash* | *careless* | *rambling* | *quic*

25. The general decided to RETREAT.
(*advance* | *withdraw* | *go forward* | *resign* | *rest for the night* | *surrende*

26. They left a BRIEF message for me.
(*paper* | *short* | *long* | *written* | *brisk* | *brigh*

27. Your eyes have a striking RESEMBLANCE to your brother's.
(*love* | *hate* | *message* | *similarity* | *remembrance* | *differenc*

In each of the following questions underline in the brackets the word which b fits the sentence.

28. The little girl's eyes sparkled as she eagerly tore open the envelope : she was obviou (*upset* | *satisfied* | *sorry* | *delighted* | *amused* | *angry*) to get the letter.

29. His horse was (*galloping* | *trotting* | *loitering* | *racing* | *gliding* | *creeping*) at a stea pace along the road ; he seemed to be in no particular hurry.

30. As he saw his friend off in the train, James, who had never been away for a holiday hi self, felt just a little (*suspicious* | *wicked* | *spiteful* | *bad* | *hateful* | *envious*).

31. The fog was so (*heavy* | *dense* | *deep* | *close* | *strong* | *choking*) that we could har see a yard in front of us.

32. Everywhere we could hear the (*roaring* | *braying* | *squealing* | *bellowing* | *grunting* *neighing*) of frightened cattle.

33. He crouched in a corner, pale and trembling. Never have I seen anyone so (*uneas* *fearless* | *serious* | *puzzled* | *terrified* | *sorry*).

GO ON TO THE NEXT PAGE WITHOUT WAITING TO BE TOLD

Read the following carefully.

So far as it was in his power, Deerslayer was as good as his word. In less than five minutes ter this speech was made, the whole party was in the raft, and in motion. There was a gentle eeze from the north ; and boldly hoisting the sail, the young man laid the head of the ıwieldy craft in such a direction as would have brought it ashore a couple of miles down the ke, and on its eastern side. The sailing of the raft was never very swift ; though, floating it did on the surface, it was not difficult to get it in motion, or to urge it along over the ater, at the rate of some three or four miles in the hour.

J. Fenimore Cooper : " The Deerslayer." (Collins.)

The next five questions are about the passage you have just read.

In the following three questions underline in the brackets the correct answer to each.

. What is the meaning of " craft " in the passage you have just read ?

(*skill* | *cunning* | *vessel* | *cheese* | *compass* | *helm* | *tiller*)

. What is the meaning of " was as good as his word " ?

(*was a good man and a good speaker* | *kept his promise* | *words cannot describe him* | *was dishonest* | *was a good slayer of deer* | *was as good as gold*)

. What is the meaning of " unwieldy " ?

(*ugly* | *unknown* | *huge* | *untidy* | *unwilling* | *clumsy*)

If you know from the passage that any of the following sentences are true mark em with a cross (×) inside the brackets. Mark only those sentences which are true.

. (*a*) A gentle wind blew them northwards . . . . . . (................)

(*b*) Five minutes after the speech they were already on the eastern side of the lake . . . . (................)

(*c*) The raft was easy to get moving . . . . (................)

. (*d*) The raft was big enough for the whole party . . . . . (................)

(*e*) The strong wind blew the raft swiftly along . . . . . (................)

(*f*) They depended entirely on oars to move the raft . . . . (................)

TURN OVER TO PAGE 5 WITHOUT WAITING TO BE TOLD

In the questions which follow, underline in the brackets that word which ends the same sound or rhymes with the word in capital letters.

Here is an example :

NEAR . . . . (*hair* | *are* | *beware* | *deer* | *pear*

" Deer " has been underlined because it is the only word which ends in the san sound as " near."

Now do these.

39. ROUGH . . . . . . (*through* | *though* | *cuff* | *cough* | *rug* | *off*

40. HEIR . . . . (*here* | *hire* | *higher* | *pier* | *pear* | *peer*

41. WEIGHT . . . . . . (*bright* | *height* | *deceit* | *wet* | *weighed* | *gate*

42. FLOWER . . . . . . (*sewer* | *sore* | *soar* | *sour* | *fewer* | *floor*

43. FAULT . . . . (*called* | *colt* | *salt* | *sold* | *fall* | *moult*

44. EYE . . . . (*ye* | *ere* | *prey* | *fry* | *eerie* | *early*

45. REIGNED . . . . (*resigned* | *mend* | *pained* | *regard* | *pined* | *regain*

Here is an example of the next questions.

ANGRY . . . . . . **He left the room in great** ....*anger*....

The word ANGRY is an adjective, and in the blank space we have written " anger which is the noun formed from this adjective.

In the following sentences you have to write in the blank space the correct nou formed from the adjective printed in capital letters.

Write the noun clearly and be sure to spell it correctly.

46. TRUE . . . . You must always tell the ....

47. IGNORANT . . . . . I am surprised at your..........................

48. WISE . . . . . . Solomon was famed for his ....

49. GENEROUS . . . . . Everyone loved her for her ....

50. BROAD . . . . . . Measure the .... of the roa

GO ON TO THE NEXT PAGE WITHOUT WAITING TO BE TOLD

Read the following carefully.

In the city lived Martin, a shoemaker. He lived in a basement, in a little room with one ndow. The window looked out on the street. Through the window he used to watch the ople passing by: although only their feet could be seen, yet by the boots he recognised eir owners. Martin had lived long in one place, and had many acquaintances. Few boots his district had not been in his hands once or twice. Some he would re-sole, some he would tch, and occasionally he would put on new uppers. Through the window he often recognised s work.

LEO TOLSTOY: "Where God is, Love is." (London: Little Blue Book Company.)

The following questions are about what you have just read. Underline in the brackets e correct answer to each.

. Where was Martin's room? . (*level with the street* | *one floor up* | *two floors up* | *below the street level* | *at the top of a high building*)

. Why could only the people's feet be seen?
(*the window was so low* | *Martin was interested only in boots* | *the people wore heavy coats* | *they were in a hurry* | *they had many acquaintances*)

. What is meant by "through the window he recognised his work"?
(*he recognised he had work to do* | *he saw boots he would have to mend some day* | *he saw boots and shoes he had mended* | *he grew tired of working* | *he saw the window needed cleaning*)

. Why had Martin many acquaintances?
(*he was a good shoemaker* | *he watched the people passing by* | *he lived in the city* | *he lived in a room with a window* | *he had lived in the same place so long*)

. What does "occasionally" mean?
(*often* | *never* | *sometimes* | *carefully* | *always* | *finally*)

. What would be a suitable title for this passage?
(*In the City* | *New Uppers* | *I did but see her passing by* | *The Shoemaker's Window* | *The Story of a Boot* | *Shoes to Mend*)

In each of the next questions find out what the word underlined should be, and en write it clearly and correctly spelt in the brackets.

. He filled his pipe with t b c . . . . . (.................................)

. Dry your tears on your han rch f . . (.................................)

. I admire her noble c r ct r . . . . . (.................................)

. I do not know you: th f r I do not trust you . (.................................)

. Many people died of the pl g . . . . . (.................................)

. The mar ge of James IV and Margaret Tudor was a great occasion . . . . (.................................)

TURN OVER TO PAGE 7 WITHOUT WAITING TO BE TOLD

In each of the following questions underline in the brackets the word that fits be there. It will help you if you remember that you are about to read a poem.

Up into the cherry tree
Who should climb but little me ?

63. I held the (*leaf* | *twig* | *trunk* | *birds* | *cherry-blossom* | *ground*) with both my hanc
64. And looked abroad on foreign (*parts* | *tongues* | *stamps* | *continents* | *countries* | *lands*

I saw the next door garden lie
Adorned with flowers before my eye,

65. And many (*pleasant* | *good* | *bright* | *entertaining* | *familiar* | *parking*) places more
66. That I had never seen (*yet* | *before* | *in store* | *on shore* | *there* | *in my life*).
67. I saw the dimpling (*railway* | *canal* | *road* | *river* | *telegraph-wires* | *sparrows*) pass
68. And be the sky's blue (*mirror* | *looking-glass* | *grass* | *bird* | *eider-down* | *moon*);
69. The (*long* | *straight* | *dusty* | *cruel* | *elevated* | *tar-macadam*) roads go up and down
With people tramping in to town.

R. L. STEVENSON : " A Child's Garden of Verses."

In the next questions underline in the brackets the word or phrase which mea most nearly the SAME as the word in capital letters.

70. In the room was a crowd of BOISTEROUS children.
(*beautiful* | *brave* | *noisy* | *frightened* | *happy* | *rebellious*
71. Do not ALTER anything . . (*forget* | *ask for* | *change* | *add* | *sign* | *offer*
72. It was SKILFULLY done (*wilfully* | *cleverly* | *quickly* | *badly* | *carefully* | *hurriedly*
73. He will never CONSENT to that (*descend* | *ascend* | *reach* | *change* | *come* | *agree*
74. He did not know the PERIL he was in
(*place* | *position* | *danger* | *difficulty* | *part* | *storm*
75. The sound was quite DISTINCT (*loud* | *soft* | *clear* | *pleasant* | *disturbing* | *dismal*

Here is an example of the next questions.

CHILD . . . . . She behaved in a very ....*childish*........ manne

The word CHILD is a noun, and in the blank space we have written " childish which is the adjective formed from this noun.

In the following sentences you have to write in the blank space the correct adjecti formed from the noun printed in capital letters.

Write the adjective clearly and be sure to spell it correctly.

76. BRITAIN . . . . We are .... peopl
77. COURAGE . . . Drake was a clever and .... sailc
78. HOPE . . . In spite of bad luck, they are still ....
79. BODY . . . . He suffered no .... injur
80. FIRE . . . . . . He has a .... tempe
81. MAN . . . . . . It was a brave and .... actio

GO ON TO THE NEXT PAGE WITHOUT WAITING TO BE TOLD

Read the following carefully.

Cicely looked for the door, through which he must have passed ; and after some little arch discovered it. When she pushed against it, it yielded to her pressure, and admitted her a low passage, evidently communicating with some of the subterranean dungeons which ie knew existed under this part of the fortress.

She had scarcely set foot within this passage, when she perceived the jailer returning ; id had barely time to conceal herself behind an angle of the wall, when he approached the ot where she stood. In his hurry he had forgotten to lock the door, and he now hastened repair his error ; cutting off by this means the possibility of Cicely's retreat.

W. H. Ainsworth : "The Tower of London." (Dent.)

The following questions are about what you have just read. Underline in the brackets ie correct answer to each.

2. Why had the jailer forgotten to lock the door ?
(*he was afraid* | *he had lost the key* | *he had been in such haste* | *he had been following Cicely* | *he had barely had time to conceal himself*)

3. Why did the jailer come towards the place where Cicely stood ? . (*he heard a noise* | *he thought she would be coming* | *to cut off the possibility of Cicely's retreat* | *he was on his way to the subterranean dungeons* | *to lock the door*)

4. What is the meaning of "to repair his error" ? . . . . . (*to make amends* | *to make his mistake worse than ever* | *to set right the mistake he had made* | *to mend his ways* | *to repent of his misdeeds*)

5. How long was it before Cicely found the door ? (*almost no time at all* | *a long time* | *far too long* | *all the time between the jailer's passing through it and his return to it* | *a fairly short time*)

6. What is the meaning of "cutting off by this means the possibility of Cicely's retreat" ?
(*preventing Cicely from going farther in* | *thus making it impossible for Cicely to go back* | *making sure he would not be attacked from behind* | *in this way making it possible for Cicely to cut through and escape* | *cutting Cicely off from him, so that she had to go back*)

7. Write down the word in the passage which means "underground" . . . . (..)

TURN OVER TO PAGE 9 WITHOUT WAITING TO BE TOLD

In the following questions underline the correct answer in the brackets.

88. I see you have (*came* | *cum* | *cam* | *comed* | *camed* | *come*) at last.

89. You certainly (*didn't ought to have did it* | *ought not to have did it* | *hadn't ought to do i,* *ought not to have done it* | *didn't ought to have done it* | *ain't ought to have done it*

90. On (*Friday* | *friday*) I visited my uncle, who is a (*London policeman* | *lond* *Policeman* | *London Policeman* | *london policeman*).

91. (*James brown* | *james Brown* | *James Brown*) has gone away to live in (*Newcast-* *On-Tyne* | *newcastle-on-Tyne* | *Newcastle-on-tyne* | *Newcastle-on-Tyne*).

92. He said that his wife and (*he* | *him*) had seen a boy (*who's* | *whoes* | *whose*) fo was bleeding.

93. He does not speak (*english* | *English*). He is a (*foreign Visitor* | *Foreign Visitor* *foreign visitor* | *Foreign visitor*).

94. This shop sells only (*womens* | *women's* | *womens'*) shoes and (*childrens* | *children's* *childrens'*) shoes.

In each of the next questions find out what the word should be, and then write clearly and correctly spelt in the brackets.

95. I can't understand it ; it's all so very m st r s . (..

96. He was an extr rd ry sight . . . . (..

97. Come whenever you find it conv nt . . (..

98. There is no doubt about this answer : it is quite def n t . . . . (..

99. Cut it out with a pair of s s rs . . . . (..

100. We were delighted at the enth s sm of the scouts . (..

101. He is a good man : he would never do anything dishon ble . . . . (.......................... ....

GO ON TO THE NEXT PAGE WITHOUT WAITING TO BE TOLD

In the next questions, underline that word in the brackets which has the same ıeaning as the phrase which is already underlined.

02. A line of people waiting to get into a cinema

(*crowd* | *multitude* | *queue* | *parade* | *waiting-list* | *row*)

03. Money paid for the release of a prisoner

(*reward* | *ransom* | *booty* | *blackmail* | *bank-notes* | *dollar-bills*)

04. Something which stands in one's way

(*wall* | *spectacle* | *nuisance* | *object* | *obstacle* | *robber*)

05. To turn upside down . (*invite* | *invert* | *invent* | *destroy* | *spoil* | *cart-wheel*)

06. A person who looks on the bright side of things

(*fool* | *optician* | *jeweller* | *pessimist* | *optimist* | *artist*)

In the next questions underline in the brackets the word or phrase which means ıost nearly the SAME as the word in capital letters.

07. The boys seemed to be quite ROBUST.

(*ruddy* | *sick* | *strong* | *wrong* | *right* | *thieving*)

08. Do not TORMENT me . . (*forget* | *touch* | *trust* | *leave* | *torture* | *report*)

09. He gave me some food out of his own MEAGRE stock.

(*scanty* | *large* | *rich* | *extra* | *private* | *mere*)

10. The solution of the problem is now EVIDENT.

(*easy* | *difficult* | *hidden* | *obvious* | *eminent* | *unknown*)

11. She is a very ENERGETIC girl.

(*elementary* | *clever* | *lazy* | *active* | *stupid* | *beautiful*)

12. We will not be deceived by VAIN promises.

(*fine* | *rash* | *worthless* | *haughty* | *honest* | *various*)

13. At last we ENCOUNTERED our enemies.

(*met* | *encircled* | *escaped* | *counter-attacked* | *saw* | *overcame*)

14. We tried to CONSOLE her.

(*force* | *command* | *persuade* | *comfort* | *question* | *restrain*)

TURN OVER TO PAGE 11 WITHOUT WAITING TO BE TOLD

In each of the following questions put a cross (×) in the brackets after that OI phrase which means nearly the same as the phrase which is underlined.

115. " To be out of pocket " means nearly the same as

To have less money than one had before . . . . . . (............
To be out in the open air . . . . (............
Out of the frying-pan into the fire . . . . (............
To have holes in one's pockets . . . . (............
To be produced by magic . . . . (............

116. " I wash my hands of this affair " means nearly the same as

I always come to the table with clean hands . . . . . (............
I committed this crime . . . . (............
I take all the blame for this on myself . . . . . . (............
I refuse to be responsible for this affair, and will take no blame for it (............
Cleanliness is next to godliness . . . . (............

117. " To show the white feather " means nearly the same as

To bury the hatchet . . . . (............
To be a coward . . . . (............
To give the secret sign . . . . (............
To wear fine clothes . . . . (............
To wear shabby clothes . . . . (............

118. " It's no use crying over spilt milk " means nearly the same as

Milk should always be carried carefully . . . . . . (............
Disasters usually cause grief . . . . (............
It's like looking for a needle in a haystack . . . . . . (............
It's no use trying to put spilt milk into the can again . . . . (............
What's done can't be helped now, and it's no use lamenting about it (............

119. " To get into hot water " means nearly the same as

To get into trouble . . . . (............
To have a bath . . . . (............
To have a cup of tea . . . . (............
To get excited . . . . (............
To make a clean breast of it . . . . (............

120. " To make a mountain out of a molehill " means nearly the same as

To make tons of money out of mole-catching . . . . . (............
To put one's best foot forward . . . . (............
Not to realise the dangers . . . . (............
To get a big job done in small stages . . . . . . (............
To make a great fuss about very little . . . . . . (............

LOOK OVER YOUR WORK TILL TIME IS UP

MAKE SURE THAT YOU HAVE NOT MISSED A PAGE

APPENDIX 2.4

Ná h-iompaiġ go ndéarfar leat

Triail Ġaeilge

Coláiste Pádraig

Dromċonraċ

Ná scríoḃ anseo	
Leaṫ.	Marc
1	
2	
3	
4	
5	
6	
Iomlán (70)	
Aois i mbliana agus míosa iomlána	
bl.	mí
G.Q.	

Líon na bearnaí anseo díreaċ:—

An Dáta..19........

Do Ṡloinne (litreaċa móra)...

Do Ainm Baiste...

Buaċaill nó Cailín..

Ainm do Scoile..

Do Rang...

Do Aois..

Lá Breiṫe : Dáta..................Mí.................................Bliain......................

Léiġ go cúramaċ :—

1. Nuair a déarfar leat tosnú, freagair na ceisteanna ċom tapaiḋ agus ċom cúramaċ agus is féidir leat.

2. Tosnaiġ ag an dtosaċ agus lean leis tríḋ síos.

3. Muna bḟuil tú ábalta ceist do ḟreagairt fág í agus ar agaiḋ leat go dtí an ċéad ċeann eile.

4. Nuair a ṫagann tú go deireaḋ leaṫanaiġ ar agaiḋ leat go dtí an ċéad leaṫanaċ eile.

5. Beiḋ 25 nóiméad agat. Is ar éigin a beiḋ éinne ábalta na ceisteanna go léir do ḟreagairt. Dein do ḋíċeall.

6. Pé atrú atá le déanaṁ agat ar do ḟreagraí, dein go soiléir é.

7. **Ná cuir ceist ar biṫ ar éinne.**

APPENDIX 2.4

NÁ h-IOMPAIĠ GO NDÉARFAR LEAT

TRIAIL ĠAEILGE

COLÁISTE PÁDRAIG

DROMĊONRAĊ

Líon na bearnaí anseo díreaċ:—

An Dáta...19.......

Do Ṡloinne (litreaċa móra)..

Do Ainm Baiste..

Buaċaill nó Cailín..

Ainm do Scoile..

Do Rang..

Do Aois..

Lá Breiṫe : Dáta....................Mí....................................Bliain......................

NÁ SCRÍOḂ ANSEO

Leaṫ.	Marc
1	
2	
3	
4	
5	
6	
Iomlán (70)	
Aois i mblianta agus míosa iomlána	
bl.	mí
G.Q.	

Léiġ go cúramaċ :—

1. Nuair a déarfar leat tosnú, freagair na ceisteanna ċoṁ tapaiḋ agus ċoṁ cúramaċ agus is féidir leat.

2. Tosnaiġ ag an dtosaċ agus lean leis tríd síos.

This is a photographic reproduction of the Irish test reduced in scale.

6. [illegible]

7. **Ná cuir ceist ar biṫ ar éinne.**

Ná scríoḃ anseo

Freagair na ceisteanna seo ċoṁ tapaiḋ agus is féidir leat. Nuair atá leaṫanaċ críoċnaiṫe agat, ar aġaiḋ leat go dtí an ċéad leaṫanaċ eile. Mura ḃfuil tú ábalta ceist d'ḟreagairt, ná bac léi.

Tosnaiġ anseo.

Cuir focal aṁáin as an liosta seo ins gaċ bearna :—

bán gorm buí

duḃ glas dearg

Mar seo : Ḃíonn daṫ **dearg** ar an rós.

1. Ḃíonn daṫ..............................ar an sneaċta .. .. .. 1 ....
2. Ḃíonn daṫ..............................ar gual .. .. 2 ....
3. Ḃíonn daṫ..............................ar an ḃféar .. .. 3 ....
4. Ḃíonn daṫ..............................ar oráiste .. . . 4 ....
5. Ḃíonn daṫ..............................ar fuil .. .. 5 ....
6. Ḃíonn daṫ..............................ar an spéir lá breá .. .. .. 6 ....

Léiġ an t-alt seo go cúramaċ.

Ḃí muintir an tí in a suí cois tine. Ḃí Mamaí ag cniotáil agus ḃí Daid in a ṡuí in a ċaṫaoir féin in aice an lampa agus é ag léaṁ an ṗáipéir. Ċuir sé an páipéar uaiḋ taréis tamaill agus ṫarraing sé ċuige a ṗíopa agus ḃí fios ag na leanaí go raiḃ tráṫ na scéalaíoċta tagṫa. D'éiriġ Síle agus ḋearg sí an píopa ḋó. Nuair a ḃí Daid ag caiṫeaṁ an ṗíopa ar a ṡuaiṁneas ṡuiġ Síle in a uċt ag éisteaċt leis agus ċuir sí a dá láiṁ tar a ṁuinéal.

Cuir líne faoi an ḃfreagra ceart ar gaċ ceann de na ceisteanna ṫíos.

Mar seo : Ḃí muintir an tí in a suí
(a) ag an mbórd
(b) cois tine
(c) in aice an dorais
(d) ag an ḃfuinneoig
(e) ar an urlár

7. Cé ḃí in aice an lampa? — 7 ....
(a) Síle
(b) Mamaí
(c) Daid
(d) an cat
(e) an leanḃ

8. Cad a ḃí á ḋéanaṁ ag Daid? — 8 ....
(a) ag léaṁ an ṗáipéir
(b) ag scríoḃ litreaċ
(c) ag ól té
(d) ag ligint a scíṫe
(e) ag caint

9. Conas a ḃí fios ag na leanaí go raiḃ tráṫ na scéalaíoċta tagṫa? — 9 ....
(a) ḃí an té tart
(b) ḃí na ceaċtanna déanta
(c) ḃíodar sa leaba
(d) ċuir Daid an páipéar uaiḋ
(e) ṫáinig cuairteoir isteaċ

10. Cad ina ṫaoḃ (cé'n fáṫ) gur ṡuiġ Síle in a uċt? — 10 ....
(a) mar ḃí sí tinn
(b) ċun an scéal a ċloisteáil
(c) mar ḃí sí tuirseaċ
(d) mar ḃí eagla uirṫi
(e) mar ḃí sí fuar

11. Cad is brí le "tráṫ na scéalaíoċta"? — 11 ....
(a) go raiḃ sé in am codlata
(b) go raiḃ am dinnéir ann
(c) go raiḃ Daid ċun scéal d'insint
(d) go raiḃ sé in am na paidreaċa a rá
(e) go raiḃ siad go léir tuirseaċ

Suim

Ná scríoḃ anseo

Scríoḃ líne faoi ḟocal aṁáin de na focla atá idir lúibíní : sé sin faoi'n ḃfocal a líonfaḋ an ḃearna.

Mar seo : Ṫug a ṁáṫair scilling........................Pádraig (le / ó / do / réal / ar)

12. Tá Seán..............................airde ná Séamus. .. 12 ....
(nios / ċom / ná / nil / láidir)

13. Ċuir siad a gcótaí báistí..............................mar ḃí sé fliuċ .. .. 13 ....
(hata / uisce / acu / orṫu / ar)

14. Ḃain tú do ċóta..............................nuair a ṫáinig tú ó'n scoil .. 14 ....
(díot / díḃ / asat / de / fliuċ)

15. Níl agam aċ an t-aon aṫair.............................. .. .. .. 15 ....
(deas / aṁáin / árd / láidir / mór)

16. Ḃíoḋ Peig in éineaċt..............................nuair a ḃíoḋ mé ag teaċt abaile. 16 ....
(againn / déanaċ / scoil / liom / tráṫnóna)

17. Léann an..............................an t-Aifreann gaċ Doṁnaċ .. .. 17 ....
(leabar / leaṫanaċ / maidin / sagart / paidreaċa)

Léiġ an t-alt seo go cúramaċ.

Luiġ an ḃeirt acu sios agus d'ḟanadar ciúin socair gan focal astu ag feiṫeaṁ. Níorḃ ḟada gur sciorr coinín amaċ as an bpoll. Ḃí dá ċluais móra air agus ḃí a ṡrón ar criṫ, fé mar a ḃéaḋ sé ag fáil bolaḋ an aeir. Lean na coinini eile amaċ é agus tosnaíodar ag iṫe an ḟéir. Ċonaic Liam na h-eireabaill ḃeaga ḃána ag dul suas sios, suas sios, agus níor ḟéad sé gan gáire a ḋéanaṁ. Ní túisce an gáire ṫar a ḃéal ná ḃí na coinini glanta leo isteaċ ins na poill.

Cuir líne faoi'n ḃfreagra ceart ar gaċ ceann de na ceisteanna seo ṫíos :

Mar atá déanta anso :

Cad a ḋein an ḃeirt?
(Ṡuíodar sios / ṫosnaíodar ag riṫ / luiġ siad sios / ḃíodar ag aṁránaíoċt / ṡeasadar suas)

18. Cad ina ṫaoḃ (cé'n fáṫ) gur ḟanadar ciúin ? .. .. 18 ....
(ċun go dtiocfaḋ na coinini amaċ / mar ḃí siad tuirseaċ / mar ḃí siad ina gcodlaḋ / mar ḃí an máistir ag teaċt / mar ḃíodar ag éisteaċt leis na h-éin).

19. Cá raiḃ an poll ? ('san doras / 'san talaṁ / 'san ċaṫaoir / 'san tiġ / 'san ċrann) .. .. 19 ....

20. Cad ina ṫaoḃ (cé'n fáṫ), is cosúil, go raiḃ a ṡrón ar criṫ ? .. .. 20 ....
(mar ḃí sé fuar / mar ḃí eagla air / mar ḃí pian air / mar ḃí sé ag fáil bolaḋ an aeir / mar ḃí slaġdán air)

21. Cad ina ṫaoḃ (cé'n fáṫ) gur ḋein Liam gáire ? .. .. .. 21 ....
(mar ḃí sé sásta / nuair d'ḟéaċ sé ar an ḃuaċaill eile / nuair a ċonaic sé na h-eireabaill ar criṫ / mar fuair sé bronntanas ó'n a ṁáṫair / mar ḃí áṫas air).

22. Cé'n uair a ċuaiġ na coinini ṫar n-ais ins na poill ? .. .. 22 ....
(nuair a ṫáinig an oíċe / nuair d'éiriġ sé fuar / nuair a ḋein Liam gáire / nuair a ċuala siad an gunna / nuair a fuair siad bolaḋ an aeir).

23. Cad ina ṫaoḃ (cé'n fáṫ) gur ṫáinig na coinini amaċ ? .. .. 23 ....
(mar ḃí sé dorċa ins na poill / mar ḃí ocras orṫu / mar ḃí uaigneas orṫu / ċun an ṗáirc d'ḟeiscint / ċun bolaḋ an aeir d'ḟáil).

Suim

ná scríoḃ anseo

Ins gaċ abairt díoḃ seo tá litreaċa fágṫa ar lár i ḃfocal aṁáin. Faiġ amaċ cad é an focal ceart agus ansin scríoḃ i gceart é ins an spás atá idir na lúibíní.

Seo sampla :

Riṫ an madra i nd..............ḋ an ċoinín (i ndiaiḋ)

24. Ḃí falla t..m....ll an gáirdín .. (..........................) 24 ....
25. Téann muintir na caṫraċ amaċ fé'n dtu....lá saoire (..........................) 25 ....
26. Ḃí na buaċaillí ag imirt leis an li..ṫ..ó..d sa ċlós (..........................) 26 ....
27. Ṫáinig t..aċ..a..re ċun an tí ar maidin .. (..........................) 27 ....
28. Is maiṫ liom na bláṫanna a fe..c..á..l ins na páirceanna .. .. (..........................) 28 ....
29. 'Sé liam an buaċaill is cl..s..e sa rang .. (..........................) 29 ....
30. Fuair Caitlín l..t..r óna haintín .. .. (..........................) 30 ....

Léiġ an t-alt seo go cúramaċ

Ḃain sí a cuid éadaiġ di go tapaiḋ. Ċaiṫ sí a gúna agus a cóitín beag i gcófra a ḃí faoi an mbord. Ċuir sí éadaí Ṗádraig uirṫi féin. Ċuir sí a cosa isteaċ sa ḃríste agus do ṫarraing aníos uirṫi féin é. Ní raiḃ aon ċrios aici agus b'éigin di crios a ḋéanaṁ as seanṗíosa córda. D'ḟéaċ sí sa scaṫán agus do ġeit sí. Ċeap sí gurḃ é a dearṫáir a ḃí ann. D'ḟéaċ sí ṫar a gualainn aċ ní faca sí éinne. Is ansin a ċuiṁnig sí gurḃ í féin a ḃí ag féaċaint isteaċ sa scaṫán, agus do rinne sí gáire.

Cuir líne faoi an ḃfreagra ceart ar gaċ ceann de na ceisteanna ṫíos.

Mar seo : Conus a ḃain sí a cuid éadaiġ di? (go mall / go cúramaċ / go tapaiḋ / go néata / go leisciúil).

31. Cad ina ṫaoḃ (cé'n fáṫ) ar ḃain sí a cuid éadaiġ di? (ċun dul a ċodlaḋ / ċun í féin do ní / ċun éadaí Ṗádraig a ċur uirṫi / ċun gúna nua a ċur uirṫi / mar ḃí sí ró te). 31 ....
32. Cad a ḃí sa ċófra? (éadaí / móin / gual / cupáin / aḋmad). 32 ....
33. Cad a dein sí leis an gcórda? (ċeangail sí a bróga / ċeangail sí timpeall an ḃríste é / ċuir sí ina póca é / ċuir sí timpeall ar ḃeart é / ċeangail sí na cosa leis). 33 ....
34. Cad ina ṫaoḃ (cé'n fáṫ) gur ġeit sí? (ḃí eagla uirṫi / ċuala sí glór nó torann árd / ċonaic sí taiḃse / leag an cat cupán de'n ḃord / ċeap sí go ḃfaca sí a dearṫáir). 34 ....
35. Cérḃ é Ṗádraig? (a h-aṫair / an máistir / a dearṫáir / a h-uncail / an sagart). 35 ....
36. Rinne sí gáire mar—(fuair sí milseáin / ḃí lá saor aici / ċuala sí scéal greannṁar / ċuiṁnig sí gurḃ é a scála féin a ḃí le feiscint sa scaṫán / ḃí áṫas uirṫi). 36 ....
37. Ní faca sí éinne nuair?—(d'oscail sí an doras / d'ḟéaċ sí ṫar a gualainn / ṫáinig sí isteaċ sa seomra / d'ḟéaċ sí tríd an fuinneoig / ċuir sí éadaí Ṗádraig uirṫi). 37 ....

Suim

Ná scríoḃ anseo

Scríoḃ líne faoi ḟocal aṁáin de na focla atá idir lúibíní ; 'sé sin faoi'n ḃfocal a líonfaḋ an ḃearna.

Mar seo : Níl Seán ċoṁ hárd....................Séamus (agus / le / ná / is / tá)

38. 'Sé an...........................an ceaṫrú séasúr ḋen ḃliain (saṁraḋ / Aibreán / geiṁreaḋ / earraċ / fóṁar) 38 ....

39. Ḃíonn na fir ag obair ins na páirceanna agus na....................ins an dteaċ (bean / mná / cócaire / cailín / scuabaḋ) 39 ....

40. Ḃí eagla..............................nuair a ċonaic siḃ an taiḃse (agam / ann / agaiḃ / sprid / oraiḃ) 40 ....

41. Ḃíonn an feirmeoir ag treaḃaḋ le.............................(bráca / cruiṫneaċt / /céaċta / talaṁ / eorna) 41 ....

42. Ḃí baḃóg aici, aċ ṫóg an máistir...............................í (uaiṫi / gúna / di / léasaḋ / bronntanas) 42 ....

Léiġ an t-alt seo go cúramaċ.

Ċoṁ luaṫ agus ṫit an oíċe d'éalaiġ mé amaċ agus ṫug mé agaiḋ go deifreaċ ar an Teaċ Ḃán. Ní raiḃ solas ar biṫ sa teaċ agus ṫug mé faoi deara naċ raiḃ an doras aċ leaṫ ḋúnta. Ḃuail mé cnag maiṫ trom aċ níor tugaḋ freagra dá laġad orm. Nuair nár freagraḋ an dara buille ṡiúil mé isteaċ. Ċuaiġ mé ċuig an seomra ina raiḃ mé an oíċe roiṁe sin agus las mé an lampa. Ḃí an tine beagnaċ as. Ċuir mé móin timpeall na griosaí a ḃí ar an tinteán agus ba ġearr go raiḃ tine ḃreá agam. Ṡuiġ mé le na h-ais ċun mo ṡuaiṁneas a ġlacaḋ go dtí go ḃfilleaḋ mo ċara. Ṫosaiġ mé ag léaṁ leaḃair a ḃí ar an matal agus ċuir mé oiread san suime ann nár ṁoṫaiġ mé an t-am ag sleaṁnú ṫart.

Cuir líne faoi an ḃfreagra ceart ar gaċ ceann de na ceisteanna seo ṫíos.

Mar seo: Cén uair a d'éalaiġ sé amaċ ? (ar maidin / nuair a ṫit an oíċe / nuair a ḃuail an clog / nuair a ḃí a ṡuipéar iṫe aige / nuair a stop an ḃáisteaċ).

43. Nuair a ṫit an oíċe cad a dein sé ? (ċuaiġ sé a ċodlaḋ / léiġ sé an páipéar / léiġ sé leaḃar / ċuaiġ sé go dtí an Teaċ Ḃán / d'iṫ sé a ṡuipéar). 43 ....

44. Cad ina ṫaoḃ (cé'n fáṫ) gur ḃuail sé cnag ar an doras ? (ċun an doras a ḃriseaḋ / ċun an doras a oscailt / ċun scannraḋ a ċur ar ṁuintir an tí / mar ḃí eagla air / ċun féaċaint an raiḃ éinne sa ḃaile). 44 ....

45. Cé ḃí sa tiġ ? (ḃí fear an tí ann / ní raiḃ éinne ann / ḃí an líon tí ann / ḃí cuid de na comarsana ann / a ċara). 45 ....

46. Cad is brí le " Ḃí an tine beagnaċ as ? " (ḃí an tine dearg te/ḃí a lán móna ar an dtine / ní raiḃ aon tine ann / ḃí an tine in áit eile / ní raiḃ mórán de'n tine fágṫa). 46 ....

47. Cé leis a raiḃ sé ag feiṫeaṁ (fanaċt) ? (le cara / le'n a ḃean / le cuairteoir / leis na Gárdaí / le gadaí). 47 ....

48. Conas tá fios agat gur taiṫin an leaḃar leis ? (Mar níor léiġ sé mórán de / níor ċuir sé suim ann / mar tosnaiġ sé á léaṁ / níor ṁoṫaiġ sé an t-am ag sleaṁnú ṫart / ṫit sé in a ċodlaḋ). 48 ....

Suim

Ná scríoḃ anseo

Cuir líne faoi ḟocal amáin de na focla idir lúibíní ; sé sin faoi'n ḃfocal atá ar aon ḃrí leis an ḃfocal ins na litreaċa móra.

Mar seo: Ċuir an ḃean an crúiscín ar an dTÁḂLA (bainne / lán / bórd / caṫaoir / cistin).

49. D'éiriġ an máistir agus ṫosnaiġ sé ag LAḂAIRT (caint / fearg / múineaḋ / scrioḃ / bualaḋ). 49 ....

50. Ní raiḃ mé ábalta aon NÍ a déanaṁ mar ḃí mo láṁ briste. (pian / rud / fuil / naċ / buille). 50 ....

51. Ṫug m'aṫair mé go dtí an baile mór san nGLUAISTEÁN. (trucail / saoire / bus / carr / traen). 51 ....

Léiġ an scéal seo go cúramaċ.

D'éiriġ Séamus ina ṡeasaṁ. Riṫ sé anonn go dtí an ḟuinneog agus d'ḟéaċ sé amaċ. Ḃí na gasúir ag teaċt aḃaile ó'n scoil. Agus naċ acu a ḃí an spórt leis an sneaċta. Iad ag déanaṁ cnapóg de agus caṫ ar siúl acu ar an tsráid. Na málai scoile bainte díoḃ ag cuid acu agus iad ar a ndíċeall ag caiṫeaṁ na gcnapóg le ċéile. Rinne Séamus gáire agus ḃuail sé bos gaċ uair a d'aimsiġ cnapóg an marc. Ṫaitniġ an spórt go mór leis agus ba ṁaiṫ leis ḃeiṫ mór go leor le ḃeiṫ ag dul ar scoil. Níor ṡeas an caṫ i ḃfad. Ḃí ocras ar na gasúir agus riṫ siad leo aḃaile.

Cuir líne faoi an ḃfreagra ceart ar gaċ ceann de na ceisteanna seo ṫíos.

Mar seo : Cad é an ċéad rud a dein Séamus (riṫ sé go dtí an ḟuinneog / d'ḟéaċ sé tríd an ḟuinneoig / ḃuail sé bos / rinne sé gáire / d'éiriġ sé ina ṡeasaṁ).

52. Ṫarla an eaċtra sin—(i riṫ an tsaṁraiḋ / um Ċáisc / san oíċe / sa ġeiṁreaḋ / ar maidin). 52 ....

53. Riṫ na buaċaillí aḃaile mar—(ḃí gárda ag teaċt / ḃíodar tuirseaċ / ḃuail siad fuinneog / ḃí a gcuid ceaċtanna baile le déanaṁ acu / ḃí ocras orṫu). 53 ....

54. Ḃuail Séamus bos nuair—(a ċonaic sé na buaċaillí ag teaċt / nuair a buaileaḋ buaċaill le cnapóg / nuair a ḃí an caṫ ṫart / nuair d'imiġ na buaċaillí aḃaile / nuair a riṫ sé go dtí an ḟuinneog). 54 ....

55. Cad ina ṫaoḃ (cé'n fáṫ) naċ raiḃ Séamus ar scoil ? (Ḃí sé ró-óg / mar ḃí cos tinn aige / mar ḃí an sneaċta ann / mar ḃí an scoil dúnta / mar ḃí sé ró aosta). 55 ....

56. Lean an caṫ—(ar feaḋ an tráṫnóna / go ceann i ḃfad / tamall gearr / an lá go léir / go dtí go raiḃ sé dorċa). 56 ....

Cuir síos contrárṫaċt (opposite) **gaċ focail ins na ceisteanna seo.**

Mar seo : Lag—láidir

mór—beag

57. Tapaiḋ— 57 ....

58. Naṁaid— 58 ....

59. Te— 59 ....

60. Fliuċ— 60 ....

Suim

Ná scríoḃ anseo

61. Óg— 61 ....

62. Gearr— 62 ....

63. Glan— 63 ....

64. Bog— 64 ....

Léiġ an scéilín seo go cúramaċ.

Do ġlan sí an bord, réitiġ sí an tine agus ansin ġlaoiġ sí i leiṫ ar Ṫomáisín.

" Caiṫfiḋ tú dul síos go dtí an siopa dom, a Ṫomáisín," ar sise.

" Raċaiḋ mé," arsa Tomáisín go geal. " Anois, an ea, a Ṁamaí ? "

" Sea," arsa an ṁáṫair, " beir leat Cáit agus ná lig amaċ ar an tsráid í."

Ní raiḃ leisce ar biṫ ar Ṫomáisín dul go dtí an siopa céanna mar níor lig Mac Uí Ḃroin amaċ as an siopa ariaṁ é gan briosca, nó úll, nó milseán a ṫaḃairt dó. Nuair a ṡrois na páistí an siopa ḃí a lán daoine ann rómpa agus ḃí orṫu fanaċt tamall. Ṡeas siad ag an gcúntar ag breaṫnú ar ḟear an tsiopa ag meá ime, plúir, siúcra agus bagúin d'á ċuid custiméirí. Ṫáiniġ Mac Uí Ḃroin ċuca ar deireaḋ.

" Ná caill do ċuid sóinseála," ar seisean le Tomáisín nuair a ḃí sé féin agus Cáit ar tí imeaċta. D'imiġ siad leo agus ciseán ina raiḃ dosaen uiḃeaċa ina láiṁ ag Tomáisín. Níorḃ ḟada gur ṡrois siad an teaċ.

" Céard a ċuir moill oraiḃ ? " arsa an ṁáṫair leo.

Cuir líne faoi'n ḃfreagra ceart, dar leat, ar gaċ ceist ; mar a deineaḋ anso :

Cé air gur ġlaoiġ an ṁáṫair ? (<u>Tómáisín</u> / Cáit / Mac Uí Ḃroin / na daoine san tsiopa / Cáit).

65. Cé ġlan an bord ? (Tomáisín / Cáit / an ṁáṫair / Mac Uí Ḃroin / na daoine san tsiopa). 65 ....

66. " Ní raiḃ leisce ar Ṫomáisín dul go dtí an siopa céanna." Cé'n ċiall atá leis an abairt sin ? (Níor ṁaiṫ leis dul go dtí an siopa / ḃí tuirse air / ba ḃuaċaill leisciúil é / ní raiḃ eagla air dul / ba ṁaiṫ leis dul go dtí an siopa) 66 ....

67. Cé'n sórt siopa a ḃí ann ? (siopa búistéara / siopa báicéara / oifig an ṗoist / tiġ tabairne / siopa grósaera). 67 ....

68. Cad a ċeannaiġ Tomáisín dá ṁáṫair ? (milseáin / uiḃeaċa / plúr / im / bagún). 68 ....

69. Céard a ċuir moill ar na páistí ? (Ḃí a lán daoine rompu san tsiopa / ḃí an siopa dúnta / ḃí an ciseán an-trom / d'ḟan siad ag féaċaint ar Ṁac Uí Ḃroin ag meá lóin / ḃíodar ag súil le milseán nó úll). 69 ....

70. Cad dúirt Mac Uí Ḃroin le Tomáisín ? (gan na h-uiḃeaċa a ḃriseaḋ / deifir a ḋéanaṁ abaile / naċ raiḃ milseán le fáil acu / gan an t-airgead a ċailliúint / aire a taḃairt do Ċáit. 70 ....

Suim

APPENDIX 2. 4 a

Irish Test.

Values of P (proportion of children giving correct answer) and of E_{1-3}, obtained when trying out the test.

Item	P	E_{1-3}	Item	P	E_{1-3}
1	.9	.25	34	.50	.90
2	.71	.60	35	.50	.95
3	.60	.90	36	.60	.85
4	.51	.80	37	.60	.95
5	.51	.80	38	.65	.70
6	.71	.60	39	.43	.60
7	.76	.50	40	.33	.72
8	.73	.65	41	.38	.37
9	.63	.80	42	.24	.35
10	.57	.65	43	.63	.65
11	.57	.65	44	.43	.85
12	.66	.75	45	.50	.80
13	.47	.75	46	.48	.80
14	.46	.80	47	.50	.75
15	.47	.62	48	.55	.85
16	.40	.82	49	.65	.70
17	.42	.85	50	.43	.60
18	.58	.65	51	.33	.72
19	.75	.50	52	.48	.90
20	.53	.70	53	.50	.90
21	.58	.55	54	.40	.90
22	.58	.60	55	.35	.75
23	.65	.45	56	.27	.65
24	.48	.75	57	.30	.77
25	.40	.50	58	.38	.70
26	.68	.60	59	.50	.72
27	.27	.55	60	.30	.62
28	.27	.75	61	.30	.62
29	.38	.70	62	.32	.70
30	.70	.60	63	.35	.82
31	.50	.95	64	.27	.72
32	.63	.80	65	.49	.75
33	.45	.85	66	.31	.60
			67	.47	.80
			68	.30	.60
			69	.45	.70
			70	.29	.65

APPENDIX 2.5

Instructions for Jenkins' Non-Verbal Test 1: Original Version.

Read the Following Carefully:

1. In this book there are some sets of puzzles. Do them as well as you possibly can.
2. You may not have time to do them all, but every five minutes you will be told to stop and go on to the next page.
3. You need not ask any questions because in each set you are told what to do.
4. Most of the puzzles are easy, but a few are quite hard.
5. Work steadily on without wasting time.
6. Be sure to stop whenever you are told.
7. If you alter any of your answers do so CLEARLY.
8. While you are waiting to start, underline the figure in the row below which is most unlike the other four.

"

Legend 1: On the left of each of the rows below there are three figures which are alike. On the right there are five more figures: find which one of these is most like the three figures on the left, and draw a line under it. (The first one has been done for you).

Legend 2: To the left in each of the lines below there are five squares arranged in order. One of these squares has been left empty. Find which one of the five squares on the right should take the place of the empty square and draw a line under it. (The first one has been done for you).

Legend 3: In each of the rows below there are five figures. Find ONE figure in each row which is most unlike the other four and draw a line under it. (The first one has been done for you).

Legend 4: Each of the sets of figures below can be arranged in order. Think of each set arranged in order and draw a line under the ONE which comes in the midde. (The first one has been done for you).

Legend:5: In the big square on the left of each line below, one of the four small squares has been left empty. One of the five figures to the right should fill the empty square, Find this figure and draw a line under it. (The first one has been done for you).

APPENDIX 2.5

Instructions for Jenkins' Non-Verbal Test 1.

Irish Version.

<u>Léiġ an méid seo leanas go cúramaċ:</u>

1. Sa leaḃrán so tá roinnt faḋḃ. Déan do ḋíċeall iad do réiteaċ.
2. B'féidir naċ mbeiḋ am do ḋóṫain agat iad go léir do réiteaċ, aċ gaċ cúig nóiméad déarfar leat stad agus leanúint ar aġaiḋ go dtí an ċéad leaṫanaċ eile.
3. Ní gá duit ceist ar biṫ a ċur, mar mínítear duit cad tá le déanaṁ agat i ngaċ sraiṫ faḋḃ.
4. Tá forṁór na ḃfaḋḃ furasta aċ tá cuid acu deacair go leor.
5. Obair leat go réiḋ – gan am ar biṫ a ċur amú.
6. Stad díreaċ nuair a déarfar leat.
7. Má aṫraíonn tú freagra, bíoḋ an t-aṫrú go soiléir.
8. Ḟad is atá tú ag fanaċt ċun tosnú, cuir líne fé'n léaráid is eagsúla leis na cinn eile insan líne seo ṫíos.

- - - -

<u>Legend 1</u>: Ar ṫaoiḃ na láiṁe clé i ngaċ ceann de na línte seo ṫíos tá trí léaráidí atá cosúil lena ċéile. Ar ṫaoiḃ na láiṁe deise tá cúig léaráidí eile; faiġ cé'n léaráid díoḃ is cosúla leis na trí léaráidí ar ṫaoiḃ na láiṁe clé agus cuir líne faoi. (Tá an ċéad ḟaḋḃ déanta duit.)

<u>Legend 2</u>: Ins an gcearnóg ṁór ar ṫaoiḃ na láiṁe clé de gaċ líne anso ṫíos fágaḋ folaṁ ceann de na cearnóga beaga. Ba ċeart go líonfaḋ ceann de na cúig léaráidí ar ṫaoiḃ na láiṁe deise an spás folaṁ. Faiġ an léaráid sin agus cuir líne faoi. (Tá an

ċéad ċeann déanta duit.)

<u>Legend 3</u>: I ngaċ líne ṫíos tá cúig léaráidí. I gcás gaċ líne faiġ an t-aon léaráid is eagsúla leis na ceiṫre léaráidí eile agus cuir líne faoi. (Tá an ċéad ċeann déanta duit.)

<u>Legend 4</u>: Is féidir gaċ sraiṫ léaráidí anso do ċur in ord. Faiġ amaċ an t-ord san agus cuir líne fé'n t-aon léaráid amáin a ḃéaḋ i lár báire. (Tá an ċéad ċeann déanta duit.)

<u>Legend 5</u>: Ins an gcearnóg ṁór ar ṫaoiḃ na láiṁe clé de gaċ líne anso ṫíos fágaḋ folaṁ ceann des na cearnóga beaga. Ba ċeart go líonfaḋ ceann de na cúig léaráidí ar ṫaoiḃ na láiṁe deise an spás folaṁ. Faiġ an léaráid sin agus cuir líne faoi. (Tá an ċéad ċeann déanta duit.)

Questionnaire:- Socio - Economic Status

ABOUT YOUR HOME

YOUR NAME: ______________________________

Your Address: ______________________________

Your School: ______________________________

Your Father's Address (if he does not live at home most of the time): ______________________________

____

1. (a) What is your father's work?

____

(If your father is not working now, write the work he used to do).

(b) Does he own: Part, All, None of his own business? (A farm is a business) ______________

(c) Has he a name such as a manager, foreman, ganger, supervisor etc? Yes or No? ______________

(d) If he has a name like that in his work write it here: ______________________________

(e) How many persons work for him?

None, 1, 2 to 3, 4 to 7, 8 or more.

(Just underline one of these)

2. CHILDREN IN YOUR FAMILY

(a) How many children are there in your family?

Boys: Girls:

(b) Write the Christian names and Age of your older brothers and sisters on the lines below and write their occupation or school under 'Occupation' and the country they work in under 'Country'

	Name	Age	Occupation	Country
(1)				
(2)				
(3)				
(4)				
(5)				
(6)				
(7)				
(8)				

Number (1) means the eldest, (2) means the second eldest and so on).

3. In this question just underline the correct answer.

(a) How many rooms have you in your home?

1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, more

(b) How many persons live in these rooms?

1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, more.

(c) Are there about 50 books, other than school books, in your home? Yes. No.

APPENDIX 2.6

Tú Féin agus do Ṁuintir

T'ainm: ______________________________

Do ṡeolaḋ baile: ______________________________

Do scoil: ______________________________

Seolaḋ t'aṫar (muna ḃfuil sé 'na ċónaí sa ḃaile): __________

____

1. (a) Cé an obair a ḋéanann t'aṫair:

____

(Muna ḃfuil t'aṫair ag obair faoi láṫair cuir síos cé an obair a ḃí aige roiṁe seo).

(b) An leis féin an gnó go léir? __________

An leis féin aon ċuid de? __________

Munar leis, an le daoine eile é? __________

(Is gnó feirm).

(c) An bainisteoir, maor oibre, ganger nó a leiṫéid é?

Seaḋ nó ní heaḋ? __________

(d) Másea abair céard é __________

(e) An mó duine atá ag obair do?

Níl aon duine, tá 1, 2-3, 4-8, 8 nó níos mó ná sin.

(Ní gá duit aċ líne a ċur fé'n ḃfreagra ceart).

An Clann

2. (a) An mó páiste atá sa ċlann agaiḃ?

Buaċaillí: ______________ Cailíní: ______________

(b) Cuir síos anseo ainm baiste agus aois gaċ duine de do ḋearṫáireaċa agus deirfiúraċa is sine ná tú féin; cuir síos faoi "slí ḃeaṫa" cé an tslí ḃeaṫa atá acu nó cé an scoil ina ḃfuil siad agus cuir síos fé "Tír" cé an tír ina ḃfuil siad ag obair.

	Ainm Baiste	Aois	Slí Ḃeaṫa	Tír
(1)				
(2)				
(3)				
(4)				
(5)				
(6)				
(7)				
(8)				

(Cuir ainm an duine is sine faoi (1), an dara duine is sine faoi (2) agus mar sin de).

3. Ag freagairt na ceiste seo ḋuit, ní ġá duit aċ líne a ċur fé'n ḃfreagra ceart.

(a) An mó seomra sa teaċ agaiḃ sa ḃaile?

1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, nó tuilleaḋ?

(b) An mó duine atá ina gcónaí ins na seomra sin?

1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, nó tuilleaḋ?

(c) An ḃfuil tuairim is 50 leaḃar sa ḃaile agaiḃ taoḃ amuiġ de leaḃair scoile? Tá, Níl.

APPENDIX 3

Tables Relating

to

Chapter 6

APPENDIX 3.1

Irish Test: Conversion Table.

Age in Yrs.& mts.	Test Score 1	5	10	15	20	25	30	35	40	45	50	55	60	65
10-0	79	90	99	106	112	118	123	128	132	136	141	143	147	-
10-2	78	89	98	105	111	117	122	127	131	135	140	142	146	-
10-4	77	88	97	104	110	116	121	126	130	134	139	141	145	--
10-6	76	87	96	103	109	115	120	125	129	133	138	140	144	150
10-8	75	86	95	102	108	114	119	124	128	132	137	139	143	149
10-10	74	85	94	101	107	113	118	123	127	131	136	138	142	148
11-0	73	84	93	100	106	112	117	122	126	130	135	137	141	147
11-3	72	83	92	99	105	111	116	121	125	129	134	136	140	146
11-6	71	82	91	98	104	110	115	120	124	128	133	135	139	145
11-9	70	81	90	97	103	109	114	119	123	127	132	134	138	144
12-0	69	80	89	96	102	108	113	118	122	126	131	133	137	143
12-4	68	79	88	95	101	107	112	117	121	125	130	132	136	142
12-7	67	78	87	94	100	106	111	116	120	124	129	131	135	141
12-11	66	77	86	93	99	105	110	115	119	123	128	130	134	140
13-4	65	76	85	92	98	104	109	114	118	122	127	129	133	139
13-9	64	75	84	91	97	103	108	113	117	121	126	128	132	138

APPENDIX 3.2

MHE 14: Conversion Table (for use in Ireland).

Age in yrs.& mts.	Test Score 1	5	10	15	20	25	30	35	40	45	50	55	60
10-0	86	94	101	108	113	118	121	125	127	130	132	135	137
10-2	85	93	100	107	112	117	120	124	126	129	131	134	136
10-4	84	92	99	106	111	116	119	123	125	128	130	133	135
10-6	83	91	98	105	110	115	118	122	124	127	129	132	134
10-8	82	90	97	104	109	114	117	121	123	126	128	131	133
10-10	81	89	96	103	108	113	116	120	122	125	127	130	132
11-0	80	88	95	102	107	112	115	119	121	124	126	129	131
11-3	79	87	94	101	106	111	114	118	120	123	125	128	130
11-6	78	86	93	100	105	110	113	117	119	122	124	127	129
11-9	77	85	92	99	104	109	112	116	118	121	123	126	128
12-0	76	84	91	98	103	108	111	115	117	120	122	125	127
12-4	75	83	90	97	102	107	110	114	116	119	121	124	126
12-7	74	82	89	96	101	106	109	113	115	118	120	123	125
12-11	73	81	88	95	100	105	108	112	114	117	119	122	124
13-4	72	80	87	94	99	104	107	111	113	116	118	121	123
13-9	71	79	86	93	98	103	106	110	112	115	117	120	122

APPENDIX 3.3

Jenkins' Non-Verbal Test 1: Procedure 1.

Conversion Table (for use in Ireland).

Age in yrs. & mts.	Test Score 1	5	10	15	20	25	30	35	40	45	50	55
10-0	83	91	99	106	114	121	126	131	135	138	141	145
10-2	82	90	98	105	113	120	125	130	134	137	140	144
10-4	81	89	97	104	112	119	124	129	133	136	139	143
10-6	80	88	96	103	111	118	123	128	132	135	138	142
10-8	79	87	95	102	110	117	122	127	131	134	137	141
10-10	78	86	94	101	109	116	121	126	130	133	136	140
11-0	77	85	93	100	108	115	120	125	129	132	135	139
11-3	76	84	92	99	107	114	119	124	128	131	134	138
11-6	75	83	91	98	106	113	118	123	127	130	133	137
11-9	74	82	90	97	105	112	117	122	126	129	132	136
12-0	73	81	89	96	104	111	116	121	125	128	131	135
12-4	72	80	88	95	103	110	115	120	124	127	130	134
12-7	71	79	87	94	102	109	114	119	123	126	129	133
12-11	70	78	86	93	101	108	113	118	122	125	128	132
13-4	69	77	85	92	100	107	112	117	121	124	127	131
13-9	68	76	84	91	99	106	111	116	120	123	126	130

APPENDIX 3.4

Data used in comparison of boys who were taught arithmetic bilingually with boys who were taught it through English from 2nd to 5th Standard - linguistic group 3.

Y_s = problem arithmetic quotients.

X_s = non-verbal reasoning quotients.

ΣY

	West	n.	Rest	n.	Total	n.
English	5203	56	3100	36	8303	92
Bilingual	610	8	1086	13	1696	21
Total	5813	64	4186	49	$\Sigma\Sigma Y = 9999$	

$Y^2 = 945635$

ΣX

	West	n	Rest	n.	Total	n
English	6004	56	3492	36	9496	92
Bilingual	695	8	1178	13	1873	21
Total	6699	64	4670	49	$\Sigma\Sigma X = 11369$	

$\Sigma\Sigma X^2 = 1179169$

APPENDIX 3.5

Data used in comparison of girls who were taught arithmetic bilingually with girls who were taught it through English from 2nd to 5th Standard - linguistic group 3.

Y_s = problem arithmetic quotients.

X_3 = non-verbal reasoning quotients.

ΣY

	West	n	Rest	n	Total	n
English	665	8	1609	19	2274	27
Bilingual	1074	13	4382	51	5456	64
Total	1739	21	5991	70	$\Sigma\Sigma Y = 7730$	

$\Sigma\Sigma Y^2 = 673661$

ΣX

	West	n	Rest	n	Total	n
English	802	8	1820	19	2622	27
Bilingual	1322	13	4957	51	6279	64
Total	2124	21	6777	70	$\Sigma\Sigma X = 8901$	

$\Sigma\Sigma X^2 = 891487$

APPENDIX 4

Regression Analysis; Covariance Analysis:

Sums, Sums of Squares, Sums of Products.

X_1 = N -VR.	Y_1 = SPA.
X_2 = Socio-Econ. Status.	Y_2 = SMA.
X_3 = Rating of Teaching Skill.	Y_3 = Irish.
	Y_4 = MHE 14.

2-t = 2-Teacher Schools.

3-t = 3-Teacher Schools.

m-t = Schools with more than three teachers.

Sums & Sums of Square X - West.

Group 1.

	Boys. 2-t	Boys. 3-t	Boys. m-t	Girls. 2-t	Girls. 3-t	Girls. m-t
ΣX_1	455	211	-	665	404	-
ΣX_1^2	52175	22273	-	76055	41262	-
ΣX_2	13	4	-	23	11	-
ΣX_2^2	49	8	-	89	37	-
ΣX_3	48	32	-	84	64	-
ΣX_3^2	624	512	-	1272	1024	-
n	4	2	-	6.	4	-

Group 2.

	Boys. 2-t	Boys. 3-t	Boys. m-t	Girls. 2-t	Girls. 3-t	Girls. m-t
ΣX_1	1570	1677	1631	1548	1724	-
ΣX_1^2	166200	168321	180697	162396	177044	-
ΣX_2	54	46	33	47	60	-
ΣX_2^2	208	164	93	179	222	-
ΣX_3	276	318	300	264	327	-
ΣX_3^2	5130	5976	6000	4734	6327	-
n	15	17	15	15	17	-

Group 3.

	Boys. 2-t	Boys. 3-t	Boys. m-t	Girls. 2-t	Girls. 3-t	Girls. m-t
ΣX_1	1407	990	4658	1743	1118	-
ΣX_1^2	145125	92146	514384	182241	114764	-
ΣX_2	35	32	141	55	35	-
ΣX_2^2	107	112	535	203	131	-
ΣX_3	241	184	774	310	182	-
ΣX_3^2	4195	3088	13932	5746	3020	-
n	14	11	43	17	11	-

Sums & Sums of Squares - West.

Group 4.

	Boys. 2-t	3-t	m-t	Girls. 2-t	3-t	m-t
ΣX_1	1320	2629	2114	2495	320	1752
ΣX_1^2	137074	261185	210548	243583	24272	173078
ΣX_2	38	82	75	77	8	46
ΣX_2^2	138	306	325	265	32	170
ΣX_3	234	479	462	448	38	324
ΣX_3^2	4278	8613	9702	7982	740	5832
n	13	27	22	26	2	18

Group 5.

ΣX_1	4224	2066	449	2542	1314	634
ΣX_1^2	421582	229022	40741	272922	137436	58254
ΣX_2	151	89	16	86	47	23
ΣX_2^2	615	467	56	322	213	85
ΣX_3	755	408	100	505	278	140
ΣX_3^2	14027	8766	2000	10369	5948	2800
n	43	19	5	25	13	7

Group 6.

Boys N = 66. $\Sigma X_1 = 6392$ $\quad \Sigma X_2 = 153$ $\quad \Sigma X_3 = 1139$

$\Sigma X_1^2 = 64078.$ $\quad \Sigma X_2^2 = 451.$ $\quad \Sigma X_3^2 = 20253$

Girls N = 89 $\Sigma X_1 = 9009.$ $\quad \Sigma X_2 = 195.$ $\quad \Sigma X_3 = 1481.$

$\Sigma X_1^2 = 933267.$ $\quad \Sigma X_2^2 = 496.$ $\quad \Sigma X_3^2 = 25547.$

Sums & Sums of Squares X - Rest.

Group 1.

	Boys. 2-t	Boys. 3-t	Boys. m-t	Girls. 2-t	Girls. 3-t	Girls. m-t
ΣX_1	4609	1417	1012	3104	1313	3012
ΣX_1^2	460619	135639	103438	327016	126771	327274
ΣX_2	118	53	28	85	33	41
ΣX_2^2	376	229	90	295	117	87
ΣX_3	753	290	200	510	248	596
ΣX_3^2	12819	5700	4000	9060	4436	12712
n	47	15	10	30	14	28

Group 2.

	Boys. 2-t	Boys. 3-t	Boys. m-t	Girls. 2-t	Girls. 3-t	Girls. m-t
ΣX_1	2475	1255	-	3510	1370	2138
ΣX_1^2	248927	123459	-	352252	138502	258298
ΣX_2	82	30	-	119	37	52
ΣX_2^2	326	92	-	445	139	182
ΣX_3	476	207	-	720	219.	378
ΣX_3^2	9224	3321	-	14718	3447	7938
n	25	13	-	36	14	18

Group 3.

	Boys. 2-t	Boys. 3-t	Boys. m-t	Girls. 2-t	Girls. 3-t	Girls. m-t
ΣX_1	3962	708	-	1721	1162	3592
ΣX_1^2	394960	64474	-	167631	115606	359586
ΣX_2	121	26	-	60	38	85
ΣX_2^2	457	98	-	222	140	237
ΣX_3	679	161	-	313	246	555
ΣX_3^2	12805	3257	-	5519	5070	8325
n	41	8	-	18	12	37

Sums & Sums of Squares - Rest.

Group 4.

	Boys. 2-t	3-t	m-t	Girls. 2-t	3-t	m-t
ΣX_1	2218	652	-	2276	1046	-
ΣX_1^2	229176	53802	-	240308	111474	-
ΣX_2	61	19	-	56	29	-
ΣX_2^2	235	53	-	178	121	-
ΣX_3	430	144	-	438	180	-
ΣX_3^2	8452	2592	-	8796	3240	-
n	22	8	-	22	10	-

Group 5.

	Boys. 2-t	3-t	m-t	Girls. 2-t	3-t	m-t
ΣX_1	873	1875	-	1485	-	4219
ΣX_1^2	86831	214551	-	141549	-	465297
ΣX_2	31	106	-	42	-	128
ΣX_2^2	127	696	-	138	-	544
ΣX_3	216	306	-	312	-	702
ΣX_3^2	5184	5508	-	6624	-	12636
n	9	17	-	15	-	39

Sums and Sums of Squares - Entire Sample.

$N = 1083$

$\Sigma X_1 = 108829$ $\qquad \Sigma X_1^2 = 11210169$

$\Sigma X_2 = 3181$ $\qquad \Sigma X_2^2 = 11779$

$\Sigma X_3 = 19618$ $\qquad \Sigma X_3^2 = 366412$

Sums & Sums of Squares Y - West.

Group 1.

	Boys.			Girls.		
	2-t	3-t	m-t	3-t	3-t	m-t
ΣY_1	390	154	-	577	378	-
ΣY_1^2	38070	12020	-	57919	36550	-
ΣY_2	419	166	-	629	414	-
ΣY_2^2	43935	13906	-	67083	43298	-
ΣY_3	442	180	-	684	404	-
ΣY_3^2	49052	16488	-	79942	42328	-
ΣY_4	438	204	-	662	447	-
ΣY_4^2	48238	21096	-	47710	50777	-
n	4	2	-	6	4	-

Group 2.

ΣY_1	1351	1589	1311	1338	1441	-
ΣY_1^2	123757	153749	115491	121956	125365	-
ΣY_2	1396	1627	1430	1416	1628	-
ΣY_2^2	132062	159395	138450	135604	159988	-
ΣY_3	1487	1752	1329	1473	1837	-
ΣY_3^2	149945	185712	118815	149133	201669	-
ΣY_4	1530	1679	1498	1510	1826	-
ΣY_4^2	158278	169943	153600	154266	199362	-
n	15	17	15	15	17	-

Sums & Sums of Squares Y - West.

Group 3.

	Boys.			Girls.		
	2-t	3-t	m-t	2-t	3-t	m-t
ΣY_1	1269	833	4047	1425	924	-
ΣY_1^2	144337	65361	390563	121549	79346	-
ΣY_2	1283	911	4328	1600	985	-
ΣY_2^2	121795	78041	446576	152180	90669	-
ΣY_3	1379	988	4208	1714	1136	-
ΣY_3^2	140639	95202	416298	177220	118924	-
ΣY_4	1373	1058	4636	1700	1198	-
ΣY_4^2	139171	107016	507532	172582	132282	-
n	14	11	43	17	11	

Group 4.

	2-t	3-t	m-t	2-t	3-t	m-t
ΣY_1	1183	2410	1978	2216	195	1576
ΣY_1^2	110959	221414	188660	193432	19073	140306
ΣY_2	1251	2497	2090	2387	225	1813
ΣY_2^2	122749	237079	207702	223679	25733	185627
ΣY_3	1225	2691	2101	2598	252	1689
ΣY_3^2	120635	274469	206363	266188	31802	160741
ΣY_4	1204	2764	2261	2603	227	1733
ΣY_4^2	125818	289968	239561	265893	25789	172961
n	13	27	22	26	2	18

Sums & Sums of Squares Y - West.

Group 5.

	Boys.			Girls.		
	2-t	3-t	m-t	2-t	3-t	m-t
ΣY_1	3516	1773	328	2062	1143	477
ΣY_1^2	300688	169313	22222	173032	102167	33041
ΣY_2	4073	2069	417	2346	1396	633
ΣY_2^2	400575	228947	35615	223702	153370	57650
ΣY_3^2	4125	2078	417	2673	1391	611
ΣY_3^2	406193	232530	35243	289403	153231	54011
ΣY_4	4207	2160	454	2531	1383	616
ΣY_4^2	422275	250478	42093	260441	149611	54894
n	43	19	5	25	13	7

Group 6.

Boys: $N = 66$

$\Sigma Y_1 = 5150$ $\Sigma Y_2 = 5711$ $\Sigma Y_3 = 6553$ $\Sigma Y_4 = 5957$

$\Sigma Y_1^2 = 418678$ $\Sigma Y_2^2 = 512939$ $\Sigma Y_3^2 = 673899$ $\Sigma Y_4^2 = 544335$

Girls: $N = 89$

$\Sigma Y_1 = 7026$ $\Sigma Y_2 = 7877$ $\Sigma Y_3 = 9367$ $\Sigma Y_4 = 8282$

$\Sigma Y_1^2 = 577606$ $\Sigma Y_2^2 = 720125$ $\Sigma Y_3^2 = 1010707$ $\Sigma Y_4^2 = 787288$

Sums & Sums of Squares Y – Rest.

	Boys. 2-t	Boys. 3-t	Boys. m-t	Girls. 2-t	Girls. 3-t	Girls. m-t
Group 1.						
ΣY_1	4045	1373	919	2583	1228	2304
ΣY_2	359503	128825	84847	228267	111810	193708
ΣY_2	4217	1465	1013	2829	1358	2682
ΣY_2^2	388845	146535	102785	272191	133372	262992
ΣY_3	4119	1327	762	2900	1405	2669
ΣY_3^2	371613	119827	58466	286366	143495	258067
ΣY_4	4584	1533	886	3115	1499	2821
ΣY_4^2	457256	158633	78318	327761	162509	285671
n	47	15	10	30	14	28
Group 2.						
ΣY_1	2331	1114	–	3060	1156	1598
ΣY_1^2	223243	97754	–	273954	97690	145248
ΣY_2	2416	1185	–	3443	1299	1656
ΣY_2^2	238874	109345	–	341413	122783	155404
ΣY_3	2299	1155	–	3410	1346	1344
ΣY_3^2	217661	104081	+	330704	133846	101334
ΣY_4	2627	1299	–	3700	1405	1925
ΣY_4^2	281659	130701	–	388480	144305	209293
n	25	13	–	36	14	18

Sums & Sums of Squares Y - Rest.

Group 3.

	Boys.			Girls.		
	2-t	3-t	m-t	2-t	3-t	m-t
ΣY_1	3516	670	-	1565	987	3204
ΣY_1^2	317120	56504	-	139091	84857	284425
ΣY_2	3728	733	-	1793	1105	3770
ΣY_2^2	351904	67859	-	182149	105845	391708
ΣY_3	3814	733	-	1750	1119	3394
ΣY_3^2	367950	67693	-	172838	107853	318194
ΣY_4	4042	788	-	1818	1216	3750
ΣY_4^2	410256	79812	-	185846	127240	389198
n	41	8	-	18	12	37

Group 4.

ΣY_1	1973	544	-	1981	947	-
ΣY_1^2	184617	38434	-	183921	91991	-
ΣY_2	2084	621	-	2116	1053	-
ΣY_2^2	204684	48937	-	210698	112989	-
ΣY_3	2110	605	-	2397	999	-
ΣY_3^2	206884	46687	-	264839	102887	-
ΣY_4	2237	670	-	2411	1022	-
ΣY_4^2	223773	57104	-	266607	107110	-
n	22	8	-	22	10	

Sums & Sums of Squares Y - Rest.

Group 5.

	Boys.			Girls.		
	2-t	3-t	m-t	2-t	3-t	m-t
ΣY_1	707	1675	-	1246	-	3062
ΣY_1^2	57693	168831	-	109888	-	350228
ΣY_2	839	1800	-	1472	-	3466
ΣY_2^2	79453	193488	-	150642	-	315600
ΣY_3	887	1976	-	1618	-	3935
ΣY_3^2	89533	235990	-	178898	-	404287
ΣY_4	869	1898	-	1649	-	4113
ΣY_4^2	84675	218192	-	184537	-	441105
n	9	17	-	15	-	39

Sums & Sums of Squares - Entire Sample.

$N = 1083$

$\Sigma Y_1 = 92529$ $\quad \Sigma Y_1^2 = 8222612$

$\Sigma Y_2 = 101969$ $\quad \Sigma Y_2^2 = 11884745$

$\Sigma Y_3 = 105690$ $\quad \Sigma Y_3^2 = 10627330$

$\Sigma Y_4 = 108883$ $\quad \Sigma Y_4^2 = 11206641$

Sums of Products - West.

Group 1.

	Boys.			Girls.		
	2-t	3-t	m-t	2-t	3-t	m-t
X_2	1475	422	-	2531	1120	-
X_3	5390	3376	-	9682	6464	-
$-X_3$	162	64	-	318	176	-
Y_1	44355	16202	-	66113	38492	-
Y_1	1281	308	-	2194	1042	-
Y_1	4716	2464	-	8498	6048	-
Y_2	47790	17473	-	7116	41818	-
Y_2	1355	332	-	2396	1130	-
Y_2	5006	2656	-	9114	6624	-
Y_3	50190	18930	-	77613	41054	-
Y_3	1429	360	-	2603	1160	-
Y_3	5236	2880	-	10000	6464	-
Y_4	49845	21462	-	74829	45477	-
$_4$	1398	408	-	2520	1244	-
Y_4	5156	3264	-	9620	7152	-
n	4	2	-	6	4	-

Group 2.

Sums of Products - West.

	Boys.			Girls.		
	2-t	3-t	m-t	2-t	3-t	m-t
X_1X_2	5680	4640	3587	5002	6118	-
X_1X_3	28880	31387	32619	27597	33048	-
X_2X_3	1006	870	660	863	1161	-
X_1Y_1	142306	159865	143365	140006	147625	-
X_2Y_1	4935	4377	2855	4297	5156	-
X_3Y_1	24912	29780	26220	23733	27810	-
X_1Y_2	146979	162671	157032	147197	166313	-
X_2Y_2	5084	4496	3116	4451	5839	-
X_3Y_2	25620	30468	28599	24915	31427	-
$_1Y_3$	156104	175696	145238	154850	188246	-
X_2Y_3	5448	4882	2886	4865	6489	-
X_3Y_3	27648	32810	26580	26400	35281	-
$_1Y_4$	160564	167482	165279	157753	187296	-
X_2Y_4	5563	4629	3238	4828	6491	-
X_3Y_4	28257	31446	29961	26820	35096	-
n	15	17	15	15	17	-

Sums of Products - West.

Group 3.

	Boys.			Girls.		
	2-t	3-t	m-t	2-t	3-t	m-t
X_1X_2	3562	2861	15401	5672	3644	-
X_1X_3	24383	16698	83847	31693	18440	-
X_2X_3	602	532	2539	1003	566.	
X_1Y_1	130721	76974	443345	147174	94668	-
X_2Y_1	3262	2442	13444	4682	2976	-
X_3Y_1	22111	14012	72849	25904	15264	-
X_1Y_2	131759	83983	474952	165522	100986	-
X_2Y_2	3270	2717	14436	5214	3166	-
X_3Y_2	22411	15324	77903	29163	16277	-
X_1Y_3	141908	92848	459236	178532	116144	-
X_2Y_3	3547	2936	13857	5582	3626	-
X_3Y_3	24127	16684	75743	31432	18788	-
X_1Y_4	141363	98703	507144	175687	122494	-
X_2Y_4	3432	3129	15335	5507	3829	-
X_3Y_4	23938	17852	83445	31157	19811	-
n	14	11	43	17	11	-

Sums of Products - West.

Group 4.

	Boys. 2-t	Boys. 3-t	Boys. m-t	Girls. 2-t	Girls. 3-t	Girls. m-t
X_1X_2	3815	8162	7318	7366	880	4537
X_1X_3	23835	46884	44394	43049	4216	31535
X_2X_3	762	1449	1575	1314	152	829
X_1Y_1	12191	237049	197169	214835	21516	153757
X_2Y_1	3574	7519	6995	6599	780	4079
X_3Y_1	21421	42994	41538	38236	3738	28369
X_1Y_2	128515	246331	207555	230599	24924	177552
X_2Y_2	2721	7813	7202	7145	900	4711
X_3Y_2	22563	44573	43890	41216	4362	32633
X_1Y_3	125643	264965	207232	251398	27780	164965
X_2Y_3	3822	8204	7093	7587	1008	4369
X_3Y_3	22287	48144	44121	45078	4818	30401
X_1Y_4	124574	272296	222558	252046	25012	170600
X_2Y_4	3574	8385	7719	7654	908	4708
X_3Y_4	21917	49247	47480	45242	4334	31195
n	13	27	22	26	2	8

Sums of Products - West.

Group 5.

	Boys. 2-t	Boys. 3-t	Boys. m-t	Girls. 2-t	Girls. 3-t	Girls. m-t
ΣX_1X_2	14675	9833	1440	8671	4972	2098
ΣX_1X_3	74001	44449	8980	51813	28166	12680
ΣX_2X_3	2610	1915	320	1705	1010	461
ΣX_1Y_1	349495	195841	29698	211399	117688	43589
ΣX_2Y_1	12414	8483	1046	7060	4331	1531
ΣX_3Y_1	61473	38139	6560	41940	24470	9540
ΣX_1Y_2	403740	227502	37341	240417	143755	57585
ΣX_2Y_2	14537	9812	1316	8075	5301	2061
ΣX_3Y_2	70501	44500	8340	47677	29925	12641
ΣX_1Y_3	407707	229349	37633	274309	143538	55919
ΣX_2Y_3	14538	9898	1332	9109	5260	1986
ΣX_3Y_3	72615	44709	8340	64434	29820	12221
ΣX_1Y_4	418255	237746	40990	260313	142259	56144
ΣX_2Y_4	14760	10357	1438	8623	5189	2006
ΣX_3Y_4	73076	46477	9080	51330	29621	12320
n	43	19	5	25	13	7

Sums of Products - Rest.

Group 1.

	Boys.			Girls.		
	2-t	3-t	m-t	2-t	3-t	m-t
ΣX_1X_2	11648	5121	2853	8774	3017	4437
ΣX_1X_3	73602	27424	20240	52585	23476	64128
ΣX_2X_3	1973	1041	560	1462	581	856
ΣX_1Y_1	402644	130763	92986	270860	116937	249701
ΣX_2Y_1	10127	4963	2570	7475	2988	3485
ΣX_3Y_1	64571	26720	18380	43824	22052	48877
ΣX_1Y_2	418369	139908	102645	296098	127689	290992
ΣX_2Y_2	10580	5255	2843	8238	3312	4028
ΣX_3Y_2	67561	28335	20260	48074	24117	56923
ΣX_1Y_3	407791	126286	77100	303451	132903	288174
ΣX_2Y_3	10322	4666	2098	8237	3355	3717
ΣX_3Y_3	65585	25934	15240	49313	25126	57041
ΣX_1Y_4	454427	145567	89705	325441	142033	304797
ΣX_2Y_4	11636	5429	2427	8858	3580	4152
ΣX_3Y_4	73556	29771	17720	52871	26739	60027
n	47	15	10	30	14	28

Sums of Products - Rest.

Group 2.

	Boys. 2-t	Boys. 3-t	Boys. m-t	Girls. 2-t	Girls. 3-t	Girls. m-t
ΣX_1X_2	8280	2894	-	11905	3752	6207
ΣX_1X_3	49419	19930	-	70401	21324	44899
ΣX_2X_3	1609	464	-	2400	564	1092
ΣX_1Y_1	233233	108341	-	306486	115483	192467
ΣX_2Y_1	7840	2564	-	10237	3149	4676
ΣX_3Y_1	44605	17824	-	62025	18063	33559
ΣX_1Y_2	242228.	115506	-	342445	129369	199217
ΣX_2Y_2	8123	2745	-	11534	3523	4842
ΣX_3Y_2	46193	18882	-	69501	20253	34776
ΣX_1Y_3	228834	111859	-	337409	134729	161097
ΣX_2Y_3	7522	2607	-	11380	3677	3930
ΣX_3Y_3	43794	18508	-	68931	21036	28225
ΣX_1Y_4	262158	125968	-	366899	140349	231767
ΣX_2Y_4	8657	2919	-	12485	3813	5563
ΣX_3Y_4	50215	20747	-	74650	21914	40423
n	25	13	-	36	14	18

Sums of Products - Rest.

Group 3.

	Boys.			Girls.		
	2-t	3-t	m-t	2-t	3-t	m-t
ΣX_1X_2	12030	2175	-	5874	3714	8217
ΣX_1X_3	65429	14403	-	29975	23880	53879
ΣX_2X_3	2030	512	-	1038	764	1277
ΣX_1Y_1	348847	59595	-	151876	98198	317809
ΣX_2Y_1	10921	2161	-	5274	7233	7266
ΣX_3Y_1	58854	13516	-	27176	20234	48057
ΣX_1Y_2	369298	65266	-	173982	109513	372105
ΣX_2Y_2	11514	2365	-	6056	3620	8533
ΣX_3Y_2	62250	11797	-	31078	22620	56549
ΣX_1Y_3	375595	65303	-	168673	109949	335282
ΣX_2Y_3	11609	2377	-	5895	3657	7700
ΣX_3Y_3	65138	14779	-	30423	22881	50910
ΣX_1Y_4	399144	71576	-	175375	120403	371198
ΣX_2Y_4	12358	2450	-	6126	3917	8554
ΣX_3Y_4	66511	16007	-	31488	24978	56249
n	41	8	-	18	12	37

Sums of Products - Rest.

Group 4.

	Boys. 2-t	3-t	m-t	Girls. 2-t	3-t	m-t
ΣX_1X_2	6361	1500	-	5764	3146	-
ΣX_1X_3	43452	11736	-	45282	18828	-
ΣX_2X_3	1192	341	-	1146	522	-
ΣX_1Y_1	202247	44541	-	207626	100780	-
ΣX_2Y_1	5762	1326	-	5232	2899	-
ΣX_3Y_1	38670	9792	-	39582	17046	-
ΣX_1Y_2	212842	50976	-	221975	111379	-
ΣX_2Y_2	6043	1470	-	5582	3231	-
ΣX_3Y_2	40888	11179	-	42350	18954	-
ΣX_1Y_3	215690	49837	-	248803	106554	-
ΣX_2Y_3	6031	1426	-	6252	2928	-
ΣX_3Y_3	41372	10891	-	47869	17982	-
ΣX_1Y_4	229469	55071	-	251975	108656	-
ΣX_2Y_4	6410	1592	-	6180	2995	-
ΣX_3Y_4	43800	12060	-	48034	18396	-
n	22	8	-	22	10	-

Sums of Products - Rest.

Group 5.

	Boys. 2-t	Boys. 3-t	Boys. m-t	Girls. 2-t	Girls. 3-t	Girls. m-t
ΣX_1X_2	3011	11780	-	4212	-	14126
ΣX_1X_3	20952	33749	-	31219	-	75942
ΣX_2X_3	744	1909	-	895	-	2303
ΣX_1Y_1	69760	188991	-	128003	-	337850
ΣX_2Y_1	2374	10489	-	3635	-	10522
ΣX_3Y_1	16968	30150	-	26508	-	55816
ΣX_1Y_2	82460	201623	-	149707	-	380275
ΣX_2Y_2	2882	11236	-	4321	-	11912
ΣX_3Y_2	20136	32399	-	31308	-	62387
ΣX_1Y_3	87640	222802	-	163757	-	430544
ΣX_2Y_3	3040	12413	-	4667	-	13312
ΣX_3Y_3	21288	35569	-	33979	-	70825
ΣX_1Y_4	85083	215162	-	166553	-	449395
ΣX_2Y_4	2971	11854	-	4701	-	13824
ΣX_3Y_4	20865	34165	-	34524	-	74033
n	9	17	-	15	-	39

Sums of Products - Group 6.

Boys: $N = 66.$

$\Sigma X_1X_2 = 15078$	$\Sigma X_1Y_1 = 507155$	$\Sigma X_1Y_2 = 563212$
$\Sigma X_1X_3 = 109028$	$\Sigma X_2Y_1 = 12167$	$\Sigma X_2Y_2 = 13488$
$\Sigma X_2X_3 = 2624$	$\Sigma X_3Y_1 = 88892$	$\Sigma X_3Y_2 = 98799$

$\Sigma X_1Y_3 = 644050$	$\Sigma X_1Y_4 = 588364$
$\Sigma X_2Y_3 = 15459$	$\Sigma X_2Y_4 = 14021$
$\Sigma X_3Y_3 = 1129289$	$\Sigma X_3Y_4 = 102720$

Girls: $N = 89$

$\Sigma X_1X_2 = 19990$	$\Sigma X_1Y_1 = 719244$	$\Sigma X_1Y_2 = 806137$
$\Sigma X_1X_3 = 148731$	$\Sigma X_2Y_1 = 15623$	$\Sigma X_2Y_2 = 17470$
$\Sigma X_2X_3 = 3256$	$\Sigma X_3Y_1 = 118337$	$\Sigma X_3Y_2 = 132683$

$\Sigma X_1Y_3 = 955721$	$\Sigma X_1Y_4 = 847724$
$\Sigma X_2Y_3 = 20782$	$\Sigma X_2Y_4 = 18399$
$\Sigma X_3Y_3 = 157247$	$\Sigma X_3Y_4 = 138943$

Sums of Products - Entire Sample.

$N = 1083$

$\Sigma X_1X_2 = 323710$	$\Sigma X_1Y_1 = 9453914$	$\Sigma X_1Y_2 = 10395012$
$\Sigma X_1X_3 = 1973134$	$\Sigma X_2Y_1 = 278456$	$\Sigma X_2Y_2 = 306599$
$\Sigma X_2X_3 = 58209$	$\Sigma X_3Y_1 = 1683526$	$\Sigma X_3Y_2 = 1854490$

$\Sigma X_1Y_3 = 10758347$	$\Sigma X_1Y_4 = 11106735$
$\Sigma X_2Y_3 = 315241$	$\Sigma X_2Y_4 = 325199$
$\Sigma X_3Y_3 = 1923481$	$\Sigma X_3Y_4 = 1979598$

APPENDIX 5

Main analysis: inverted matrices

Y-vectors

Regression sums of squares.

(1) Inverted matrix calculated from SSw and SPw: <u>First 5 linguistic groups. N = 919.</u>

	C_1	C_2	C_3	C_4	C_5
C_1	.000004732				
C_2	-.000008545	.0005040			
C_3	-.000001704	-.000008721	.0001224		
C_4	.000007108	-.00004671	-.00001583	.001420	
C_5	-.00001497	-.0003135	-.0001572	-.003348	.01606

	SPA	SMA	Irish	English.
Σx_1y	137707.3	125887.9	119611.34	137479.0
Σx_2y	5126.28	5811.37	4335.88	3915.5
Σx_3y	4110.66	3320.28	8257.22	3372.56
Σx_4y	-1273.42	532.819	3131.25	672.83
Σx_5y	-547.662	221.450	966.647	345.628
Σy^2	96143.6	78231.9	75972.4	86907.1

(2) Inverted matrix calculated from SSw and SPw: Boys - West and Rest: N = 465.

	C_1	C_2	C_3	C_4	C_5
C_1	.000009285				
C_2	-.00001829	.0009812			
C_3	.0000001417	-.00004464	.0002107		
C_4	.00001537	-.00009444	-.00009953	.002892	
C_5	-.00004225	-.0009479	-.00010095	-.006400	.03249

	SPA	SMA	Irish	English
Σx_1y	73302.1	71517.8	66082.2	75106.8
Σx_2y	3179.08	3556.93	3016.39	2380.9
Σx_3y	1742.12	1881.93	4898.56	1024.53
Σx_4y	-577.601	680.128	1496.71	343.12
Σx_5y	-150.126	377.509	461.757	250.76
Σy^2	53181.97	49279.1	45438	50495.9

(3) Inverted matrix, calculated from SSw and SPw: <u>Girls - West and Rest</u>: N = 454.

	C_1	C_2	C_3	C_4	C_5
C_1	.000009822				
C_2	-.00001677	.0010697			
C_3	-.000008947	.00002724	.0003084		
C_4	.000009953	-.00008320	.00006715	.002853	
C_5	-.000006645	-.0003998	-.0006524	-.007133	.03277

	SPA	SMA	Irish	English
Σx_1y	64405.14	54370.07	53529.2	62372.3
Σx_2y	1947.19	2254.44	1319.49	1534.6
Σx_3y	2368.54	1438.35	3358.66	2348.03
Σx_4y	-695.821	-147.309	1694.53	329.71
Σx_5y	-397.535	-156.059	504.891	94.864
Σy^2	42756.5	30862.2	31574.1	36897.5

(4) Inverted matrix, calculated from SS_w and SP_w: <u>Boys and Girls - West.</u> N = 411.

	C_1	C_2	C_3	C_4	C_5
C_1	.00001049				
C_2	-.00001639	.001269			
C_3	-.000006477	-.00002530	.0004049		
C_4	.00003463	-.00006515	-.0001658	.004625	
C_5	-.00004165	-.0006454	-.0004998	-.009123	.03385

	SRA	SMA	Irish	English
Σx_1y	55283.2	54314.3	54998.5	59298.4
Σx_2y	1764.79	2309.2	1741.06	1554.30
Σx_3y	1059.45	1319.2	3964.23	1381.36
Σx_4y	-983.38	283.34	94.49	-137.24
Σx_5y	-409.662	236.68	115.360	42.848
Σy^2	35276.8	31393	34890	35960

(5) Inverted matrix, calculated from SSw and SPw: <u>Boys - West</u>. N = 250.

	C_1	C_2	C_3	C_4	
C_1	.00001761				
C_2	-.00002515	.001948			
C_3	-.000005305	-.0001092	.0006550		
C_4	.00006756	-.0002956	-.0002278	.008018	
C_5	-.0001048	-.0009642	-.0003983	-.01597	.05877

	SPA	SMA	Irish	English
Σx_1y	39186.3	39087.1	34460.1	40336.3
Σx_2y	1335.17	1701.10	1214.33	1078.68
Σx_3y	699.85	293.090	1950.14	407.33
Σx_4y	-662.871	279.230	-10.880	83.16
Σx_5y	-248.147	186.267	40.8476	105.726
Σy^2	29862.5	29004	22567	28237

(6) Inverted matrix, calculated from SSw and SPw: Girls - West: N = 161.

	C_1	C_2	C_3	C_4	C_5
C_1	.00002639				
C_2	-.00005315	.003831			
C_3	-.00003123	.00009625	.001131		
C_4	.00006735	.0003365	-.0005117	.01108	
C_5	-.000006957	-.002343	-.002311	-.02127	.081995

	SPA	SMA	Irish	English
Σx_1y	16096.9	15227.2	20538.5	18962.2
Σx_2y	429.618	608.10	526.73	475.62
Σx_3y	359.580	1026.13	2014.09	974.03
Σx_4y	-420.509	4.11	105.33	-220.40
Σx_5y	-161.515	50.41	74.512	-62.878
Σy^2	7584.9	6698.9	12710.2	9705.1

(7) Inverted matrix, calculated from SSw and SPw: Boys - Rest: N = 215

	C_1	C_2	C_3	C_4	C_5
C_1	.00002061				
C_2	-.00004617	.002057			
C_3	.000004292	-.00008123	.0003128		
C_4	.00001406	-.00002192	-.0001676	.004680	
C_5	.0001647	-.003810	-.0002114	-.01260	.09389

	SPA	SMA	Irish	English
Σx_1y	34115.9	32430.7	31622.1	34770.5
Σx_2y	1843.92	1855.83	1802.06	1302.22
Σx_3y	1042.27	1588.84	2948.42	617.2
Σx_4y	-14.730	400.898	1447.59	259.96
Σx_5y	98.0206	191.242	420.909	154.038
Σy^2	23913.4	21451.7	24818.9	22784.0

(8) Inverted matrix, calculated from SSw and SPw: Girls - Rest. N = 293.

	C_1	C_2	C_3	C_4	C_5
C_1	.00001589				
C_2	-.00002759	.001725			
C_3	-.00001483	.00002900	.0004527		
C_4	.00001155	-.0002271	.0001530	.004092	
C_5	-.00003200	-.0005143	-.0006186	-.011495	.05837

	SPA	SMA	Irish	English
Σx_1y	48308.2	39142.9	32990.7	43410.1
Σx_2y	1517.58	1646.34	792.76	1058.98
Σx_3y	2008.96	412.22	1344.57	1374.0
Σx_4y	-275.312	-151.419	1589.20	550.11
Σx_5y	-236.021	-206.471	430.379	157.743
Σy^2	39600.7	27895.5	21238.7	28847.4

(9) Inverted matrix, calculated from SS_t and SP_t: <u>Native Irish Speakers</u>. N = 155.

	C_1	C_2	C_3
C_1	.00002609		
C_2	-.00005795	.006343	
C_3	.00004350	-.00001575	.0007343

	SPA	SMA	Irish	English
$\Sigma x_1 y$	16575.9	19227.8	17939.3	21282.6
$\Sigma x_2 y$	374.362	363.084	395.323	259.284
$\Sigma x_3 y$	1415.21	1801.63	1136.22	977.66
Σy^2	10832	15048	11272	14250

(10) Inverted matrix, calculated from SSw and SPw: <u>Entire Sample</u>: N = 1083.

	C_1	C_2	C_3
C_1	.000003741		
C_2	-.000006166	.0004260	
C_3	-.0000002656	-.00002168	.00009176

	SPA	SMA	Irish	English
Σx_1y	155818	148305	137722	165250
Σx_2y	6678.6	7094.49	4807.12	5386.61
Σx_3y	7409.95	7372.45	8959.99	7237.07
Σy^2	99281	92890	77483	106026

APPENDIX 6

(A) Analysis of Covariance: N = 919

Tests of mean differences between the twelve subgroups recognised in main analysis.

(1) Problem Arithmetic.

Source	DF	SS	MS	F
Between	11	478	43.455	.231, not significant.
Within	902	169541	187.96	
Total	913	170019		

(11) Mechanical Arithmetic.

Source	DF	SS	MS	F
Between	11	2997	272.45	1.639, not significant.
Within	902	149933	166.22	
Total	913	152930		

(111) Irish.

Source	DF	SS	MS	F
Between	11	19757	1796.09	10.242, highly significant.
Within	902	158182	175.37	
Total	913	177939		

English.

(1V)

Source	DF	SS	MS	F
Between	11	16583	1507.55	11.84, highly significant.
Within	902	114822	127.30	
Total	913	131405		

(B) **Analysis of Covariance: N = 919.**

Tests of mean differences between

West and Rest; other subdivisions of

data being ignored.

(1) Irish.

Source	DF	SS	MS	F
Between	1	1328	1328	6.858, highly significant.
Within	912	176611	193.65	
Total	913	177939		

(11) English.

Source	DF	SS	MS	F
Between	1	297	297	2.066, not significant
Within	912	131108	143.76	
Total	913	131405		

APPENDIX 7

Regression Coefficients.

in

Subdivisions of Data.

Notes: (1) West = English-speaking districts in counties which have Irish-speaking districts.

Rest = Other Counties

(2) m-Teacher Schools = Schools which have more than three teachers.

(3) b_1 = The regression of coefficient of Y on X_1

b_2 = " " " " " " " X_2, etc.

Boys: 2-Teacher Schools: West. N = 89.

	SPA	SMA	Irish	English
b_1	.658	.604	.503	.712
b_2	2.733	3.568	3.011	1.718
b_3	-.016	-1.011	.674	-.299
b_4	1.894	2.785	-2.054	-2.223
b_5	-11.523	-4.414	2.957	6.827

Boys: 3-Teacher Schools: West. N = 76

	SPA	SMA	Irish	English.
b_1	.606	.542	.750	.685
b_2	1.341	1.714	.509	.462
b_3	1.911	1.847	2.473	.783
b_4	.434	.328	.857	2.201
b_5	-11.824	.527	-9.866	-2.610

Boys: M-Teacher Schools: West: N = 85

	SPA	SMA	Irish	English
b_1	.608	.672	.472	.618
b_2	1.479	.664	-.974	-.454
b_3	-.463	-.510	-1.395	-1.256
b_4	4.434	3.946	7.719	6.268
b_5	-25.076	-11.650	-18.448	-15.670

Girls: 2-Teacher Schools: West. N = 89

	SPA	SMA	Irish	English
b_1	.304	.258	.380	.324
b_2	1.228	.979	.913	-.364
b_3	.535	.355	1.656	1.081
b_4	-1.623	-1.833	-1.153	-1.215
b_5	-3.239	1.744	3.003	-.821

Girls: 3-Teacher Schools: West. N = 47

	SPA	SMA	Irish	English
b_1	.535	.536	.687	.659
b_2	1.229	2.085	.852	.294
b_3	1.040	2.368	1.816	.083
b_4	-1.646	-2.386	2.238	-.696
b_5	2.504	9.957	-11.553	-.308

Girls: m-Teacher Schools: West. N = 25

	SPA	SMA	Irish	English
b_1	.199	.422	.341	.685
b_2	.635	.206	-.021	.783
b_3	-19.111	8.840	3.406	7.929
b_4	19.693	-25.414	-11.035	-16.279

Note: The Schools of this subdivision are in linguistic groups 4 and 5; none are in Group 1, 2 or 3. Consequently, b_4 and b_5 are identical.

Boys: 2-Teacher Schools: Rest. N = 144.

	SPA	SMA	Irish	English
b_1	.653	.608	.512	.602
b_2	1.332	1.463	-.043	1.134
b_3	.306	.325	.640	.024
b_4	-.129	.454	2.005	.475
b_5	-11.027	-2.511	-1.929	-4.767

Boys: 3-Teacher Schools: Rest. N = 61

	SPA	SMA	Irish	English
b_1	.463	.446	.506	.661
b_2	1.230	.779	-.243	-1.391
b_3	1.344	.683	1.935	1.647
b_4	-4.519	-3.599	-.808	-2.700
b_5	14.623	14.194	23.474	14.372

Boys: m-Teacher Schools: Rest. N = 10.

	SPA	SMA	Irish	English
b_1	-.012	.119	.046	.133
b_2	-.257	.369	-3.145	-4.860

Note: Since there is only one school in this subdivision, Regression Coefficients which depend upon inter-school variation could not be calculated, i.e., b_3, b_4 and b_5.

Girls: 2-Teacher Schools; Rest. N 2 121.

	SPA	SMA	Irish	English
b_1	1.081	.931	.766	.883
b_2	1.023	2.606	.216	.383
b_3	.822	.722	.761	.395
b_4	1.190	.958	3.593	1.528
b_5	-7.151	-.425	-1.192	1.848

Girls: 3-Teacher Schools: Rest. N = 50.

	SPA	SMA	Irish	English
b_1	.615	.456	.576	.634
b_2	2.369	2.684	1.365	1.054
b_3	1.109	-.356	.444	1.103
b_4	-1.143	.229	-3.016	4.354

Note: None of the Schools of this subdivision belonged to linguistic Group 5, so b_5 could not be calculated

Girls: M-Teacher Schools: Rest. N = 122

	SPA	SMA	Irish	English
b_1	.538	.589	.420	.581
b_2	1.125	1.283	-.829	.390
b_3	2.257	-6.207	-5.661	-1.345
b_4	11.967	-13.894	-16.773	-1.036
b_5	-43.565	25.602	57.513	3.429

APPENDIX 8

Tables and Tests Relating

to

Chapter 9

APPENDIX 8.1

Proportion of children who solved each problem.

SPA

Item No.	1-4	Groups 5	Groups 6	Item No.	1-4	Groups 5	Groups 6
1	.79	.91	.83	26	.31	.24	.12
2	.74	.60	.58	27	.03	.02	.00
3	.72	.70	.62	28	.22	.26	.15
4	.77	.86	.77	29	.38	.30	.25
5	.64	.72	.60	30	.17	.09	.06
6	.74	.87	.76	31	.10	.07	.01
7	.72	.81	.70	32	.01	.00	.01
8	.73	.60	.65	33	.15	.12	.06
9	.68	.60	.54	34	.08	.07	.03
10	.67	.52	.41	35	.10	.10	.03
11	.64	.60	.52	36	.05	.09	.03
12	.69	.68	.66	37	.11	.11	.03
13	.61	.59	.55	38	.004	.00	.006
14	.47	.60	.42	39	.006	.00	.00
15	.56	.50	.45	40	.00	.00	.00
16	.63	.67	.52	41	.04	.02	.02
17	.51	.33	.26	42	.05	.02	.006
18	.46	.46	.36	43	.02	.01	.03
19	.49	.49	.43	44	.003	.00	.006
20	.09	.06	.02	45	.04	.01	.01
21	.35	.36	.17	46	.003	.00	.00
22	.40	.30	.18	47	.00.	.00	.00.
23	.15	.12	.10.	48	.006	.00	.006
24	.44	.52	.27	49	.006	.00	.00
25	.32	.37	.18	50	.003	.005	.00

APPENDIX 8.2

Proportions of children who gave the correct answer to each sum in SMA

SMA

Item No.	Groups 1-5	Groups 6	Item No.	Groups 1-5	Groups 6
1	.85	.84	26	.58	.52
2	.86	.96	27	.43	.21
3	.84	.94	28	.46	.27
4	.80	.70	29	.53	.38
5	.82	.91	30	.57	.35
6	.78	.82	31	.42	.28
7	.83	.83	32	.37	.25
8	.83	.87	33	.23	.11
9	.80	.82	34	.33	.20
10	.79	.75	35	.17	.06
11	.81	.83	36	.12	.04
12	.79	.77	37	.30	.19
13	.79	.89	38	.32	.27
14	.78	.79	39	.20	.14
15	.75	.76	40	.12	.08
16	.76	.75	41	.05	.03
17	.80	.83	42	.03	.04
18	.54	.45	43	.06	.04
19	.64	.47	44	.04	.02
20	.72	.77	45	.26	.19
21	.58	.45	46	.08	.05
22	.63	.57	47	.09	.05
23	.52	.37	48	.07	.05
24	.67	.63	49	.14	.06
25	.55	.32	50	.05	.03

Irish Test.

Numbers of children in each linguistic group who answered correctly each question in the Irish test Ns in the 6 groups = 160, 188, 215, 170, 195, 155 respectively.

Item No.	Groups 1	2	3	4	5	6	Item No.	Groups 1	2	3	4	5	6
1	.83	.85	.83	.83	.83	.83	36	.19	.24	.28	.24	.33	.29
2	.61	.59	.57	.74	.83	.77	37	.14	.18.	.19	.15	.27	.21
3	.56	.55	.55	.68	.66	.75	38	.17	.23	.18	.20	.31	.30
4	.33	.37	.38	.45	.57	.64	39	.14	.19	.24	.22	.31	.48
5	.38	.31	.35	.44	.47	.75	40	.16	.19	.21	.24	.28	.44
6	.49	.53	.50	.57	.67	.68	41	.24	.24	.23	.30	.32	.34
7	.58	.59	.59	.58	.65	.44	42	.09	.11	.10	.14	.24	.38
8	.64	.70	.68	.69	.76	.58	43	.12	.20	.17	.18	.31	.25
9	.43	.37	.35	.40	.51	.40	44	.04	.09	.09	.09	.15	.16
10	.31	.33	.36	.35	.47	.36	45	.08	.16	.17	.21	.23	.23
11	.35	.27	.37	.39	.48	.41	46	.05	.07	.10	.10	.14	.19
12	.54	.56	.51	.71	.71	.68	47	.13	.10	.09	.12	.19	.23
13	.33	.41	.33	.51	.52	.54	48	.04	.08	.05	.05	.14	.20
14	.34	.40	.40	.46	.50	.65	49	.11	.12	.14	.20	.23	.22
15	.32	.43	.40	.46	.60	.70	50	.08	.10	.09	.10	.15	.14
16	.36	.45	.42	.53	.54	.55	51	.13	.14	.11	.18	.18	.23
17	.50	.55	.60	.62	.68	.69	52	.06	.07	.07	.09	.12	.12
18	.39	.32	.41	.43	.44	.38	53	.07	.08	.08	.10	.10	.16
19	.64	.59	.57	.60	.59	.58	54	.06	.05	.06	.08	.10	.11
20	.30	.24	.32	.28	.38	.30	55	.04	.03	.04	.09	.06	.13
21	.39	.40	.40	.36	.46	.34	56	.05	.03	.02	.06	.06	.07
22	.28	.33	.33	.37	.43	.35	57	.02	.04	.03	.06	.07	.05
23	.36	.44	.38	.42	.41	.40	58	.01	.02	.00	.02	.04	.03
24	.18	.18	.23	.22	.33	.21	59	.03	.03	.02	.05	.03	.06
25	.21	.13	.18	.20	.18	.14	60	.01	.00	.00	.04	.04	.05
26	.29	.27	.25	.30	.35	.30	61	.03	.02	.03	.06	.08	.06
27	.03	.05	.04	.06	.09	.12	62	.02	.02	.03	.05	.06	.05
28	.04	.08	.07	.09	.09	.23	63	.03	.00	.02	.06	.05	.05
29	.08	.15	.11	.26	.24	.37	64	.02	.01	.02	.02	.02	.04
30	.15	.16	.13	.25	.27	.25	65	.07	.05	.05	.08	.08	.05
31	.37	.32	.39	.32	.46	.35	66	.02	.03	.01	.04	.03	.03
32	.38	.41	.47	.41	.54	.50	67	.06	.02	.02	.04	.06	.03
33	.16	.22	.20	.22	.25	.26	68	.01	.02	.01	.04	.05	.05
34	.18	.21	.23	.21	.30	.31	69	.02	.01	.01	.03	.03	.03
35	.24	.26	.26	.27	.37	.42	70	.01	.00	.00	.02	.05	.05

APPENDIX 8.4

Proportions of Irish children (groups 1 to 5, and group 6), and of a random sample (N = 254) of English children in one L.E.A. area (1941), who answered each question in MHE 14 correctly.

Item No.	Groups 1-5	Groups 6	English Children	Item No.	Groups 1-5	Groups 6	English Children	Item No.	Groups 1-5	Groups 6	English Children
1	.25	.10	.53	41	.22	.16	.48	81	.04	.01	.27
2	.48	.23	.72	42	.18	.10	.51	82	.15	.06	.57
3	.50	.32	.68	43	.38	.22	.53	83	.09	.03	.27
4	.40	.117	.72	44	.33	.21	.72	84	.15	.08	.43
5	.39	.17	.67	45	.16	.08	.56	85	.08	.03	.39
6	.55	.33	.80	46	.38	.20	.72	86	.06	.04	.22
7	.37	.19	.54	47	.24	.11	.48	87	.01	.01	.21
8	.28	.15	.61	48	.18	.06	.39	88	.15	.11	.59
9	.52	.28	.74	49	.06	.01	.19	89	.06	.02	.43
10	.56	.34	.77	50	.02	.01	.19	90	.08	.06	.41
11	.50	.34	.70	51	.25	.10	.44	91	.08	.04	.48
12	.41	.28	.50	52	.36	.22	.66	92	.05	.01	.23
13	.10	.05	.32	53	.30	.12	.57	93	.03	.01	.22
14	.22	.15	.48	54	.23	.13	.40	94	.08	.03	.24
15	.26	.19	.33	55	.21	.10	.46	95	.03	.01	.17
16	.79	.46	.67	56	.12	.05	.47	96	.02	.00	.11
17	.50	.26	.65	57	.16	.08	.30	97	.02	.01	.19
18	.18	.10	.38	58	.08	.09	.37	98	.01	.01	.05
19	.06	.02	.38	59	.02	.03	.18	99	.03	.02	.29
20	.45	.20	.72	60	.06	.02	.31	100	.01	.00	.11
21	.27	.13	.59	61	.05	.02	.28	101	.01	.01	.11
22	.37	.17	.46	62	.05	.03	.28	102	.06	.03	.45
23	.45	.21	.61	63	.20	.14	.49	103	.06	.01	.43
24	.25	.13	.51	64	.30	.16	.70	104	.03	.01	.21
25	.17	.06	.47	65	.33	.16	.65	105	.02	.00	.28
26	.18	.08	.52	66	.26	..14	.66	106	.01	.04	.27
27	.20	.08	.48	67	.14	.08	.36	107	.05	.03	.31
28	.52	.33	.75	68	.16	.07	.59	108	.06	.00	.29
29	.40	.25	.70	69	.15	.06	.46	109	.02	.01	.24
30	.22	.09	.46	70	.24	.11	.48	110	.03	.02	.27
31	.15	.06	.51	71	.19	.06	.76	111	.03	.03	.28
32	.25	.10	.53	72	.20	.06	.53	112	.03	.03	.19
33	.39	.15	.65	73	.19	.09	.54	113	.02	.05	.16
34	.34	.09	.57	74	.23	.13	.63	114	.07	.00	.22
35	.48	.25	.66	75	.19	.10	.54	115	.03	.00	.33
36	.14	.12	.25	76	.17	.04	.63	116	.02	.00	.20
37	.07	.03	.17	77	.02	.01	.19	117	.02	.00	.26
38	.13	.07	.39	78	.07	.02	.26	118	.03	.00	.31
39	.27	.15	.56	79	.10	.03	.18	119	.03	.01	.33
40	.14	.10	.43	80	.02	.01	.11	120	.01	.00	.24

APPENDIX 8.5

"Irish - Arithmetic Test"

NAME: . . . . DATE of BIRTH . . . . . .

SCHOOL . . . .

<u>Write the answer on the dotted line.</u> <u>ANSWER</u>

1. I have a stick 1 foot long. What is four times that length? ....
2. John paid £5 for a bicycle, and James paid £1 more for his own bicycle. How much did James pay for his bicycle? ....
3. Divide £1 into two halves. ....
4. I bought a car for £400 and I sold it for £425. What was my profit? ....
5. I have a bag of apples in each hand; one weighs 7 lbs. the other weighs 6 lbs. What is the entire weight of apples which I have? ....
6. My father is 5 feet 6 inches tall. I am 3 inches taller than my father. What height am I? ....
7. Write ½ as a percentage. ....
8. I worked 4 hours on Monday and 2 hours on Tuesday. How many hours did I work on an average? ....
9. I have £4. 10.0, but James has four and a half times that much. How much money has James? ....

10. Divide 21/- between John and William so that John will have 2/6 more than William. John ...... William ....

11. I worked for 8 hours on Monday, 7 hours on Tuesday and 3 hours on Wednesday. How long did I work per day, on an average? ....

12 One piece of meat weighted 4 lbs. 11 ounces, and another piece weighed 1 lb. more. Mother bought both pieces. How much did she buy altogether? ....

13. I had a shilling and I bought a pencil for 2d. and a pair of shoe laces for 2d. Write the amount I paid as a percentage of the money I had at the beginning. ....

14 I owe John 2/-. James owes me three times that amount. How much money is mine? ....

15. When a man sold every house in a street from number 20 to number 31 he made a profit of £90.10. per house. What was his entire profit for the sale of the houses? ....

16. A shopkeeper sold 2½ lbs of tea to one man, ¾ lb. to another and 3¾ lbs to a third man. What was the entire weight of tea which he sold? ....

17. My mother bought two pieces of material; one piece was 4 ft. 10 in. long and the other piece was 1 ft. longer. How much material did she buy altogether? ....

18. John owes me 31/9, and I owe Peter one third of that amount. How much money is mine? ....

"Irish - Arithmetic Test"

Irish Version

Ainm. . . . . Lá Breiṫe. . . . . . .

Scoil . . . .

Scríoḃ an freagra ar an líne ponganna

Freagra

1. Tá slat 1 troiġ agam. Cad é a ċeiṫre oiread san ar ḟaid? . . . . . .

2. Ṫug Seán £5 ar roṫar, agus ṫug Séamus punt sa ḃreis ar a roṫar féin. Cé ṁéad a ṫug Séamus ar a roṫar? . . . . . .

3. Roinn £1 in a ḋá leaṫ . . . . . .

4. Ċeannaiġ mé gluaisteán ar £400 agus ḋíol mé ar £425 é. Cad é an socair a ḋein mé? . . . . . .

5. Tá mála úll i ngaċ láṁ agam; 7 ún. 1 mála acu agus 6 ún. san mála eile. Fáiġ meáċain iomlán na n-úll. . . . . . .

6. Tá m'aṫair 5 troiġ 6 órlaċ ar airde. Tá 3 órlaċ agam ar m'aṫair. Cé'n airde mé? . . . . . .

7. Scríoḃ $\frac{1}{2}$ mar ċéadċodán (céadadán). . . . . . .

8. D'oibriġ mé 4 uaire Dé Luain, agus 2 uair Dé Máirt. Cé ṁéad uair d'oibriġ mé ar an meán? . . . . . .

9. Tá £4.10.0 agam, aċ tá a ċeiṫre oiread san go leiṫ ag Séamus. Cé ṁéad airgid atá ag Séamus? . . . . . .

10. Roinn 21s. idir Ṡeán agus Liam i dtreo is go mbéiḋ 2s. 6d. sa ḃreis ag Seán ar Liam. Seán. . . . . Liam. . .

Freagra

11. D'oibriġ mé 8 n-uaire a ċloig Dé Luain, 7 n-uaire Dé Máirt agus 3 h-uaire Dé Céadaoin. Cén ḟaid d'oibriġ mé, ar an meán, in aġaiḋ an lae? . . . .

12. Ḃí 4 pt. 11 ún. meáċain i bpíosa feola agus 1 pt. sa ḃreis i bpíosa eile. Ċeannaiġ Mamaí an dá ṗíosa. Cé'n meáċain ar fad a fuair sí? . . . .

13. Ḃí scilling agam, agus ċeannaiġ mé peann luaiḋe ar 2d. agus péire iall bróige ar 2d. Scríoḃ an méid d'íoc mé mar ċéadċodán (ceadadán) de'n ṁéid airgid a ḃí agam i dtosaċ. . . . .

14. Tá 2s. ag Seán orm. Tá a ṫrí oiread san agamsa ar Ṡéamus. Cé ṁéid airgid is liom féin? . . . .

15. Nuair a ḋíol fear gaċ tiġ i sráid ó uiṁir a 20 go dtí uiṁir a 31 ḃí socair £50.10. an tiġ aige. Cad é soċair iomlán as díol na dtiġ? . . . .

16. Ḋíol siopadóir $2\frac{1}{2}$ pt. tae le fear aṁáin, $\frac{3}{4}$ pt. le fear eile agus $3\frac{3}{4}$ pt. leis an dtriú fear. Cad é meáċain iomlán an tae a ḋíol sé? . . . .

17. Ċeannaiġ mo ṁamaí dá ṗíosa éadaiġ; ḃí píosa aṁáin 4 tr. 10 órl. ar ḟaid, agus ḃí 1 tr. sa ḃreis san bpíosa eile. Cé ṁéad éadaiġ ar fad a ċeannaiġ sí? . . . .

18. Tá 31s. 9d. agam ar Ṡeán, agus tá an triú cuid de sin ag Peadar ormsa. Cé ṁéad airgid is liom féin? . . . .

APPENDIX 8. 6

"Three - Term Relations Test"

AME . . . . DATE of BIRTH. . . . .

CHOOL. . . . .

Underline the correct answer

1. John is taller than James; James is taller than Tim.
   Which boy is the tallest, John, James or Tim?

2. Mary is prettier than Nancy; Nancy is prettier than Anne.
   Who is the prettiest, Mary, Anne or Nancy?

3. Jim is to the left of John; John is to the left of Andrew.
   Which boy is furthest to the left, Andrew, John or Jim?

4. John is taller than Tim; James is not as tall as Tim.
   Who is the tallest, Tim, John or James?

5. Nancy is prettier than Mary; Anne is not as pretty as Mary.
   Who is the prettiest, Nancy, Mary or Anne?

6. Jim is to the left of John; Andrew is to the right of John.
   Which of them is furthest to the left, John Jim or Andrew?

7. Andrew is taller than John; John is taller than James.
   Which boy is smallest, Andrew, John or James?

8. Anne is prettier than Nancy; Nancy is prettier than Mary.
   Which of the girls is least pretty, Nancy, Mary or Anne?

9. Jim is to the left of Andrew; Andrew is to the left of Tim.
   Which of the boys is furthest to the right, Tim, Jim or Andrew?

10. Tim is faster than John; James is faster than Tim.
    Who is the fastest, John, James or Tim?

11. Mary is older than Anne; Peggy is older than Mary.
    Who is the oldest, Mary, Anne or Peggy?

12. H.M.S. Victory is North ofH.M.S. Vanguard; H.M.S. Nelson is
    North of H.M.S. Victory. Which is farthest North, H.M.S. Victory,
    H.M.S. Vanguard or H.M.S. Nelson?

"Three - Term Relations Test" (Irish Version)

Ainm..............................Lá breiṫe....................

Scoil....................................

Cuir líne fé'n ḃfreagra ceart.

1. Tá Seán níos airde ná Séamus; tá Séamus níos airde ná Taḋg. Cé'n buaċaill is airde, Seán, Séamus nó Taḋg?

2. Tá Máire níos deise ná Úna; tá Úna níos deise ná Áine. Céacu is deise, Máire, Áine nó Úna?

3. Tá Jimín ar ċlé Ṡeáin; tá Seán ar ċlé Airt. Cé'n buaċaill is fuide ar ċlé, Art, Seán nó Jimín?

4. Tá Seán níos airde ná Taḋg; níl Séamus cóṁ h-árd le Taḋg. Cé acu is airde, Taḋg, Seán nó Séamus?

5. Tá Úna níos deise ná Máire; níl Áine cóṁ deas le Máire. Cé acu is deise, Úna, Máire nó Áine?

6. Tá Jimín ar ċlé Seáin; tá Art ar ḋeis Ṡeáin. Cé acu is fuide ar ċlé Seán, Jimín nó Art?

7. Tá Art níos airde ná Seán; tá Seán níos airde ná Séamus. Cé'n buaċaill is lú, Art, Seán nó Séamus?

8. Tá Áine níos deise ná Úna; tá Úna níos deise ná Máire. Cé hí an cailín is gránúla, Úna, Máire nó Áine?

9. Tá Jimín ar ċlé Airt; tá Art ar ċlé Ṫaiḋg. Cé'n buaċaill is fuide ar ḋeis, Taḋg, Jimín nó Art?

10. Tá Taḋg níos tapúla ná Seán; tá Séamus níos tapúla ná Taḋg. Cé acu is tapúla, Seán, Séamus nó Taḋg?

11. Tá Máire níos sine ná Áine; tá Peig níos sine ná Máire. Cé acu is sine, Máire, Áine nó Peig?

12. Tá H.M.S. Victory taoḃ ṫuaiḋ de H.M.S. Vanguard; tá H.M.S. Nelson taoḃ ṫuaiḋ de H.M.S. Victory. Cé acu is fuide ṫuaiḋ, H.M.S. Victory, H.M.S. Vanguard ~~+~~ no H.M.S. Nelson?

mm

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