

THE
PROGRESSIVE MATRICES INTELLIGENCE TEST
APPLIED TO THREE RACIAL GROUPS IN CAPE TOWN

by

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CHAPTER I

INTRODUCTION:
NON-EUROPEAN INTELLIGENCE

The intelligence of non-White races has long been a matter of controversy, the point at issue being whether inferiority indicated by test-results is innate. In the United States much research into differences between Negroes and Whites has already been done. Available data have been utilised in discussions of the problem as it arises in South Africa, but the pattern in this country is more complicated. The vast majority of our non-Europeans, viz. the Africans, are indigenous. They have their own language and cultural traditions, roughly five-sixths of their number living in the Reserves or on farms, where tribal conditions and customs still prevail. This situation is not encountered in America. The nearest approach in South Africa to the American Negro population is the Coloured community. Numerically and comparatively small, this group is in no way representative of non-European South Africans in general, while the Indians, particularly in Natal, form another substantial group adding to the diversity of races.

As the investigation to be discussed was carried out at the Cape, the Indian group need not be considered in a summary of the general position.

Intelligence of the African

At the New Education Fellowship Conference held in Johannesburg in 1934, one of the topics for discussion

was "The Educability of the Bantu". Dr. M.L.Fick, then Psychologist of the National Bureau of Educational and Social Research, presented a paper reporting on an investigation of African intelligence. He claimed that the average mental age of the African eventually reaches the level of 9 or 10 years. A different attitude was adopted by G.R.Dent, who pointed out that, up to that time, the majority of investigators had used tests involving "knowledge acquired in schools and thought-material represented by words rather than subjects". He suggested that reasoning based on concrete objects presented to the sense and that based on the mental representation of objects might not be highly correlated, and that both involve education to some extent.

Dent found the time-factor to assume considerable importance in the case of Africans. None of the African children faced with, e.g., the Goddard Form Board worked at their maximum speed, but were deliberate and painstaking. The scoring of this test depends either on time taken or on time-plus-errors. The necessity for haste is not appreciated by the African child, to whom the Western attitude towards time is completely alien. Dent was of the opinion that an increase of speed is one important factor contributed by schooling, which affords training in quickness and the co-ordination of movements.

He had given nine standard performance tests of intelligence (some of which had been used by Fick) to rural and urban samples of African children, a number of whom were at school, others having received no formal education. He came to the conclusion that, while these performance tests are discriminative within each racial group, different standards and norms from those adopted for Europeans would be necessary for the correct evaluation

of African results. Environmental and educational factors had appreciably influenced the results, differences being attributable largely to unfamiliarity with the material of the tests and to the speed factor. Dent agreed with Fick that African children were retarded as much as 4 or 5 years, if judged according to accepted standards and norms, but he stressed the importance of environment. The range of abilities and emotional responses, he said, is more restricted among the Bantu, owing to their altogether simpler mode of life and environment. In Dent's opinion the total environmental factor might be responsible for the differences between European and African results.

Fick subsequently undertook further research on substantially the same lines as his earlier work, this leading to the publication of his well-known monograph, "The Educability of the South African Native", in 1939. He claimed that the results had confirmed his previous finding that "around the ages of 13 and 14 Native children are from 4 to 5 years inferior to European children in educability" (as measured by intelligence tests). Fick therefore advised that only the rudiments of education should be provided for the mass of Africans, since very few of them possess the mental equipment necessary for more advanced education.

Although these opinions have wide currency, the validity of ~~xxx~~ Fick's conclusions was not universally accepted. The principal challenge came in the form of Dr. Simin Biesheuvel's book, "African Intelligence", published in 1943. A detailed discussion of the environmental and temperamental factors which may affect test-intelligence, of the suitability of existing tests and the difficulty of obtaining a representative and at the same time comparable European control-group, leads up to a critical review of Fick's publication.

Biesheuvel contends that Fick's sample cannot be regarded as representative of the Union African population. He rejects the claim that the 4 to 5 years' retardation of the African group is innate, on the grounds that, not only are the tests used unsuitable, but that inadequate precautions were taken to equate the attitudes of European and African towards the test situation, and that measures for controlling other environmental factors involved were far from adequate. The corroborative evidence (such as achievement-test performance) adduced by Fick is also rejected by Biesheuvel. The criticisms levelled are that, in interpreting test scores, Fick made no allowance for the inferior tuition received by Africans; in addition, he assumed the existence of a causal relationship between the retardation shown by intelligence test scores and that reflected by achievement tests, whereas it is possible that both sets of scores might have been depressed by environmental factors; finally, Biesheuvel suggests that the agreement noted between the results of various investigators is due to all having used substantially the same tests and procedures on experimental groups which were similarly affected by environmental factors.

In consideration of the fact that the growth and development of intelligence are probably profoundly affected by environmental circumstances, Biesheuvel indicates that it is premature to make claims for comparisons on the basis of existing tests. These are not equally fair to European and African, having been constructed and standardised in conformity with European culture in general; and it is virtually impossible to find a really reliable control-group which would facilitate the evaluation of results.

The Cape Coloured

As noted, this group has much in common with the American Negroes, and American research work has more

direct bearing on "Coloured Intelligence" than on that of the other groups. These studies have indicated that differences between Negro and White decrease with decreasing differences in environment. This view is held by one school of thought to be true for the Coloureds. As in the case of the Africans, however, others maintain that an inborn inferiority is responsible for the lower mean test-intelligence of the Coloured child, arguing that the admixture of European blood explains the fact that Coloured children score higher, on average, than African children. The Report of the Cape Coloured Commission (U.G. 54-1937) stated that there can be no doubt that, in the case of the majority of Coloured children, intelligence test results are affected by unfavourable environmental influences, with the result that under present circumstances, the Coloured child is less well able to perform the tasks involved than is the European child.

Within the Coloured group there is a good deal of diversity - social, economic and religious - especially in Cape Town, where there is a fairly distinct divergence between Christians and ^{the} Malays (or Moslems), who tend to adhere to cultural norms of their own. For nearly all, the home language is a dialect of Afrikaans peppered with English words, although English enjoys a certain prestige. The home environment is not uniform, varying from an almost primitive and frequently precarious existence in shanties on the Cape Flats and in similar poor areas, to the vastly superior condition of the better educated and more affluent. Parental discipline is often poor, drunkenness and shebeening prevalent and juvenile delinquency common, particularly in the towns. Slum conditions have been eliminated to a small extent by the institution of sub-economic housing schemes.

Education, until the Parliamentary Session of 1945, was not compulsory for Coloured children. For some time to come the new legal machinery will not be able to operate fully since schools have first to be built and

equipped. From a survey carried out in the Cape Peninsula towards the end of 1945, it appears that approximately two-thirds of Coloured children of school-going age are already attending schools. There is great variation in quality among existing schools, many being private or mission enterprises, inspected periodically by officials of the Cape Department of Public Education. Classes are large, equipment and tuition often inadequate and attendance irregular. Many parents regard their children as supplementary bread-winners and keep them from "wasting their time" at school, sending them out to work instead.

A recent study by F.P. Joshua * of the social, economic and educational background of the Coloured school child throws light on many aspects of the situation. For instance, an illustration of the effect of the attitude toward schooling is provided by examination of the official statistics for 1942. There was a striking fall in enrolment from Sub-Standard A to Sub-B (or Class I to Class II) , indicating that many children leave school after only one year.

For his sample of 374 children in Standards III to VI, Joshua found the average I.Q. to be 89.9, which is roughly 6 points higher than the minimum requirement for a successful school career for the Poor White child. ** Assuming, on the basis of the chi-square test, that the sample was statistically reliable, Joshua concluded that there is a difference of 10 points on average between European and Coloured children. As the ten schools from which the sample was drawn were selected from a wide range of geographic localities, he was able to investigate the influence of environmental factors on intelligence, and found that average intelligence varied according to locality.

Among the aspects of environment studied figured planes of living (or economic status), overcrowding, the

/ academic

*JOSHUA, F.P. "The Coloured School Child". (B.Ed. Thesis, U.C.T.)

** MALHERBE, E.G. "Education and the Poor White". (Carnegie Comm. Report, vol. III)

academic equipment of the teachers and the size and quality of the school. Joshua found that the low standards of professional and academic training of the teachers and the deficiencies in their cultural background were associated with "the general lowness of Coloured I.Q." He found a decrease in mean I.Q. with increasing chronological age. This he ascribed to generally unfavourable environmental conditions, and more specifically to poor home-conditions, the effects being cumulative. There was a marked positive correlation between the economic status of parents and their children's intelligence, when results were grouped according to the regions in which the schools were situated. Where the environment approximated most closely to that of the European child, the I.Q. of the Coloured child reached its highest level, almost equalling that of the European.

The general conclusions drawn were that the differences in I.Q. between ~~the~~ Coloured and European children are due to certain depressing environmental factors, the cultural deficiencies and poor home conditions reacting more and more to the disadvantage of the Coloured child as the upper childhood ages are reached. Thus, the indications are that the retardation of the Coloured, as shown by the results of intelligence tests, is "due more to nurture than to nature", and that the causes can be remedied.

These conclusions are in line with those of Biesheuvel and others. The material of verbal intelligence tests such as the S.A. Group Test will, clearly, not be so unfamiliar to a racial group which has absorbed a certain amount of European culture as it will to African pupils. Nevertheless, the environment of the average Coloured child is such as to handicap his test performance, the language factor and inferior educational opportunities being of no little importance.

General

In considering inter-racial differences in intelligence, one must always remember that inferiority in test-intelligence does not necessarily imply inferiority in innate intelligence. The crux of the matter is that no test has so far been found which is equally well suited to European and non-European children. As Ferguson stated in his book, "The Reliability of Mental Tests", a person's abilities can never be exactly determined by a test situation. The application of a test amounts to measuring, "under certain specified conditions, a limited number of things a person can do, regarding the performance on a limited number of tasks as representative of his hypothetical potential performance".

If an instrument is imperfect, it is natural to question the validity of measurements made with it. If, in other words, a test is unsuitable for application to a particular racial group, the results obtained must not be accepted without serious reservations.

Any test, therefore, which holds out promise of being a better instrument deserves investigation. It was for this reason that the present study was undertaken.

CHAPTER II

THE PROGRESSIVE MATRICES INTELLIGENCE TEST

Information regarding a series of perceptual tests which later became known as the "Progressive Matrices, 1938" was first published by L.S.Penrose and J.C.Raven in 1936. In an article in the B.J.M.S. *, They described the preliminary attempt to construct a series of non-verbal tests of wide applicability.

"The design", wrote the authors, "of true intelligence tests has become a pressing need in psychiatry. The accurate diagnosis of innate mental capacity is required for studies in heredity and for sociological and anthropological investigations. Differences in educational background must, as far as possible, be eliminated and tests for special abilities which may depend on physical factors avoided. Thus both verbal problems and problems whose technical performance is difficult are inadmissible. Moreover, tasks which involve repetition are not pure intelligence tests"

The new tests were designed with the aim of avoiding the disadvantages of such perceptual tests as were already in use. Spearman, in "The Abilities of Man", had divided mental operations into two classes: those which are mainly "eductive" and those which are mainly "reproductive" or repetitive. He considered that all intelligent or creative mental activity is essentially of the eductive type. The work of W.Stevenson ("Tetrad Differences for Verbal and Non-Verbal Sub-tests", Am. J. Ed.Psy., 1931) and W.P.Alexander ("Intelligence, Concrete and Abstract", B.J.Psy. Monog. Supp. No.15, 1935) had shown that group factors, i.e.factors which occur in more than one but less than all of any given

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* PENROSE, L.S. and RAVEN, J.C. "A New Series of Perceptual Tests: Preliminary Communication".
B.J.Med.Psych., vol.XVI, 1936

set of abilities, are present in verbal eductive tests and performance tests of intelligence, respectively.

If group factors were to be eliminated, the new tests would have to be " strictly eductive in character and adequately presented in a purely perceptual form". Since analogies have become accepted as among the most suitable tests of eductive ability, the analogy-principle was adopted, the problems being presented in the form of patterns. Raven undertook the preparation of a graded series of sixty "Matrix"-tests, working in the Research Department of the Royal Eastern Counties Institution, Colchester.

Nature of the Tests

Each component test consists of a pattern or matrix from which a piece has been omitted. Below each matrix are placed several pieces, identical in size and shape with the gap in the pattern and variously decorated. The testee has to examine the matrix and choose from among the alternatives the piece which completes it. The number of the alternative chosen is then recorded on an answer-paper. As finally published, the test consists of five sets of twelve problems, the relationships involved becoming progressively more complicated. The problems are graded in such a way as to train the testee as he proceeds. The printed form of the test is suitable for use as an individual or a group test, and Raven claims that it "can be given successfully to almost any testee, irrespective of age, linguistic ability or physical defects." As there are no time-limits, the speed-factor is eliminated, but the time taken and the nature of the errors made may be taken as indicative of temperamental or emotional traits. As Raven has stated, "the rate of eduction may be a good measure of ability to work under examination conditions: it does not follow that it is the best measure of innate eductive ability".

This observation is particularly pertinent to the testing of Africans. Characteristic of Western Civilisation is the emphasis on haste and the importance of completing tasks in the shortest possible time. Among the Africans, with their background of a far more leisurely way of life, this attitude towards time does not operate. Their logic, in fact, is that many important considerations may be omitted through a too direct and thus too hurried drive towards the goal. Although the impingement of Western Civilisation necessarily modifies the outlook of the African (e.g. through school training) it is doubtful whether speed as such has any great significance for the majority of Africans, whether urbanised or not.

Consequently tests which demand speed of performance probably give a false impression of the ability of African testees.

Standardisation

The series was standardised as an individual and a group test for children, in the County Borough of Ipswich, between June and December, 1938 and as a group test for men in 1940. It was subsequently adopted as the standard intelligence test in the British fighting services and was also used by the Union Defence authorities.

Norms for the group form of the test were constructed from the scores of 1,407 children and 3,665 men. For every six months of chronological age from 8 to 14 years, as well as for the adult group, percentile points were calculated from the scores. Once the testee's percentile rating has been established, he can be classified according to Raven's five-point percentile grading, which is given on the next page.

MATRIX PERCENTILE GRADES

Grade I	" <u>Intellectually Superior</u> ", if the score lies at or above the 95 percentile score for the testee's age group.
Grade II	" <u>Definitely Above Average</u> ", if the score lies at or above the 75 percentile score for the testee's age group.
Grade III	" <u>Mentally Average</u> ", if the score lies between the 75 and 25 percentile scores: III+ , if testee's score is greater than the median score for his age group; III- , if his score is less than the median score.
Grade IV	" <u>Definitely Below Average</u> ", if the score lies at or below the 25 percentile score.
Grade V	" <u>Intellectually Defective</u> ", if the testee's score lies at or below the 5 percentile score for his age group.

Matrix Percentile Grade and Terman Merrill I.Q.

The relationship between these Matrix Percentile grades and Terman Merrill I.Q. was investigated by means of applying the Progressive Matrices, 1938 and the Terman Merrill 1937 revision of the Binet scale to 301 patients referred to Psychiatric Clinics in London. Terman Merrill I.Q.s were grouped in classes comparable with the Matrix Test grades (c.f. Table I). No discrepancies of more than two grades were found between the two tests. Raven concluded that if the Terman Merrill scale could be accepted as correctly standardised for English children, then his norms for the Matrices as an individual test were approximately correct.

This comparison led to the observation that the Terman Merrill test "appears to depend for young children too much upon normal school accomplishments; and for older persons too much upon their acquired vocabulary and fluent speech". On the other hand, tests like the Progressive Matrices "probably make slow, self-critical, shy or shut-in testees appear a little brighter and more intelligent than they are, while quick, impulsive testees are at a disadvantage".

Raven considers that one of the chief merits of the Progressive Matrices is that they differentiate clearly

TABLE I *

RELATIONSHIP BETWEEN MATRIX TEST PERCENTILE
GRADE AND TERMAN MERRILL I.Q.

MATRIX TEST Percentile	Grade	TERMAN MERRILL I.Q.					Totals
		Under 73	Under 89	89-111	Over 111	Over 127	
95 and over	I	-	-	6	6	17	29
75 and over	II	-	3	20	19	14	56
Over 25 and under 75	III	2	20	85	15	10	132
25 and under	IV	9	23	16	-	-	48
5 and under	V	26	9	1	-	-	36
TOTALS		37	55	128	40	41	301

* From Table 5 in "Standardisation of Progressive Matrices, 1938"
by John C. Raven, B.J.M.Psy. vol.XIX, 1943.

Between genuine intellectual superiority and merely superficial brightness which is due to verbal fluency and quick recall.

The Progressive Matrices in Relation to South Africa

From the above we may infer that the three principal claims made for the Progressive Matrices Test are : first, that it is relatively free from group factors and avoids special skills; second, that differences in educational (though possibly not cultural) background are eliminated as far as possible; and third, but most important, that it differentiates clearly between genuine intelligence and verbal fluency.

It has been shown that the study of inter-racial differences in intelligence is severely hampered for lack of an adequate instrument for measurement. Presumably, we may accept that the Progressive Matrices Test does distinguish between verbal fluency and genuine intelligence, for English testees at least. Presumably we may accept the claim that

/differences

differences in educational background have been eliminated if we place the narrower interpretation on "educational". The possibility remains that cultural differences and environmental influences may still have a depressing effect on the performance of non-Europeans. Although African children, for instance, are familiar with patterns, they may be less familiar with the test material and situation than European children, who have been accustomed to amusing themselves with toys and puzzles involving the manipulation of shapes and patterns.

Form and Pattern in African Life

To the unschooled African child, concepts of measurement and number seem to be entirely foreign. There is apparently no call for the appreciation of subtle space-relationships in tribal life, nor any particular stress on accuracy of measurement or proportion, and utility may be said to outweigh considerations such as perfect symmetry and geometrical accuracy. Although, for instance, European building plans may influence the rural African to build a house of more or less rectangular design, or there may be attempts to imitate other European culture-objects involving measurement and particular spacing, the results will be on the whole rather poor imitations.

In tribal life techniques are passed on by means of direct demonstration. From an early age, the African comes to accept that he will be shown exactly how to do a thing, and does not try to work out the underlying principles for himself. When, therefore, he is presented with a new type of object which he may wish to copy, his approach will be to find the person who made the original and go to him for instruction. At all times he will be concerned principally with producing an article with a reasonable resemblance to the traditional shape or form. Perfect symmetry and proportions do not matter as long as the article is serviceable.

Semi-civilised Africans who have had more contacts with Europeans have begun to respond to the stimuli of Western culture. Western pattern and design may be seen to have influenced the building of kraal hedges and cattle kraals, to some extent, while the round grass huts of the Zulu are beginning to be replaced by structures of sun-dried brick with doors and windows in imitation of European houses. There is also some imitation of European prototypes in the construction of simple furniture. In the finer points of construction and finish, however, there are inaccuracies which are probably due to lack of measurement and failure to appreciate the straight line as such, to lack of opportunities for dealing with the originals at first hand or to inability to obtain the proper materials. In the same way, African craftwork and needlework often fail to satisfy Western ideals of good proportion and correct measurement, although school children show marked improvements as they progress through the schools.

In urban areas Africans are learning Western techniques, but will not necessarily utilise their knowledge on returning to tribal life in the Reserves. On the one hand, where their skill would be of use, e.g. in building bridges, the outlay for the requisite materials or machinery may be beyond the resources of the individual or tribal community. On the other hand, the particular values involved may have no place. In agriculture, a man who has learned modern farming techniques may be perfectly capable of putting his knowledge into practice without European supervision, but will not do so in tribal life. Since there is no premium on production for the market he will not bother to make his land give its maximum yield, probably reverting to the old methods of cultivation.

Among school children in urban areas, education

is modifying traditional attitudes and outlook, but these linger on. It has been noticed that urban children do tend to show more self-reliance in their work, and try to discover principles for themselves, in many cases. It is important to note that unless the ordinary African child, whether in the town or the Reserves, knows the use of a particular new object, he will find it meaningless and will fail to accept or attach any importance to it. This has obvious implications for the application of mental tests. Abstract concepts seem to have no place in African life.

In their decorative arts, ritual and symbolism familiar patterns involving colours, colour-schemes and combinations of lines have been handed down by the process of imitation. The African thinks of these patterns in the concrete, in their relationship to particular aspects of his culture. They have no significance for themselves alone. Bead-work, the decoration of dance-sticks and pottery and similar art forms embrace almost the whole field of African pattern-work, although the various tribes differ in respect of the richness of their decorative and symbolic arts.

These traditional patterns tend to be symmetrical as such, but are not always geometrically symmetrical in the manner to which Europeans are accustomed. Dr. K. Cunningham, in the course of a discussion at the N.E.F. Conference in 1934, suggested that the African's conception of symmetry differs from that of the European. In this connection, one finds that a line or figure appearing in one half of a pattern may be omitted from the corresponding half or else decorated differently. Mr. Selby Ngcobo, when asked for an explanation of this phenomenon suggested that it may be due to the desire for variation : Once an African has an article such as, for example, a dance-stick or clay pot, he is at liberty to decorate it as he pleases. Although he may choose a familiar pattern small variations may be introduced without regard for

the symmetry of the pattern as a whole, in order to attract attention and approval for originality and individuality of effort while preserving the traditional form.

Although certain patterns may at one time have had symbolic significance, this has been lost in the course of time, the forms being passed on through sheer imitation. Some observers have stated that each of a number of Africans asked to interpret a particular symbol will give a different answer.

A test such as the Progressive Matrices, which is composed of a series of abstract patterns, may thus easily lack significance for the African, who customarily relates pattern and design to concrete objects. The questions of lack of colour and the familiarity of particular shapes arise. Linear and angular patterns are familiar to Africans, and the circle is a familiar shape - huts are circular, kraals are more or less circular and the people arrange themselves in circles at meetings and councils - but the circle or are seldom appear in pattern-work. This may be due to the nature of the materials. Africans tend to prefer bright colours, and although patterns in black-and-white are familiar, the testee may be disconcerted when confronted with flat black-and-white patterns which are unfamiliar to him. This situation may not, however, arise in the case of the urban child attending school.

The school child will doubtless have become accustomed to seeing designs involving shapes based on the circle. Similarly, although it seems that the African does not fully appreciate representations of objects he has not handled in the concrete, school children probably become accustomed to working with pictures and designs incorporating material they may not have seen or handled. Hence, a pattern test may not place the urban African school child

at so great a disadvantage relative to the European as it would the untutored African child. A real disadvantage arises through lack of cubes, building-blocks, kaleidoscopes and similar toys which are available to the average European child at home or in the nursery school or kindergarten class.

From the discussion which follows, it will be seen that no child tested in the course of this investigation had attended school for less than five years. It is possible that, having been subjected for at least that period to the impact of Western culture through medium of the school, the African children tested had absorbed sufficient of Western ideas to make them fairly conversant with material of the type composing the Matrices Test. It is very likely that lack of training in abstract thinking and lack of incentive, due to doubt as to the object and value of the test, exercise at least as much influence on performance as the material itself.

If, in spite of difficulties such as these, the Matrices Test can be shown to minimise the differences in test-intelligence between racial groups, its use in inter-racial studies should reduce the number of factors demanding control.

CHAPTER III

THE PRESENT STUDY: I

The Tests

It was decided to compare the Progressive Matrices with the South African Group Test of Verbal Intelligence on the basis of the performance of European, Coloured and African children in the Cape Town Municipal Area.

The S.A.Group Test is well known in South Africa as a standard verbal group-test. It relies to a certain extent on education and presupposes that the child can read and do at least elementary arithmetic. There has been no attempt to eliminate environmental influences.

R.W.Wilcocks, in his description of the test, states, "The test presupposes that the child is able to read and is to a certain extent familiar with numbers. From this alone it is clear that a child's test-performance must be influenced by his school career, e.g. through the efficiency of tuition, the regularity or otherwise of his school attendance, by the home circumstances and atmosphere and by the amount of reading he has done". *

The test was constructed and standardised by a committee appointed by the Research Grant Board of the Union Department of Mines and Industries. The personnel were: Prof. R.W.Wilcocks (Chairman), Prof. R.F.A.Hoernlé, Prof. J.J.Strasheim, Mr. P.J.Oosthuizen, Prof. J.Chr. Coetzee, Prof. H.A.Reyburn, Dr. J.T.Dünston, Dr. L. van Schalkwyk,
/ Dr. M.L.Pick

* Free translation from the Afrikaans version of the Description and Instructions.

Dr. M.L.Fick, Mr. I.D.MacCrone, Dr. H.E.Brown and Mr. O.K.Winterton. Various members of this committee and other testers working under their supervision applied the test to 16,574 European children in the Union. Prof. Wilcocks was responsible for the statistical treatment of the data so obtained.

Although there are four forms of the test - two in English and two in Afrikaans - Form I of the English version was chosen, since Africans do not learn Afrikaans at school. As the Coloured children are taught through medium of both English and Afrikaans, the Coloured sample was retested after a lapse of five to six months with Form II of the Afrikaans version. The scores of 239 children showed a high degree of consistency of performance on the two forms of the test. A correlation coefficient of $+0.82 \pm 0.01$ was obtained by means of the Pearson product-moment formula, in the form:

$$r = \frac{\frac{\sum dxdy}{N} - C_x C_y}{\sigma_x \sigma_y}$$

where $\sum dxdy$ = the product of the deviations from the assumed means of the two variables, in class intervals,

N = the number of cases,

C_x and C_y = the differences between the true and assumed means, in class intervals,

and σ_x and σ_y = the standard deviations, also in class intervals.

The Probable Error was calculated by the formula :

$$P.E._r = \frac{.6745(1 - r^2)}{\sqrt{N}}$$

In view of this substantial measure of agreement, it was considered justifiable to take an average of scores on the two forms of the test as the S.A.Group Test index for the Coloured group, particularly as a number of

the children stated that they speak English at home, not the dialect of Afrikaans common in this group.

The form of the Matrices Test administered was that produced by the Department of Psychology of the University of Cape Town, under the supervision of Professor H.A.Reyburn. In this form, a sixth set of twelve problems has been added to the original five sets and there are nine alternative solutions from which to choose the answer to each problem, as against six or eight in the original test. This addition was apparently intended to reduce the number of correct solutions which may be scored by guesswork. The alternatives are numbered from 1 to 36, so that each set of 36 numbers covers four problems. Norms have been calculated for European children aged 9 to 15 years, in the Western Cape.

Although it was first intended to include scores on this sixth series and use the South African norms, certain practical difficulties led to a change of plan. As a result, scores on only the first five series were considered, the English norms being used.

Additional Tests

In addition to the intelligence tests, all children were given an English Usage and English Vocabulary test and an Arithmetic test. European and Coloured children were given Afrikaans Usage and Vocabulary tests as well. The language tests and the Standard IV and V Arithmetic tests were those used by the Cape Education Department in the survey mentioned below. The Standard VI Arithmetic test was constructed by the writer under the supervision of Inspector Puttick, who is responsible for Departmental arithmetic papers.

Owing to the immense amount of data collected,

/use

use of the educational index obtained in this way has had to be deferred. In this context, attention has been confined to the intelligence test results.

The Experimental Samples

(a) The Schools

The choice of schools was restricted by the necessity for avoiding schools included in a survey which was being carried out by the Cape Department of Public Education during the same period.

Two schools were to be selected for each racial group in such a way that the pupils of one were drawn from areas near the centre of Cape Town, the other to serve a peripheral area. The geographical and hence economic background of the three groups was to be as nearly similar as possible. Unfortunately, this plan could be put into effect only in respect of the European and Coloured groups. For African pupils above Std. IV the only schools are in the Langa Location which is segregated from the rest of Cape Town. It will be understood that any children residing elsewhere who continue beyond Std. IV attend these schools, sometimes travelling long distances.

In the more central area, the Regent Street Primary School (for Europeans) lies below the Main Road in Woodstock, near the business centre of Cape Town. The Ashley Street Primary School for Coloureds is situated higher up the mountain, on the fringe of "District 6". It is roughly the same distance from the centre of Cape Town as the Regent Street School, and the pupils of both are drawn from the same or similar areas. At the periphery, the Kensington Central School, chosen to represent the Coloured group, serves what is on the whole a poorer

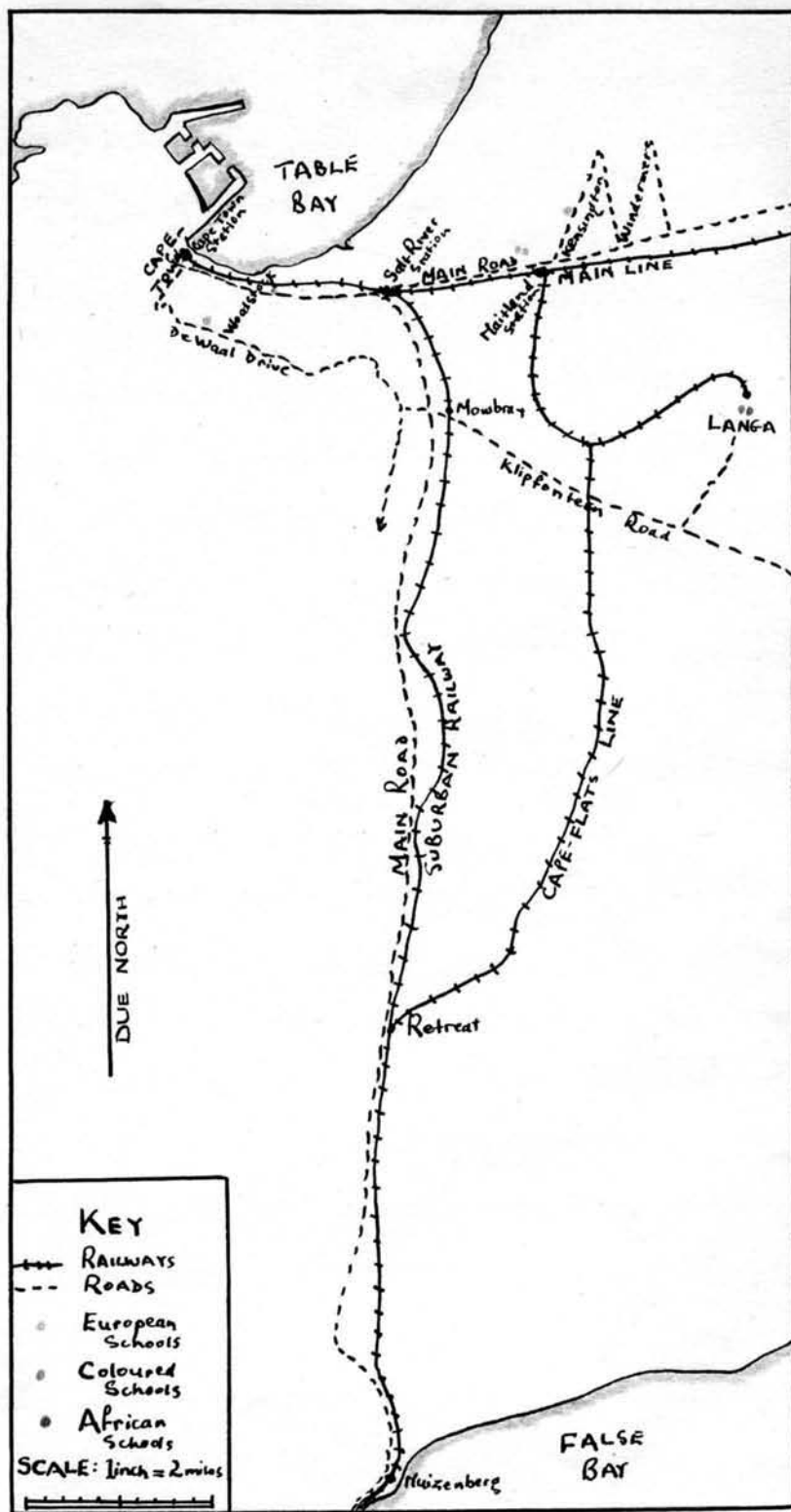


Fig. i.

ROUGH MAP OF PART OF THE CAPE PENINSULA

[TAKEN FROM A MAP OF THE CAPE FLATS INCLUDED IN
THE REPORT OF THE CAPE FLATS ENQUIRY COMMISSION -
U.G. 18 - 1943]

section of the Coloured community, including pondokkie-dwellers from Windermere. A few blocks away, slightly nearer the centre of the city, are the Maitland Public School and the Maitland High School. Since the former does not cater for children beyond Standard V, the Standard VI group was drawn from the High School.

(N.B. The relative positions of the schools are shown in Figure 1, page 23).

The African schools were the Langa Methodist Primary School and St. Cyprian's (Anglican) School, both of which are staffed entirely by Africans. Although these schools are sponsored by religious bodies, there is no religious bar to admission. These schools are overcrowded; accommodation is far from adequate and equipment is poor. Many of the teachers are trying to improve their educational qualifications in their spare time, doing a few Matriculation courses at a time by correspondence. The children are taught in Xhosa-medium up to Standard III, when they begin to learn English, and in Xhosa and English after that.

Both the Coloured schools are under the Cape School Board, and stand out amid the mass of schools for Coloureds. Although they are crowded, they are well-equipped (particularly the Ashley Street School) and well run. Dual-medium tuition is provided.

The European schools are all Board Schools, the pupils being taught through medium of English. At the parallel-medium Maitland High School, the English-medium Standard VI classes provided the sample. According to the official regulations, only those children whose home language is English may be placed in an English-medium class.

The pupils of all these schools included both sexes. Classes were usually mixed, although there was sex-separation in one or two cases.

~~Selection of Children~~

(b) Selection of Children

(b) Selection of Children

Since the S.A.Group Test caters only for children aged 10 to 16 years, the selection of samples was confined to Standards IV to VI. The school Principals were asked to allow 50 children (or as many below that number as were available) to be tested in each standard, these to represent all grades, e.g. Std. IV a, b and c, or "Boys" and "Girls", etc., as the case might be. Anyone under 10 or over 16 was excluded, while numbers were later further reduced as children who had not done both intelligence tests were eliminated. In the case of the Coloured children, three tests had to be performed, viz. the English and Afrikaans forms of the S.A.Group Test and the Matrices Test.

(c) Age Distribution

Dates of birth were furnished by the children (in completing the questions prefacing the S.A.Group Test) and also by the teachers who were requested to fill in a General Information Sheet * for every child tested, in co-operation with the families. If the information were omitted or discrepancies occurred, the class register was consulted.

As will be seen from Table II, on the next page, the mean age for the whole European group worked out at 13.16 years (S.D. 1.37), the means for the Coloured and African groups working out at 13.12 years (S.D. 1.19) and 13.94 years (S.D. 1.45), respectively. The Coloured group was slightly younger, on average, than the European group, while the African group was nearly a year older, on average. The details indicate that the Coloured children, although slightly older than the Europeans in Std. IV, were slightly
/ younger

* c.f. Sample sheet, Appendix B.

younger in the other standards. The Africans were considerably older, on average, in each standard, there being

TABLE II
AGE DISTRIBUTION OF PUPILS COMPRISING
THE TEST SAMPLES
(as on 30th June, 1945)

RACE	AGE GROUPS	IV	V	VI	TOTAL
EUROPEAN	10-11	15	-	-	15
	11-12	22	11	1	34
	12-13	30	20	10	60
	13-14	9	25	29	63
	14-15	6	11	24	41
	15-16	1	9	14	24
	16-	-	-	1	1
	<u>TOTAL</u>	<u>83</u>	<u>76</u>	<u>79</u>	<u>238</u>
	Mean	12.16	13.33	13.94	13.16
		S.D. 1.37			
COLOURED	10-11	6	-	-	6
	11-12	21	17	1	39
	12-13	24	23	20	67
	13-14	19	23	25	67
	14-15	4	17	27	48
	15-16	-	4	8	12
	16-	-	-	-	-
	<u>TOTAL</u>	<u>74</u>	<u>84</u>	<u>81</u>	<u>239</u>
	Mean	12.42	13.12	13.76	13.12
		S.D. 1.19			
AFRICAN	10-11	4	-	-	4
	11-12	12	3	-	15
	12-13	19	9	-	28
	13-14	17	11	5	33
	14-15	14	19	15	48
	15-16	6	17	14	37
	16-	4	3	1	8
	<u>TOTAL</u>	<u>76</u>	<u>62</u>	<u>35</u>	<u>173</u>
	Mean	13.28	14.23	14.81	13.94
		S.D. 1.44			
ALL RACES:*	TOTAL	233	222	195	650

comparatively more children aged 15 and 16 years.

The age distribution is brought out clearly in the accompanying graphs, Figures ii to v. There is a general tendency for the Coloured distribution to be the most symmetrical, while the curve for the Africans is skewed to the left in most cases.

In order to compare the above data with the official statistics, means were calculated for the same

AGE DISTRIBUTION OF THE TEST SAMPLES

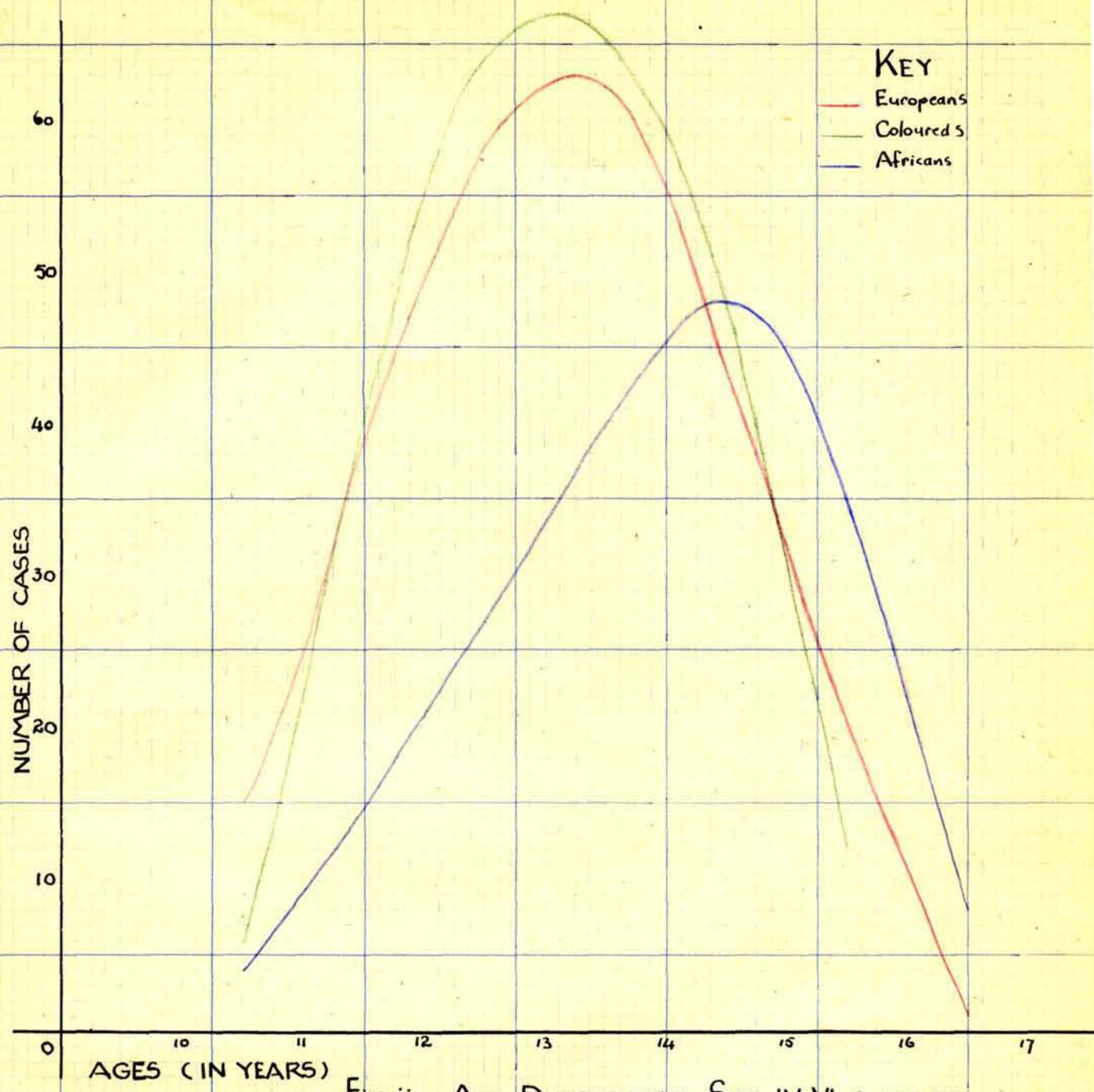


Fig. ii. AGE DISTRIBUTION: STDS. IV-VI COMBINED

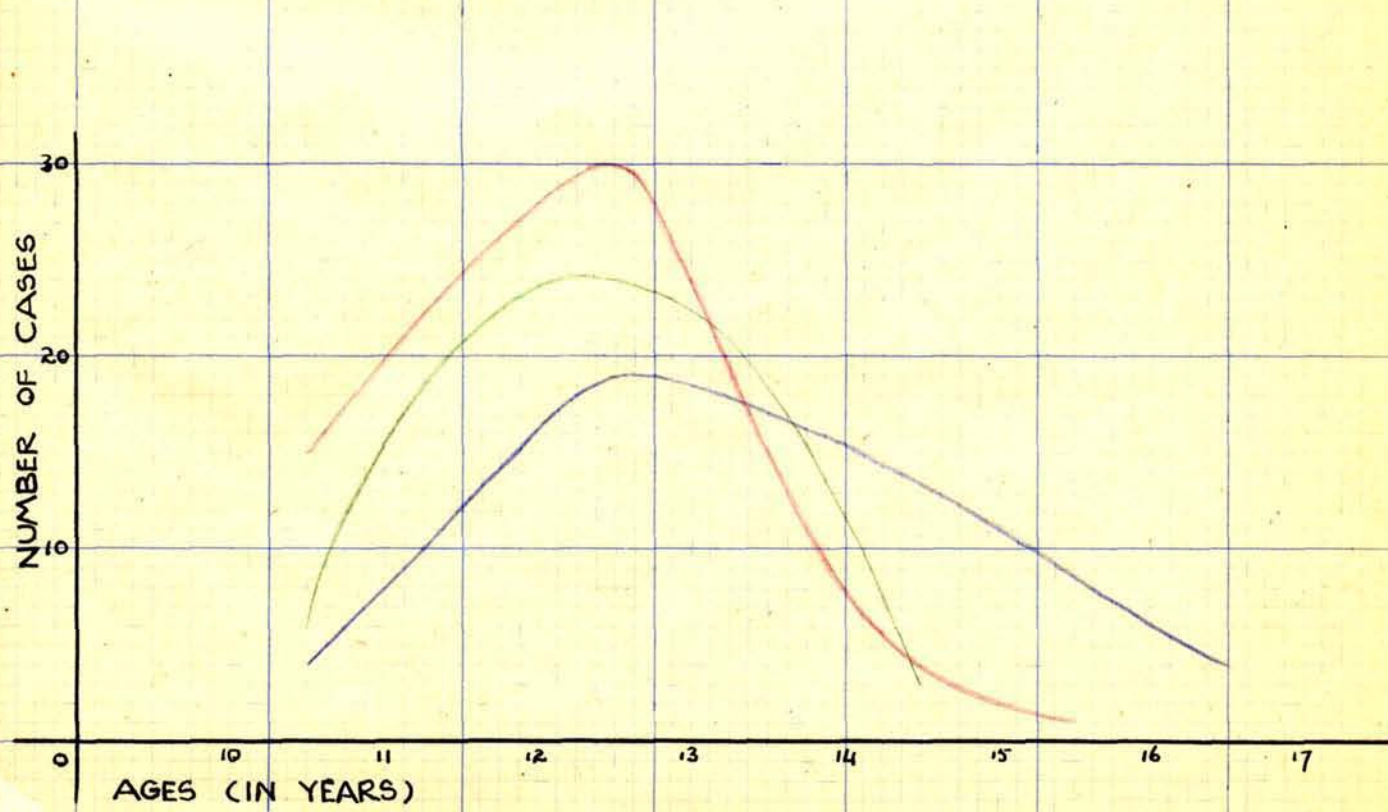


Fig. iii. AGE DISTRIBUTION: STD. IV

AGE DISTRIBUTION [CONTINUED]

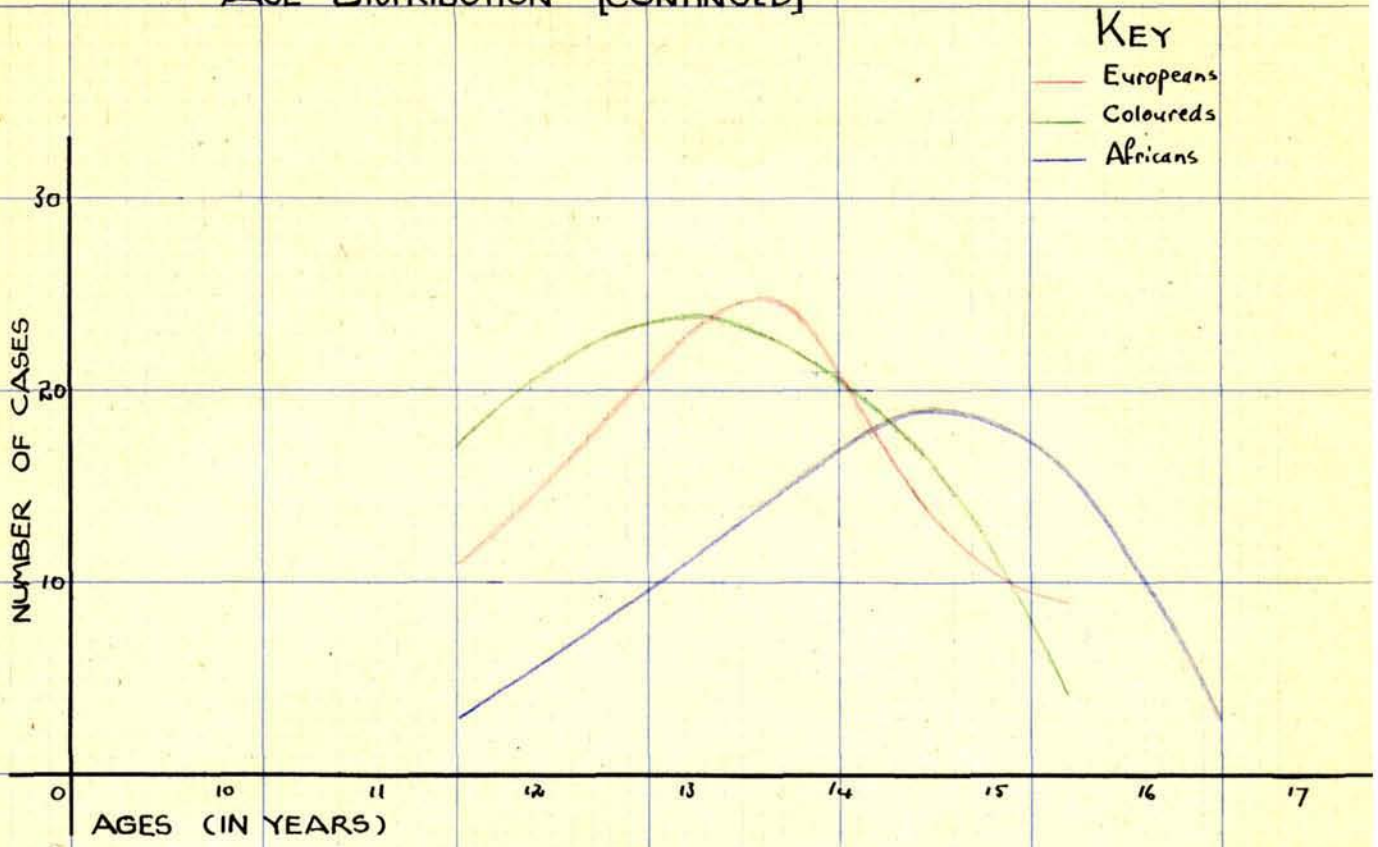


Fig. IV. AGE DISTRIBUTION: STD. V

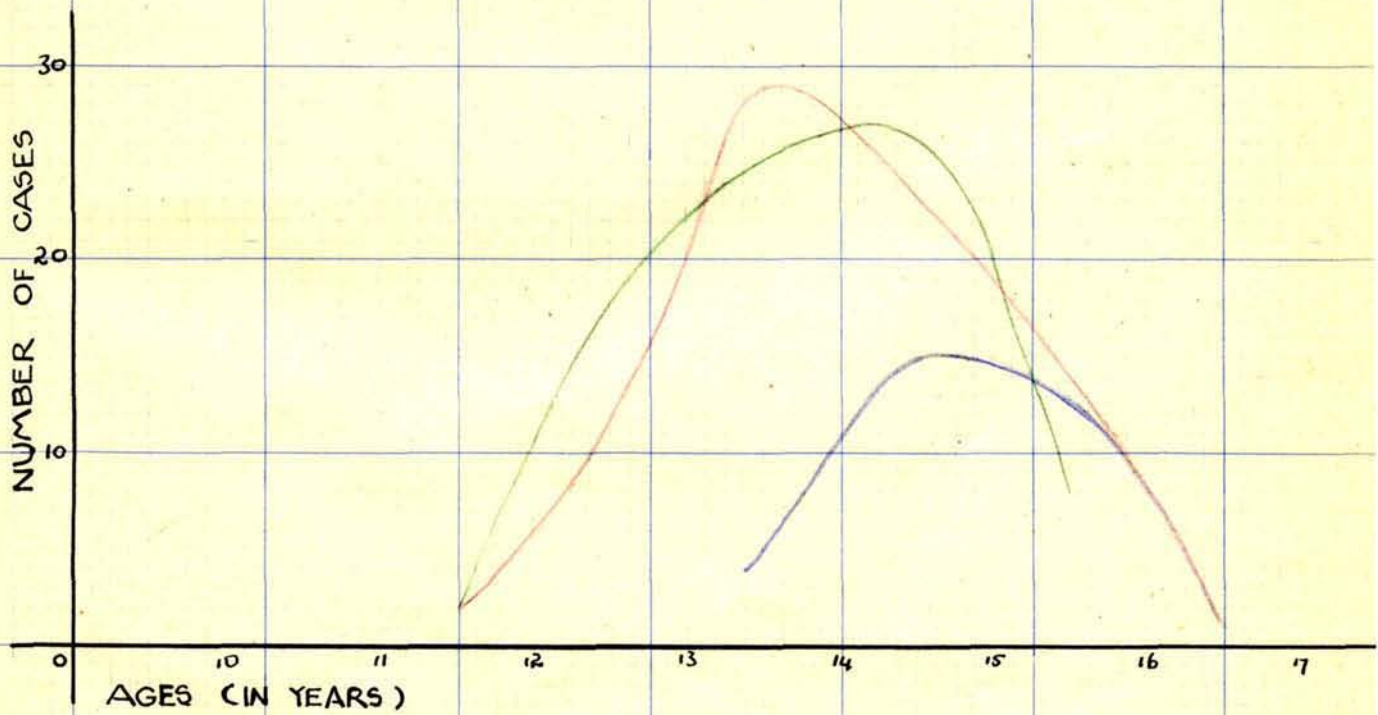


Fig. V. AGE DISTRIBUTION: STD. VI

age-groups from data (for the whole Province) published in the Cape Department of Public Education Bulletin of Educational Statistics (1940). The mean ages are compared in Table III, and the detailed analysis of the Departmental statistics is given in Table IV.

TABLE III

MEAN AGES AND STANDARDS OF PUPILS
IN THE TEST SAMPLE AND PUPILS ENROLLED
IN SCHOOLS UNDER THE CAPE DEPARTMENT
OF PUBLIC EDUCATION (4th June, 1940)

R A C E	GROUPS COMPARED :	M E A N		A G E S	
		STD.IV	STD.V	STD.VI	IV-VI
EUROPEAN	Cape E.D.	12.00	13.01	14.00	13.00
	Test Sample	12.16	13.33	13.94	13.16
COLOURED	Cape E.D.	13.13	13.79	14.54	13.62
	Test Sample	12.42	13.12	13.76	13.12
AFRICAN	Cape E.D.	14.40	14.91	15.50	14.75
	Test Sample	13.28	14.23	14.81	13.94

It must be pointed out that the official statistics are five years old, none having been published since 1940, and that they cover both urban and rural schools. In addition, the test sample includes no children who were more than 16.00 years old at the time of the tests, whereas the 16-year group obtained from the Departmental statistics includes children aged 16 and under 17 years. This is undoubtedly responsible to a great extent for the relatively higher mean ages obtained for most of the Cape Province groups. It will be noted that the mean for the European test sample was slightly higher than the Departmental mean, whereas our Coloured and African samples were slightly younger than the Departmental groups. In all the Std.VI groups, the means for the test sample were less than the Departmental figures. Again, according to these official

/ figures

figures, the average Coloured child is older than the average European child in the same standard. In the case of the test samples, the position is reversed, except in Std. IV.

TABLE IV

THE AGES AND STANDARDS OF PUPILS ENROLLED IN STDS. IV-VI IN EUROPEAN, COLOURED AND AFRICAN SCHOOLS, UNDER THE CAPE DEPARTMENT OF PUBLIC EDUCATION ON THE 4/6/40
(Extracted from Bulletin of Educ. Stats.)

R A C E	A G E S	S T A N D A R D S :			T O T A L	All Races
		I V	V	V I		
EUROPEAN	10-	3590	346	16	3592	
	11-	6167	2868	308	9343	
	12-	4308	2770	2675	12753	
	13-	2041	4309	5253	11603	
	14-	778	2168	4270	7216	
	15-	295	958	2392	3645	
	16-17	44	135	668	847	
	<u>TOTAL</u>	<u>17223</u>	<u>16554</u>	<u>15582</u>	<u>49359</u>	49359
	Mean	12.00	13.01	14.00	13.00	
COLOURED	10-	461	37	3	501	
	11-	1483	335	25	1843	
	12-	2307	1143	286	3736	
	13-	2155	1661	875	4691	
	14-	1411	1249	1111	3771	
	15-	655	709	835	2199	
	16-17	244	281	421	946	
	<u>TOTAL</u>	<u>8716</u>	<u>5415</u>	<u>3556</u>	<u>17687</u>	17687
	Mean	13.13	13.79	14.54	13.62	
AFRICAN	10-	121	13	-	134	
	11-	443	86	5	534	
	12-	1359	420	51	1830	
	13-	2092	983	299	3374	
	14-	2520	1653	721	4894	
	15-	2341	1903	1206	5450	
	16-17	1592	1463	1381	4436	
	<u>TOTAL</u>	<u>10468</u>	<u>6521</u>	<u>3663</u>	<u>20652</u>	20652
	Mean	14.40	14.91	15.50	14.75	
<u>ALL RACES</u>		<u>TOTAL</u>	<u>36407</u>	<u>28490</u>	<u>22801</u>	<u>87698</u>

(d) Occupational Status

The occupations of parents and working members of each child's family were recorded on the Information Sheets provided. This makes it possible to give an

/ indication

indication of the occupational background of the groups tested.

A fairly large percentage of the EUROPEANS were on active service at the time. The majority of the rest were artisans, Tramways, Railway and Post Office employees, shopkeepers and small traders, shop assistants and salesmen, factory-hands and motor drivers. Among the women were a few dressmakers and typistes. Other occupations noted were: customs officials and police, clerks, insurance agents and building contractors, although these were rare.

The majority of the COLOUREDS were artisans, factory-hands and labourers, domestic servants, washerwomen and laundry employees, dressmakers and a small proportion of shopkeepers and small tradesmen. In addition, there were a few teachers, servicemen, waitresses, clerks and shop-assistants, drivers, garage-hands and building contractors.

Among the AFRICANS labourers, domestic servants and nurses predominated. There were a number of factory-hands, but it must be understood that Africans employed in factories are usually engaged as labourers. A few drivers and garage-hands, hawkers, shopkeepers, artisans and police were noted, and there were several teachers and ministers of religion.

It is thus clear that some occupations were common to all three groups, although the proportions varied. A good deal of overlapping was found, particularly between the European and Coloured groups. So far as occupations are concerned, then, the attempt to equalise the environmental influences was fairly successful in the case of the European and Coloured samples.

CHAPTER IV

THE PRESENT STUDY:II

Procedure

At each school, each intelligence test was applied to Stds. IV to VI in rotation, the S.A.Group Test being given first. On the following day, or as soon afterwards as possible, the Progressive Matrices Test was applied, the same order being observed. Wherever possible the second test was applied at the same time of day as the first.

The children were spaced out, sitting one-at-a-desk in straight rows. This arrangement could not be satisfactorily carried out at the African schools, where long desks which accommodate five children are in general use. Shortage of space and equipment meant that it was usually necessary to seat three children at each of these desks, so that the intervening spaces were narrower than was desired.

In administering the S.A.Group Test, the standard procedure was followed, so that the period occupied (including time taken to answer the preliminary questions and the regulation interval of at least 15 minutes between Part I and Part II) was roughly one and a-half hours for each group.

The Progressive Matrices Test took somewhat longer, on average. It was decided to follow the procedure adopted by the Psychology Department, U.C.T. This deviates from the original procedure in that, instead of demonstrating only the first two problems in Series A, thereafter leaving the group to do all the rest on their own, the tester demonstrates the first two problems in Series A and the first problem in each subsequent series, waiting until all or nearly all the group have finished each series before proceeding to the next. This procedure has obvious

/disadvantages

disadvantages, as well as certain advantages.

The children were all told beforehand to bring with them something to read or some work to do, so that those who finished first would be kept occupied while waiting for the rest to complete each series. Before the test began, they were warned that they must on no account talk to or interfere with each other. In spite of all precautions, it was difficult to curb the restlessness of the quicker members of the groups. The principal advantage of demonstrating the first problem of each series is that it breaks the monotony and adds incentive and encouragement for those who tend to lose interest. Whatever procedure is followed, however, it seems that this test is more suitable for application to individuals than to groups, since children who lag behind tend to become flustered and hurry unduly in order to catch up, when they notice that the majority have completed the work, thus probably vitiating their test-performance.

Instructions were given in English throughout, but were repeated in Afrikaans to the Coloured group, and the class teachers were requested to repeat the directions in Xhosa to African Std. IV pupils. Where school intervals occurred in the course of this test, the children were allowed to go out after completing the series upon which they were engaged. Constant supervision was exercised in order to prevent copying and to ensure that directions had been understood.

The General Information Sheets mentioned already were handed to the class teachers, who were requested to complete them in collaboration with the children, or with the parents if necessary.

Scoring

It has already been stated that practical difficulties led to abandonment of the plan to utilise the South African norms for the Matrices Test. These norms were for mental ages ranging from 9 to 15 years in three-monthly intervals. * This meant that mental ages could not be calculated for children scoring below the norm for 9 years or above the norm for 15 years. It was therefore decided to revert to the English norms. These are given in the form of scores corresponding to percentile points for each six months of chronological age from 8 to 14 years, and after that, for adults. The items which had been demonstrated were included in the raw scores, so that there was a basic score of 6 points for all groups. The validity of inter-racial comparisons is not affected, as all groups were treated alike.

In order to facilitate comparisons between the two tests, while allowing for differences in age, the following procedure was adopted:

(a) Scores were first converted into Percentile Ratings by reference to the available norms.

For the S.A.Group Test, individual scores were converted into I.Q.s by use of the graph provided, the corresponding P.R.s (in the case of Europeans and Africans) being read off from the table given. Since the S.A.Group Test index adopted for Coloureds was the average of their performance on the English and Afrikaans forms of the test, the average I.Q. in a number of cases was not a round figure. A Percentile Graph was therefore plotted (c.f. Figure vi) for use in such cases.

For the Matrices Test, a graph was made of the percentile points for each age-group from 10 to 14 years. (c.f. Figure vii). The "Adult" norms were omitted
/ as they

* See Appendix C

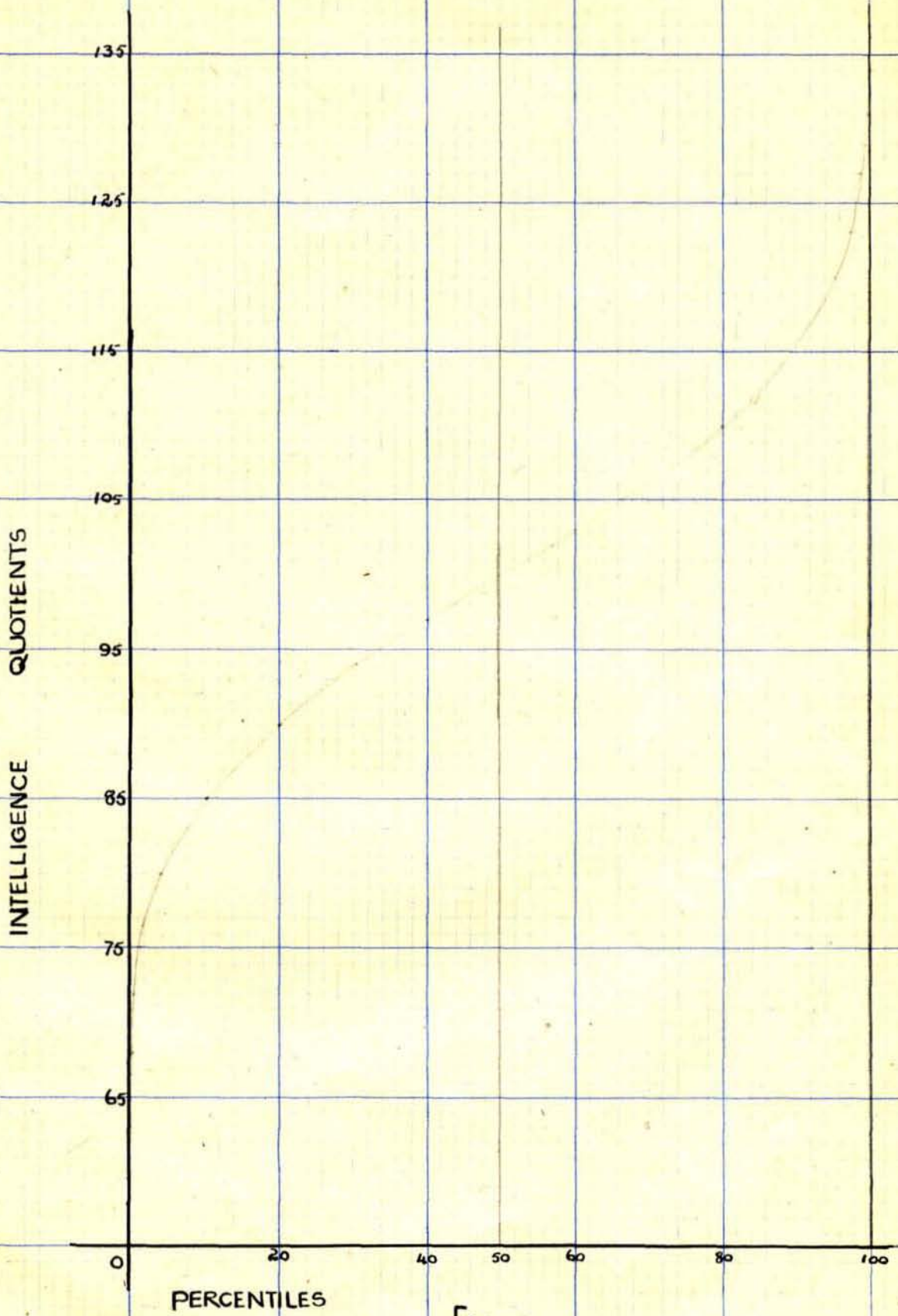


Fig.vi

GRAPH OF PERCENTILE RATINGS AND
INTELLIGENCE QUOTIENTS FOR THE S.A. GROUP TEST
[HALF ORIGINAL SCALE]

as they are almost identical to those for 14 years, up to P.R.50 , after which the two graphs would have intersected. Children older than 14 were treated as though 14 years old. Percentile Ratings were read off from the graph.

(b) The P.R.s were then converted into Standard Scores by reference to a Table * which gives the average distance from the mean, in terms of standard deviation, of each single percentage of a normal distribution. Each Percentile Rating was treated as a percentage-value of the normal distribution and its sigma-value was read off from the table. In this way, positive and negative sigma-scores were obtained. The signs and decimal points were eliminated by application of the formula:

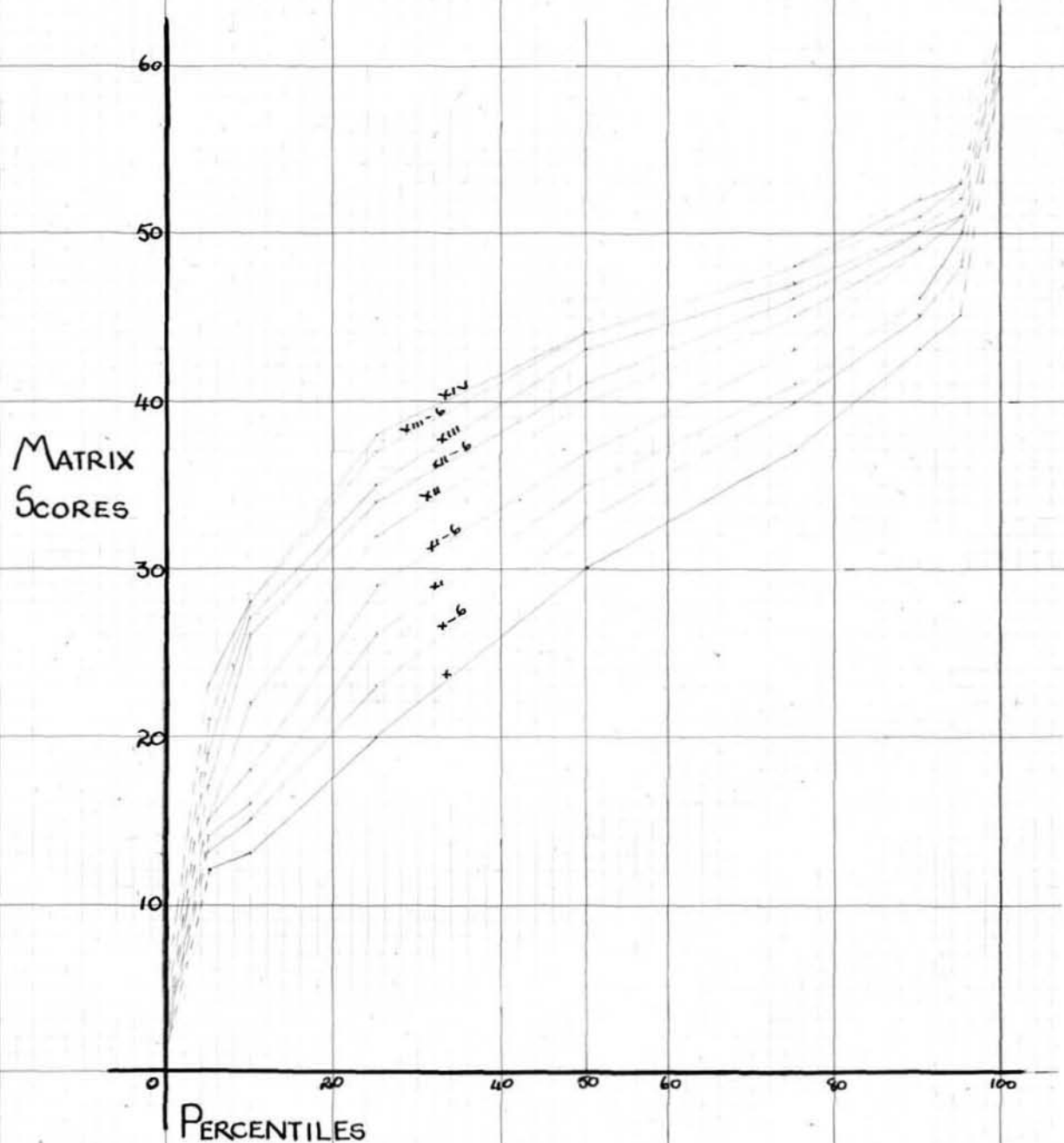
$$\text{Score} = 100(x + 3)$$

where x = the sigma-score obtained from the table, to correspond to the P.R.

On this basis, a P.R. of 50 is equal to a sigma-score of .00, hence to a standard score of 300. This means that the mean test score, according to existing norms, is equal to a standard score of 300.

The sigma-scores were thus transformed into easily handled standard scores. Negative values of sigma become standard scores smaller than 300, while positive values of sigma become standard scores greater than 300, with the original rank-order preserved.

*GARRETT, H.E. "Statistics in Psychology and Education", Table 27, Page 165.



CHAPTER V

THE TESTS COMPARED

Relationship between the Tests

Since the S.A.Group Test was standardised for South African children and the Matrices Test for English children, any direct comparison of standard scores on the two tests would have little significance. It will be of interest, however, to know what relationship was found between the two tests as performed by the three racial groups.

The Pearson coefficient of correlation (c.f. the formula on page 20) and the standard error * were calculated for each group, with the following results:

TABLE V

CORRELATION BETWEEN THE S.A.G.T. AND MATRICES SCORES

EUROPEANS	$r = + .57 \pm 0.04$
COLOURED	$r = + .56 \pm 0.04$
AFRICANS	$r = + .57 \pm 0.05$

The coefficient of correlation was approximately + .6 throughout, although it might have been expected that a lower figure would be obtained for the African group than for the European and Coloured groups, respectively. The difference in number between the European and African groups makes a difference of .01 in standard error.

The correlation method provides at best an indirect approach to the comparison of the two tests, since so many factors may have influenced the results obtained. More detailed analysis of the data is required before conclusions can be drawn.

/ Distribution of Scores

* Formula for standard error: $S.E._r = \frac{1 - r^2}{\sqrt{N}}$

Distribution of Scores

The method adopted for comparing the two tests was the examination of the differences between the mean scores of each group on each test in turn.

Before these results are tabulated, the distribution of scores must be considered. The distributions for the two tests are shown in Table VI, which should be read in conjunction with Figures viii and ix.

TABLE VI
DISTRIBUTION OF STANDARD SCORES

STD. SCORES	S. A. GROUP TEST			MATRICES TEST		
	Eur.	Col.	Afr.	Eur.	Col.	Afr.
20-60	-	-	2	-	-	-
60-	-	-	6	-	-	-
100-	-	-	16	4	16	57
140-	-	10	57	20	41	49
180-	6	22	45	30	40	27
220-	16	33	22	56	43	20
260-	34	53	15	45	41	10
300-	62	48	8	35	24	6
340-	48	40	2	26	21	2
380-	29	18	-	9	8	1
420-	16	12	-	12	3	1
460-	22	3	-	1	2	-
500-	3	-	-	-	-	-
540-80	2	-	-	-	-	-
<u>TOTAL</u>	<u>238</u>	<u>239</u>	<u>173</u>	<u>238</u>	<u>239</u>	<u>173</u>

From the discussion of scoring in the previous chapter, it will be remembered that a P.R. of 50 is equal to a standard score of 300. The table shows that, on the S.A.Group Test, the European scores are for the most part distributed above the South African mean, whereas the Coloured scores are distributed more or less about this mean. The African scores reach or exceed this mean only in ten cases. These differences are brought out in Figure viii. All three curves tend to resemble the ideal curve of normal distribution in shape, the curve for Coloured scores bearing the closest resemblance when position is taken into account. All are skewed to the right.

Matrices Test scores are distributed over much

/ the same

S. A. GROUP TEST: DISTRIBUTION OF STANDARD SCORES

KEY
Europeans
Coloureds
Africans

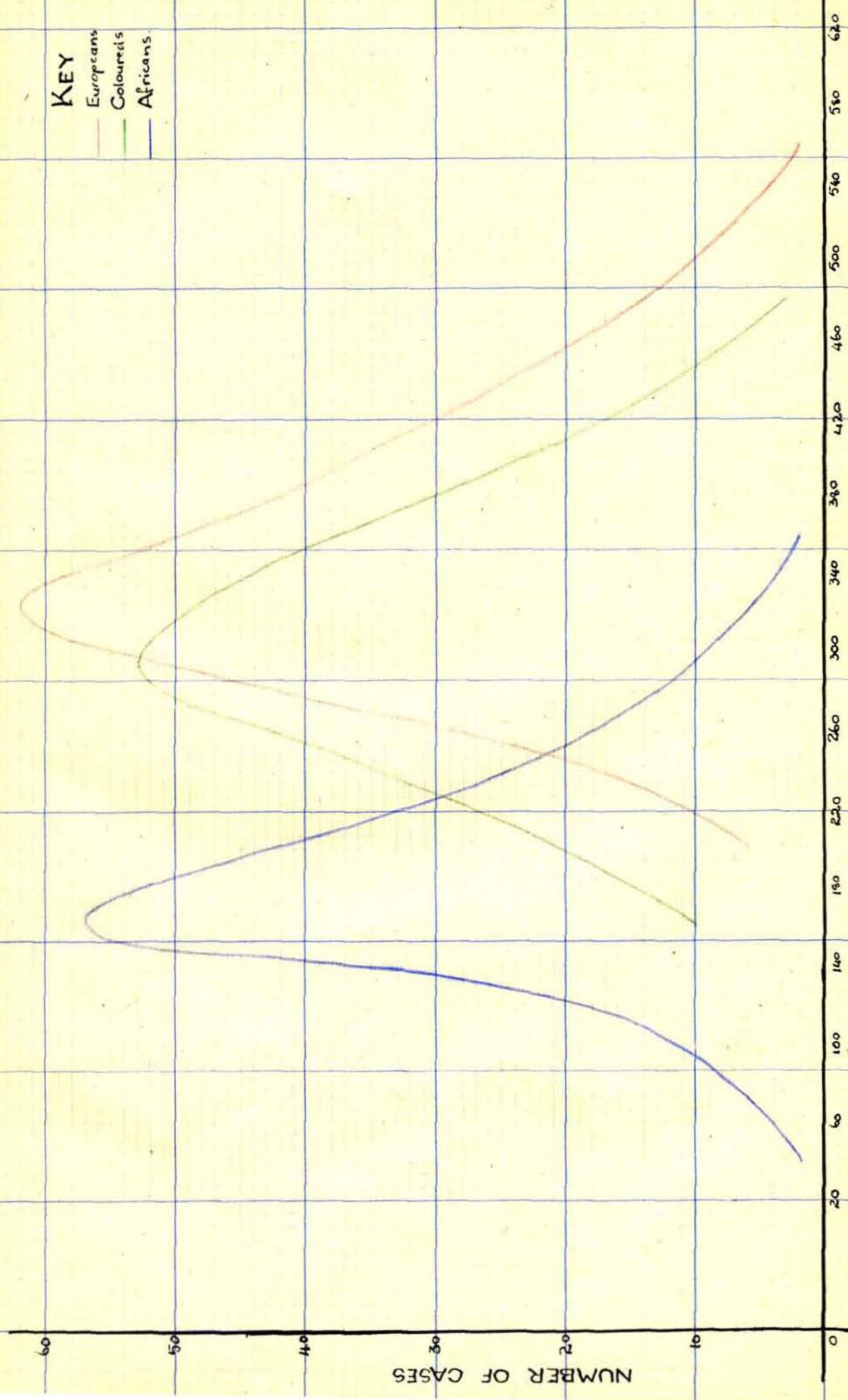


Fig. viii

the same range in all three groups. As will be noted, however, the bulk of the scores fall below the English mean, represented by the standard score of 300. In this case, although the distributions for Europeans and, to a lesser extent, for Coloureds tend to take on a normal shape there is a marked difference in the curve for African scores. The frequencies decrease continuously from the 100-140 class of scores to the 420-460 class. This decline is emphasised by the graphs in Figure ix.

It is difficult to find an adequate explanation for this phenomenon, especially as the scores on the verbal test tend towards normality of distribution. It may be that the Matrices Test involves specific operations which Africans are less well able to perform than other groups. The time-factor is not relevant, and the language factor does not apply. Unfamiliarity of the material or boredom may have influenced test performance. Even so, ability to perform the operations involved should have been more normally distributed within the group.

It might be argued that the Matrices Test sets out to gauge innate ability, and that the results point to a marked inferiority in the case of Africans. If this were so, the verbal test scores should, surely, have been distributed in a similar manner.

Here it may be mentioned that there seems to be a tendency for Africans to anticipate that any problem presented by Europeans will prove very difficult, if not beyond their capacities - an inferiority feeling which has no doubt been fostered by the attitude of the average European encountered. Suspicion of the motives of the European tester undoubtedly affects the African child who may, in addition, be unable to appreciate the end in view when presented with a test, and thus be uninterested. In

PROGRESSIVE MATRICES: DISTRIBUTION OF STANDARD SCORES

KEY
Europeans
Coloureds
Africans

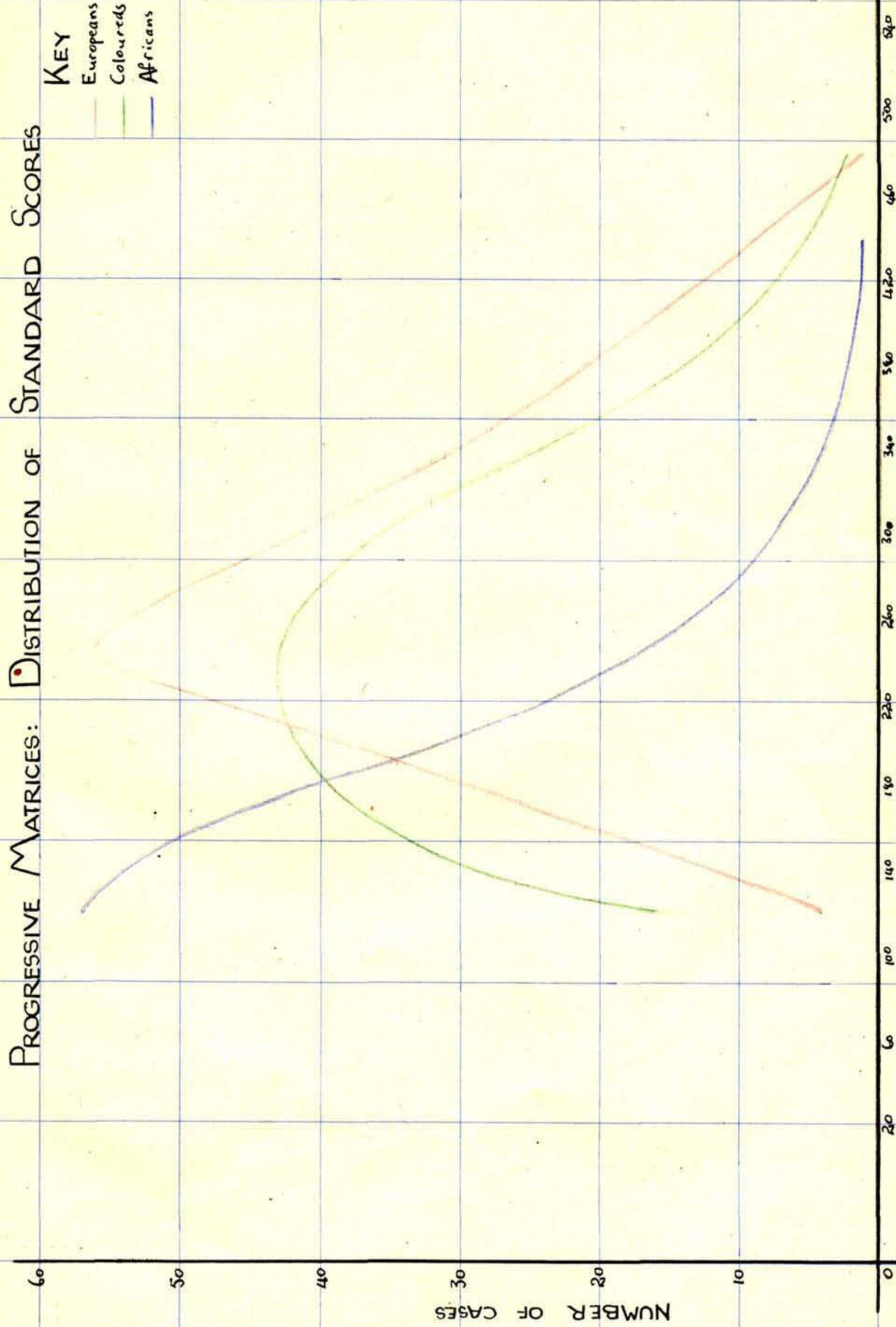


Fig. ix

such a situation he may have little incentive to devote his full attention to the solution of the problems and may therefore merely cast about and fill the blanks with anything, possibly choosing an alternative which is aesthetically pleasing to him. This would apply to the more complex problems.

These remarks are mainly conjecture. Before any definite interpretations are made, the test should be applied to larger and more representative samples of the African population, and attitude and reaction to the test situation more carefully studied.

Distribution of Scores among Children aged 12 - 14

The central age-groups (12 to 14 years) comprised approximately 50% of the European sample, 60% of the Coloured sample and 37% of the African sample. Details of the distribution of scores within this range were extracted and it was noted that the results follow much the same trend as those for the whole groups. The frequency distributions are given in Table VII, with the complementary graphs in Figures x and xi. (N.B. On account of the irregularity of the distribution of Coloured Matrices scores, the graphs in Figure xi have not been smoothed.)

Comparison with Table VI reveals that, within this group, no verbal-test score below 100 was found, whereas African children had scored less than 100 in the group taken as a whole. This indicates that the lowest scores were found among the children in the lowest and highest age-groups. Similarly, four of the five highest European scores were made by children in the age-groups excluded from Table VII. Apart from this, the distributions tend to be similar in shape to those for the whole groups, with the exception that there seem to be two modes for the Coloured group aged 12 to 14, on the Matrices Test. These fall in the 140-180 class

/ and the

and the 220-260 class, the frequencies being 30 and 29, respectively. Once again, the African Matrices scores

TABLE VII
DISTRIBUTION OF STANDARD SCORES
(Children aged 12 - 14)

STD. SCORES	S. A. GROUP TEST			MATRICES TEST		
	Eur.	Col.	Afr.	Eur.	Col.	Afr.
100-	-	-	8	1	12	18
140-	-	6	20	10	30	22
180-	1	10	19	12	14	11
220-	6	21	8	31	29	5
260-	18	32	6	19	26	5
300-	32	32	2	21	14	1
340-	29	26	1	14	9	1
380-	14	9	-	6	6	-
420-	10	5	-	5	1	1
460-	9	1	-	1	1	-
500-520	1	-	-	-	-	-
<u>TOTAL</u>	<u>120</u>	<u>142</u>	<u>64</u>	<u>120</u>	<u>142</u>	<u>64</u>

show a tendency to fall off continuously from the lower to the higher groups of scores, except that frequencies for the first class are slightly lower than those for the second class. Apart from this, the curve is very similar in shape to that in Figure ix.

The means about which the 12 to 14-year groups are distributed approximate very closely to those for the whole groups, as will be seen from the data included in the next section.

Once again, the Coloured distribution on the verbal test shows the greatest resemblance to the ideal curve.

Mean Scores

The data relating to the entire samples will first be considered, and later compared with those for the central age-groups. The results are given in terms of both the standard scores and the original sigma-scores. Reference to Table VIII reveals that the S.A.Group Test mean for the

/ European

DISTRIBUTION OF STANDARD SCORES S.A. GROUP TEST: CHILDREN AGED 12-14

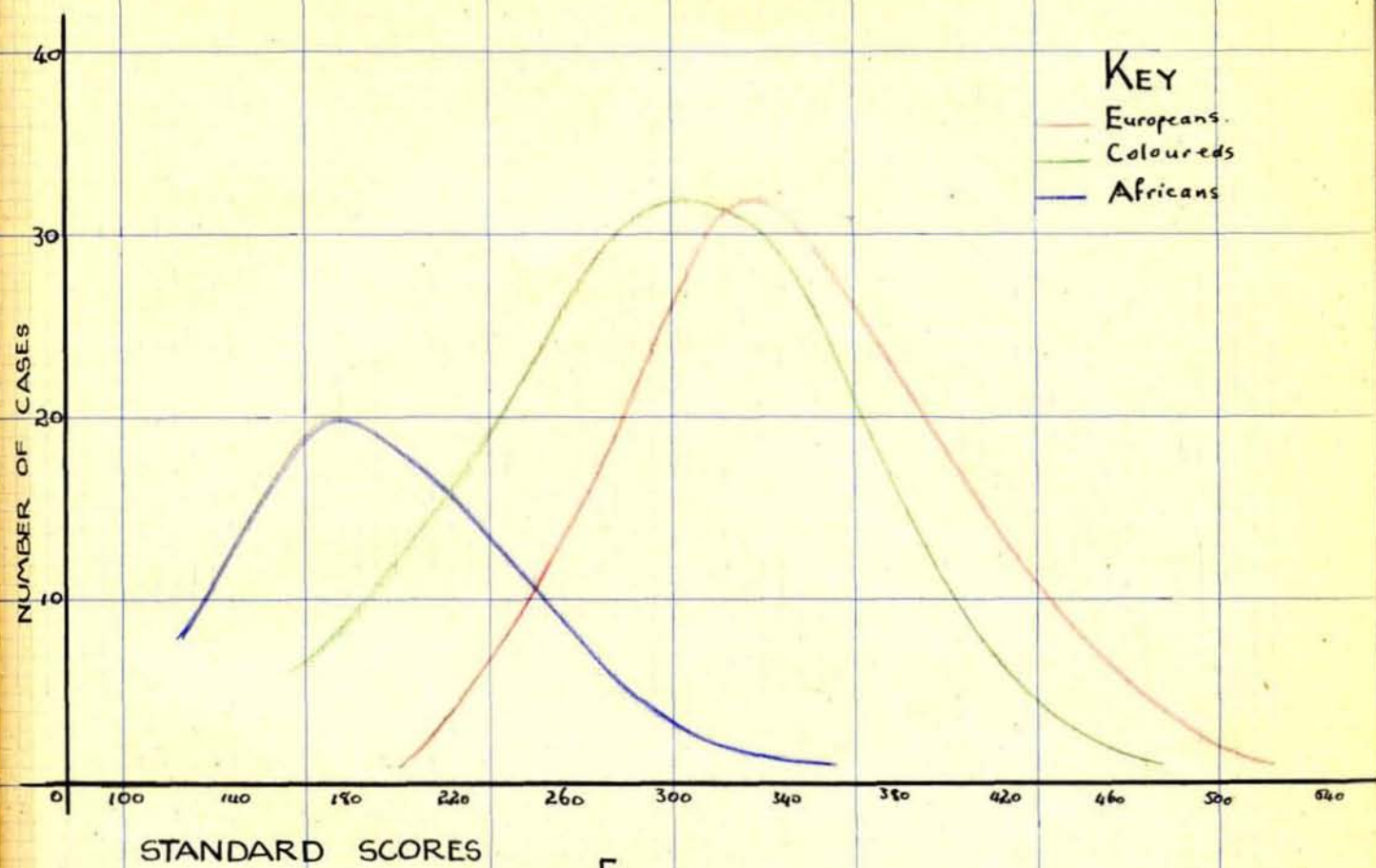


Fig. x

DISTRIBUTION OF STANDARD SCORES PROGRESSIVE MATRICES: CHILDREN AGED 12-14

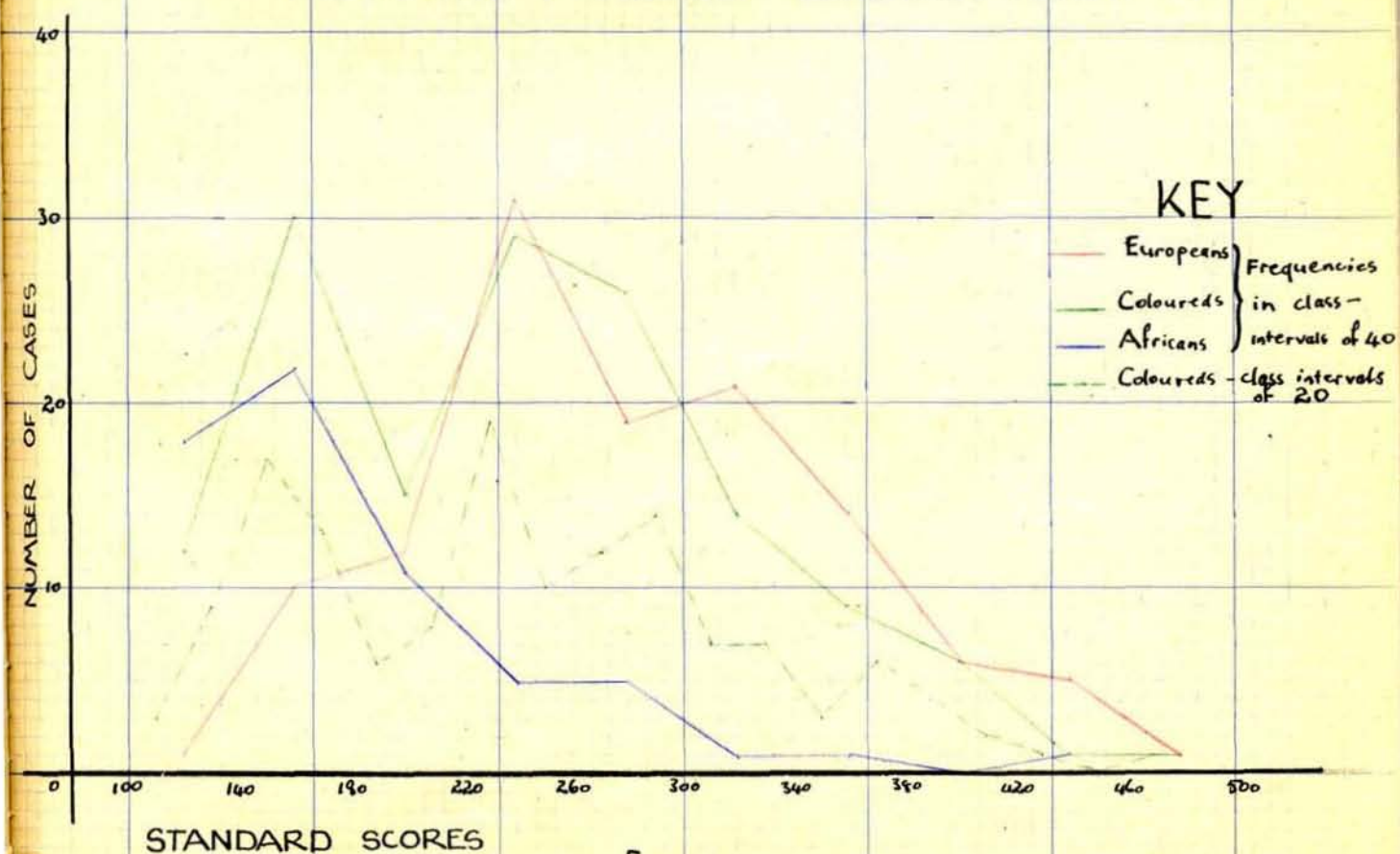


Fig. xi.

European group (in terms of standard scores) is 351.18, with a standard deviation of 74.3. The mean for the European sample therefore exceeds the South African mean by 51.18 points of standard score. The sample is admittedly somewhat specific, having been selected from urban schools alone, whereas the test was standardised on representative samples of South African children.

The mean standard score for the Coloured group exceeds the South African mean by 1.88 points of standard

TABLE VIII
MEAN STANDARD SCORES FOR THE
S.A.GROUP TEST AND MATRICES

R A C E	S.A.GROUP TEST		MATRICES TEST	
	Mean	S.D.	Mean	S.D.
EUROPEAN	351.18	74.30	274.79	75.68
COLOURED	301.88	71.44	246.57	78.96
AFRICAN	191.04	59.50	178.09	63.74

score, while the African mean falls below it by nearly 109 points of standard score. This brings out clearly the effect of the language factor, if no other, but other environmental factors are undoubtedly at work. Such factors are discussed in detail by Biesheuvel in "African Intelligence".

Biesheuvel points out that even the city-bred African has not thoroughly assimilated European culturally conditioned attributes, such as the characteristic competitive spirit, individualism and "hustle". Intelligence tests are constructed and applied on the assumption that these attributes are present in all testees.

In analysing the cultural environmental factors affecting the test-performance of Africans, he distinguishes two main groups. In the first, the "Attitude towards the Test-situation and Test Requirements", he places

/ familiarity

familiarity with the test-situation and test requirements, the reaction of African children to the European tester (i.e. apprehension, suspicion, antagonism and doubt as to the motives of the European), and the attitude of the African towards education. Biesheuvel found that African scholars preferred to do his tests outside school hours. Education being a privilege and a means for gaining prestige and material advantages, interruptions of regular school work are unwelcome.

Under the head of "Cultural Unfamiliarity of Intelligence Test Contents", Biesheuvel discusses his second group of factors. In the first place, the type of problem or the medium in which it is set may be unintelligible to a person unfamiliar with its cultural background. Difficulties of this type arise in relation to language differences and differences in the socialisation process which is responsible for building up special expectations and meanings. Secondly, habits providing for efficient adaptation to one set of environmental circumstances may not be present in people reared under conditions which do not promote these specific adjustments. A clear example is the speed factor. The African child, to whom the Western emphasis on speed is alien, is handicapped by tests with time-limits. He does not respond to instructions to work as quickly as he can, and becomes confused if he tries to do so, since his training has not provided him with the necessary habits.

The effects which environmental influences exercise on test-intelligence may be "extrinsic" or "intrinsic". Extrinsic effects arise as a result of unsuitability of the test and test-situation, e.g. unfamiliarity of language medium, symbolism or cultural content. Intrinsic effects are those involving ~~some~~ intelligence itself, not merely test-intelligence. Such effects may be qualitative or quantitative. Qualitative influences are those leading to the establishment of thought-processes, perceptual habits,

special skills and interests specific to a particular culture. Quantitative influences affect the growth of intelligence and ultimate intellectual capacity. Although the cultural milieu usually exercises intrinsic qualitative effects, it may have quantitative effects, e.g. in primitive communities where repressive education, parental aloofness and a lack of formative stimuli and favourable emotional conditions may permanently retard the development of innate potentiality.

Biesheuvel states that the home environment seems to exercise a measurable effect on test intelligence. "The average African home environment is bound to stunt very markedly the growth of intelligence of the children reared in it, not only failing to provide those stimuli which alone would enable the most to be made of innate potentialities, but also creating situations which have an adverse effect on such growth as might spontaneously occur." African parents make the promotion of material well-being their first care, and traditionally consider parental love best expressed by the inculcation of a (to them) desirable attitude of submission to authority. Questions are not answered and day-time supervision is at a minimum. In the urban areas an important factor is the instability of the African home and the looseness of family ties under these circumstances. Nursery schools, which would offset these disadvantages to some extent, are not available.

There is evidence that malnutrition affects intelligence. After discussing the nutritional condition of the African, Biesheuvel concludes that in the Reserves, on the farms and in the towns, alike, poor diet combined with tribal customs or other environmental circumstances, impairs the growth of intelligence - the development of genetic potentiality - to a marked extent.

The part played by temperament is difficult

/ to assess

to assess. Although the lack of perseverance shown by African testees may be due to attitudes of indifference or hostility, it may be due partly to a real "Inactivity" as a result of a "temperamental deficiency". If there is a real lack of "volitional staying-power" which causes the African child to give up easily, the Biesheuvel considers that, if all other factors were controlled, inferior test-intelligence would be less indicative of intellectual deficiency.

Influences of these types must be borne in mind when the test results of the Coloured and African samples are being considered.

When the Group Test means are expressed in terms of the original sigma-scores *, the European mean is read as + .51 σ . Similarly, the Coloured mean is + .02 σ and the African mean -1.09 σ . (c.f. Table IX). The South African mean is, of course, .00 σ in these terms.

These results bear out the expectation that Coloured and African children will respectively score lower

TABLE IX
MEAN TEST-SCORES IN TERMS
OF STANDARD DEVIATION

R A C E	MEAN SIGMA-SCORES			
	S.A.G.T.		MATRICES TEST	
	Mean	S.D.	Mean	S.D.
EUROPEAN	+0.51	0.74	-0.25	0.76
COLOURED	+0.02	0.71	-0.53	0.79
AFRICAN	-1.09	0.60	-1.22	0.64

than Europeans on a verbal test standardised for Europeans.

/ For the

* This was done by dividing the Standard-score mean by 100 and then subtracting 3 from the result. The S.D.s obtained for the Standard-score distribution were divided by 100.

For the Progressive Matrices the mean scores of all three racial groups were below the English mean. Here again, the Europeans scored higher, on average, than the Coloured and African groups, respectively. Table VIII shows the European mean to be roughly 275, or 25 points of standard score lower than the English mean. The reason for this discrepancy is not clear, especially as, judging by the distribution of scores and the mean for this group's verbal test performance, they represent a superior sample of South African European children. Possibly cultural differences are responsible. On the other hand, the additional alternatives in the U.C.T. version of the test may have limited the number of correct solutions obtained by chance. It would appear that if the Matrices Test is to be used on a large scale in South Africa, it will have to be restandardised. Some work in this direction has already been undertaken by the Psychology Department of the University of Cape Town, but it has already been stated that their norms include scores on a sixth series of tests.

In comparing the results of the test samples with the English norms, it must also be remembered that six of the problems were demonstrated to our groups, whereas only two were demonstrated to the English groups. This means that the South African means may possibly be slightly lower than the figures actually obtained, although any such differences would probably have been insignificant since the answer to the initial problem in each series is more or less obvious.

Table IX shows the mean scores on the Matrices in terms of sigma, and all are, naturally, negative values, since they are less than the English mean of $.00\sigma$.

Group Differences

In view of the fact that direct comparisons of mean scores on the two tests will contribute nothing of

value, in this context, each of the tests was considered independently, the differences between the three races' means being calculated. It was then possible to discover which of the tests produced greater inter-racial differences in mean score.

(a) Standard Scores

The S.A.Group Test mean for the European group exceeded the mean for the Coloured group by 49.3 points of standard score, and exceeded the mean for the Africans by 160.14 points. There were differences of only 28.22 and 96.7 points, respectively, on the Matrices Test. The Coloured mean exceeded the African mean by 110.84 points on the S.A.Group Test, as against 68.48 points on the Matrices Test. (c.f. Table X).

TABLE X
DIFFERENCES BETWEEN GROUP MEANS
(STANDARD SCORES)

GROUPS COMPARED	DIFFERENCES IN MEAN SCORE	
	S.A.G.T.	MATRICES
European and Coloured	49.30	28.22
European and African	160.14	96.70
Coloured and African	110.84	68.48

(b) Sigma-Scores

In terms of the original sigma-scores, as set out in Table XI, the S.A.Group Test differences between European and Coloured, and European and African were, on average, 0.49 and 1.60, respectively, as against

/ 0.28 and

0.28 and 0.97 on the Matrices Test, while the differences between the Coloured and African groups were 1.11 on the S.A.Group Test and 0.69 on the Matrices.

TABLE XI
DIFFERENCES BETWEEN GROUP MEANS
(SIGMA-SCORES)

GROUPS COMPARED	DIFFERENCES IN MEAN SCORE	
	S.A.G.T.	MATRICES
European and Coloured	0.49	0.28
European and African	1.60	0.97
Coloured and African	1.11	0.69

These differences were found to be significant. The method adopted for testing the significance of differences between means is described in Appendix D.

It is clear that the differences between mean Matrices scores are considerably less than the differences between mean verbal-test scores. According to the performance of the three experimental groups, the Matrices Test definitely minimises the differences between the average performance of children of different races, and to no small extent. This is particularly evident in the case of the African group. It will be remembered, in addition, that the correlation between the two tests is almost identical for all three racial groups.

Group Means in Terms of European S.D.

The last procedure adopted for comparing group differences, is to express the differences in terms of the standard deviations of the European group, using

the statistics provided in Tables IX and XI. It will be seen that, since the mean European sigma-score on the S.A. Group Test is + .51 with a standard deviation of 0.74, and the difference between European and Coloured means is 0.49, this difference is equivalent to $(0.49/0.74)$ in terms of the European standard deviation, i.e. the Coloured mean is 0.66 of 1 European S.D. lower than the European mean. Similarly, the African mean is the equivalent of 2.14 European S.D.s lower than the European mean.

The mean Matrices score for the European group is -0.25 with a standard deviation of 0.76. This mean exceeds the Coloured mean by 0.37 of 1 European S.D., while the African mean is 1.28 European S.D.s lower than the European mean.

Expressed in these terms, the group differences in performance of the verbal test are seen to be nearly twice as great as the differences produced by the Matrices Test. Substantially the same result was shown in Table XI.

Children Aged 12 to 14 years: Means and Differences

The distribution of standard scores for these children was given in Table VII, page 44. Table XII below shows the means and standard deviations for the 12 - to 14-year groups, in terms of standard scores. The same data, expressed in terms of the original sigma-scores, are shown in Table XIII.

The means for this central group approximate fairly closely to the means for the whole test-samples, particularly in the case of the European and Coloured verbal-test means.

In terms of the original sigma-scores, the European verbal-test mean for the 12- to 14-year group is identical with that for the whole European group.

TABLE XII

CHILDREN AGED 12 to 14 YEARS:
MEAN STANDARD SCORES

R A C E	S.A.GROUP TEST		MATRICES TEST	
	MEAN	S.D.	MEAN	S.D.
EUROPEAN	351.33	65.18	280.00	74.69
COLOURED	301.13	66.19	241.41	79.47
AFRICAN	193.75	54.88	180.63	64.03

TABLE XIII

CHILDREN AGED 12 to 14 YEARS:
MEAN SIGMA-SCORES

R A C E	S.A.GROUP TEST		MATRICES TEST	
	MEAN	S.D.	MEAN	S.D.
EUROPEAN	+0.51	0.65	-0.20	0.75
COLOURED	+0.01	0.66	-0.59	0.79
AFRICAN	-1.06	0.55	-1.19	0.64

The differences between the group means for the two tests, shown in Table XIV, were calculated from the data in Table XIII. Here again, the differences are fairly similar to those found for the whole groups.

TABLE XIV

CHILDREN AGED 12 to 14 YEARS:
DIFFERENCES BETWEEN GROUP MEANS
(Sigma-Scores)

GROUPS COMPARED	DIFFERENCES IN MEAN SCORE	
	S.A.G.T.	MATRICES
European and Coloured	0.50	0.39
European and African	1.57	0.99
Coloured and African	1.07	0.60

These differences were found to be significant.

/It

It remains to express the differences in terms of the European S.D.s, as a final comparison for the central age-groups.

The Coloured verbal-test mean falls (.50/.65) of 1 European S.D. below the European mean, i.e. it is 0.77 of 1 European S.D. lower than the European mean. The African verbal-test mean is 2.42 European S.D.s lower than the European mean.

As regards the Matrices Test, the European mean score is 0.52 of 1 European S.D. greater than the Coloured mean, and 0.80 of 1 European S.D. greater than the African mean.

Within these age-groups, the Progressive Matrices Test again reduces the differences in mean score between the racial groups, although not in precisely the same proportions as it does for the whole groups. The difference between the European and African children aged 12 to 14 years is reduced by roughly two-thirds by the Matrices.

Conclusions

In view of the above facts, it seems justifiable to state that, for the experimental samples, at any rate, racial differences in mean score are nearly halved when the Matrices Test is used, and that the S.A.Group Test tends to exaggerate such differences as may exist. The reasons for this are to be found in the nature of the test-material and test-situation.

It is advisable to bear in mind:

(a) the possibility that differences in performance of the Matrices Test itself may be due to unsuitability of the test-material for use with non-Europeans, particularly Africans (as c.f. the discussions of cultural

/ influences

influences in Chapter II and the first part of this Chapter);

(b) the fact that African pupils are accustomed to being tested primarily on pure knowledge and information;

(c) that African, and to a lesser extent Coloured, children's performance on both tests may have been influenced by their attitudes towards tests presented by a European;

and (d) that the minimum period of five years' schooling may have modified the effects of cultural influences on the test performance of non-Europeans.

CHAPTER VI

SCHOOLING AND INTELLIGENCE

An attempt was made to discover whether what may be called "educational level" had influenced test performance, and whether any such effect were more pronounced in the case of either test. The index of educational level chosen was the number of years of schooling completed by the child. Only "normal" children were included, i.e. those who had passed directly from one class to the next, having begun in Sub-A. Any child who had been retarded or advanced was therefore excluded. The "normal" child in Std. IV, no matter what his age, would have completed five years' schooling, the "normal" child in Std. V, six years' schooling and the "normal" child in Std. VI, seven years' schooling.

The relevant details were obtained from the General Information Sheets. In a few cases, the required information had not been supplied, so that the statistics for educational level and test scores refer only to those children for whom definite information was available.

Of the European children, 56 (or 70%) of the Std. IV pupils were classed as normal, as were 39 (or 56.52%) of the Std. V pupils and 51 (or 65.38%) of the Std. VI pupils. Similarly, among the Coloured pupils, 56 (or 76.71%) of those in Std. IV, 67 (or 79.76%) of those in Std. V and 58 (or 74.36%) of those in Std. VI qualified for inclusion. The figures for Africans were considerably lower. Of the Std. IV group, 28 (or 37.84%) were classed as "normal", while in Stds. V and VI there were 26 (41.94%) and 18 (54.55%) "normal" children, respectively. This information is set out in Table XV.

The European and Coloured "normal" groups may be taken as fairly representative in all standards,

TABLE XV
PROPORTION OF "NORMAL" CHILDREN
IN EACH STANDARD

R A C E	NORMAL CHILDREN					
	STD. IV		STD. V		STD. VI	
	NO.	%age	NO.	%age	NO.	%age
EUROPEAN	56	70	39	56.52	51	65.38
COLOURED	56	76.71	67	79.76	58	74.36
AFRICAN	28	37.84	26	41.94	18	54.55

but "normal" children comprised less than half of the African groups, apart from the 18 children in Std.VI. One reason for the small numbers and proportion of these pupils is that African children often begin their school careers late, so that a number of otherwise "normal" children were over 16 years of age and were not included in the sample. On the other hand, many children who might otherwise have

TABLE XVI
EDUCATIONAL LEVEL AND MEAN S.A.G.T.
STANDARD SCORES OF "NORMAL" CHILDREN IN STDS. IV-VI

R A C E	COMPLETED YEARS OF SCHOOLING					
	5 years (Std. IV)		6 years (Std. V)		7 years (Std. VI)	
	MEAN	NO.	MEAN	NO.	MEAN	NO.
EUROPEAN	372.50	56	385.90	39	366.47	51
COLOURED	294.64	56	308.51	67	335.17	58
AFRICAN	210.71	28	200.00	26	238.89	18

have had successful school careers and have qualified for the "normal" groups had left school and gone to work in order to supplement the family income — and were therefore not available.

The relationship between mean standard score and educational level for the S.A.Group Test and the Matrices Test is shown in Tables XVI and XVII.

It will be seen that, for the S.A.Group Test, "normal" European pupils in Std.IV had a mean standard score of 372.5. The mean for Std.V rose to 385.9, but there was a drop of roughly 19 points to a mean of 366.47 for Std.VI. For the Coloured children, there was a regular increase of mean standard score with years of schooling, the increment of 13.87 points between Stds. IV and V being almost doubled (26.66 points) between Stds.V and VI. It is interesting that the same phenomenon occurred in the case of the Coloured Matrices scores, although the absolute increases were less (6.05 and 12.68 points of standard score). For the African children there was a drop of 10.7 points of standard score from Std.IV to Std.V, but an increase of 38.9 points from Std.V to Std.VI

TABLE XVII

EDUCATIONAL LEVEL AND MEAN STANDARD
SCORES OF "NORMAL" CHILDREN IN STDS.IV - VI
(Matrices Test)

R A C E	COMPLETED YEARS OF SCHOOLING					
	5 years(Std.IV)		6 years(Std. V)		7 years(Std.VI)	
	MEAN	NO.	MEAN	NO.	MEAN	NO.
EUROPEAN	270.36	56	311.03	39	291.18	51
COLOURED	236.79	56	242.84	67	255.52	58
AFRICAN	182.86	28	183.85	26	217.78	18

The European Matrices results followed the same pattern as the European Group Test results, i.e. an initial rise from Std.IV to Std.V was followed by a drop from Std.V to Std.VI, but the initial increase in standard score was 40.67 points on the Matrices, as against 13.4 points on the verbal test. The drop from Std.V to Std.VI was almost identical for both tests. The Coloured Matrices scores have already been discussed. The African Matrices scores showed a slight increase from Std.IV to Std.V, followed by a rise of nearly 34 points from Std.V to Std.VI.

The differences in mean score for both tests are given in Table XVIII. Here, (+) denotes an increase and (-) denotes a decrease from one class to the other.

TABLE XVIII
DIFFERENCES IN MEAN STANDARD SCORE FROM
CLASS TO CLASS

T E S T	STANDARDS	EUROPEANS	COLOURED	AFRICANS
S.A.GROUP TEST:	IV to V	+13.40	+13.87	-10.71
	V to VI	-19.43	+26.66	+38.90
MATRICES TEST:	IV to V	+40.67	+ 6.05	+ 1.00
	V to VI	-19.85	+12.68	+33.93

Except in the case of the Coloured children, educational level does not seem to have had any regular effect on mean test performance. For the Europeans, there was a rise in mean score from Std. IV to Std. V (particularly on the Matrices) followed by a decrease from Std.V to Std.VI, for both tests. The African means showed no regular tendency, which is hardly surprising since the numbers were so small. Although the African Group Test means fluctuated, their Matrices means increased, although unsteadily, with years of schooling.

In all cases the numbers of children are comparatively small and the proportion of "normal" children in each standard varies considerably. For this reason little weight should be given to the results obtained.

The marked regularity of increase with years of schooling of the Coloured group's mean scores on both tests is interesting in the light of the relationship Joshua found to exist between I.Q. and school standard.

For his sample, he obtained mean S.A.Group

Test I.Q.s of 89.2 for Std. IV, 96 for Std.V and 95.7 for Std.VI. These I.Q.s would be equivalent to 210, 268 and 268 in terms of our standard scores. The standard-score form of these ratings masks the slight fall in mean I.Q. from Std.V to Std.VI. For both our selected group of "normal" Coloured children and for our whole Coloured group there was a marked rise in standard score from Std.V to Std. VI on this test. Our mean standard scores for the whole group are compared with Joshua's means in Table XIX. From this table it will be seen that, not only are the mean standard scores altogether higher, for

TABLE XIX

COMPARISON OF S.A.GROUP TEST MEANS
FOR JOSHUA'S AND FOR THIS STUDY

SCHOOL STANDARD	JOSHUA'S STUDY		THIS STUDY Mean Std. Score
	Mean I.Q.	Equivalent Std. Score	
IV	89.2	210	278
V	96.0	268	297
VI	95.7	268	326

Our sample, but that there are progressive increases of mean score with standard. In the case of Joshua's means there is a rise equivalent to 58 points of standard score from Std.IV to Std.V, but a slight decrease instead of an improvement from Std.V to Std.VI, this slight decline in I.Q. not being reflected by the equivalent standard scores.

Joshua assumed that his sample was statistically reliable, since application of the chi-square test of goodness of fit to a normal distribution revealed no significant differences between the actual and theoretical frequencies. It will be remembered that our sample was drawn from Coloured schools of a superior type (for reasons already stated), whereas Joshua's sample was

/ selected

selected from schools of all types. In view of the fact that the quality of schooling certainly affects scores on the S.A.Group Test, it is not surprising that our means were higher than Joshua's.

Since our sample of Cape Coloured children appears to be somewhat specific, generalisations on the basis of these results alone would be inadmissible.

Conclusions

On the whole, it does not appear from this set of results that educational level affects intelligence test performance in any regular manner. The European sample showed an increase from Std. IV to Std.V, followed by a decrease from Std.V to Std.VI in the case of both tests. The Coloured sample showed progressive and regular increases in mean standard score from class to class. These increases possibly reflect the composition of the sample rather than the effects of schooling on test performance. The inter-standard differences for the Africans do not follow the same pattern for both tests, and differ in this respect from the differences for the other racial groups.

The proportion of "normal" children varied considerably from class to class and race to race, the numbers of Africans being too small to provide reliable results.

CHAPTER VII

SUMMARY AND CONCLUSIONS

The controversial topic of the intelligence of non-Europeans was discussed in the first chapter. It was indicated that the low test-intelligence scores of non-Europeans may be due either to inferior innate intellectual ability, as is claimed by certain observers, or to unsuitability of the tests utilised as a basis for inter-racial comparisons. Inferior test-intelligence does not necessarily mean innate intellectual inferiority. No test, to date, can be accepted unreservedly as being equally adapted to all races, particularly when there are distinct differences in environmental circumstances.

The Progressive Matrices Test was designed with a view to eliminating group factors, special skills and differences in educational background, and it is claimed that it differentiates clearly between genuine intelligence and mere verbal fluency. It is necessary for us to admit the possibility that the broader cultural differences and environmental influences may have a depressing effect on the performance of non-Europeans.

As is well known, the South African Group Test of Verbal Intelligence does not set out to test intelligence as divorced from education, and it relies on a certain standard of education for its successful performance. It was therefore to be expected that Coloured and African children would be handicapped, relative to European children on account of language and educational factors. For the Coloured group, since dual-medium tuition is provided by their schools, an average of scores on the English and Afrikaans forms of the test was adopted. This was justified in view of the substantial correlation ($+0.82 \pm 0.01$)

/ between

between the two forms of the test. Although Africans are also taught through two media, English and Xhosa, there is no Xhosa version of the test, so that only the English form could be administered.

The Progressive Matrices and S.A.Group Tests were applied to European, Coloured and African children aged 10 to 16 years. As far as possible, the social and economic background of the groups was equalised, but circumstances necessitated drawing the African sample from the Langa Location only. All were mixed schools, the samples including children of both sexes.

Age Distribution and Mean Age

With the exception of children in Std.IV, it was shown that the Coloured children tested were slightly younger, on average, than the European children, whereas the Africans were older, on average, than either of the other groups. The official statistics of the Cape Department of Public Education were quoted to show that the trend for the whole Cape Province (in 1940) was for African children in Standards IV to VI to be older than Coloured children who, in turn, tend to be older than European children. The mean age of the European test-sample was 0.16 of a year in excess of the mean age for all European children (Cape, 1940), while the Coloured test-sample had a mean age roughly 6 months less than the mean for all Coloured pupils in the Cape Province. The African sample had a mean age equivalent to 0.81 of a year less than the Departmental mean. The figures quoted for the Cape Province cover children within the same age-range as those in the test-samples.

Scores

All raw scores were converted into standard scores in such a way as to take cognisance of age-differences.

All results were given in terms of these standard quantities, not in terms of Mental Age or I.Q.

Results

A correlation of roughly + 0.60 was found to exist between the Progressive Matrices and the S.A.Group Test as performed by each of the three racial groups.

The distribution of standard scores on the verbal test confirmed the expectation that the European group would show up to advantage relative to the Coloured and African groups. The European sample appeared to be a superior sample of the South African population, in that scores were distributed about a mean somewhat in excess of the mean for all South African European children (which is a standard score of 300, equivalent to a percentile rating of 50 or an I.Q. of 100). Scores of the Coloured group were distributed about a mean slightly in excess of this South African mean, while almost all African scores fell below this figure.

On the Matrices, the scores of all three groups were distributed about means lower than the English mean (equivalent to a standard score of 300). Whereas the European and Coloured distributions tend to take on the shape of the ideal curve of normal distribution, the peculiar shape of the African distribution-curve was noted. Here, frequencies declined continuously from a peak at the lowest group of scores, a situation which did not arise in the case of African verbal-test scores.

Consideration of the central age-groups (12 to 14 years) revealed substantial agreement with the findings for the whole groups.

/ Group

Group means for both tests were calculated for the three races. While, in each case, the European group scored higher on average than the Coloured and African groups, the differences between group means proved to be considerably greater in terms of the verbal-test scores than as measured by the Progressive Matrices.

When these differences were expressed in terms of the standard deviations of the European group, it was found that the Matrices almost halved the differences reflected by the S.A.Group Test. Once again, consideration of the central age-groups produced substantially similar results.

Educational Level

Judging by our results, the number of years of schooling completed by the testees does not appear to have had any regular effect on mean test performance, except in the case of the Coloured sample. It is possible that the relationship discovered in this case is a reflection of the composition of the sample.

CONCLUSIONS

The investigation of reasons for inter-racial differences in test-intelligence has been carried out by many research workers. The principal factors so far postulated appear to be: differences in socio-economic background; inferiority of educational opportunities, including the poor qualifications and equipment of non-European teachers; hostility towards and suspicion of the motives of European testers or their representatives; and unfamiliarity with the test-situation, including lack of appreciation of the

need for haste evidenced by African children.

The Progressive Matrices Test cuts out the speed-factor. It is a non-verbal test and the instructions can be simply and economically given. Formal education is eliminated, beyond the necessity (in the group-test form) to be able to write down the numbers of the solutions selected. No child included in the sample was unacquainted with numerals.

From the results obtained, it is clear that the Matrices Test does minimise inter-racial differences in intelligence, as measured by intelligence tests. In comparing Matrices differences with S.A.Group Test differences, we may take it that the Matrices Test discriminates convincingly against verbal fluency as independent of such operations as are measured by the Matrices. The S.A.Group Test leans heavily on verbal ability and tuition. The relationships involved cannot, in most cases, be evoked without familiarity with the vocabulary and subtleties of meaning usually taught at school. In the Matrices Test, the relationships and problems are presented in perceptual form.

The reservation must be made, in terms of our previous discussion, that even the material of the Progressive Matrices may be unfamiliar to children reared in cultural environments where manipulation of such patterns is not common. Possibly this, combined with hostility to and fear of the European tester, as well as unfamiliarity of the test-situation and inability to value a test for its own sake — through inability to see the end in view — may be responsible for the inter-racial differences in mean score. Under the prevailing circumstances, these factors would militate more strongly against the Africans than against the Coloureds.

Observation of the reactions of children of all races leads to the conclusion that the Matrices Test

/ is less

is less suitable as a group test than as an individual test, particularly if the University of Cape Town procedure is adopted. This demands that all or almost all the group must complete one series before the first problem of the subsequent series may be demonstrated, after which the group may proceed. It is difficult to control the restlessness of the quicker children, even though reading-matter is provided. Whether this procedure or the original procedure be followed, there is still the disadvantage that slower workers who find that the majority have completed the test tend to become flustered or impatient and rush through the remaining items, rather than lag behind.

The investigation described in these pages should be regarded as a preliminary study of the applicability of the Matrices Test to South African children of all races. It becomes clear that there is a need for further research in order to determine, among other things,

(a) whether the lowness of the South African European mean, according to the English norms, is general or merely a phenomenon confined to the sample tested;

(b) whether the peculiar distribution of the African test-scores is confined to the test sample;

and

(c) what factors operate to affect the scores of non-European subjects (including a study of the effect on test-results of the African conception of pattern and design.)

In the meantime, the Matrices Test is recommended for use, either on its own, or as an auxiliary, if

/ comparisons

comparisons are to be drawn between the test-intelligence of different races, although such comparisons violate the rule that intelligence-test scores should not be compared unless the subjects concerned have substantially the same environmental background.

Once adjustments such as may prove necessary have been made, the Progressive Matrices may serve as a useful instrument for research into problems of inter-racial differences in intelligence.

APPENDIX A

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APPENDIX B
GENERAL INFORMATION SHEET

SCHOOL:

STD. :

1. FULL NAME:
2. ADDRESS :
3. How long resident in area?
4. (a) Date of Birth:
- (b) Place of Birth:
5. How long has child lived in a city?
6. FAMILY:
 (State whether real, step- or foster- relationship)

	N A M E	A G E	O C C U P A T I O N
a) Father			
b) Mother			
c) <u>Children</u>			
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			

REMARKS:

7. Religion
8. Home Language
9. Medium of Instruction
10. Age at which child began attending school
11. Date of admission to present school
12. Number of schools attended by child
13. Has child been kept back in any class?

State which; give reason.

14. (a) No. in Class.....
(b) Position in Class.....

15. JUDGMENT OF TEACHER

- (a) School performance.....
(b) Behaviour.....
(c) School attendance.....

REMARKS:

- (d) Subjects (average, good, below average, etc.)

Afrikaans.....

English.....

Reading.....

Arithmetic.....

16. Health.....

17. Deformities or Impediments.....

18. Has child ever been in employment?.....

Give details of period and occupation.....

19. Previously tested?.....

20. IF IN A REFORMATORY, ONLY :

(a) Date and Place of Sentence.....

(b) Crime.....

(c) Date of admission.....

(d) Period of committal.....

21. REMARKS:

APPENDIX C

SOUTH AFRICAN NORMS FOR THE MATRICES

With the addition of a sixth series of problems, the Matrices Test was standardised as the "Non-Verbal Pattern Test: Advanced Form", by the Department of Psychology of the University of Cape Town, under the guidance of Professor H.A. Keyburn.

The test was applied to about 600 children attending 20 schools in Cape Town and in surrounding areas. The selection of samples was confined to the average child in each standard, i.e. the child who, according to the official statistics, was of normal age for his standard at that time of the year.

Norms for the Western Cape

AGE		NORM	AGE		NORM
Yrs.	Mos.		Yrs.	Mos.	
IX		26	XII		39
-	3	27	-	3	40
-	6	28	-	6	41
-	9	29	-	9	42
X		30	XIII		43
-	3	31	-	3	44
-	6	32	-	6	45
-	9	33	-	9	47
XI		34	XIV		48
-	3	36	-	3	49
-	6	37	-	6	50
-	9	38	-	9	51
			XV		52

APPENDIX D

THE SIGNIFICANCE OF DIFFERENCES BETWEEN MEANS

Tests of the significance of differences between means are directed towards finding out whether there is a real difference between two observational means, i.e. (CHAMBERS) whether the difference~~x~~ is such that they might have been drawn from the same population by random sampling or from two different populations.

Where the samples are large (i.e. those of 50 or more observations) the significance may be tested by comparing the difference between the two means with the standard error of the difference. If the difference is more than twice the standard error, then the means are significantly different.

The standard error of the difference is calculated by the formula:

$$\text{S.E. diff.} = \sqrt{\frac{\sigma_1^2}{N_1} + \frac{\sigma_2^2}{N_2}}$$

where σ_1^2 and σ_2^2 are the ^{Squared} standard deviations of the two variables
and N_1 and N_2 are the number of observations in each of the two variables.