AN EXPERIMENT IN AFRICAN EDUCATION IN KENYA

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AN EXPERIMENT IN AFRICAN EDUCATION IN KENYA

I. The New Idea

In the Rhodes memorial lectures, General Smuts emphasises the importance of recognising that the development of the African depends largely on the reaction of the African to the European civilisation with which he comes inevitably into contact. His educational policy for the civilised native is summed up in the sentence, ‘white employment is his best school.’

It is not the least of the difficulties with which those who are responsible for guiding the development of the native have to contend that the politicians, who in the last resort are our masters in these things, fail to recognise that there has been of late years a great revolution in regard to the handling of the educational problems of the native. On the one hand, it is no longer true that those who desire the development of the native believe in the efficacy of a purely literary education; on the other hand, the education of the native by means of forced labour is, as far as the great bulk of European opinion is concerned, a thing of the remote past. These are the Aunt Sallies which are put up either by those who hold that education is in itself bad or by those who regard the
past errors of some despotic European as typical of all Europeans.

The problem of native development in its widest sense is recognised more and more as being both an economic problem and a social problem. On the social side the development of the native involves a revolution, not necessarily in his tribal life or in his relation to his neighbours, but in his manner of living in his own home. That social revolution, which has begun in the native reserves, involves inevitably an economic revolution not less important. If the efforts which are being made in Africa to help the native to develop socially and economically are a success, that success carries with it inevitably a complete change in the relations between black and white. To express the result in its lowest terms, the native will come to realise more and more that his social betterment involves him in greater needs, which he can secure either by working for the European or by improving his own methods of production. The European will realise that by encouraging the native in both directions, he is working in his own interests as well as in those of the native.

How far it is possible and practicable to help the native to develop along those lines is a question which the following account of the results, in an individual instance, of an educational experiment in Kenya may help to answer.
II. Justin, a Pioneer

He was a little fellow, as most of his people still are, about the height of Mr. Lloyd George, perhaps, though slighter, for he was suffering from phthisis; but it was only later, as I thought over the full magnitude of his achievement and realised the infinite capacity for taking pains which alone could have made it possible, that I remembered that he was not tall. At the time I was too much interested in the things he was showing me and the explanations he was giving to notice much about him; he was too good a propagandist to allow his visitor's attention to be diverted to anything so unimportant as himself. He was an artist as well as a craftsman, and for two hours he never failed to 'get across.' I doubt if inspiration has ever failed him, for he is in love with life; the wonder is how he does it all, how he can find the energy to translate it all into action, and the time. The chemists have a word for the energy part of it, catalytic, but the question of time must remain a mystery. He is a Kikuyu by race, and a Jeanes teacher by profession, and his father, who died only the other day, was a witch doctor of some repute. But before I tell of the truly remarkable demonstration which he gave me of the way in which his particular patch of Africa was being remade, and of all that he hoped to do, I must first explain as best I can what a Jeanes teacher is, and tell something of the dragon of ignorance and superstition and fear against which he has couched his lance and of the squalor of the Augean stables which he means to clean.

His folk, the Akikuyu, are a Bantu-speaking
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people living on rich land in the Highlands of Kenya. They are an agricultural tribe and own no small number of stock, both cattle and sheep and goats. They have been settled sufficiently long to have a complicated system of land tenure, and they have some fables and make rude pottery and have worked iron. They are a pleasant folk if you know them, though this is not, perhaps, the general opinion, and many of them are very charming little people, but fear still holds them only too often, fear of a thousand things seen and unseen, and they are suspicious and self-conscious; they have not found themselves; and they class ourselves on occasion with nature and the Masai, who have ever been against them. That is as far as their culture goes. They are intelligent, but they have little knowledge, and the tribe maintains its numbers by bringing into the world many times the number of babies that should be necessary. The folk are of small stature for the most part, perhaps to some degree because it is inborn, but to no small degree because as babies they are wrongly fed, and because childhood is spent acquiring immunity from disease. Parasites play a great part in hindering their development, and probably in reducing their capacity for both physical and mental work. And ever they spend the hours of darkness in a hut, the atmosphere of which is vitiated beyond belief.

Their villages, like almost all African villages, are squalid to a degree. Goat dung and cattle dung and all kinds of domestic refuse litter the village, and outside the ground is fouled with human excrement. The folk themselves are unwashed. The young men on a gala day, shining with oil and bright with feathers and red clay, may be a fine sight, and the young
women also, but they are not clean, nor are their dressed skins or blankets. When the oil and the red mud go, caked dirt remains, and for the doctor or the nurse who handles the children and the older folk it is often no pleasant business. In the dust and ashes of the village pot-bellied children play—pot-bellied children scabbed with itch or yaws, with filthy hands, and dirty skins, and running noses. And enough survive to maintain the numbers of the tribe, or, as is likely nowadays, to increase it. The women are no better—caked in dirt, clothed in filthy skins, they prepare the food with hands which are never washed, in pots that are never cleaned; and at night the family, together with the goats and calves and fowls, crawl to rest in mean, airless, unlit hovels filled with smoke and the stench of animals and man; and the countless rats awaken.

Such is the average Kikuyu village to-day, and for that matter the average village of Africa, the villages he is going to remake; and in such a village Justin first saw the light, for, thirty years ago, when railhead had not yet reached Nairobi, there was nothing else. The tale as here told is true, plain, and unvarnished, and under such conditions women are brought to bed and delivered, and children die or live to die old men, and in the years between are on occasion merry, and almost always the pleasant little people whom we know. But is it a wonder that fear is never far away? Plague and pestilence come in a night, the young men die and the cattle sicken, the rains fail and the locust cloud looms on the horizon, and stark famine stalks through the land. To have witch doctors in such circumstances is only common sense, and if these doctors, bred of fear, come ultimately to
batten on it, who can wonder? Till but a few years ago the dying were cast from the huts into the bush, there, dead or still dying, to be devoured by the hyena, for, as no one might touch the dead, the dying must be removed in time. But it would be wrong to call the people cruel—the custom was cruel, the people only ignorant and afraid. The custom is disappearing now, though it is still almost impossible to get a Kikuyu to touch the dead body of a stranger, and there are other things they fear to deal with. Superstition, doubtless soundly sanitary in its origin, makes sanitation difficult to-day.

These are some things we know, but few of us speak their language, and still fewer know the innumerable taboos of native life, and ever we must be offending, whether we would help at childbirth, or in the ordinary affairs of life, or, as we have done, at death. It is for these reasons among others that my friend's work is so remarkable.

I have described the average village, the great majority of villages in fact, but in places changes have taken place. The business of throwing the dying into the bush is stopping. Some of the men folk of the tribe have been trained, in the King's African Rifles or as police Askari, to be clean, and have learned discipline and to have less fear of the unknown. Some men and a few women have learned new things at missions and on European farms, and a few homes have been affected. Slowly khaki is replacing skins or blankets, and of late years even the fashions of the women have been changing. For a generation now government officers in the native reserves have built roads, have endeavoured to improve crops, to afforest the land, and to prevent famine.
They have governed with an even hand, and in a hundred ways have laboured and struggled through long days and against great odds to do something for the land, and for a fear-ridden and suspicious people, or at the least to keep both from harm; they have been no mean missionaries of action, and much has been accomplished. Famine is less often terrible, pestilence is sometimes held in check, fear has in places been conquered, and some confidence has been established. Some few of the Kikuyu are beginning to look out on to the world which has opened to them, and some are browsing over new ideas; but because we started at so low a point, because fear was so dominant that for long but little was possible, and partly because in these circumstances the outlook was too dark to encourage much hope of carrying out any fundamental reconstruction, and partly, perhaps, because our conception of the meaning and possibilities of education were those of our time, but little reconstruction has yet been achieved in the home life of the people. The villages of to-day are just such as that in which some thirty years ago Justin, naked and unashamed, played and survived. A few men folk have been affected, it is true, but it is only too well known that the labourer, or even the soldier or the policeman, when he returns to his reserve, reverts, and the culture of their children is that of their wives, the culture of the average village.

But the work of these years in Africa has opened a vista, the folk are approachable now and the District Officer recognised as a protector, and during these same years there has been progress elsewhere. Administration in England to-day is a far more comprehensive business, and covers a far wider field
than was the case even a few years ago; education has become a function of administration and has a wider meaning, and is a more liberal term. Educational methods which result in education have been devised to replace methods which were productive of little good and often of much harm; the importance and the possibilities of the child have been realised; the Local Authority—the meeting of the elders as it were—employs not only a sanitary inspector, but a child welfare officer, the conscience of the Councillor has developed, the Authority is propagandist, and the remaking of urban and rural England is in hand. What is being done in Africa?

In Kenya a beginning has been made, though but little has yet been heard of it, for the experiment has so far been carried out in its completeness only on a small scale, and Government itself has made the experiment; it has been done through the Education Department, carefully and scientifically, and my friend, who was a pupil of the Jeanes School, has carried it out.

Now up to the present, as we have seen, we have hardly touched the people in their homes, for even such important agents as the District Officer, the King's African Rifles, the police and the settler have affected only the male members of the population. The missions and the settlers' wives, it is true, have done something for the women, but the opportunities of the latter have been limited, and the equipment and the training of the former have been inadequate for the task, nor always has the task been understood. Fundamentally the task was to educate, but the administrator had little hand in direction, the task was relegated to the missionary, and for the
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most part letters alone received attention; and little more was accomplished or attempted than to cover the country with a network of 'bush' schools where pupil teachers, themselves but poorly educated, haltingly, and without method or supervision, taught the three R's for a living. And innumerable children wasted time—Justin, I expect, was no exception. But the bush schools, if poor or even bad, were all that there were, and at the least they represented an organisation stretching out over rural Africa. Constructive supervision was required, a leaf was taken from an American notebook, and a Jeanes school was established in Kenya with the help of the Carnegie Trust. To this school, which is a school for the training of teachers, come native teachers selected by the missions, and among them only four years ago came Justin, then a bush teacher and still but poorly educated. He was accompanied by his wife and children, and the whole family was trained. He was taught new methods of teaching and new subjects: hygiene and better methods of living had an outstanding place; agriculture and economics had also a place, and everything had a definite relation to village life. The importance of play and the importance of beauty were not forgotten. It was impressed on him that he had a function among the parents as well as among the children, and a great function in relation to the life of the whole community in his district. And his wife was taught to knit, and sew, and cook. After two years he returned to his district and settled in his village to do what he could to put new life into the bush schools in his area, and to help his people—a difficult job. Without powers, without prestige, the Jeanes
teacher goes back to his district to battle with custom, prejudice, and disease, to teach and to inspire his people with enthusiasm for new things, and to do this without losing or wasting whatever may be of value in native life and custom as it now is—to remake rural Africa. It is a fine conception, and if a system has been established which enables it to be carried into effect it is a great thing; and I went out to see how a Jeanes teacher works in the field.

We met Justin at a bush school, it was in the native reserve, but it did not, like most such schools, justify its name. There was no bush. Instead there were trim lawns of Kikuyu grass, green and fresh, neat paths and flowers and fruit trees, and a large field cultivated by the pupils. The school building, a mud and wattle affair with a grass roof, was none too good, but it was clean and tidy. Justin quite rightly is dissatisfied with it, and he has collected over a thousand shillings for its rebuilding. There are some other small buildings or shelters in which outdoor classes are held, and one in which his wife teaches the mothers knitting and sewing. I saw some of the knitting. To begin with I was shown an enormous sock. It would have been an out-size even for a giant, and for the moment I was grievously disappointed, till it was explained that this was a practice sock; it was made of material obtained by unripping sacking, and it had been unripped and re-knitted many times. Then I saw other socks, and jumpers for the children, all made of real wool, and all well made. The knitting needles are fashioned from bamboo cane. If these jumpers become popular many lives will be saved, for the mornings and the evenings are cold in this part of the country, and pneumonia is our most killing disease. Then there was a workshop.
The bench and all the fittings had been made by Justin, and here he taught both children and parents simple carpentry, how to make chairs and tables and cots, and door and window frames, and food cupboards and boxes out of packing case wood which he buys in Nairobi. He is building a new carpentry shed, and it is being excellently done. The framework is of wattle poles, of which I shall have more to say later. I asked if there was a school latrine, and it was shown to me. It was a pit latrine, and clean, and it is being used. The adult Kikuyu has strong objections to using a latrine, but if the children are being trained our difficulties will soon be over. As for the children themselves, they were all fairly clean and many of them remarkably so. They are taught to come clean to school and they are taught to sweep the school daily. Justin himself has six children, and two of the oldest attend this school. I saw them. They had decent print dresses and could not possibly have been cleaner.

Then we went to his own house. We went by car, with some little difficulty, it is true, over a rough road which he had lately persuaded the native authority to put through. Most of the way the road was bordered by native wattle plantations. After about a couple of miles a sharp turn to the right brought us into a neat, well-swept path, bordered with the kind of carnation plant which does not flower well in this country but which is excellent for edging paths, and we found ourselves at his house. It was not a large house, even as the houses of some of the better educated natives go, but it was full of interest. He intends to build a better house shortly, but of that later. The present house is well built of wattle and daub, and it has a grass roof, the walls are eight feet high, and it
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has three rooms. The central room has a door back and front and is the living room; it contained an oblong table covered with a clean cotton trade blanket, and there were three bent-wood chairs. All had been made by himself. An interesting feature of the room was that it had a ceiling—made of flattened kerosine tins. On the right, opening off the central room, was his wife’s room, and on the left the children’s room. The latter contained two smallish beds or cots, but no blankets or bedding. I asked about the bedding and was told that children’s bedding had to be washed not infrequently. I noticed it later spread out over a neat macrocarpa hedge drying in the sun. It was ragged, perhaps, but clean. His own bedroom was a small detached building of light but unmuddied wattle construction through which all the winds of heaven could blow—he had, as I have said, phthisis. To one side of the house was a small detached wattle and daub kitchen, and on a rough table pots and pans of aluminium, and plates and mugs of enamel were turned out in the sun. The kitchen was swept and clean.

Behind the house and to one side was a thing I had never before seen in the Kikuyu country—a pleasure garden. An excellent piece of green turf with some shade trees, a path surrounded it, and outside of that were beds bright with flowers. On the small lawn and on a rug of some kind were his four younger children, clothed, clean, fat, and healthy. Further over was a large kitchen garden with rows of most excellent cabbages, carrots, beans and peas, among which his wife, bare-footed but cleanly clad in a blue print frock, was working. In front of the house was a large orchard with well-grown custard apple trees, lemons, and loquots. Here and there were some trees and
shrubs, which, he explained, were old-fashioned remedies. He asked me to have the roots analysed. Then there was a store full of hoes and odds and ends, and an improved type of grain store, all built of wattle. About fifteen yards from the house was a pit latrine. Beyond was a piece of land about a quarter of an acre in extent enclosed by a high palisade of interwoven wattle branches. He unlocked a door to let us in and we found it to be a large hen run, complete with coops and perches. In the centre a wattle frame building about fifteen feet by eight was in course of construction. I asked what it was and he explained that it was to be a goat house. 'Our people,' he said, 'say that goats will not thrive unless they are kept in the huts we sleep in, but it is not true; my goats will get fat here and then the people can come and see.' Another sanitary reform to be begun! Then we went down the hillside by a good path, and here I was surprised indeed. At the end of the path was a small mud and wattle building with a tin roof. Another latrine, I thought. But no. He unlocked the door—there were padlocks everywhere—and showed me a protected water supply! A barrel had been let into the ground, all but two inches, which remained to keep back spillings, and a gourd with a handle was available for ladling out the water. It was spring water, and it was certainly well protected. Lower down, he said, he had a tree nursery which was irrigated from a furrow, but I had no time to explore further, and we returned to the house. Here I was shown more things—a hut with a dwarf wall, and a table and some chairs where he could sit with his friends, and a curious little square building with a wooden floor set on piles which he called his office. It had a
window and a table and chair, a file of *Habari*, the native monthly paper edited at the Jeanes school and published by Government, piles of odd papers and letters, and notebook upon notebook filled with Kikuyu proverbs, tales, and folk-lore which he had written down and which he is anxious to have published. Though he was a seller of new lamps he had no intention of letting the old ones go out so long as their light was needed. And he kept old lamps lit also in another way. He wore a queer fur cap; it was the badge, I was told, of a kind of scouting organisation he had instituted among the boys in the neighbourhood, which kept old names and was interwoven in a curious fashion with old ways and discipline.

Then at last we sat down on his home-made bentwood chairs in the shade of his wattle trees to discuss methods of building and the design of houses. He was going to build a new house, and it was already pegged out. I wanted to measure it, but he knew the measurements, twenty-four feet long by fourteen feet, rectangular, with windows, and to be divided into two large rooms, one to be a living room, and one for his wife, and two small rooms for the children. The children were growing up and the girls must have a room to themselves. The height of the walls was to be eight feet. He would cut his wattle poles ten feet long, char two feet at the ends which went into the ground to protect them from white ants, and that would leave him with an eight foot wall. I asked why not a higher wall, say ten feet, it would be cooler and airier, eight feet was perhaps on the small side. He agreed that ten feet might be better. ‘But,’ he said, ‘I am not merely building this house to live in. I want other people to build such houses
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also. It has to serve as a demonstration. To-day our people live in huts with walls only four feet high. If you put them in a house with walls ten feet high, they might feel lost. But I think we can get eight feet.' It was the correct answer. He is going to put a corrugated iron roof on his new house, and for that I am sorry, but I do not know what else he can do. The grass in his part of the country is poor stuff for thatching; but undoubtedly corrugated iron is ugly. It is a curious thing, that squalid and terrible as the huts below them are, the thatched roofs which his people have made for generations fit into the countryside; they make a picture which is Africa, and they suggest a home. But there is nothing homely about corrugated iron. I think I know what could replace them without spoiling Africa, if only it could be done. If I blot out the grass roofs and see instead red tiles or shingles showing through the openings in the wattle and on the hillsides over mile upon mile of country which will be better wooded than the country of to-day, I know that I have not spoiled the picture. Surely in remaking Africa we need not spoil it as in some places already we have begun to do!

One other thing he showed me—his plantations. He had some well-grown plums planted ten years ago, and much wattle, and it was the latter that had enabled him to do much that he had done. His house, his stores, his kitchen, the splendid palisading round his fowl run, his excellent goat house, all were due to wattle, for without it there is little wood in all that countryside. It costs him little but time and a few nails to build; it enables him to build high and well, it provides him with firewood, and he sells the bark, and Europe benefits, and, in addition, his plant-
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ations and his people's—for all Kikuyu is now being planted up—have transformed the country-side, and in what was hot, unshaded land, show dark and throw long shadows. Surrey and Perthshire know no better views; but tin roofs—surely we could prevent that desecration! India and Ceylon and all the East have known better this thousand years or more, and the prosperous peasant there passes not to tin but tiles.

Be that as it may, Justin has set his hand to a great work, he has shown what can be done, and he has been the first to do it, and though imperfect, yet his work is outstanding in that it is comprehensive and complete; no point of hygiene has been overlooked, his children are cared for, and everywhere was evident the practical application of new knowledge; and culture, too, was evident—and, when you think of it, culture in one of its highest forms—a self-made library of the stories of his people.

But alone Justin cannot remake Africa, he is a pioneer, not an administrator. He has, however, shown the way and the possibilities, and he is one of an increasing band. I meant to ask about his accomplishment in the neighbourhood, but we had no time. It did not matter. An example such as he has set cannot but have effect, and in the school his influence was evident. Can the movement be made more general? Can the remaking of Africa now go on? In Kenya undoubtedly it can.

I have commented on the completeness of Justin's work, but it was remarkable also in another way, in its simplicity. It was simple to a degree, it was only a matter of wattle poles and nails, a measuring tape and holes in the ground, and a needle and thread and soap and water, a few print frocks and some pots of
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aluminium and some mugs of enamelled iron, and the keeping of accounts. Simple as it was, however, it would not have been achieved without an infinite capacity for taking pains. But think of the implications. Justin, though a teacher first, is yet no mean producer; he hires a man, and because he has given him effective tools and method, more work is done at smaller charges and there is the greater surplus for exchange. How many millions of enamelled mugs, of bags of nails, of yards of print, of ploughs and hoes are still required? And later, how much in the way of glass and steel-framed windows? Another chapter in the romance of commerce to be written, for none of these things are made in Africa.

I have spoken of the magnitude of Justin's achievement, and the words are not wrong. Born and bred in the squalor of Africa, he had acquired new knowledge and applied it, he had built a home which it was a pleasure to visit, squalor had utterly disappeared, and he had made no mistakes; there was nothing of Europe but what should be there, though some things still were wanting. I thought of other homes I knew, the squalid, untouched villages, the improved houses of the towns where an equal if a different squalor sometimes reigns, and ragged pictures paper the walls of some houses which had been built for show and are not used, and serve no purpose but to point to ignorance. I realised the length of the road he had travelled and the magnitude of his achievement, for not only had he remade Africa, but he had spoiled nothing as he worked.

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THE ROUND TABLE

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THE COMPARISON OF THE ABILITIES OF RACES:
WITH SPECIAL REFERENCE TO EAST AFRICA.
THE COMPARISON OF THE ABILITIES OF RACES:
WITH SPECIAL REFERENCE TO EAST AFRICA.

By R. A. C. Oliver, M.A., B.Ed.*

The purpose of this paper is to take stock of the comparisons which have been made of the abilities of races. It is not necessary for our purpose to define the term "race" in an ethnological sense; suffice it to denote such groups as Englishmen and Frenchmen on the one hand, and on the other the native Africans of their colonies. The abilities to be discussed are the culture-making abilities, of which we may assume the chief to be that commonly known as "general intelligence," a factor entering into the performance of every kind of task.

There have been three main bases for the comparison of the abilities of races. Racial abilities have been judged first by cultural achievement, secondly by performance in psychological tests, and thirdly by certain anatomical and histological measurements. The first basis of comparison has been largely theoretical and qualitative; the second and third bases have been mainly experimental and quantitative. Let us enquire what conclusions can be drawn from such comparisons.

A. COMPARISONS OF CULTURAL ACHIEVEMENT.

When a comparison is made between the cultural achievement of Europeans and that of a primitive people, it is generally agreed that the former is superior. It is perhaps true that "each tribe, or true national unit, regards itself as superior to all others and holds its culture to be the best" (1). However, only a few paradoxical minds deny that in the mastery of environment European culture has been more successful than primitive culture. This at any rate is the judgment usually made, and assuming it to be correct, the question we have to discuss is whether this superiority in cultural achievement necessarily implies a corresponding superiority in racial ability. It can be shown that it does not necessarily do so.

That difference in level of achievement does not depend on difference in level of racial ability alone may be reasonably deduced from a comparison of the cultural achievement of the Teutonic tribes which Caesar conquered, with that of their

* The author is engaged in research in Kenya Colony on behalf of the Carnegie Corporation of New York. He himself, however, is solely responsible for the opinions expressed.
present-day descendants. It is generally adjudged that there has been a considerable cultural advance, yet there is no reason to believe that there has been any corresponding change in innate racial ability. There is indeed no known biological mechanism by which a change so profound could have taken place. It is not to be supposed, for example, that every change in culture, for better or for worse, has somehow been paralleled by an inheritable morphological change in the organisms of the tribesmen; so that if a man learned to read, for example, or to make boots, his children would be born with an increased innate ability to learn the art of reading or of boot-making. Such theories of the inheritance of acquired characteristics are discredited in biology. Nor could a process of natural selection, working either with small variations or with large mutations in germ-plasm, have operated so to raise the whole racial level of ability; these processes would have to operate for a very long time to effect a change of this magnitude, and biologically the interval in question has been but brief. In any case it may be doubted whether within these historical times the environment, geographical and social, has favoured the multiplication of the more intelligent to the necessary degree; there is evidence that, at the present time at least, the tendency is the other way.*

We are therefore driven to the conclusion that an advance of this kind is not to be explained by biological principles. Where then are we to look for an explanation? Psychology and anthropology both feel that they can go some way towards providing a solution; and with due allowance for difference in point of view their solutions are the same. They claim that, supposing the innate equipment of the Teutonic tribes not to have changed, the change in their cultures can still be accounted for in terms of the psychology of learning or in terms of the known principles of the development of cultures. We may here take the anthropological point of view, as affording the clearer explanation at present, and glance at a few of the factors, other than differences in ability, which make for differences in cultural progress.

Human progress is due to inventions, in the widest sense of that word. Now even if human intelligence and inventiveness were everywhere of one uniform level, yet there exist factors which would make for unevenness in the quantity and

* For example, a negative correlation between intelligence and size of family is reported by H. E. G. Sutherland and G. H. Thomson, "The Correlation between Intelligence and Size of Family," British Journal of Psychology, 1926-27, 17, 81-92.
quality of inventions. One of these factors is accident. They are significant myths in the history of scientific progress that ascribe the discoveries made by Newton and by James Watt to the accidents of a falling apple and a spluttering kettle. Many important scientific discoveries have in sober fact been due to some agency beyond the control of the scientist, such as the mere carelessness of a laboratory underling. In like manner geographical discoveries that were destined to lead to the most radical cultural changes have in some cases been made by mariners who were seeking something else, or who had merely been blown out of their courses by winds they were powerless to cope with. In lesser degree this factor of accident must be at work all the time. It is entirely conceivable that lucky accidents may have befallen some groups more than others, with consequent differences in progress.

A second condition of cultural progress is the geographical environment. On the one hand, it is possible that environments differ in the incentive they offer to the exertion of inventiveness. One and the same inventive ability may be called less into play by an environment well adapted to the needs of human life than by a less kindly habitat. Necessity is the mother of invention, and it needed the necessity of the desert island to make an inventor of Robinson Crusoe. On the other hand, it is certain that environments differ in the resources they offer to human inventiveness. This is probably the chief means by which the environment conditions cultural progress—it sets the limits to what inventiveness can accomplish. One cannot make bricks without straw; and it is possible that the lack of coal deposits in the environment of a group imposes a serious limit on what that group can accomplish.

A yet more important variable in the culture-making of groups is their ethnological environment. Accretions to the culture of a group are not necessarily the inventions of that group itself. With few or no exceptions groups have borrowed and assimilated the culture traits of other groups with which they were in any way, direct or indirect, in communication. The diffusion of traits from the centres where they originate is a most pervasive phenomenon. One school of anthropologists, indeed, denies that any culture trait is ever invented more than once, and asserts that the appearance of a trait in the culture of any group other than that which originated it must infallibly be due to diffusion. The use of this principle of explanation alone seems to require a distortion of the facts to fit it, and to be a gratuitous rejection of other explanatory principles. But there
can be no doubt that it is a most potent instrument of explanation to anthropologists, and that the most advanced cultures have been foremost in borrowing the traits of their neighbours. Now some cultures, more than others, have undoubtedly had the advantage of fertile ideas which they did not themselves originate. The successive conquests of England, quite apart from the new blood they brought, must have carried with them very valuable contributions to the culture of the island. Western Europe learned a good deal of its mathematics, its astronomy and its medicine in the school of the Crusades. Africa on the other hand has always been the Dark Continent. Its unindented coast-line, its steep plateau, its un navigable rivers, its climate, its fauna, its diseases, all have been barriers to the penetration of cultural traits which have been of such inestimable value to more favourably placed races.

Another factor which conditions cultural progress is the mere size of the group. This factor operates in two ways. In the first place, the larger the number of individuals in a group, the greater is the chance of its producing a genius; for we may regard a genius as an individual possessing a peculiarly happy combination of characteristics. And it is important to note that it is the actual number of geniuses in a group that counts, not the proportion they bear to the group as a whole. Once a genius makes an invention, it is as easy for a million people to use it as for a thousand; it took an Edison to invent electric light, but whole continents of people can turn a switch. But there is a second way in which the size of a group conditions its cultural progress. On the number of people who act together depends the degree of division of labour which is possible. Without division of labour, specialization is impossible; and inventions are mainly the work of specialists, who have the leisure and the knowledge to allow them to make original contributions.

But perhaps the most important of all the non-biological factors which condition the rate of growth of a culture, is the size of the existing culture base. The culture base is the sum-total of all the culture traits. The more traits there are, the greater are the chances of new combinations of traits, that is, of inventions. In the infancy of a culture, when the number of existing traits is comparatively small, the origination of a new trait must be very gradual, and must call for the exercise of great inventiveness in proportion to its apparent difficulty. The invention of the wheel from the data of pre-wheel days, for example, must have been a prodigious achievement (or possibly
a lucky accident), though since its invention it has required comparatively little ingenuity to fit it to carts and chariots, to locomotives and motor-cars. Nowadays inventors have at their disposal tremendous resources of past achievement in every field of human activity; it is therefore not surprising that inventions accrue at an ever-increasing rate. It seems, indeed, that the more inventions are made, the more inevitable do fresh inventions become. So used are we now to inventions, that we often say of some invention vaguely foreseen but not yet realized, as we said of television, that it is "bound to come." An individual may come into the world no better equipped for life than his ancestors, but it is not so with cultures. What is gained at one stage of a culture may be passed on to the next; the inheritance of acquired characteristics, though it does not hold for individuals, does hold for cultures, and is indeed a main condition of their growth. Every new acquisition increases the chances of still further achievements. The growth of cultures has a dynamics of its own. If by reason of any of the factors we have discussed—accident, the geographical or ethnological environment, or the size of the group—the culture of a race gains a lead, its lead is only likely to be increased with the course of time.

We may conclude that were the abilities of all races biologically the same, their cultural achievements might still differ immensely. Therefore from a comparison of their cultural achievements no final conclusion as to their abilities can be drawn. An advanced or a primitive stage of culture may at most be regarded as an indication of a superior or an inferior level of racial ability; it cannot be considered a proof of it.

B. COMPARISONS OF PERFORMANCE IN PSYCHOLOGICAL TESTS.

The general attitude of psychologists to the comparison of the mental processes of races is well expressed in the following quotation (2). The statement was made twenty-two years ago, but it is substantially true to-day.

"One thing the psychologist can assert with no fear of error. Starting from the various mental processes which are recognized in his text-books, he can assert that each of these processes is within the capabilities of every group of mankind. All have the same senses, the same instincts and emotions. All discriminate, compare, reason and invent. In all, one impulse can inhibit another, and a distant end can be pursued to the neglect of present incitations. State-
ments to the contrary, denying to the savage powers of reasoning, or abstraction, or inhibition, or foresight, can be dismissed at once. If the savage differs in these respects from the civilized man, the difference is one of degree, and consistent with considerable overlapping of savage and civilized individuals. The difference of degree calls for quantitative tests."

From this point of view, comparisons have been made of the abilities of racial groups on the basis of their behaviour in psychological tests. A few words may be in place as to the nature of such tests. The ability of a person is shown by what he can do when confronted with a problem. The individuals who make up a tribal group face a series of problems in their daily life, and their success in solving them constitutes the cultural achievement of the group. The abilities of such groups have therefore been compared, though, as we have seen, inconclusively, by their cultural achievements. The comparison of cultures is however necessarily a qualitative comparison, and as such is not wholly satisfactory to science, which prefers where possible to work with quantitative concepts. A psychological test, then, is an instrument for making quantitative comparisons between the abilities of individuals or groups. It is merely another problem which the individual must face. It is, however, a problem in which, ideally, all the conditions are definitely controlled, and which calls into play in a measurable manner the ability being studied. As a scientific instrument, it has proved of great service in many branches of psychology, pure and applied; and, as was to be expected, it has been used in the study of the problem before us. There is, in fact, an extensive and varied literature on the comparison of racial abilities by means of psychological tests. In the five years from 1925 to 1929, for example, some twenty-three experimental studies of this problem were published(3). These reported the testing of some thirty-seven thousand individuals, belonging to a variety of racial and national groups, with a wide range of tests. The group most studied has been the American negro, owing to the interest of the investigators; but many other groups have also been studied, including American Indians, Mexicans, Chinese, Hawaiians, Filipinos, Jews and representatives of most of the European nations. The ability most studied has been general intelligence, partly because it has proved most amenable to measurement, partly because it has been demonstrated to be the most important of the abilities of man, being a factor in every problem which he is called upon to solve. As the data on the
performance of the American negro in intelligence tests are the most extensive and the most germane to our interests, to them I shall here confine the discussion, first presenting the results obtained, and reserving till later a consideration of the general question of the applicability of the test instrument to the problem.

Assuming for the moment, then, that the tests used were valid measures of negro intelligence, we may first compare the average intelligence of the American negroes tested with the average intelligence of American whites. Almost without exception, the average intelligence of the negro groups has been found to be definitely lower than that of the white groups. The relation between the two averages could be expressed in a number of ways, of which the following is perhaps as clear and as representative of the findings as any. The intelligence of the average American negro child develops at only about eighty per cent. of the rate at which the intelligence of the average American white child develops. Therefore at the age of fifteen, when the intelligence of the average person of whatever race may be considered to have reached maturity, the average American negro's intelligence will have reached a level of development no higher than that of an average white child of about twelve years old.* This grade of intelligence could certainly not be called feeble-mindedness, but might be described as dullness. Terman, one of the chief authorities on intelligence, describes children of this level of ability as

"those children who would not, according to any of the commonly accepted social standards, be considered feeble-minded, but who are nevertheless far enough below the actual average of intelligence among races of western European descent that they cannot make ordinary school progress or master other intellectual difficulties which average children are equal to."(4)

In this class the intelligence tests would place the average American negro.

But in comparing two groups in respect of intelligence, it is not sufficient to compare only their averages. The individuals who make up the group of American whites, for example, are not all equal in intelligence. They vary about the

* In psychological terminology, the average intelligence quotient (IQ) of the white American is 100, that of the American negro is about 80; the average mental age of white American adults is in the neighbourhood of 15 years, that of American negro adults is about 12 years.
average, and, it is found, they vary in a definite manner. They are distributed, in fact, according to what is known as the "normal probability curve," or simply the "normal curve." This curve, which is illustrated in Figure 1, is well known in many sciences, fitting equally well such varied measurements as the statures of men, Mendelian cross-fertilization ratios, and intelligence quotients. It is a symmetrical, bell-shaped curve. It will be seen from Figure 1 that most people are about average in intelligence, and that the higher or lower we go above or below the average the smaller does the number of persons become, until we reach the comparatively few geniuses and feeble-minded respectively. The normal curve has been found to express the distribution of intelligence in American whites, in American negroes, and in all other racial groups which have been adequately tested. There is every reason to believe that it holds likewise of the distribution of intelligence in African tribes. It is therefore ridiculous to speak of the intelligence of the African natives as if it were throughout of one dead level. The African tribes have doubtless their highly intelligent and their feeble-minded members like other peoples.

To obtain a true picture of the relation between the intelligence of American negroes and that of American whites, then, we must compare not only averages but whole distributions. This comparison may be made by superimposing the curve for the negroes on the curve for the whites. Figure 2 shows the kind of results actually obtained. It will be seen that the negro average is lower than the white average, and that the whole scale of negro intelligence is lower than that of white intelligence. But it is important to notice the two distributions. Some American whites fall below the average American negro in intelligence; these are the dull, the border-line cases, and the definitely feeble-minded. Some negroes rise above the average.

FIG. 1.
The normal distribution of intelligence in a race.
white in intelligence. As a matter of fact, it has been found that approximately twenty per cent. of American negroes equal or exceed the average of American whites in intelligence. The ablest negroes—the authors, the artists, the actors, the business men and the like—are doubtless drawn from this section of the distribution. The most eminent negroes of all—those at the upper extreme of the distribution—are probably the intellectual equals of quite eminent whites.

The American negro is derived mainly from Bantu stock. We should therefore expect the facts concerning the intelligence of Bantus to be of approximately the same order as those we have seen to hold of American negroes. And the little we know of these facts seems to confirm our expectations. We know that in native mental hospitals and reformatories there are many natives who by all reasonable standards would be diagnosed as feeble-minded. As will be shown later, the present writer has applied intelligence tests to natives in the middle and upper ranges of ability, and has found that they appear to be less intelligent on the average than Europeans, and that they vary considerably about their own average. For the topmost section of native African intelligence, we have the evidence of the careers of such eminent Africans as Dr. Aggrey, men who, from their achievements, must have been much above the average European in ability.

We may thus summarize the results of the comparison, by means of intelligence tests, of the ability of American negroes with the ability of American whites—and we have reason to believe that similar results would probably be found for Bantus and Europeans. If we assume that the tests used were valid measures of the intelligence of whites and of negroes, then the
average intelligence of the negroes is less than the average intelligence of the whites; but the difference between these two averages is much less than the difference between the most able and the least able of either group. The difference between the average negro intelligence and the average white intelligence is in fact approximately one-eighth* of the entire range of white ability. There is thus an extensive overlapping in the intelligence of the two groups.

It is interesting to note the close similarity between these results, actually obtained with the intelligence tests at present in use, and Julian Huxley's forecast of the results that would be obtained by perfect measures of intelligence. Huxley writes:

"I am prepared to believe that if we ever do devise a really satisfactory method of measuring inborn mental attributes, we shall find the races of Africa slightly below the races of Europe in pure intelligence and probably certain other important qualities.

"But—and the but is a big one—I am perfectly certain that if this proves to be so, the difference between the racial averages will be small; and that they will be only an affair of averages, and that the great majority of the two populations will overlap as regards their innate intellectual capacities."

Up to this point we have assumed that the intelligence test results provide an accurate picture of the real state of affairs. This is true, however, only with certain qualifications; and in interpreting the results it is necessary to have these qualifications clearly in mind. An intelligence test is an instrument designed to measure innate educable capacity. It is of course impossible to measure this inborn learning ability directly, detached from what has actually been learned; nature and nurture are inextricably mixed up in a man. Yet it is possible indirectly to measure innate intelligence, sufficiently well, at least, for such purposes as the classification, guidance, and selection of children and adults. This can be done by means of a test in which the factor of nurture is held constant for all individuals tested. Among individuals who have been bought up in the same cultural environment, there is a considerable body of

* In statistical terms, the difference in PE units is usually found to approximate 1.25. This is one-eighth of the entire PE range, which is usually taken to be 10 PE. It is noteworthy that this difference agrees exactly with the estimate made by Galton in 1892 (Hereditary Genius), from a survey of the eminent men of the two races.
common experience; and it is comparatively easy to devise tests which, drawing only upon this highest common factor of their experience, measure only the residual factor, their varying degrees of intelligence. But for individuals from radically different cultural groups, the construction of such tests is a much more difficult matter. Between civilized and primitive groups especially, the highest common factor of experience may be too small to provide a neutral ground of comparison. Psychologists interested in this problem of the comparative abilities of races have made careful attempts to devise tests which, eschewing any condition likely to be more familiar to one racial group than to another, would be equally fair to every group. But to equalize for a civilized and a primitive group the cultural elements in a test is very difficult. There are many cultural factors which condition an individual’s performance in a test. The following are some of these.

Some intelligence tests make use of language, either spoken or written. Obviously, if the language used be native to one group of subjects and foreign to another, the latter group is handicapped. This source of error is obvious, and can be avoided without great trouble. But the use of language may involve a more subtle fallacy. Even if each of the groups tested is allowed to use its own vernacular, or some other language well known to it, it does not necessarily follow that neither group is handicapped. For language itself occupies a different place in the cultures of different groups, some peoples resorting to verbal expression more readily than others.

To avoid the errors involved in the use of language, tests may be employed which dispense with it, in part or altogether. For example, the subject may be required to react to such non-verbal stimuli as pictures, symbols, or blocks of wood. But these objects too are not equally familiar in different cultures. The seeing of pictures as standing for things is a habit which is learned, and one which most European children, for example, have more opportunity of learning than most African children. Similarly, the actual symbols used in tests may be as unfamiliar to European children as to African children, yet European children are probably more accustomed to the mere use of symbols as such. The case is the same with blocks; most European children are accustomed to playing with shaped pieces of wood more than most African children are. We have only to compare the European child’s equipment of toys, blocks and picture books with the scanty odds and ends an African child
plays with before he is sent out to herd goats, to see how much more familiar with such test material the European may be. Such material may be admirable for distinguishing among Africans themselves, but quite unsuitable for making comparisons between Africans and Europeans.

Further, the activity called for by a test may be no more complicated than making the simplest marks with a pencil on a piece of paper; yet the comparative strangeness of pencil and paper to many Africans may impose an unknown handicap on them. Again, account is sometimes taken of the speed with which the activity is performed; the subject may be given a task to perform, and the time he takes is measured, or he may be given a certain time, and the amount he can accomplish in that time is measured. But speed too is to some extent at least a cultural trait; each people has its characteristic tempo, at which it is accustomed to work.

Further, however interesting and even amusing the tests may be made, the test situation as such is as yet more familiar to most Europeans than to most Africans. The tester, too, is usually a European, and the whole institution of tests is a European one, so that an African being tested may perhaps be thrown into an inferiority attitude prejudicial to his performance more readily than a European would be. And in addition to all these conditions which may adversely affect the performance of primitive groups in tests, there may be others which we have not yet begun to imagine.

It is therefore probably safe to say that no test has yet been devised which draws equally upon the experience of advanced and primitive groups, and which is therefore a completely true measure of the intelligence of such groups. Applied to groups differing widely in culture, the tests are measures of intelligence plus a cultural factor of unknown amount. On the extent to which this cultural factor is equalized or allowed for in the groups compared will depend the degree of significance to be attached to the comparison of them.

Another difficulty in the way of the use of psychological tests, and indeed of any other measures, is the difficulty of adequate sampling. It is impossible to test an entire racial or tribal group; only a sample of the group can be tested. Before conclusions can be drawn concerning the intelligence of the group as a whole, it must be shown that the sample tested is truly representative of the whole group. Obviously, the distribu-
tion of intelligence in a race as a whole cannot be determined merely from measurements of that race's representatives in a mental hospital at one extreme or in a high school at the other. Such samples of one race can however be compared with approximately equivalent samples of the other race, hospital patients, for example, with hospital patients, and high school pupils with high school pupils. The comparison will be significant in proportion as the groups compared are selected from similar strata of their respective populations.

The significance of a comparison of the abilities of races by means of tests is therefore proportional to the degree to which it satisfies two conditions; first, that the tests used are equally fair to the several races, and secondly, that the samples of the races tested are truly comparable.

With this evaluation of mental test data in mind we may venture to examine some preliminary data of this kind on natives and Europeans in East Africa. Nowhere perhaps is this problem of racial differences more hotly canvassed. The native and the European populations are freely compared with one another, and conclusions of considerable practical importance reached. For want of better evidence, the conclusions have too often been arrived at on the ground of mere opinion. Any evidence of an objective and measurable kind must therefore be not without value. A comparison of an African group with a European group by means of a standardized intelligence test is accordingly presented. Provided we keep the conditions of a valid comparison clearly before us, the results should give us a first approximation to the truth. How close the approximation will be, will of course depend on the extent to which the necessary conditions of comparison have been fulfilled.

The two groups of subjects were the pupils of the Prince of Wales School, Kabete, and the pupils of the Alliance High School, Kikuyu.

The Prince of Wales School is a secondary school for European boys. The number of pupils tested was 124, the number attending the school on the day of the test. The great majority of the pupils are of British stock, some of them are of South African Dutch descent, a few of foreign European descent. Fifty per cent. of those tested were born in East Africa, the great majority of the other half in the British Isles or South Africa. The European population of Kenya is of a higher social and economic status than the average in most countries; the
pupils of the school are, generally speaking, of the middle classes—the sons of civil servants, professional and business people, farmers, and the like. Their average age was 14.95 or 14 years 11 months.*

The Alliance High School is a secondary school for selected African Protestant boys. The number of pupils tested was 93, the number attending the school on the days of the test. Ninety-two per cent. of the pupils belonged to Bantu tribes, eight per cent. to Nilotic tribes. Eighty per cent. of the total were of the Kikuyu tribe. The social and economic status of the group is of course beyond all comparison lower than that of the European group; but it is somewhat above the average for Kenya Africans as a whole, since many of the pupils receive assistance from their families in paying their school fees and in supporting themselves at school for two or three years. Only fifteen of the pupils' ages were known with any accuracy; the ages of the others have however been estimated by the principal from height and weight data. The average of the ages, known or estimated, was 19.42 years or 19 years 5 months.† If 15 years be taken as the limit of growth in intelligence, 99 per cent. of the pupils were adults in intelligence, whereas only 43.5 per cent. of the European pupils were, the remainder being mostly 12 to 14 years old.

The measuring instrument applied to both groups was the "General Intelligence Test for Africans." This is a standardized group test of intelligence, prepared by the present writer. All of its component tests are non-verbal, consisting of problems dealing with pictures, numbers, letters and other symbols. The pupils are not required to write words, but only to make crosses, letters, numbers or other signs on the paper. In one of the tests, for example, the problem is to make a cross through any part of a given picture which is absurd. The "General Intelligence Test for Africans" has been standardized by the usual techniques. The two groups were tested under conditions as nearly identical as possible. The examiner, the instructions, the time allowances and the methods of scoring were the same in each case. In both cases the instructions were given in English, the language used in both schools.

Before we turn to the results of the comparison, let us be clear to what extent the conditions of a valid comparison have been met. The racial and national origins of the one group are predominantly British, of the other group are predominantly Bantu. In social and economic status, the Europeans are far

* Standard deviation = 1.54 years or 1 year 6 months.
† Standard deviation = 2.28 years or 2 years 3 months.
above the Africans, though both Europeans and Africans are probably above the average of their respective peoples in social and economic status, how much it is impossible to say. The African group has an advantage over the European in that a larger proportion of the Africans had reached the probable age of maturity of intelligence. The length of time each group has attended school is probably about equal; for though the Africans are older, they have probably not gone to school until they were older, nor attended as regularly as the Europeans. The quality of the schooling has doubtless been superior in the case of the Europeans. The amount and quality of schooling are probably, however, factors of minor importance, since comparatively little school learning is required in the intelligence test, and both groups have had ample opportunity to acquire that little. The test was designed for Africans, but the pictures in it represent objects probably equally well known to Europeans after a few days in the country. The Europeans undoubtedly had an advantage in that the instructions were given them in their native language, whereas the Africans were told what to do in a language learned more or less imperfectly at school; and this although the verbal instructions were frequently repeated and were accompanied by demonstration and practice in both groups.

To sum up, the samples of the races tested were far from being identical apart from race, yet were probably as nearly comparable as could at present be obtained; while the tests used were probably fairer to both groups than any others available.

The highest possible score in the test is 884 points. The average (mean) European score was 812.84, the average African score was 266.40. The average African score is thus 85.3 per cent. of the average European score.

It will be remembered that groups must be compared not only with respect to averages but also with respect to whole distributions. The distribution of scores for the two groups is accordingly shown in Figure 3.

It will be seen that the two distributions overlap considerably. The European median score, or score above and below which lie fifty per cent. of the scores, was found to be 315.45. At or above this score lie 14.08 per cent. of the African scores. The African median or midmost score is 266.43. Below this score lie 9.85 per cent. of the European scores.

The two main facts emerging from this comparison are (1) that the average African score in the intelligence test is about 85 per cent. of the average European score, and (2) that about 14 per cent. of the Africans reach or exceed the median European score.
It is interesting to put these facts concerning a group predominantly British and a group predominantly Bantu alongside the facts concerning white Americans and American negroes, who are largely of western European and West African Bantu stocks respectively. We have seen (1) that the average American negro score in intelligence tests is about 80 per cent. of the average white American score, and (2) that about 20 per cent. of the American negroes reach or exceed the median white American score.

(To be continued.)
C. Comparisons of Head and Brain Measurements.

(a) Anatomical.

A third basis for the comparison of the abilities of races has been sought in certain measurements of the head and the brain. The use of this basis of comparison depends on the hypothesis that there is a substantial correlation between these measurements and mental ability. Therefore before these measurements can be admitted as evidence, it is necessary to examine the validity of this hypothesis.

The measurements chiefly used have been head size, cranial capacity, brain volume and brain weight. These measurements are closely related to one another. Brain volume, for example, can be estimated by a formula from head length, breadth and height, though the estimate is in error by five to six per cent. as compared with brain volume measured by displacement of water. For our purpose, we may consider the various measurements equivalent.

The belief in a close relationship between the size of the head, skull or brain, and intelligence had several origins. One of these was phrenology. The phrenologists were unduly influenced by one type of feeble-mindedness, microcephalic idiocy, which is characterized by extremely small head size. Ignoring other types of feeble-mindedness, which are associated with normal or supernormal head size, Gall, the founder of phrenology, made the generalization that "There is undoubtedly a very close connection between the absolute size of the brain and the intellectual powers and functions of the mind. This is evident from the remarkable smallness of the brain in congenital idiocism, few much exceeding in weight that of a new-born child." And again he writes: "The heads of idiots unless otherwise diseased, are characterized by deformity or smallness; the heads of eminent men, by their magnitude."(*)

Another ground for this belief has been found in comparative studies of skull capacity in the apes, and in prehistoric and contemporary man. These have revealed that there does exist, from a phylogenetic point of view, a relationship, though an unmeasurable one, between skull capacity and the stage of cultural evolution.

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Finally, numerous studies have been made in which measurements of head size were correlated with a variety of indices of mental ability, such as progress in school or university, teachers' estimates, and intelligence quotients derived from standardized tests. These studies have been competently reviewed by a recent writer (7), so that it is necessary only to indicate briefly their trend.*

Investigations made in the latter part of the nineteenth century and the early years of the twentieth century are found on examination to be fairly consistent in disclosing a positive but slight correlation between cranial measurements and intelligence. Owing to the use of inadequate statistical procedures, however, the investigators tended greatly to exaggerate the amount of correlation they had actually found, and the belief in an intimate relationship remained widespread. Then in 1906 Karl Pearson, the leader of the British biometric school, undertook his classic investigation in the hope of clearing up the question once and for all. Pearson's subjects were 4,500 boys and girls, all of them twelve years old, and 1,010 Cambridge University students. The subjects were sorted into groups on the basis of teachers' estimates and scholastic records, and three cranial measurements were made on each subject. Pearson's correlational analysis was of course entirely competent. The highest coefficient of correlation he found was only +0.14. This study, though not conclusive, goes a considerable way towards proving that the relationship between head size and mental ability is but slight. Pearson himself remarks, "Though I am hardly hopeful, it may help to convince the anatomist and the old school anthropologist that head measurements are not of real service as intelligence tests."(8)

Pearson's work does however seem to have been convincing, for a time at least. After its publication, the claims made

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* Parenthetically, it may be mentioned that these measurements of head size are by no means always in favour of the white as against the coloured races. Thus Paterson (op. cit., pp. 188-189) cites MacDonald's study of school children in Washington, D.C., including 16,473 white children and 5,475 coloured children, at ages 5 to 17. The data were head circumference and teachers' estimates. "At seven ages the coloured boys have greater head size measurements, at one age the two sets of measurements are equal, and at three ages head dimensions of the white boys are larger. At every age the head size of the coloured girls is greater than that of the white girls. The largest difference is over half an inch (.56 in.). If one argues that head size varies directly with intelligence, it should follow that coloured girls are the mental superiors of white girls and that coloured boys at most ages are superior in intelligence to white boys".

† A coefficient of correlation of +1 indicates a perfect relationship. A coefficient of 0 indicates an entire absence of relationship.

‡ Eta coefficient, intelligence and head length, 2,298 boys. Probable error = ± 0.01.
on behalf of cranial measurements as indicators of mental ability were fewer and more modest until Porteus, in collaboration with Berry, revived them in a series of publications beginning in 1918. Porteus advocates the use of cranial measurements as part of a scheme for the diagnosis of mental deficiency. He claims, with some experimental support, that many cases of mental deficiency will be found among individuals whose cranial capacity falls within the lowest ten per cent. of the range or within the highest ten per cent. He apparently has in mind cases of microcephaly and of hydrocephaly respectively, and this claim is not to be disputed. But this is far from establishing the relationship throughout all levels of mental deficiency and over the whole range of normality. His failure to present detailed correlational evidence of this kind leaves the broader hypothesis unproven.

Not only does Porteus fail to establish a general relationship between cranial capacity and intelligence, but his assumption of such relationship would seem to involve him in some quite untenable conclusions. Paterson's criticism on this point is so trenchant that it deserves to be quoted almost in full, as showing that the validity of the fundamental hypothesis is at least doubtful.

"It is in line with our interests to comment briefly on the possible significance of the sex difference in cranial capacity shown in the detailed tables. If we permit ourselves to indulge in the sort of logic typical of the Porteus studies we arrive at the inference that the average girl of eighteen (cranial capacity = 1300 cu. cm.) is retarded eight years in brain size, since the average cranial capacity for boys at age ten is 1304 cu. cm. If in turn this amount of cranial retardation is accepted as having genuine intellectual significance then the average eighteen-year-old girl is mentally equivalent to a ten-year-old boy. The fallacy in such reasoning is evident, but only because the example is a caricature. Here, in the Porteus data, we are actually confronted with the same contradiction with reference to comparative brain size and intelligence of the two sexes as that which faced us in MacDonald's data on comparative head size and intelligence in the white and coloured races. By what rule of logic can it be insisted that variation in head size is accompanied by variation in intelligence among the boys of the white race, but deny that variation in head size would be accompanied by similar variation in intelligence when we compare boys and girls within the white race or when we compare individuals of the same sex in two different races?"
Porteus and his followers must be required either to straighten out this logical difficulty or to provide a quality and quantity of empirical evidence hitherto lacking before their assertions can be admitted to the body of attested scientific generalizations.

"In 1926, Porteus, this time in collaboration with Marjorie Babcock, published a book entitled 'Temperament and Race' in which considerable space is devoted to racial and sex differences in cranial capacity. We might well have expected to find here the answer to the query raised in the preceding paragraph. With reference to sex differences in cranial capacity we note that boys have a greater capacity by some 50 to 60 cu. cm. throughout the age range 6 to 14. Thereafter the curves diverge, revealing an ever widening gap between male and female head size due to the apparent continued growth of the male head coupled with a marked slowing down in rate of female head growth. Indeed, this earlier maturity of the female head size results in an arrest of head size at about the level Porteus had established for Australian aborigines and definitely below that reached by adult male mental defectives. This sex difference cannot be explained away on the basis of differences in bodily size, since it is equally pronounced at age 12 when girls tend to exceed boys in height and weight.

"But what mental significance is to be attached to this difference in view of the accumulated mass of evidence pointing to a practical equality of the sexes in measured intellectual ability? Porteus mentions this evidence and freely accepts it as well established. His escape from inconsistency is attempted by insisting that the differential head size is significant not with reference to abstract intellect (he uses the term 'learning capacity') but rather with reference to 'the maturing of other powers.' These 'other powers' cover a wide range of non-intellectual personality traits... In the end, then, Porteus deserts his previous position regarding the intellectual significance of brain size and embraces a substitute theory which stresses brain size in relation to personality traits. In the absence of proof regarding the latter relationship within each sex, we can only suspend judgment on this new position. In the meantime, we cannot but doubt the validity of his earlier assertions regarding head size and intellect, since he himself so readily abandons that position when confronted with the fact of sex equality in intellect along with an impressive sex inequality in cranial capacity."(9).
Since Porteus revived the claims of cranial measurements as indirect measures of intelligence, several other studies have been made. They are almost unanimous in revealing only a slight positive correlation. One of them may be briefly described in conclusion, as it is one of the best studies of the problem yet made. This is the work of Murdock and Sullivan in Honolulu. Their subjects were some 600 pupils of old American, British, German and Scandinavian descent, constituting a fairly homogeneous race group. The mental measurements were made by means of some of the best intelligence tests, administered by Murdock as school psychologist. The physical measurements were made by Sullivan, an anthropologist representing the American Museum of Natural History. An excellent statistical procedure was followed, and the correlation between head diameter and intelligence quotient was found to be +0.22.*

From this and other investigations we may conclude with fair assurance that there does exist some relationship between the dimensions of the head or brain and intelligence, but that the degree of this relationship is slight. Therefore a demonstrated superiority or inferiority of an individual or a group in these dimensions goes some way towards proving an intellectual superiority or inferiority, but it does not go very far.

With this brief review of the evidence regarding the significance of cranial and brain measurements before us, we are in a position to evaluate the important recent work of Dr. F. W. Vint on the brain weight of natives of East Africa(10). Dr. Vint is to be congratulated on his effort to contribute some definite objective evidence on a question where hitherto it has been almost entirely lacking.

Vint examined post-mortem in the native hospitals of Nairobi the brains of 351 male natives of East Africa, of various tribes, all believed to be eighteen years or more of age. He found that the average weight of these brains was 45 ounces or 1276 grams. For purposes of comparison, he quotes the average brain weight of adult male Europeans as being 1453 grams (according to Shennan's figure) or 1428 grams (according to an average obtained by Shennan from the figures of others). The average brain weight of the Africans was therefore 87.8 per cent. or 89.4 per cent. of the average brain weight of the Europeans (according to which figure we take for the European average).

Vint himself avoids any inference from brain weight to educable capacity. In the light of the evidence previously quoted

* Probable error = ± 0.03.
regarding the significance of brain weight, however, his findings may be interpreted as definite, but not strong, evidence of the inferiority of East African natives to Europeans in intellectual capacity.

Vint's services to the problem of the comparative cerebral development of East African natives do not, however, stop here. He has contributed a different and probably a more valuable line of evidence, which we may now briefly consider.

(b) Histological.

The use of brain measurements as a basis for the comparison of racial abilities has recently been extended in an interesting and promising direction. Dr. F. W. Vint, in the study previously referred to, submitted the brains of natives of East Africa to histological examination, and arrived at certain conclusions regarding "the stage of cerebral development reached by the average native."(11) Although Vint himself refrains from drawing any inference from cerebral development to mental development, he clearly, and I think rightly, regards his findings as having some bearing on the comparative mental development of East Africans. What this bearing is, he does not venture to say; yet if we are to regard his work as providing evidence as to mental development, and not merely as a study in cerebral histology, we must try to arrive at some conclusion, however tentative, as to the significance of cerebral development in relation to mental development. The present writer disclaims competence to reach a definite conclusion on this question; yet since the question is in part a psychological one he ventures to suggest some considerations from a psychological point of view.

Psychologists of course believe that intelligence is a function of the brain. What the precise relationship is, neither they nor the brain physiologists know. As Vint says,(12) "The functions of the human brain as Herrick remarks, 'are still largely wrapped in mystery.' Research has lifted the veil but there still remains a vast amount of work to be done before one can have a full conception of the functions of this master-organ of the human body." As a result of research, including, as Vint points out, "extensive research on animals," the sensory functions, such as seeing and hearing, and the motor functions, such as the initiation of movements of the arm, the leg or the muscles used in speech, have been definitely localized in the brain. The "higher" mental functions, however, of which intelligence is one, have not been definitely localized. Now, in the words of Vint,(13) "the areas of the brain which do possess a known
physical function gradually shade off into the surrounding brain tissue." These surrounding areas of unknown function have, for want of a better name, been termed the "association areas," and one of the functions which has been hypothetically assigned to them is the control of intelligent behaviour. Could it be shown that these "association areas" were indeed the structure underlying intelligent behaviour, histological examination of their development in an individual might throw a valuable light on the mental development of that individual. Let us glance briefly at a few of the lines of evidence relating to this hypothesis. The line of evidence on which Vint most relies is Bolton's study of the cerebral cortex in growth and in disease. I shall try to supplement this evidence by citing data from the physiology and psychology of learning.

Vint gives the following account of Bolton's work:

"Bolton has shown that there is a normal measurement for each layer of the cerebral cortex, which varies little in different normal individuals and that from a developmental point of view the laminae are evolved from within outward, i.e. layer 5 is developed before layer 4, etc. Turning his attention to mental diseases he proves that the different cortical laminae show decreases in size in proportion to the degree of amentia or dementia present and that the layer most affected is the one developed last, the pyramidal cell layer. The inner or polymorphic cell layer is involved appreciably only in complete idiocy."(14)

In other words, Bolton has proved that in cases of mental disease (amentia and dementia) the cerebral cortex, and especially the pyramidal cell layer of it, is thinner than in cases where mental disease is absent; and that the decrease in thickness is proportional to the degree of mental disease. He has thus proved that at the lower end of the intellectual scale, the thickness of the cortex, and especially of layer 2 of it, is proportional to degree of mental ability. His work on this point appears to be entirely conclusive; though it has to be remembered that it does not necessarily prove a close relation between the thickness of the cortical layers (which according to Vint "varies little in different normal individuals") and mental ability in non-diseased cases (which ranges all the way from bare normality up to genius).

Further evidence regarding the way the cerebral cortex functions in the control of behaviour has been contributed by the combined physiological and psychological study of learning. The
early work of Franz in this field has been followed up by the important recent work of Lashley. Lashley’s subjects were laboratory animals. One of his methods was to extirpate from the cerebral cortex that amount and that area which he wished to study, and then to measure the effect of the cerebral destruction on the learning capacity of the animals in a test situation. He found that, apart from the sensory and motor areas, it did not seem to matter which area of the cortex he removed; the animals learned as well with one part as with another. The amount of cortical tissue removed, however, did matter: in fact, the interference with the animals’ learning ability was closely proportional to the amount of tissue removed.* The results of Lashley’s fine series of experiments are summarized under two principles, which may be stated as follows:—

(1) The principle of equipotentiality. Any part of the cerebral cortex, apart from the sensory and motor areas, is potentially the same as any other in its ability to take part in any sort of learned performance.

(2) The principle of mass action. The cerebral cortex acts as a whole, so that the more cortex there is available, the more effectively it operates and the more quickly the animal learns.

These results of Lashley’s combined physiological and psychological work are rendered all the more impressive by their agreement with the results of the purely psychological work of the “Gestalt” school in Germany and Spearman’s school in London, themselves entirely independent schools. The “Gestalt” psychologists,(15) from their study of perception and learning in the higher primates, in children and in adults, are led to postulate just some such system of brain dynamics as Lashley’s work actually points to. Spearman,(16) in his studies of the abilities of man, submits mental test performances to a mathematical analysis, and finds a factor “g” functioning in all of them. Spearman’s “g” seems to be the same thing as general intelligence; he regards it as all of a person’s mental or cortical energy. Lashley’s finding that the cortex acts as a whole, so that learning capacity is proportional to amount of cortical tissue, “seems to accord,” as he himself says,(17) “with Spearman’s view that intelligence is a function of some undifferentiated nervous

* In one group of rats, lesions ranged from 1.5 to 31.9 per cent. of the neopallium. The correlation between extent of lesions and relearning a visual discrimination problem was 0.71. K. S. Lashley, “Studies of Cerebral Function in Learning, VII.” “The Relation between Cerebral Mass, Learning and Retention.” J. Compar. Neurol, 1926, 41, 1-48.
energy." The more cortical tissue a person has, the greater is his cortical or mental energy or his general intelligence.

Thus, alike from Bolton's work on the cerebral cortex in relation to mental deficiency and mental disease, and from Lashley's work on the cerebral cortex in relation to learning ability, we can be sure that there is a functional relationship between cerebral development and mental capacity. Of the nature of that relationship we can be less sure, but there is fair evidence for supposing that an individual's educable capacity is fairly closely proportional to the amount of cortical tissue in his "association areas." If this tentative conclusion be warranted, Vint's measurements of the cerebral cortex of natives of East Africa immediately become data on the educable capacity of those natives. Vint's subjects were thirty-five male natives of East Africa, of various tribes, all being general hospital patients. All were believed to be adults. Their brains were "apparently normal." This small group can be taken as a representative sample of East African natives in general only for a preliminary comparison, as Vint points out.

Vint measured the thickness of the cerebral cortex and of each of its component laminae. Bolton has shown that the total thickness of the cerebral cortex is less significant than the thickness of the second lamina of it, the pyramidal cell layer. Vint accordingly places his chief emphasis on the thickness of this layer.

Vint measured the thickness of the pyramidal cell layer only in the prefrontal area of the cortex. If we are to use the support afforded by Lashley's work, we must assume the thickness of this layer in this area to be representative of its thickness or quantity throughout the association areas as a whole.

Vint found that the average thickness of the pyramidal cell layer of the prefrontal cortex in his East African native subjects was 84 per cent. of its average thickness in Europeans according to Bolton's norms. He also found that the thickness of this layer in the different individuals was so distributed that some 6 per cent. of the Africans exceeded the European average in this measurement. (18)

If we may argue from the thickness of the pyramidal cell layer of the prefrontal cortex to intelligence or educable capacity—and we have seen there is some experimental evidence though no proof that we may so argue—and if we may take Vint's subjects as representative of adult male natives of East Africa and as comparable with Bolton's European subjects, then we may interpret Vint's findings as follows: (1) That the average intelli-
gence or educable capacity of adult male natives of East Africa is about 84 per cent. of the average intelligence of adult male Europeans, and (2) that about 6 per cent. of the natives exceed the average European in intelligence.

These conclusions from the histological data should be compared with the conclusions drawn from the mental test data. The similarity of the histological and psychological conclusions is at once apparent. The agreement as to the average educable capacity of East African natives is striking, though its extreme closeness may be a coincidence. The agreement as to the percentage of natives reaching or exceeding the European average is less strikingly close. It is not impossible that Vint's small group of hospital subjects did not include any individuals from the upper ranges of ability. Or it is, of course, quite conceivable that the range of variation about the average is in actual fact less in African tribes than in European nations. The East African tribes are comparatively few in numbers, so that the chances of an extreme variation in any trait are lessened. In so far as the members of a tribe marry only within their own tribe, they may be regarded as to some extent inbreeding, and inbreeding tends to curtail the range of variation. It is conceivable that when inter-marriage between the tribes becomes more frequent, the range of variation about the average will be increased, and the chances of the production of highly intelligent or highly talented Africans heightened; for, as we have seen, a genius may be regarded as an individual endowed with a peculiarly happy conjunction of characteristics.

Summary and Conclusions.

The method followed in this paper has been to try to form some judgment as to the validity of each basis for the comparison of racial abilities, and in the light of that judgment to examine the relevant experimental evidence. The results may be summarized as follows:—

(1) Attempts have been made to compare the abilities of races by comparing their cultural achievements. Since differences in cultural achievement can be accounted for without recourse to the assumption of differences in ability, this basis of comparison was judged not to afford evidence of an unequivocal kind.

(2) The abilities of races have been measured and compared by means of mental tests. This basis of comparison is valid to the extent that the influence of the cultural environment
on the test results is equalized for the groups compared. In so far as this has been accomplished, the scanty evidence indicates that the average intelligence of Kenya natives is about 85 per cent. of the average intelligence of Kenya Europeans, and that some 14 per cent. of the natives equal or exceed the average European in intelligence.

(3) A third basis of comparison depends on the hypothesis that intelligence can be measured by measuring cranial capacity or brain weight. A survey of the experimental research relating to this hypothesis shows that it holds to only a slight extent. The available data, then, those of Vint, afford slight confirmatory evidence that natives of East Africa are inferior to Europeans in intelligence.

A more refined comparison of this type has been made, using as data the amount and quality of cortical tissue. The exact significance of such data is relation to educable capacity is not known, but there is evidence that it may be considerable. If it be so, Vint’s data on the cerebral development of natives of East Africa would seem to show that these natives have on the average about 84 per cent. of the educable capacity of the average European, and that about 6 per cent. of them exceed the average European in educable capacity.

From the evidence thus summarized, the following conclusions seem reasonable:

(1) That there are not sufficient data to establish definitely how the abilities of natives of East Africa compare with those of Europeans. As far as the data go, however, they seem to suggest

(2) That the average cerebral and mental development of natives of East Africa is in the neighbourhood of 85 per cent. of that of Europeans; and

(3) That a certain percentage of East African natives equal or excel the average European in cerebral and mental development.

A Note on the Future.

If these conclusions are warranted, they point to what requires to be done in the future. The first need is for further research. Just as we make a geological survey of a country, so we should make a survey of the hidden talents of its inhabitants. Such a survey would reveal facts of importance in the shaping of policy. The facts would be important, for example, in education—and every measure affecting native development is in a sense a measure in education. We might find, for example, a
small section of the native population fitted by its capacity to profit by an education of university difficulty, though not necessarily of traditional university type. A larger section might have the capacity to profit by a full secondary education; a section larger still might merit a simpler secondary course. The great mass of the population might be found to be fitted for education in the elementary schools, especially perhaps in what would correspond to the C sections of the standards in European schools. A considerable section of the population would probably be found to be too backward to profit much by education unless special schools were provided for them. A lesser but still not inconsiderable section would be found to be definitely feeble-minded, and for them too special measures would have to be taken. From idiot to genius, every individual could be helped by mental tests and otherwise to find the education for which he is best fitted.

These, however, are mere speculations. The immediate need is the need for further research.

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General Intelligence Test for Africans

MANUAL OF DIRECTIONS

Prepared under the auspices of the Carnegie Corporation of New York

By

R. A. C. OLIVER

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General Intelligence Test for Africans

MANUAL OF DIRECTIONS
PREFACE

The General Intelligence Test for Africans which is given in this Manual represents the result of investigations which Mr. Oliver has been conducting in Kenya under the auspices of the Carnegie Corporation during the last two years and a half, with the help of teachers in different schools, both mission and Government.

It is not necessary for me to emphasize the importance of the work done by Mr. Oliver. The day has long passed when it was necessary to plead for a recognition of that importance. But the application of general intelligence tests in East Africa is a novelty and has involved difficulties peculiar to this country. The standard of education in the ordinary acceptance of the term is extremely low. The country is inhabited by a large number of tribes, using different languages, and thinking in entirely different ways owing to the diversities of their environments. All these differences have rendered the work of Mr. Oliver more difficult than it would otherwise have been.

It is perhaps still too early to say how far Mr. Oliver has succeeded in producing a reliable standard general intelligence test, but that he has gone a great way towards success is indubitable.

He has certainly gone far enough to justify us in applying the test in connexion with the selection of boys for admission to secondary education at the end of this year, and this application will be of very great interest in enabling us to make a simultaneous use of the test over a much larger area than has been possible in the past.

We are indebted to the Carnegie Corporation for their generosity in enabling Mr. Oliver to do this most valuable piece of work in Kenya. It is to be hoped that the Corporation will not take it amiss if we indicate our appreciation by expressing the hope that they will give us more of Mr. Oliver's time in order that he may evolve a standard test applicable to a much lower standard of attainment, in order that we may assess the educable capacity of the Kenya African at a very early age.

H. S. SCOTT,
Director of Education, Kenya.

NAIROBI, KENYA COLONY.
29th August, 1932.
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I.—INTRODUCTION.

1.—THE NATURE OF A GENERAL INTELLIGENCE TEST.

The nature of a general intelligence test may perhaps be best understood by comparing it with the ordinary scholastic examinations with which educationists are familiar. An intelligence test and a school examination resemble one another in that both are measuring instruments. They differ from one another in two respects, namely, what they measure, and how well they measure it.

A scholastic examination, broadly speaking, measures a pupil's achievement in a school subject, such as arithmetic or hygiene or a foreign language. The pupil's achievement is the resultant of a number of factors, among which are his native intelligence, the length of time he has attended school, his health, his industry and the quality of teaching he has received. A school examination, however, rightly makes no attempt to distinguish among these various conditions of success.

An intelligence test, on the other hand, is designed to measure only one of the factors of scholastic achievement, but one of the most important. Intelligence, from the educational point of view, may be defined as the ability to acquire and to apply knowledge. Psychological research has sufficiently demonstrated that this ability exists, and that it is called into play not only in school work but in most of the tasks we have to perform. It has been shown, too, that individuals differ enormously in the amount of it with which they are by nature endowed. From the point of view of education, a person's capacity for learning and for applying his knowledge is one of the most important things one can know about him. Teachers have long recognized some such ability under the name of common sense, and that, more or less, is what a good intelligence test measures.

The question how well school examinations measure what they do measure can best be answered by educationists themselves. The essence of a good measuring instrument is that it should yield the same result whoever applies it and whenever he uses it. The deficiencies of a school examination as a yardstick are well known to anyone who has had to mark a large number of examination papers. He cannot be sure that his standards are not higher or lower than those of others who are marking a similar set of papers. A reputation as a "hard marker" or an "easy marker" is easily made. But not only do standards vary from person to person; it is commonly said that the standards of any one person fluctuate, so that it is difficult to mark consistently the first paper and the last hundred. Examination marks are therefore a scale of scholastic achievement which is subjective and variable.
A good intelligence test, on the other hand, does approach the yardstick in its reliability as a measuring instrument. This is because the procedure for its use, as laid down in the manual of directions, has been carefully standardized. The method of giving the test is the same for all examiners, wherever or whenever they give it. The pupil’s answers are scored by a simple system which does not vary. Thus a score of 40 or of 90 means the same thing in all circumstances. An intelligence test is therefore a measure which is objective and reliable.

2.—THE “GENERAL INTELLIGENCE TEST FOR AFRICANS.”

The “General Intelligence Test for Africans” represents an adaptation to East African conditions of the mental test technique now widespread in other continents. The several tests in the set are of the same general types as have been successfully used elsewhere, but in their specific form and content they are based upon local conditions. No item has been included unless it has been found by actual experiment to be itself a good test of intelligence in the Africans for whom it is intended.

It is obvious that the class of Africans to which the test can be applied is limited. No one intelligence test or scholastic examination is suitable for persons of all ages and of all degrees of education. The test here described was designed primarily for African youths and adults who have received a certain amount of schooling. There are no upward limits of age, ability or schooling, above which the test becomes too easy for Africans. The downward limits of age and ability, below which the test becomes too difficult, can be found only by experiment. The minimum amount of school learning required will be obvious from an inspection of the tests: it will include the ability to recognize the digits 0 to 9 and the letters of the alphabet, the ability to see meaning in pictures, a knowledge of simple arithmetical operations, and the ability to use a pencil. Obviously, the test cannot be given to a quite uneducated native; to test such a one would require the use of a different type of test, which it is beyond the scope of this manual to discuss.

One limitation it has been possible to avoid is that which the diversity of tongues in East Africa might have been expected to impose. The instructions given by the examiner to the pupils may be translated into any language, while the pupils’ answers require no use of language whatever.

It is the duty of anyone who publishes a test to provide statistics proving that the test is both “valid” and “reliable.” A test is “valid” if it really measures what it purports to measure. It is “reliable” if it measures that thing in a reliable or verifiable way. Before anyone uses the test he should be satisfied that these two statistical criteria of its value have been met. It will be shown briefly that the “General Intelligence Test for Africans” is both valid and reliable.
(1) The Validity of the Test.

The "General Intelligence Test for Africans" purports to measure intelligence. The following experiment shows that it does so.

The test was given to 100 boys in Standards V and VI of Maseno Central School. At the same time, the Principal and staff1 of the school compiled a list of those boys, arranged in order of intelligence as they estimated it from their intimate knowledge of their pupils. The measurements made by the test and the estimates made by the teachers were then compared, and it was found that they agreed quite closely. The closeness of the agreement is indicated by a coefficient of correlation2 \( r = .60 \).

Thus the test will yield results which will be independently confirmed by an intimate knowledge of the persons tested.

(2) The Reliability of the Test.

The "General Intelligence Test for Africans" then, does measure intelligence. Does it do so in a dependable way? If we measure a man's height with a yardstick, we regard the measurement as reliable, since, if we repeat it, we get approximately the same result. The reliability of a test can be assessed in the same way.

The "General Intelligence Test for Africans" was given to 67 boys in Forms I to III of the Alliance High School3 in February, 1932. In June, 1932, the same test was given to the same boys. When the two sets of results were compared, they were found to be in close agreement. The general run of the scores was of course higher, owing to the practice effect and to the four months' development of the pupils; but the positions of the boys relative to one another were almost unaltered. The closeness of the agreement between the first set of measurements and the second is indicated by a coefficient of correlation \( r = .81 \).

Thus the "General Intelligence Test for Africans" not only measures intelligence, as intelligence is understood by teachers, but it measures intelligence in a trustworthy way.

3.—The Use of a General Intelligence Test in East Africa.

The use of intelligence tests is now widespread in many countries. Those who have had experience of their applications know what a powerful instrument they have been in improving

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1 Mr. E. Carey Francis and his staff, to whom the author is greatly indebted.

2 A coefficient of correlation \( r = 1 \) indicates perfect agreement. A coefficient \( r = 0 \) indicates an entire absence of agreement.

3 To the Principal, Mr. G. A. Grieve, and his staff, the author is deeply indebted for continual assistance.
education. Not only have they assisted the master in solving the problems of school organization, but, far more important, they have been of inestimable value as signposts directing the child along the path of education and of life. The purpose of this section is merely to refer briefly to some of the ways in which an intelligence test might prove useful in East Africa.

(1) The Selection of Entrants to a School.

There are often more applicants for admission to a central or secondary school than can be accommodated. Yet all of the applicants may have reached the educational standard required for admission. It then becomes necessary to make use of some additional means of selection. In that case the use of an intelligence test as the selective instrument may be considered. It will have the advantage of eliminating the influence of some of the more adventitious circumstances which may have contributed to the gaining of the necessary school certificates. For example, one of the applicants may have reached the required standard by dint of hard "cramming," or of specially good teaching, or simply of "easy-marking" of his examination papers; while another may have qualified for entrance in spite of poor teaching or of having to herd goats too often when he should have been at school. The intelligence test would pick out the innately brighter boy.

(2) Vocational Guidance.

A central school may provide a variety of courses of study, such as a general course, a commercial course, a teachers' course and a handwork course. The principal of the school may be called upon to direct a pupil into one or other of these courses. One of the items of information which might then be useful to him would be the pupil’s score in an intelligence test. Suppose that the principal knew, for example, that his teachers’ course called as a rule for a higher degree of general ability than his handwork course, he would, while taking other circumstances into consideration, tend to advise the teachers’ course for his brighter boys.

(3) The Classification of Pupils.

Pupils vary enormously in intelligence, or the ability to learn. In almost any class of Standard III pupils, for example, there will be found some pupils who are brighter than the average pupil in Standard V, and others who are not so bright as the average pupil in Standard I. To teach fractions, say, to children at such different levels of mental development, by the same method and at the same rate, is obviously a difficult and certainly a wasteful task. Now in a school with a large enrolment, it is sometimes necessary to divide a standard into two or more sections. Where this is so, it is advantageous both to teacher and pupils if the pupils are grouped on the basis of learning capacity; and of learning capacity an intelligence test score is a fairly reliable index. There should be three sections, if possible—one for the
backward pupils, one for the advanced pupils, and one for those round about the average. Each section will be able to progress at its own rate. The dull pupil will not be discouraged by a hopeless competition against his intellectual superiors. The clever pupil will be able to finish his course more quickly, or to cover much more ground in the same time. The teacher's task will be greatly simplified. Even if it is not possible to run three separate classes, it may be possible to group the pupils within one class according to ability, for some subjects at least; or else the more advanced pupils may be moved up to a higher class sooner than the others. In one way or another, the instruction should be adapted to the individual differences in learning capacity revealed by the intelligence test.

(4) The Discovery of Unusual Cases.

In the process of applying an intelligence test to a class he does not yet know, the teacher may discover, sooner than he otherwise would, pupils who suffer from some mental or physical abnormality. A pupil whose score is greatly below the scores of other pupils whom he might have been expected to equal, may quite possibly be found to suffer from defective vision or hearing, or from some maladjustment of personality.

An intelligence test will often throw new light on pupils whom the teacher thought he already knew quite well. He will probably be surprised at the range of ability in his class, for one's almost inevitable tendency is to over-estimate the intelligence of the duller pupils and to under-estimate that of the brighter. He may come to realize the need for special opportunities for his best pupils, who, after all, are to be the leaders of their people. He will be reconciled to the slow progress of most of the weaker brethren, realizing that they may be doing very creditable work in view of their limited abilities. On the other hand, it may come as a shock to him to find that a pupil whom he had definitely relegated to the ranks of these same weaker brethren may turn out to be one of the most intelligent boys in his class, and he will take steps to ensure that this talent is no longer buried.

(5) Vocational Selection.

The employer's task in selecting a candidate for a post where intelligence is a desideratum, is analogous to that of the school principal in selecting applicants for admission to his school. An intelligence test will indicate which candidate is likely to adapt himself best to the new conditions of work; and, if he is qualified in other respects, this is the candidate whom the employer will choose.

(6) Research.

Scientific research requires the use of accurate measuring instruments. A good intelligence test is such an instrument, and the use of one in East Africa would begin to make practicable
large number of important and fascinating researches. Some of
the questions an intelligence test might be instrumental in an-
swering are as follows: How do the East African tribes compare
with one another in intelligence? Are native women less intelli-
gent than native men? At what age does the average African's
intelligence cease to develop? At what period of old age does it
definitely decline? Is there any relationship between intelligence
and stature in the native? Is the size or the shape of his head
a clue to his intelligence? Is the African's intelligence chronically
depressed by diseases, and, if so, which diseases have this effect?
Is any rise in the general level of intelligence visible over a period
of years?

4.—THE LIMITATIONS OF A GENERAL INTELLIGENCE TEST.

A general intelligence test does not pretend to give any in-
formation about a person's character. Character is a matter of
values, about which there is no general agreement. Until these
values are stable, it is useless to try to measure them, and they
must be left to subjective judgment.

An intelligence test is not a measure of temperament. Differ-
ces of temperament are matter of fact, but psychological re-
search has not yet proceeded beyond the experimental stage with
their analysis or measurement.

A general intelligence test does not measure special abilities
or skills, such as musical talent or manual dexterity. To measure
these, special tests would be required.

An intelligence test is not a substitute for common sense; it
should be its instrument. A physician, when he has taken the
temperature and the pulse rate of his patient, does not thereupon
abandon the use of his own judgment. So an intelligence test
must be used intelligently. The wise teacher will interpret a
pupil's performance in an intelligence test in the light of what
he knows of human nature in general and of this pupil in
particular.

II.—GENERAL DIRECTIONS TO EXAMINERS.

1. The "General Intelligence Test for Africans" may be given
by any good teacher who will carefully read this manual and
follow the directions contained in it.

2. It is advisable to obtain some preliminary experience in
giving and scoring the test. A practice group of persons may be
tested with this end in view before proceeding to the testing of
other groups.

3. The instructions which the examiner is to give to the
pupils are given in this manual in English and Kiswahili. The
examination may, however, be conducted in any language. The
examiner must translate the instructions beforehand into the language to be used. The translation should be as accurate, as clear and as simple as possible.

4. The examiner must make sure that all the pupils to be tested at one time understand the language to be used. Other pupils must be tested at other times, each in a language he understands.

5. The size of group which can be tested at one time is about the size of class which can conveniently be taught at one time. As a rule, not more than thirty persons should be tested together.

6. The examiner should, if possible, have one or two assistants. The division of duties between examiner and assistants is indicated in the "Directions for Examining." In general, the examiner will give the instructions to the pupils and keep the time, while the assistants will see that the pupils carry out the examiner's instructions.

7. The examination should be conducted in a well lit room, free from distractions within and without. Preferably only the examiner, his assistants and the pupils should be present. The pupils should not be crowded.

8. It is advisable to make sure beforehand that all the pages of the test booklets have been cut.

9. Pencils, not pens, should be used. Each pupil should have one or preferably two well-sharpened pencils; and the examiner or his assistants should have a supply of pencils ready to replace at once the pencil of any pupil if required.

10. The examiner's manner should be pleasant but authoritative. He should speak distinctly, rather slowly, and loudly enough to be heard by all the pupils without difficulty. The instructions should be given in a natural tone of voice; commands should be spoken authoritatively, and instant obedience enforced.

11. Each test is immediately preceded in the examination booklet by a practice exercise similar to the test proper. The exercises are on the odd-numbered pages, the tests on the even-numbered pages. The purpose of the exercises is to enable the examiner and his assistants to illustrate clearly what is required in each test, and to give the pupils practice in doing what is required. In scoring, no account is taken of the exercise, but only of the test. The instructions laid down are intended to be adequate, and must be given to the pupils as laid down. Additional instructions on the same lines may be given if necessary; but, in the interests of uniformity amongst examiners, these should be reduced to a minimum. Often it will be found sufficient simply to repeat the instructions, perhaps in a different form of words. Questions may be answered; pupils who do not understand what to do may be shown; the blackboard may be used for illustration. But it is most important to adhere strictly to the following rule: When
the page has been turned to the test proper, and the word to begin given, no further instructions may be added. All difficulties must be resolved in connexion with the practice exercise. During the test proper, no questions may be entertained, and the examiner and his assistants may give no help beyond showing the pupils where to begin or where to go on to next.

12. Accurate time-keeping is important. A stop-watch should be used if possible. Failing this, a watch with a second hand may be used if sufficient care is exercised. In that case, the exact time of beginning should be written down. Time limits are imposed both on the practice exercises and on the tests. The purpose of the time limits on the practice exercises is to reveal pupils who are having difficulty, in order that they may receive further assistance before proceeding to the test proper. The tests proper fall into two classes with respect to time limits. The first two tests may be called "speed" tests; they measure how much a person can do in a given time. The time given is short, so that the slow cannot do as much as the fast. Accurate time-keeping is of great importance here. The other four tests may be called "difficulty" tests; they measure how difficult things a person can do. Time limits are indeed imposed, but only for the simple reason that it is convenient to have all the pupils doing the same test at the same time. Speed of working is not intended to affect the score; the great majority of the persons for whom the tests are designed have time enough to do all they can without haste. The time allowances were decided on only after experimental studies of the time required by various groups. In finally fixing them, the advice of the famous psychologist, E. L. Thorndike, was kept in mind:—

"The time of the subject who is taking such tests is of very little value. His general comfort and peace of mind is of much value. . . . So my advice is to be very generous with the time."

13. The examiner must be on the look-out for signs of fatigue in the pupils during the examination, and must allow a rest interval at the end of a test whenever necessary. The test usually requires about an hour a half. As a rule, an interval of ten minutes after test 4, spent in the open air, will be found sufficient. Longer and more frequent intervals may be given at the discretion of the examiner, or the test may be taken in more than one session. During an interval, the test booklets should be left on the desks, folded to the page at which the pupils will recommence work.

14. Copying should, of course, be prevented; and no pupil should be permitted to put pencil to paper except between the commands to begin and to stop.

1 In a letter to the author.
III.—DIRECTIONS FOR EXAMINING.

When the pupils are seated, the desks cleared, and the pencils ready, say:

"I am going to give you a test. You must do your very best, because I want to see whether you can do as well as the pupils of other schools.

"I shall give each of you one booklet. Do not open it. Leave it on your desk until I tell you what to do." Assistants distribute the booklets, and see that they are not opened.

1) "Look at the first line; it is here. (Hold up a test booklet, and point to line 1.) On line number 1, write your name." Assistants see that everyone writes his name in the proper place.

2) "Look at the second line. On line number 2, write the name of your tribe."

3) "Look at the third line." If the class is composed of pupils of one sex only, say: "On line number 3, write the word 'Boy,' " or, "Write the word 'Girl.'" If the class is composed of pupils of both sexes, say: "On line number 3, write whether you are a 'Boy' or a 'Girl.'" With adults, use the words 'Man' and 'Woman.'

4) "Look at the fourth line. On line number 4, write the date when you were born, if you know it. If you do not know, do not write anything."

After the test, the examiner should check the date of birth from the school register or any other source which may be available.

5) "Look at the fifth line. On line number 5, write how old you are now, if you know. If you do not know, do not write anything."

6) "Look at the sixth line. On line number 6, write the name of this school." Mention the name of the school.

7) "Look at the seventh line. On line number 7, write what class (standard, form) you are in."

8) "Look at the eighth line. On line number 8, write today's date." Mention the date.

9, 10) On the remaining lines, the examiner may have recorded any other information he wishes, or he may use them for his own remarks.

"Pencils down!

"Now listen carefully. Do not turn over any page until I tell you to do so. Do not write anything until I tell you to do so. As soon as I say 'Stop!' you must stop at once and put your pencil on the desk.

"Now turn over to page 3. This is page 3." Hold up a test booklet open at page 3. "Fold your books so that they are open at page 3 only, like this." Fold the test booklet so that only page 3 is seen.
1. Picture Numbering.

"Page 3.

Now look at the first row of pictures. Look at the first picture in the row: it is a hen. Under the hen is a number. What number is under the hen? (Pause for correct answer.) Yes, it is a 1. Look at the next picture: it is an insect. What number is under the insect? (Pause.) Yes, it is a 2. Notice that each picture in this row has a number under it. Do you see that? (Pause.)

Now look at the other two rows of pictures, below. These pictures have no numbers yet. When I tell you to, you are to write their numbers in with your pencil. Look at the first picture in the second row: it is a panga. Find the panga just like it in the first row of pictures, above. The panga in the first row has a 5 under it, hasn’t it? (Pause.) So take your pencil and write a 5 under this panga in the second row. Write a 5 under this panga only.” Assistants see that everyone writes 5 in the proper place, and report all correct before examiner proceeds.

Look at the next picture in the second row: it is a snake. The snake in the first row, above, has a 6 under it; so now write a 6 under this snake in the second row. Write a 6 under this snake only.” Assistants supervise as before.

"Look at the next picture: it is a tree. What number should go under the tree? (Pause.) Yes, a 4. So now write a 4 under the tree.

"Look at the next picture: it is a hand. What number should go under the hand? (Pause.) Yes, a 3. So now write a 3 under the hand.

"Pencils down!

"When I say ‘Begin,’ but not before, go on in the same way yourselves. Finish the second row of pictures, then go on to the last row. Try to do all the pictures on this page. Do not turn over to the next page. Remember, UNDER EACH PICTURE MAKE THE NUMBER WHICH BELONGS TO IT. Ready? Begin!” Start the stop-watch, or note the time.

Assistants see that everyone is doing the right thing.

After 1 minute, say: “Stop! Pencils down! Hands up anyone who did not know what to do, and I shall explain it to him.” Deal with any difficulties which arise, then proceed.

"Pencils down!

"Do not turn over to the next page till I tell you. On the next page you will find some more pictures and numbers. Do them in the same way: under each picture make the number which belongs to it. Do as many as you can. Turn over to page 4. Ready? Begin!” Start the stop-watch, or make a note of the time.
After 1½ minutes, say: "Stop! Pencils down! Now look at page 5." Hold up a test booklet folded to the proper page, "Fold your books."

2. **Comparison.**

"Page 5.

"Look at the first two numbers: 5—2, 5—2. Are they the same or different? (Pause for correct answer.) Yes, they are the same. The letter S (writing it on the blackboard) is for 'same.' So take your pencil and write capital S on the line between 5—2 and 5—2. Write an S on the first line only." Assistants see that everyone writes S in the proper place, and report all correct before examiner proceeds.

"Look at the next two numbers: 9—1—2, 9—6—2. Are they the same or different? (Pause.) Yes, they are different. The letter D (writing it on the blackboard) is for 'different.' So everyone write capital D on the line between the two numbers. Write a D on the second line only." Assistants supervise as before.

"Look at the next pair, the letters C—G, C—K. Are they the same or different? (Pause.) Yes, they are different. So everyone write capital D on the line between them.

"Look at the next pair, the two diagrams. Are they the same or different? (Pause.) Yes, they are nearly the same; they are meant to be the same. So everyone write capital S on the line between them.

"Pencils down!

"When I say 'Begin,' but not before, go on in the same way yourselves. Try to do all on this page. Do not turn over to the next page. Remember, **IF THE TWO THINGS ARE THE SAME, WRITE S ON THE LINE BETWEEN THEM. IF THEY ARE DIFFERENT, WRITE D ON THE LINE BETWEEN THEM.** Ready? Begin!" Start the stop-watch, or note the time.

Assistants see that everyone is doing the right thing.

After 1 minute, say: "Stop! Pencils down! Hands up anyone who did not know what to do." Deal with any difficulties which arise, then proceed.

"Pencils down!

"Do not turn over to the next page till I tell you. On the next page you will find some more. Do them in the same way. If the two things are the same, write S on the line between them. If they are different, write D on the line between them. Do as many as you can. Turn over to page 6. Ready? Begin!" Start the stop-watch, or make a note of the time.
After 2 minutes, say: "Stop! Pencils down! Now look at page 7. This is page 7." Hold up a test booklet folded to the proper page. "Fold your books."

3. Picture Classification.

"Page 7.

"Look at the first row of pictures, row number 1. There are five pictures in the row—a man, another man, another man, a cow, and another man. Four of these pictures are like one another, one picture is different. The cow is different from the men. So take your pencil and cross out the picture of the cow. Make a large cross like this (making a large X on the blackboard) right through the picture of the cow." Assistants see that everyone makes a cross in the proper place, and report all correct before examiner proceeds.

"Look at the next row of pictures, row number 2. You see a hen, a goat, another hen, a bird, and another bird. Four of these pictures are like one another, one picture is different. Which picture is different? (Pause for correct answer.) Yes, the goat is different. So everyone cross out the picture of the goat." Assistants supervise as before.

"Look at the next row of pictures, row number 3. You see a leaf, another leaf, a tree, another leaf, and another leaf. Four of these pictures are like one another, one picture is different. Which picture is different? (Pause.) Yes, the tree is different from the leaves. So everyone cross out the picture of the tree.

"Pencils down!

"When I say 'Begin,' but not before, go on in the same way yourselves. Begin at row number 4. Try to do all the rows on this page. Do not turn over to the next page. Remember, IN EACH ROW, FIND THE ONE PICTURE WHICH IS DIFFERENT FROM THE OTHER FOUR PICTURES, AND CROSS IT OUT WITH YOUR PENCIL. IN EACH ROW, CROSS OUT ONE PICTURE ONLY. Ready? Begin!" Start the stop-watch, or note the time.

Assistants see that everyone is doing the right thing.

After 1 minute, say: "Stop! Pencils down! Hands up anyone who did not know what to do." Deal with any difficulties which arise, then proceed.

"Pencils down!

"Do not turn over to the next page till I tell you. On the next page you will find some more rows of pictures. Do them in the same way: in each row, find the one picture which is different from the other four pictures, and cross it out with your pencil. In each row, cross out one picture only. Turn over to page 8. Ready? Begin!" Start the stop-watch, or make a note of the time.
After 3 minutes, say: "Stop! Pencils down! Now look at page 9. This is page 9." Hold up a test booklet folded to the proper page. "Fold your books."

4. Picture Completion.

"Page 9.

"Look at the first picture, picture number 1. It is a man's face, isn't it? (Pause.) But the man has no mouth. So take your pencil and draw his mouth. Give him a mouth with your pencil. A line like this (quickly drawing the missing mouth on the blackboard) will do for a mouth." Assistants see that everyone draws in the mouth, and report all correct before examiner proceeds.

"Look at the next picture, picture number 2. It is a hand. But part of the hand has been left out. What part of the hand has been left out? (Pause for correct answer.) Yes, a finger. So everyone draw the finger in its proper place. A line like this (quickly drawing the missing finger on the blackboard) will do for a finger." Assistants supervise as before.

"Look at the next picture, picture number 3. It is a cow. What has been left out of the picture of the cow? (Pause.) Yes, the tail. So everyone draw the tail. A line like this (quickly drawing the missing tail on the blackboard) will do for a tail."

"Pencils down!

"When I say 'Begin,' but not before, go on in the same way yourselves. Begin at picture number 4. Try to do all the pictures on this page. Do not turn over to the next page. Remember, FIND WHAT HAS BEEN LEFT OUT OF EACH PICTURE, AND DRAW IT IN QUICKLY WITH YOUR PENCIL. Ready? Begin!" Start the stop-watch, or note the time.

Assistants see that everyone is doing the right thing.

After 1 minute, say: "Stop! Pencils down! Hands up anyone who did not know what to do." Deal with any difficulties which arise, then proceed.

"Pencils down!

"Do not turn over to the next page till I tell you. On the next page you will find some more pictures. Do them in the same way: find what has been left out of each picture, and draw it in quickly with your pencil. Turn over to page 10. Ready? Begin!" Start the stop-watch, or make a note of the time.

After 5 minutes, say: "Stop! Pencils down! Now look at page 11." Hold up a test booklet folded to the proper page. "Fold your books."
An interval may be allowed here. During the interval, the test booklets should be left folded at page 11 on the desks.

5. Number Series.

"Page 11.

"Look at the first row of numbers: 1, 2, 3, 4, 5. Look at the two dotted lines after number 5. On these two dotted lines you are to write the two numbers that should come after 5. 1, 2, 3, 4, 5—what two numbers should come next? (Pause for correct answer.) Yes, 6, 7. So take your pencil and write 6, 7, on the two dotted lines after 5." Assistants see that everyone writes the numbers in the proper places, and report all correct before examiner proceeds.

"Look at the next row of numbers: 2, 4, 6, 8, 10. What two numbers should come next?" Pause for answer. If there is any difficulty, explain that the numbers in this row increase by two at each step, and that therefore the next two numbers are 12, 14. "So everyone write 12, 14, on the two dotted lines after 10." Assistants supervise as before.

"Look at the next row: 10, 9, 8, 7, 6. What two numbers should come next?" Pause for answer. If there is any difficulty, explain that the numbers in this row decrease by one at each step. "So everyone write 5, 4, on the two dotted lines after 6."

"Look at the next row: 1, 1, 2, 2, 3, 3, 4, 4. What two numbers should come next?" Pause for answer. If there is any difficulty, explain that each number is repeated. "So everyone write 5, 5, on the two dotted lines after 4."

"Pencils down!

"When I say 'Begin,' but not before, go on in the same way yourselves. Try to do all the rows on this page. Do not turn over to the next page. Remember IN EACH ROW, TRY TO FIND OUT HOW THE NUMBERS ARE CONNECTED, AND THEN WRITE THE TWO NUMBERS WHICH SHOULD COME NEXT. Ready? Begin!" Start the stop-watch, or note the time.

Assistants see that everyone is doing the right thing.

After 1 minute, say: "Stop! Pencils down!"

Examiner demonstrates to the whole class the correct solution of the remaining problems on page 11. Every pupil must understand what is required before examiner proceeds.

"Pencils down!

"Do not turn over to the next page till I tell you. On the next page you will find some more of the same kind. Do them in the same way: in each row, try to find out how the numbers are connected, and then write the two numbers which should come next. Turn over to page 12. Ready? Begin!" Start the stop-watch, or make a note of the time.
After 10 minutes, say: "Stop! Pencils down! Now look at page 13. This is page 13." Hold up a test booklet folded to the proper page. "Fold your books."

6. Picture Absurdities.

"Page 13.

"Look at the first picture, picture number 1. There is something wrong with this picture. The man should not be on the cow's back; a man does not ride on a cow's back. So the man has been crossed out, to show that he is wrong. Do you see that?

"Look at the next picture, picture number 2. What is wrong with this picture? (Pause for correct answer.) Yes, a hen has not long ears. So take your pencil and cross out the ears. Cross out the ears only." Assistants make sure that everyone makes a cross in the proper place, and report all correct before examiner proceeds.

"Look at the next picture, picture number 3. What is wrong with this picture? (Pause.) Yes, a rat has not a short curly tail. So everyone cross out the tail. Cross out the tail only." Assistants supervise as before.

"Pencils down!

"When I say 'Begin,' but not before, go on in the same way yourselves. Begin at picture number 4. Try to do all the pictures on this page. Do not turn over to the next page. Remember, IN EACH PICTURE, FIND WHAT IS WRONG, AND CROSS IT OUT WITH YOUR PENCIL. CROSS OUT WHAT IS WRONG ONLY; DO NOT CROSS OUT WHAT IS RIGHT. Ready? Begin!"

Start the stop-watch, or note the time.

Assistants see that everyone is doing the right thing.

After 1 minute, say: "Stop! Pencils down! Hands up anyone who did not know what to do." Deal with any difficulties which arise, then proceed.

"Pencils down!

"Do not turn over to the next page till I tell you. On the next page you will find some more pictures. Do them in the same way: in each picture, find what is wrong, and cross it out with your pencil. Cross out what is wrong only; do not cross out what is right. Turn over to page 14. Ready? Begin!" Start the stop-watch, or make a note of the time.

After 4 minutes, say: "Stop! Pencils down! Close your books." Collect the booklets.
IV.—DIRECTIONS FOR SCORING.

The rules to be adhered to in scoring the tests are given below. The tests are scored by means of the scoring keys, furnished on four separate sheets of paper, so designed as to facilitate ease and accuracy of scoring. The methods of using these keys are described below.

Where the greatest accuracy is desired, the scoring should be checked by a second person, as even the most experienced scorers make occasional slips. It is advisable to use a pen or a coloured pencil in marking the booklets, so that the scorer’s markings can afterwards be distinguished from those of the pupil, if necessary. The scorer’s marks should not be made where they tend to obscure those of the pupil. A check mark (✓) may be used to indicate an item which is right, a cross (×) to indicate one which is wrong, and an 0 to indicate one which is omitted.

1.—General Rules.

(1) Each item marked by a pupil is scored either right or wrong. No fractional scores are given.

(2) If a marking has been clearly corrected by the pupil, so that there is no doubt as to his final intention, the correction is the answer which should be scored.

(3) In any case not provided for in the rules for scoring, the scorer must use his own judgment. An answer should be counted as right only if it is quite clear that the pupil has indubitably solved the problem.

(4) The number of right answers in each test (and in Test 2, page 6, the number of wrong answers also) should be entered in the bottom right-hand corner of the test page. If and when the scoring has been checked, this should be indicated by a check mark.

(5) The number of right answers in each test should be copied into the spaces provided under the heading “Number right” on the cover of the test booklet. In Test 2, the number of wrong answers also should be copied into the space under the heading “Operation,” and should be subtracted from the number right. In the spaces under the head “Operation,” the number right (in Test 2, the number right minus the number wrong) should be multiplied by the appropriate weighting factor. The weighting factor for each test is given in Table I.

<table>
<thead>
<tr>
<th>TABLE I</th>
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<tr>
<td>WEIGHTING FACTORS OF THE COMPONENT TESTS</td>
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<td>Test</td>
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The results of these operations should be entered in the spaces under the heading "Score." The sum of the six scores is the "Total Score" in the test.

(6) The score in the test may be used either in the form of total score out of the highest possible score of 400, or in the form of per cent of the highest possible score. If it is desired to use per cent scores, Table II, for the conversion of total scores into per cent scores, will be found useful. Total scores intermediate between those given in the table may be converted to the nearest per cent scores by interpolation.

### TABLE II

FOR CONVERSION OF TOTAL SCORES INTO PER CENT SCORES

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<tr>
<th>Total Score</th>
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2.—Specific Rules for each Test.

Test 1, page 4. Picture Numbering.

The key for this test is printed on a sheet of transparent paper. This sheet should be superimposed upon page 4 of the test booklet in such a way that for each item the pupil's answer in the booklet is seen beside the correct answer in the key.

1. Score is number right.
Test 2, page 6. Comparison.

The key for this test is printed down two margins of a sheet of stout paper. This sheet should be placed on page 6 of the test booklet, so that for each item the pupil’s answer is seen alongside the correct answer in the key.

1. Score is (number right minus number wrong) multiplied by two. The subtraction is to be performed before the multiplication.

2. If the number to be subtracted (that is, the number wrong) is greater than the number right, the score is 0.

Test 3, page 8. Picture Classification.

The key for this test is similar to that for Test 1, and is used in a similar fashion.

1. Score is number right.

2. If, in any item, more than one of the five pictures in the row has been crossed out, count the item as wrong; unless (a) it has clearly been the pupil’s final intention to leave only one of the pictures crossed out, in which case score as if that one alone had been crossed out, or (b) four of the pictures have been crossed out and one has not, in which case score as if that one alone had been crossed out.

Test 4, page 10. Picture Completion.

The key for this test is simply a copy of page 10 of the test booklet, with the pictures correctly completed in red ink. For each item, the pupil’s answer in pencil should be compared with the correct answer in red ink in the key. Additional rules for scoring certain items are laid down in the verbal key for Test 4.

1. Score is number right.

2. An answer is to be counted right if it is quite clear that the pupil has tried, in whatever way, to indicate correctly the missing part. The technical quality of his drawing is to be disregarded.

3. Markings in any parts of the picture, other than those shown in red in the key for Test 4, are to be disregarded.

Test 5, page 12. Number Series.

The key for this test is similar to that for Test 2, and is used in a similar fashion.

1. Score is number right multiplied by four.

2. The answer to each item consists of two numbers, both of which must be right. If one number is right and the other is wrong or omitted, count the item as wrong.

The key for this test is an entirely verbal one. For each item, the pupil's answer should be compared with the correct answer described in the key.

1. Score is number right multiplied by ten.

2. If the pupil amends the absurd part of the picture by drawing it as it should be, count as right.

3. Crosses through any parts of the picture not mentioned in the specific rules for each picture (see key for Test 6) do not affect the scoring; they are to be disregarded.

4. A cross very close to the part of the picture described in the key, but through no part of the picture, counts as right.

V.—TREATMENT OF RESULTS.

When the examiner has scored the test, he may analyse the scores, either total scores or per cent scores, in a number of ways.

The simplest step he can take is to arrange the test booklets in order of score, from highest to lowest. The highest and lowest scores, the range of scores, and the place of each pupil in the class will at once be apparent.

He may then seek some score to represent the performance of the class as a whole. For this purpose, he may use either of two types of average, the ordinary "average" (arithmetic mean) or the "median." The median is as satisfactory as the mean for most purposes, and is more easily arrived at. It is simply the middle score, that score above and below which are an equal number of scores. It is found by counting to the middle booklet when the booklets have been arranged in order of score. Thus, if there are 25 booklets in a set, the middle booklet is the thirteenth from the top or the bottom, for that booklet has 12 booklets above it and 12 below it. If there are 20 booklets in a set, the median score is midway between the scores of the tenth and the eleventh booklets, since that score will have ten scores on either side of it. Thus, if the tenth lowest score in a series of 20 is 225, and the eleventh lowest is 229, then the median score is 227.

If the class is large, or if several classes are grouped together, the distribution of scores may be of interest. This may readily be represented in graphical form. The scores, either total or per cent, must first be grouped into convenient "class intervals" of five, ten or twenty points, for example, 100 to 119 inclusive, 120 to 139 inclusive, and so on. The number or "frequency" of scores within each of these class intervals is counted. The class-
Intervals are then laid out along a base line as in Figure I, and columns are raised on them, corresponding in height to the frequency of the scores in the respective class intervals. A line joining the tops of the columns will then describe the distribution of the scores, revealing at a glance the range of the scores, the relative significance of any score, and similar facts.

**Figure I.**—A frequency distribution of scores.

**VI.**—Norms for comparison.

A score in a test, whether it be the score of an individual or that of a group, is of little significance in itself. It gains significance only when it is compared with other scores.

To the principal of a school, the most interesting comparison as a rule will be the comparison of pupil with pupil and class with class within his own school. Such a comparison he may readily make. He may, however, wish to know how his pupils compare in ability with those of other schools. This comparison he can make only when records from other schools are available. The requisite standards of comparison can be made available by testing a number of groups in different parts of the country, and collecting the results. It would be desirable to have norms for each age, each school standard, each sex and each tribe, and perhaps other norms. It will be shown how users of the test may assist in the compilation of well-founded norms for comparison. Until these are available, however, such results as have been collected up to the present are given in Table III. For the convenience of examiners, comparisons may be made in terms of either average, the mean or the median, and in terms of either total score or per cent score.
TABLE III
AVERAGE SCORES OF VARIOUS GROUPS IN THE
"GENERAL INTELLIGENCE TEST FOR AFRICANS"

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<thead>
<tr>
<th>Class</th>
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<th>Median Score</th>
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<td>Total</td>
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<td>2Standard V</td>
<td>222</td>
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<td>227</td>
<td>56</td>
</tr>
<tr>
<td>4Medical Training Depot</td>
<td>248</td>
<td>61</td>
</tr>
</tbody>
</table>

1Alliance High School, Kikuyu.
2Maseno Central School.
3Jeanes School, Kabete.
4Medical Training Depot, Nairobi.

To facilitate the compilation of useful norms for comparison, a form for a report on results has been drawn up. Sufficient copies of this "Report Form" will be sent out with each set of test booklets. The author would be very grateful if examiners would fill up this form and send it, marked "General Intelligence Test for Africans," to the Education Department, P.O. Box 340, Nairobi. Comparative statistics, throwing light on the distribution of intelligence throughout the country, could then be drawn up. Copies of such revised norms will be sent out to examiners as the necessary data accumulate.
APPENDIX A.

DIRECTIONS FOR EXAMINING IN KISWAHILI.

When the pupils are seated, the desks cleared, and the pencils ready, say:—

"Nataka kuwapa majaribio. Ni lazima kilo mmoja wenu ajitahidi kufanya bora kama awezavyo, kwa sababu nataka kuangalia kama mnaweza kufanya kazi bora kama watoto wa skuli yoyote nyongi neyo.

"Kila mmoja wenu nitampa kitabu. Msikifungue. Kiwekeni juu ya meza hata nitakapowambia jinsi ya kufanya." Assistants distribute the booklets, and see that they are not opened.

(1) "Tazameni mstari wa kwanza; ndio huu. (Hold up a test booklet, and point to line 1.) Katika mstari ulioandikwa nambari 1, andika jina lako." Assistants see that everyone writes his or her name in the proper place.

(2) "Tazameni mstari wa pili. Katika mstari ulioandikwa nambari 2, andika jina la kabila yako."

(3) "Tazama mstari wa tatu." If the class is composed of pupils of one sex only, say: "Katika mstari nambari 3, andika 'Mume,'" or "Katika mstari nambari 3, andika 'Mke.'" If the class is composed of pupils of both sexes, say: "Andika ukiwa u 'Mume' au 'Mke.'"

(4) "Tazama mstari wa nne. Katika mstari ulioandikwa nambari 4, andika tarehe uliyozaliwa, ukiwa waijua. Ukiwa huujui, usiandike chochote." After the test, the examiner should check the date of birth from the school register or any other source that may be available.

(5) "Tazama mstari wa tano. Katika mstari ulioandikwa nambari 5, andika umri wako wa sasa, ukiwa wajua. Ukiwa huujui, usiandike chochote." 

(6) "Tazama mstari wa sita. Katika mstari ulioandikwa nambari 6, andika jina la skuli hii." Mention the name of the school.

(7) "Tazama mstari wa saba. Katika mstari ulioandikwa nambari 7, andika daraja (class, standard, form) gani ya skuli uliyomo."

(8) "Tazama mstari wa nane. Katika mstari ulioandikwa nambari 8, andika tarehe ya leo." Mention the date.

(9, 10) On the remaining lines, the examiner may have recorded any other information he wishes, or he may use them for his own remarks.
"Kalamu chini.


"Sasa funua ukurasa wa 3. Huu ndio ukurasa wa 3.” Hold up a test booklet open at page 3. “Kunjeni vitabu vyenu ukurasa wa 3 uonekane juu, kama hivi.” Fold the test booklet so that only page 3 is seen.

1. Picture Numbering.

"Ukurasa wa 3.


"Tazama hiyo picha nyingine katika mstari wa pili: picha hiyo ni nyoka. Huyo nyoka aliye katika mstari wa kwanza juu, yuna nambari 6 chini yake; kwa hiyo andika nambari 6 chini ya nyoka aliye katika mstari wa pili. Andika 6 chini ya nyoka huyu tu.” Assistants supervise as before.


"Kalamu chini!

"Nitakaposema ‘Anza,’ lakini si kabla ya kusema, endeleeni vivyo hivyo wenye. Maliza huo mstari wa pili wa hizo picha, halafu endelea na mstari wa mwishe. Jaribu kufanya kilic picha

Assistants see that everyone is doing the right thing.

After 1 minute, say: “Basi! Kalamu chini! Mtu yoyote ambaye hakujua jinsi atakavyofanya alnue mkono juu, nipate kumueleza.” Deal with any difficulties which arise, then proceed.

“Kalamu chini!


After 1¼ minutes, say: “Basi! Kalamu chini! Sasa funua ukurasa wa 5. HUU ndio ukurasa wa 5.” Hold up a test booklet folded to the proper page. “Kunja vitabu vyenu.”

2. Comparison.

“Ukurasa wa 5.


“Kalamu chini!

Assistants see that everyone is doing the right thing.

After 1 minute, say: "Basi! Kalamu chini! Wale ambao hawakuelewa jinsi ya kufanya wainue mikono juu." Deal with any difficulties which arise, then proceed.

"Kalamu chini!"


After 2 minutes, say: "Basi! Kalamu chini! Sasa funua urasa wa 7. Huu ndio urasa wa 7." Hold up a test booklet folded at the proper page. "Kunja vitabu vyenu."

3. Picture Classification.

"Urasa wa 7."

"Tazama mstari wa kwanza wa hizo picha, mstari nambari 1. Kuna picha tano katika mstari huo: mtu, mtu mwingine, mtu mwingine, ngombe, na mtu mwingine. Picha nne katika hizi zimefanana, moja ni tofauti. Yule ngombe ndiye aliyefauta na wale watu. Kwa hivyo twaa kalamu yako uchore mchoro wa kumfuta huyo ngombe. Chora alama hii (making a large X on the blackboard) jua ya huyo ngombe." Assistants see that everyone makes a cross in the proper place, and report all correct before examiner proceeds.


"Kalamu chini!

"Nitakaposema 'Anza,' lakini si kabla ya kusema, endeleeni vivyo hivyo wenyewe. Jaribu kufanya kila mstari katika ukurasa huu. Kumbuka, KATIKA KILA MSTARI, TAFUTA PIOHA ILE ILIYO TOFAUTI NA ZILE ZINGINE, UKAICHORE KWA KALAMU YAKO. KATIKA KILA MSTARI, CHORA PICA MOJA TU. Tayari? Anza!'" Start the stop-watch, or note the time.

Assistants see that everyone is doing the right thing.

After 1 minute, say: "Basi! Kalamu chini! Mtu yoyote ambaye hakujua jinsi ya kufanya anue mkono juu, nipte kumueleza." Deal with any difficulties which arise, then proceed.

"Kalamu chini!


After 3 minutes, say: "Basi! Kalamu chini! Sasa tazama ukurasa wa 9. Huu ndio ukurasa wa 9." Hold up a test booklet folded to the proper page. "Kunja vitabu vyenu."

4. Picture Completion.

"Ukurasa wa 9.

"Tazama picha ya kwanza, picha nambari 1. Ni uso wa mtu, sivyo? (Pause.) Lakini mtu mwenyewe hana mdomo. Basi twaa kalamu yako ukaichore mdodo wake. Mtie mdodo kwa kalamu yako. Mstari kama huu (quickly drawing the missing mouth on the blackboard) utafaa kwa mdodo." Assistants see that everyone draws in the mouth, and report all correct before examiner proceeds.


"Kalamu chini!


Assistants make sure that everyone is doing the right thing.

After 1 minute, say: "Basi! Kalamu chini! Mtu yoyote ambaye hakujua jinsi ya kufanya aime mkono jui." Deal with any difficulties which arise, then proceed.

"Kalamu chini!


After 5 minutes, say: "Basi! Kalamu chini! Sasa funua ukurasa wa 11. Huu ndio ukurasa wa 11." Hold up a test booklet folded to the proper page. "Kunja vitabu vyenu."

An interval may be allowed here. During the interval, the test booklet should be folded at page 11 on the desks.

5. Number Series.

"Ukurasa wa 11.

"Tazama mstari wa kwanza wa nambari: 1, 2, 3, 4, 5. Tazama ile mstari miwili midogo iliyoko baada ya nambari 5. Juu ya mstari hili andika nambari zile mbili zinazoefutana baada ya 5. 1, 2, 3, 4, 5,—ni nambari gani mbili zitakazofuata? (Pause for correct answer.) Ndio, ni 6, 7. Kwa hivyo twaa kalamu yako uandike 6, 7, juu ya mstari ile miwili midogo baada ya 5." Assistants see that everyone writes the numbers in the proper places, and report all correct before examiner proceeds.

"Tazama ile mstari miwili midogo iliyoko baada ya nambari 5. Juu ya mstari hili andika nambari zile mbili zinazoefutana baada ya 5. 1, 2, 3, 4, 5,—ni nambari gani mbili zitakazofuata?" Pause for answer. If there is any difficulty, explain that the numbers in this row increase by two at each step, and that therefore the next two numbers are 12, 14. "Kwa hivyo kila mmoja basi aandike 12, 14, katika hiyo mstari miwili ifuatayo 10." Assistants supervise as before.

"Tazama ule mstari wa pili wa nambari: 2, 4, 6, 8, 10. Ni nambari gani mbili zitakazofuata?" Pause for answer. If there is any difficulty, explain that the numbers in this row decrease by one at each step. "Kwa hivyo kila mmoja aandike 5, 4, juu ya ile mstari miwili midogo ifuatayo 6."
"Tazama huo mstari mwingine: 1 1, 2 2, 3 3, 4 4. Ni nambari gani mbili zitakazofuata?" Pause for answer. If there is any difficulty, explain that each number is repeated. "Kwa hivyo kila mmoja aandike 5 5 katika ile mistari miwili midogo ifuatayo 4."


Assistants see that everyone is doing the right thing.

After 1 minute, say: "Basi! Kalamu chini!" Examiner demonstrates to the whole class the correct solution of the remaining problems on page 11. Every pupil must understand what is required before examiner proceeds.


After 10 minutes, say: "Basi! Kalamu chini! Sasa tazama ukurasa wa 13; huu ndio ukurasa wa 13." Hold up a test booklet folded to the proper page. "Kunja vitabu vyenu."

6. Picture Absurdities.


"Kalamu chini!


Assistants see that everyone is doing the right thing.

After 1 minute, say: "Basi! Kalamu chini! Mtu yoyote ambaye hakufahamu jinsi ya kufanya ainue mkono juu." Deal with any difficulties which arise, then proceed.

"Kalamu chini!


After 4 minutes, say: "Basi! Kalamu chini! Fungeni vitabu vyenu." Collect the booklets.
GENERAL INTELLIGENCE TEST
FOR AFRICANS

Prepared under the auspices of the Carnegie Corporation of New York by R. A. C. Oliver

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GENERAL INTELLIGENCE TEST FOR AFRICANS

REPORT FORM

School or Institution: .................................................. Class: ..................................................
Name of Examiner: .................................................. Date: ..................................................

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*Mark with a cross those ages which are estimated only, not definitely known.

To be filled up by examiner and sent to:
"General Intelligence Test for Africans,"
Education Department,
P. O. Box 340, Nairobi.
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*Mark with a cross those ages which are estimated only, not definitely known.
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GENERAL INTELLIGENCE TEST FOR AFRICANS

DIRECTIONS FOR SCORING

General Rules.

1. Each item marked by a pupil is scored either right or wrong. No fractional scores are given.

2. If a marking has clearly been corrected by the pupil, so that there is no doubt as to his final intention, the correction is the answer which should be scored.

3. In any case not provided for in the rules for scoring, the scorer must use his own judgment. An answer should be counted as right only if it is quite clear that the pupil has indubitably solved the problem.

Specific Rules.


If the number to be subtracted (number wrong) is greater than the number right, the score is 0.

Test 3, page 8. Picture Classification.

If, in any item, more than one of the five pictures in the row has been crossed out, count the item as wrong; unless (a) it has clearly been the pupil’s final intention to leave only one of the pictures crossed out, in which case score as if that one alone had been crossed out, or (b) four of the pictures have been crossed out and one has not, in which case score as if that one alone had been crossed out.

Test 4, page 10. Picture Completion.

An answer is to be counted as right if it is quite clear that the pupil has tried, in whatever way, to indicate the missing part. The technical quality of his drawing is to be disregarded.

Markings in any parts of the picture, other than those shown in red in the key for Test 4, are to be disregarded.

Test 5, page 12. Number Series.

The answer to each item consists of two numbers, both of which must be right. If one number is right and the other wrong or omitted, count the item as wrong.


If the pupil amends the absurd part of the picture by drawing it as it should be, count as right.

Crosses through any parts of the picture not mentioned in the specific rules for each picture (see key for Test 6) do not affect the scoring; they are to be disregarded.

A cross very close to the part of the picture described in the key, but through no part of the picture, counts as right.

The method of calculating the score in each test is shown in Table A:

<table>
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<th>Table A. Methods of Calculating Scores.</th>
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<td>Test 5, page 12</td>
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<tr>
<td>Test 6, page 14</td>
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‘R’ means ‘number right’.

‘W’ means ‘number wrong’.

‘×’ means ‘multiplied by’.
Key for Test 4, Page 10.

The missing part in each picture is shown correctly in red ink in the pictorial key for Test 4. The following are additional rules for scoring certain items:

1. The missing horn may be drawn of any shape and in any position.
2. Any kind of letter D counts as right.
3. At least two lines joining the broken stream of water must be shown.
4. The digits of the number ten must be shown in their correct order; that is, since the ruler is drawn upside down, 01.
5. The missing spoke must be indicated by two lines from rim to hub; a larger or smaller number of lines, apart from shading, counts as wrong. A line completing the rim is to be disregarded.
6. The missing ear may be drawn of any shape and in any position.
7. Any date beginning with the digits 19, on any part of the coin, counts as right.
8. Either a stopper in the neck of the bottle, or liquid issuing from the neck of the bottle, but not both, counts as right. Both stopper and liquid have, however, been shown in the key.

Key for Test 6, Page 14.

After the number of the picture, the part of the picture which should be crossed out is stated. Where necessary for clarity, crossings-out which count as wrong are also described.

1. Either tail, not both. A cross near both tails, but through neither, counts as wrong.
2. Any one leg. If two or three legs are crossed out, count as wrong.
3. Either hump, not both. A cross near both humps, but through neither, counts as wrong.
4. The figure 1 in the 2 o'clock position. If the other figure 1 is crossed out, count as wrong.
5. The middle eye only. If either or both of the other eyes is crossed out, count as wrong.
6. The coin.
7. Either the blank space between 4 and 5, or the 5, or both.
8. Any part of the ruler between, but not including, 9 and 11.
9. Any part of the ruler between, but not including, 5 and 8.
10. The vessel upside down on the ground.
11. The animal paw. If the hen’s claw is crossed out, count as wrong.
12. Any one finger. The crossing out must be more or less confined to one finger. If more than one finger is clearly crossed out, count as wrong. A cross through the thumb is to be disregarded.
13. Any part of the arrow to the left of the bowstring. If the arrowhead nearest the bow is crossed out, count as wrong.
14. Any one of the fingers. If more than one finger is crossed out, count as wrong. A cross through the thumb is to be disregarded.
15. The smoke from the house on the left. If either or both of the other two smokes is crossed out, count as wrong.
<table>
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<th>SUBJECTS</th>
<th>DATES OF LETTERS OR NUMBERS</th>
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**MEMORANDA OF AND REGARDING PAPERS REMOVED FROM THIS FOLDER.**

**NOTE.-** Do not make yourselves "Slaves to System" there is no necessity to index every letter, if correspondence is small, there is NO NECESSITY to index at all.
THE APPLICATION OF PSYCHOLOGICAL TESTS
TO CERTAIN PROBLEMS OF NATIVE EDUCATION
IN EAST AFRICA

A Thesis
submitted to
the Faculty of Arts
of the University of Edinburgh
in fulfilment of the requirements
for the degree of Doctor of Philosophy

By Richard Alexander Cavaye Oliver
M.A.(Edin.), B.Ed. (Edin.).

October, 1932.
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(b) Statement of the Problems............. 4

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Set of the Test Material for the "General Intelligence Test for Africans." 34
1. INTRODUCTION.
I. INTRODUCTION.

(a) Native Education in East Africa.

The native peoples of East Africa have always possessed their own methods of educating their young. These methods presented the main features typical of primitive education. The children learned the modes of behaviour characteristic of their tribe by play with their fellows and by participation in the work of their elders. At puberty or adolescence they were initiated into the adult practices and beliefs of their tribe, and thereafter they completed their education by assisting in the councils, the rites, the work and the warfare of their fellow tribesmen.

These primitive methods of education still play an important part among the tribes of East Africa. They have, however, been considerably modified and supplemented since East Africa came under European influence. During the second half of the nineteenth century, the contact of natives with European missionaries, traders and administrators inevitably had educational consequences. This commerce of black and white, indirectly but powerfully educative, still of course goes on, intensified now by the presence of European agricultural settlement. Gradually, however, most of the East African tribes have been brought under the influence of European agencies aiming directly at education. There have been two directly educational forces, the Christian missions and government.
The missions were first in the educational field. Their main object was, of course, evangelical. Like missions in other countries, however, they found it desirable to teach as well as to preach. Their proselytes must be taught to read the religious writings, and this was for long the main object of mission schools. Within recent years, mainly owing to government influence, the curriculum of mission schools has been greatly widened, especially by the inclusion of manual and vocational studies. It has, however, retained much of the literary flavour with which it started.

Mission education tends to offer to the African full participation in European culture, and to take an optimistic view of the extent to which he can assimilate that culture.

Government was slow to follow the missions into the field of education. In recent years, however, it has taken upon itself an increasingly important part. Working through its education departments, it has established a considerable measure of control by means of financial aid, advice, regulations, inspection and common examinations. It has also opened schools of its own, to serve districts where there are no mission schools, and to provide types of education which the missions are not providing. At first the type of education fostered by government is said to have been somewhat narrowly vocational. The authorities were accused of attempting merely to turn out workmen for the use of European employers.

1. The first mission school in East Africa was opened by Rebmann and Krapf of the Church Missionary Society at Rabai in 1846. (3).

2. The first Director of Education in British East Africa was appointed in 1911. (4).
This accusation is now less frequently made. At the present time the educational policy of government appears to be directed at the betterment of the conditions of the native life, especially through the raising of his economic position. The aim of the school teaching, and of a great deal of educational work outside the schools, is the improvement of the African's health and housing, his methods of agriculture and marketing, and his standard of living in general. Government education offers the African the opportunity to advance in the direction of European civilization, especially along the path of material improvement. It appears to keep an open mind on the question how far the African will be capable of progressing.

An outstanding feature of the system which has developed under the influence of these educational forces is its diversity. One cause of this diversity lies in the nature of the African population and its environment. The Africans belong to several distinct races and numerous tribes. Their habitat varies from desert to extremely fertile agricultural lands, and their modes of livelihood, and their wealth, vary accordingly. They dwell at very varying distances from the centres of European population and influence. All these conditions affect the education a native receives. The European educational agencies, too, are very diverse. The missions represent many different churches and organizations. They come from different countries. They have different conceptions of education. They vary greatly in the resources of wealth and personnel at their command. The result of these two sets of varying conditions is that each school tends to have its own aims and its own standards of achievement. The chief unifying force in this situation is of course government. By the means we have already noted, the education departments
attempt to co-ordinate and evaluate the educational efforts of the various schools. The degree of unification which results is, however, of necessity small.

The present system of native education in East Africa, then, is of recent development, it has grown up under a wide variety of influence, and it still maintains a great diversity of forms. It might be expected that such a situation would present many educational problems, and indeed of these East Africa has its full complement. It was suggested by representatives of the Carnegie Corporation of New York, who visited East Africa in 1927, that certain of these problems could be attacked by means of mental tests. The studies reported in this thesis were carried out in Kenya Colony as a result of that suggestion, and were financed by the Carnegie Corporation.

(b) Statement of the Problems.

There appeared to be two major problems and one lesser one, the solution of which might be approached by means of mental tests. Of the major problems, one was immediately practical, the other a problem apparently theoretical, but in reality having a profound bearing on educational policy and indeed on the entire policy of government. The minor problem was of both theoretical and practical interest. These three problems may be stated as follows:—

(i) The Construction of an Intelligence Test for the Selection of Pupils for Higher Education.

The schools of Kenya Colony, like those of other countries, form an educational "ladder." (3). At the foot of the ladder are the "bush schools" or village schools.
These are small schools where a native teacher gives instruction mainly in the three R's, in the vernacular of the district. Pupils who show proficiency in the bush schools may step up the ladder to the "central schools." These are schools at a mission or government station, where European and African teachers complete the primary education of the pupils, in Kiswahili, the lingua franca of Kenya, and possibly in English. At the top of the educational ladder are a number of institutions, serving different purposes. There are secondary schools, such as the Alliance High School, a school supported by the Protestant missions with assistance from government. There is the Jeanes School, a government institution, where "Jeanes teachers" are trained as supervisors of bush school teachers and as village welfare workers. There are also special institutions such as the Medical Training Depot, conducted by the Medical Department, where a very elementary medical training is given to hospital assistants, and the agricultural schools conducted by the Agricultural Department. Each of these higher institutions accepts students from all over the country, and provides a comparatively advanced course conducted either in Kiswahili or in English.

The arrangement of the schools as a ladder involves, in Kenya as in other countries, the problem of sorting out, at each stage, the pupils for further advancement. The problem of selection arises even at the level of the central school: a good central school attracts from the village schools in its district many more pupils than it can accommodate. At the level of the higher schools and institutions, the difficulty of selection may be acute. One instrument of selection which can be and is used, is, of course, an examination on school work. Even in countries with a more unified and homogeneous
school system than Kenya, however, it has been found desirable to supplement school examinations with intelligence tests. In Kenya the use of intelligence tests becomes almost essential. As we have seen, the school system of Kenya is extraordinarily diversified. Consequently, there are great inequalities in the educational opportunities available to different natives. A scholastic examination is therefore, in Kenya more than in more settled countries, a measure of other factors besides the capacity to profit by instruction.

The nature of the problem of selection varies, of course, with the type of school. For entrance to a secondary school such as the Alliance High School, certain standards of scholastic attainment are necessary. These standards, however, are reached by considerably more pupils than can at present be accommodated; and in any case the need is felt of a test of ability more equitable than, in the circumstances, an examination on school work can be. At an institution like the Jeans School, the problem is somewhat different. The degree of scholastic attainment requisite for success as a Jeans teacher is comparatively small. The prerequisites in one whose work is to be the improvement of village life are rather personal qualities, among which intelligence takes an important place. The object of selection for the Jeans School is therefore to choose Africans who, almost irrespective of their educational attainments, will be sufficiently intelligent to assimilate modern ideas and to propagate them in their communities. The other institutions of higher education have likewise their special problems. All of the higher schools, however, and even the central schools, while maintaining their own standards of educational proficiency, agree in setting a premium on intelligence. There is need, therefore, for a measuring
instrument which will minimize differences in educational opportunity, and throw into prominence differences in educable capacity.

No such instrument existed. The first problem, therefore, was to construct an intelligence test for the selection of pupils for higher education.

(11) An Enquiry into the Educable Capacity of Natives of East Africa.

The educational policy of a country is necessarily founded on a knowledge or opinion of the educable capacity of the inhabitants. In a young country such as Kenya, where organized education has been at work for only a few years, and educational research has hardly begun, the estimate of the educable capacity of the inhabitants is almost entirely at the mercy of opinion. In Kenya, there is as yet very little basis on which a reasonable estimate can be founded. Opinions, however, based to some extent on intercourse with the natives, but more on personal bias, are strongly espoused. These range from the opinion that Africans are at least potentially the equals of Europeans in mental capacity, to the opinion that they are so inferior that they can be educated only at the risk of their mental derangement. (6, discussion). The former opinion is characteristic of the missionaries, though not confined to them nor held by all of them. Many natives who have received some degree of schooling take the same view. The opposite opinion is characteristic of the European settlers. It has recently received some support in informed circles, owing to an interpretation of certain data on cranial and cortical development which will be discussed later. (6). Those responsible for the official direction of policy appear to keep the open mind necessitated by the lack of data,
They are, however, assailed on either flank by the opinionated. The assault is heaviest from the party which considers that the African's intellectual capacity is low. It has even been hinted that there is no need for an education department; and those engaged in education of natives have felt the need of justifying their efforts. (5). Thus the question what is the relative educable capacity of the natives of East Africa is not only of theoretical interest; on the solution which prevails will depend in a very practical manner the policy and practice of native education.

It was not claimed that a complete solution of this problem could be reached by means of mental tests. It appeared that the first necessary step was to make a survey of the possible lines of evidence bearing on the problem, to evaluate the validity of each line of evidence, and to draw such tentative conclusions as were possible from whatever evidence was adjudged valid. This task was attempted in the paper which forms the second part of this thesis, and which, under the title "The Comparison of the Abilities of Races: With Special Reference to East Africa," appeared in "The East African Medical Journal," Vol. IX. Nos.6 and 7, in September and October, 1932. Incidentally, some fresh data were presented, which had been obtained by means of the intelligence test described in the first part of the thesis.

(iii) A Study of the Musical Talent of Natives of East Africa.

The third problem was minor in scope. It was of both theoretical and practical interest. In a sense it was a replica of the two major problems together with
a group of special abilities, those underlying musical talent, substituted for general ability or intelligence. The interest for theory lay in the comparison of the musical endowment of African's with that of white people. The practical end was to demonstrate that what the Americans would call a "blanket" judgement on African capacities is an insufficient basis for an educational policy. While intelligence is the factor of broadest scope amongst the abilities of man, there are also factors of narrower scope of which education must take account. Whatever conclusion is reached regarding the general intelligence of Africans must not shut out consideration of his special abilities. It is desirable that as complete a picture of African abilities as possible should be obtained, so that the stresses within the educational system may be distributed accordingly. Even those who place a low estimate on the African's general intelligence are sometimes willing to concede him "cleverness with his hands," or "linguistic facility," or "a turn for music." Such special abilities should be investigated, and, if found to be strong in the African, should be brought into play by his education. Provision should be made for the discovery of individuals specially well endowed with any ability. As an example of what might be done with other special abilities, musical talent was chosen for study.

The third problem, then, was to make a comparative study of musical talent in natives of East Africa, and to show how individual Africans specially well endowed with musical talent could be discovered and selected for special training. This part of the thesis appeared as a paper in
The British Journal of Psychology (General Section)," Vol. XXII, Part 4, in April 1932, under the title "The Musical Talent of Natives of East Africa."

The three problems of native education dealt with in this thesis are, then, as follows:-

1. The construction of an intelligence test for the selection of pupils for higher education.

2. An enquiry into the educable capacity of natives of East Africa.

3. A study of the musical talent of natives of East Africa.

These three problems will be discussed in turn.
II. THE CONSTRUCTION OF AN INTELLIGENCE
TEST FOR THE SELECTION OF PUPILS
FOR HIGHER EDUCATION.
II. THE CONSTRUCTION OF AN INTELLIGENCE TEST FOR THE SELECTION OF PUPILS FOR HIGHER EDUCATION.

1. Object of the Experiment.
As we have seen, the object of this experiment was to construct an intelligence test, for use in selecting natives of East Africa for education in central and higher schools, and for cognate purposes.

2. Requirements of the Test.
The use to which the test was to be put determined the requirements it had to fulfill. It had to test intelligence in pupils whose experience is derived from an East African environment. Its difficulty had to be adjusted to the ability of such pupils at the stage of development when they seek to enter central and higher schools. Since the educational opportunities of the pupils have varied greatly from individual to individual, the influence of schooling on performance in the test had to be minimized. Since there is no body of experienced psychological examiners in the country, and, still more, that the time required for testing should not be excessive, the test had to be a group test. Since the natives to be tested speak a number of different languages, and have a varying command of the lingua franca, Kiswahili, the test had to call for a non-verbal response. The instructions to the subjects could if necessary be verbal, provided that natives who understood the same language were tested together, and provided the verbal instructions were combined with practical demonstrations and with forepractise.
3. Assembly of the Test.

A survey was made of types of non-verbal group test which might be adapted to fulfill these requirements. Six types of test were chosen for trial. The general form of each test was decided on, and test items were invented. The six tests are described and illustrated below. The descriptive titles were affixed for convenience of reference.

Test 1. "Picture Numbering."

This is a form of the well-known symbol-digit test. The symbols are pictures of objects familiar in the African environment. The key and the first line of the test are given in Figure 1.

![Figure 1. Key and First Line of Test 1.](image)

Test 2. "Comparison."

Tests similar to this have been frequently used, as in the American "National Intelligence Tests." The subject has to write S if the two things in a pair are the same, D if they are different. In languages other than English, other letters may of course be used. Typical pairs are shown in Figure 2.
Test 3. "Picture Classification."

The writer is not acquainted with any test closely resembling this, though it is of course not entirely new in conception. In each item, four pictures are like one another in some way, a fifth is unlike the others and has to be crossed out. Two items are illustrated in Figure 3.

Test 4. "Picture Completion."

This is an example of the well-known picture completion test. Two items are given in Figure 4.
Test 5. "Number Series."

This is a test of easy number series continuation.

Typical items are shown in Figure 5.

2 3 4 5 6 7 ....... .......
99999 9999 999 ....... .......
1 2 4 7 11 16 ....... .......

Fig. 5. Items from Test 5

Test 6. "Picture Absurdities"

This type of test is also well known. Examples of the items are given in Figure 6.

Fig. 6. Items from Test 6.
It will be seen that the test material is entirely non-verbal. It consists for the most part of pictures. Nearly all the Africans of the class for which the test is intended are fairly familiar with pictures and able to interpret them. The objects represented are all objects of everyday experience to the Africans to be tested, apart perhaps from local differences of detail of a very minor sort. The non-pictorial material consists of letters, digits and designs which, it is believed, are either equally familiar or equally unfamiliar to all the intended subjects.

These six tests were drawn up in preliminary form for a try-out. In each test, approximately twice as many items as would probably be required in the final form were invented, so that items which proved unsuitable in the try-out might be discarded. Each test was provided with a preliminary exercise similar to the test itself. The author made rough sketches of all the pictures, and an artist was engaged to draw them properly. The six tests in their preliminary forms were printed separately on a duplicating machine. A procedure for administering each test was tentatively laid down. The procedure consisted in general of verbal instructions accompanied by demonstrations, followed then by assisted practice and finally by the test itself.

4. The Try-Out and its Results.

The battery of tests in its preliminary form was tried out at the Alliance High School, near Nairobi, Kenya Colony. This, it will be remembered, is a secondary school, and one of the institutions for which the test is intended to select pupils. It therefore provided an excellent situation in which to submit the test battery to trial.
For Test 1, obviously a "speed test" of homogeneous difficulty, a limited time allowance was tentatively fixed after a few experiments on individual natives. For the other tests, all of which were taken to be "difficulty tests," unlimited time was allowed, in order that each item should be attempted by every pupil. To furnish some notion of a fitting time for each of these tests, however, the pupils were instructed to record on their papers how long they had taken, as indicated by the elapsed time written periodically on the blackboard by the examiner.

To secure a criterion of the value of the test items, recourse was had to estimates of the pupils' intelligence made by their teachers. In the present circumstances of East African education, teachers' estimates are probably the best criterion available. An age criterion is out of the question, as only a very small percentage of natives know their ages; and it follows that what the Americans call "age-grade location" is likewise out of the question. Since the school is a small one, and all the pupils are boarders, the principal and his European staff of three were in a position to form good judgements of their pupils' ability. The method of securing the criterion was that described by Hull (1). Briefly, each of the four teachers ranked all the pupils in order of intelligence. The four ranks thus assigned to each pupil were transmuted into scores on a linear scale by means of Hull's formula and table. The four scores of each pupil were then averaged to give his "criterion score," and independent criterion of his intelligence with which could be compared the measurement made by the intelligence test.

The reliability coefficient of the criterion scores was found to be \( r = 0.77 \), which represents a fairly high reliability for teachers' estimates. This coefficient was obtained by correlating the combined scores of two teachers with the
combined scores of the other two teachers, and substituting the resulting value, \( + 0.63 \), for \( r \) in the appropriate form of the Spearman-Brown formula, namely

\[
\frac{2r}{1 + r}
\]

The criterion scores formed a standard for determining the value of each test item and of each test as a measure of intelligence. The pupils were divided into three groups, approximately equal in numbers, on the basis of their criterion scores. These groups, called the A, B and C groups, contained pupils whose scores formed respectively the highest, the middle and the lowest thirds of the distribution of criterion scores. The percentage of each group passing each item was computed. Those items which showed a higher percentage of passes in the A group than in the B, and a higher percentage in the B group than in the C, were selected; the other items were rejected.

The items selected for use in the final form of the test were arranged in order of difficulty. The difficulty of an item was taken as inversely proportional to the number of pupils passing it. It became clear that not only in Test 1 ("Picture Numbering"), as had been anticipated, but also in Test 2 ("Comparison"), all the items were approximately equal in difficulty, and that in these two tests the subject's score depended almost entirely on his rate of working. The other four tests showed considerable gradations of difficulty. To them, ample time could be allowed, and the range of difficulty rather than the time allowance could be relied upon to differentiate the subjects. The first two tests, in other words, proved to be "speed tests," the other four proved to be "difficulty tests."
As a preliminary indication of the value of each test, the pupils' scores in each test were correlated with their criterion scores. The test scores were of course computed on the selected items only.

In the case of Test 2, a speed test for which unlimited time had been allowed, the time taken instead of the number right provided a temporary method of scoring. The Pearson coefficients of correlation between test scores and criterion scores are given in Table 1. Since we are interested in the correlation of test scores not with fallible criterion scores but with true criterion scores, the coefficients have been corrected for attenuation in the criterion scores.

Table 1. Coefficients of Correlation, between Scores in the Preliminary Forms of the Tests, and Criterion Scores

<table>
<thead>
<tr>
<th>TEST</th>
<th>r</th>
<th>P(r)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 &quot;Picture Numbering&quot;</td>
<td>+0.56</td>
<td>+0.05</td>
</tr>
<tr>
<td>2 &quot;Comparison&quot;</td>
<td>-0.41</td>
<td>-0.06</td>
</tr>
<tr>
<td>3 &quot;Picture Classification&quot;</td>
<td>+0.35</td>
<td>+0.07</td>
</tr>
<tr>
<td>4 &quot;Picture Completion&quot;</td>
<td>+0.45</td>
<td>+0.06</td>
</tr>
<tr>
<td>5 &quot;Number Series&quot;</td>
<td>+0.44</td>
<td>+0.06</td>
</tr>
<tr>
<td>6 &quot;Picture Absurdities&quot;</td>
<td>+0.46</td>
<td>+0.06</td>
</tr>
</tbody>
</table>
Since none of these coefficients is less than five times its probable error, all six tests seemed sufficiently promising to be proceeded with.

They were accordingly printed as a booklet, entitled "General Intelligence Test for Africans." The procedure for administering the tests was amended in minor ways suggested by the try-out. The time allowances appropriate to each test were estimated, pending further experiment. The methods of scoring found most suitable were laid down. As aids to quick and accurate scoring, special keys were devised and printed. The keys for Test 1 ("Picture Numbering"), and Test 3 ("Picture Classification"), were printed on transparent paper which could be superimposed upon the test pages so as to reveal the pupils' answers and the correct answers together. The keys for Test 2 ("Comparison") and Test 5 ("Number Series") were printed down the margins of a card, for use in a similar fashion. The key for Test 4 ("Picture Completion"), consisted of a test page, printed on a card, with the pictures correctly completed in red. The key for Test 6 ("Picture Absurdities"), was a verbal one, printed on a card, describing the part of the picture which was to be crossed out.

5. Fixing the Time Allowances.

With the tests printed in their final form, experiments could be carried out finally to fix the time allowances. Four groups were tested with this end in view, successively closer approximations to the best fitting time limits being made. These groups were as follows:-

1. 23 Jeanes teachers in training;
2. 25 Jeanes teachers in training;
3. 23 Alliance High School pupils;
4. 44 Alliance High School pupils.

In deciding upon the time limits for the "speed tests," Tests 1 and 2, the principles followed were:-
(1) That all or nearly all the subjects should have sufficient time to make a score above zero;
(2) That few subjects or none should have sufficient time to make a perfect score;
(3) That in the time given, the average score made by the Joanne teachers, who were considered to be the most typical subjects, should be approximately half the highest possible score.

The time allowances for the four "difficulty tests" were determined in accordance with the principle that at least 90 per cent of the subjects should have sufficient time to complete all the items they were capable of completing. A further principle which was applied to all the time allowances was that, for convenience of administering, they should be a whole number of minutes or half-minutes. In accordance with these principles, the time allowances for the six tests were finally fixed at $1\frac{1}{2}$, 2, 3, 5, 10 and 4 minutes respectively.

A uniform time allowance of 1 minute each was found to be adequate for the preliminary exercises. The time required for the entire test, including the giving out of the booklets, the recording of data such as name and tribe by the pupils, the instructions, demonstrations, exercises and tests proper, and an interval of ten minutes for rest, was found to be approximately an hour and a half.

6. Weighting and Validation.

The next step was to determine how the scores in the six component tests were to be combined, and what was the validity of the resulting total scores. To this end, the test was applied under standard conditions to 126 boys in Standards V and VI at Maseno Central School, near Victoria Nyanza.
The principal of the school and two European members of his staff ranked these pupils in order of intelligence as they estimated it. The group was reduced to 100 by excluding the 26 pupils, regarding whose intelligence the judges were least in agreement. The three ranks of each pupil were converted into scores by Hull's method, and his scores were averaged to give his "criterion score." The average coefficient of correlation between the scores assigned by any two teachers was \( r = 0.797 \), and substituting this value for \( r \) in the usual form of the Spearman-Brown formula gave \( r = 0.922 \) as the reliability coefficient of the criterion scores.

The coefficient of correlation between each test and the criterion, and the coefficient of correlation between each test and each of the other tests, were computed. They are given in Table 2. All the coefficients are positive.

<table>
<thead>
<tr>
<th>Test</th>
<th>Criterion</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>.407</td>
<td>.504</td>
<td>.229</td>
<td>.416</td>
<td>.340</td>
<td>.453</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>.367</td>
<td>.504</td>
<td>.130</td>
<td>.384</td>
<td>.225</td>
<td>.392</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>.131</td>
<td>.229</td>
<td>.130</td>
<td>.216</td>
<td>.166</td>
<td>.195</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>.316</td>
<td>.416</td>
<td>.334</td>
<td>.216</td>
<td>.278</td>
<td>.487</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>.446</td>
<td>.340</td>
<td>.225</td>
<td>.156</td>
<td>.278</td>
<td>.437</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>.539</td>
<td>.453</td>
<td>.392</td>
<td>.195</td>
<td>.487</td>
<td>.437</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

To determine the weight to be assigned to each test score in the composite score, the regression equation technique was used, in the form of Kelley's "method of successive approximations." (2).
The third approximation weights resulting are given in Table 3. These are the weights to be assigned to the component tests, assuming the standard deviations of the tests to be equal. The multiple correlation coefficient was found to be $R = \mp 0.613$.

Table 3. Weights of the Component Tests, assuming Equal Standard Deviations.

<table>
<thead>
<tr>
<th>Test</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.1283</td>
</tr>
<tr>
<td>2</td>
<td>0.1401</td>
</tr>
<tr>
<td>3</td>
<td>-0.0090</td>
</tr>
<tr>
<td>4</td>
<td>-0.0189</td>
</tr>
<tr>
<td>5</td>
<td>0.2339</td>
</tr>
<tr>
<td>6</td>
<td>0.3532</td>
</tr>
</tbody>
</table>

Since it is not desired to predict the criterion scores, but only to combine the component tests scores in the best proportions, there is no need to use the actual regression weights and constant but only to use weights proportional to the regression weights. We may therefore multiply the weights given in Table 3 by 100 to get the more convenient weights given in Table 4, column 2.
Test 4. Derivation of Weighting System.

<table>
<thead>
<tr>
<th>Test</th>
<th>Weight assuming equal S.D.'s, x 100</th>
<th>Actual S.D.</th>
<th>Weight, given actual S.D.'s.</th>
<th>Weight assigned (first system)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>12.83</td>
<td>10.32</td>
<td>1.25</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>14.01</td>
<td>6.68</td>
<td>2.10</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>-0.90</td>
<td>2.07</td>
<td>-0.48</td>
<td>-1</td>
</tr>
<tr>
<td>4</td>
<td>-1.89</td>
<td>2.38</td>
<td>-0.84</td>
<td>-4</td>
</tr>
<tr>
<td>5</td>
<td>23.39</td>
<td>5.67</td>
<td>4.06</td>
<td>4</td>
</tr>
<tr>
<td>6</td>
<td>35.32</td>
<td>2.57</td>
<td>13.62</td>
<td>14</td>
</tr>
</tbody>
</table>

Since the standard deviations of the tests are, of course, not equal, the tests are intrinsically weighted in proportion to their respective standard deviations, which are given in Table 4, column 3. The weight actually required for any test, therefore, is

\[
\text{Weight assuming equal standard deviations} = \frac{\text{Actual standard deviation}}{\text{standard deviation of the test}}
\]

The weights thus calculated are given in Table 4, column 4.
Since fractional weights are inconvenient to use, the weight actually chosen for each test was the whole number or half nearest to the required weight. The approximate weights thus chosen are given in the last column of Table 4.

When this scoring system was put into practice by the writer and other examiners, it was found that certain of the weights were very inconvenient to use. The negative weights of Tests 3 and 4, the fractional weight of Test 3, and the inconvenient multiplier, 14, of Test 6, were so clumsy that they seemed likely to give rise to errors of scoring as serious as would a deliberate departure from the scoring system, and even to hinder the general use of the test. Theoretical perfection was therefore sacrificed to practical convenience, and a system of scoring adopted which was based on the regression equation, but which included no negative weight, no fractional weight, and no weight greater than the convenient multiplier 10. The weights thus finally adopted are given in Table 5.
Table 5. Weights finally assigned to the Component Tests.

<table>
<thead>
<tr>
<th>Test</th>
<th>Final Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>6</td>
<td>10</td>
</tr>
</tbody>
</table>

The separate test scores of the 100 Maseno pupils were combined into total scores by this system of weighting, and the total scores were correlated with the criterion scores. The coefficient of correlation between total scores and criterion scores was found to be \( r = +0.585 \). Correcting this coefficient for attenuation in the imperfect criterion scores proved the correlation between the test and a perfect criterion of the teachers' estimates type to be \( r = +0.60 \pm 0.04 \). This figure may be taken as a measure of the validity of the test.

A table was provided for converting the total score obtained by this scoring system into a percentage score.
7. Reliability

As a measure of the reliability of the test, its self-correlation was found. The group tested for this purpose was a comparatively homogeneous group of highly selected pupils in two school forms, namely 67 pupils in Forms 1 and 2 of the Alliance High School. This group was tested at the beginning of a school year, and retested four months later. The coefficient of correlation between the scores in the first testing and those in the second testing was $r = +0.614 \pm 0.028$.

8. Standardization

The "General Intelligence Test for Africans" has not been thoroughly standardized as yet. Some progress in standardization however has been made, and some of the most useful norms are already available. These include norms for the only government-aided secondary school in Kenya, for a typical large mission central school, for the Medical Training Depot, and for the Jeane School. The whole body of Jeane teachers, certificated and in training, has been tested. The mean and the median scores of these groups are given in Table 6, both in the form of total score out of a possible of 409 and in the form of percent score.
Table 6. Preliminary Norms for Various Groups, in the "General Intelligence Test for Africans"

<table>
<thead>
<tr>
<th>CLASS</th>
<th>Mean Score</th>
<th>Median Score</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total</td>
<td>Per cent</td>
</tr>
<tr>
<td>Form III</td>
<td>329</td>
<td>80</td>
</tr>
<tr>
<td>Form II</td>
<td>315</td>
<td>77</td>
</tr>
<tr>
<td>Form I</td>
<td>274</td>
<td>67</td>
</tr>
<tr>
<td>Standard VI</td>
<td>276</td>
<td>67</td>
</tr>
<tr>
<td>Standard V</td>
<td>222</td>
<td>54</td>
</tr>
<tr>
<td>Jenes Teachers</td>
<td>227</td>
<td>56</td>
</tr>
<tr>
<td>Medical Training Depot</td>
<td>248</td>
<td>61</td>
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1. Alliance High School, Kikuyu.

It is hoped eventually to establish norms for various schools and classes, and norms showing the influence of tribe, sex and other conditions. In view of the variety of the conditions, the extent of the country and the difficulty of travel, a complete standardization will depend on the co-operation of the principals of schools and others. This has already been offered both by education departments and by missionaries.
9. Manual of Directions

A manual of directions has been published, containing an account of the nature, the uses and the limitations of the test, and complete instructions for examining, for scoring, and for the treatment and interpretation of the results.

10. Applications

The "General Intelligence Test for Africans" is already in use for the selection of candidates for training as Jeannes teachers. The staff of the Jeannes School, during their periodical visits to Jeannes teachers in the field, apply the test to the candidates assembled at various centres, and by means of it select candidates for interview and possibly for admission.

Principals and inspectors of schools are now using the test for the selection of entrants, for the classification of pupils, for the award of scholarships to the Alliance High School and as a matter of general interest.

The Education Department of Kenya Colony intends to have the test applied to all candidates for the Primary School Certificate in December, 1932, and probably in succeeding years. The test will be conducted by the Department's examiners at the examining centres throughout the country. The results will be used along with the results of the Primary School Certificate examination in the selection of pupils for higher education at the secondary schools. In addition to this immediately practical result, it is expected that other data of interest and value may also accrue from this widespread application of the test.
It may therefore be claimed that the object of the experiment is being realized.

A complete set of the test material is given in the Appendix. It consists of:

2. Test booklet.
3. Directions for scoring, and keys for tests 2, 5 and 6.
4. Key for Test 1.
5. Key for Test 3.
III. AN ENQUIRY INTO THE EDUCABLE CAPACITY OF NATIVES OF EAST AFRICA.
THE COMPARISON OF THE ABILITIES OF RACES:
WITH SPECIAL REFERENCE TO EAST AFRICA.

By R. A. C. Oliver, M.A., B.Ed.*
THE COMPARISON OF THE ABILITIES OF RACES:
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The purpose of this paper is to take stock of the comparisons which have been made of the abilities of races. It is not necessary for our purpose to define the term "race" in an ethnological sense; suffice it to denote such groups as Englishmen and Frenchmen on the one hand, and on the other the native Africans of their colonies. The abilities to be discussed are the culture-making abilities, of which we may assume the chief to be that commonly known as "general intelligence," a factor entering into the performance of every kind of task.

There have been three main bases for the comparison of the abilities of races. Racial abilities have been judged first by cultural achievement, secondly by performance in psychological tests, and thirdly by certain anatomical and histological measurements. The first basis of comparison has been largely theoretical and qualitative; the second and third bases have been mainly experimental and quantitative. Let us enquire what conclusions can be drawn from such comparisons.

A. COMPARISONS OF CULTURAL ACHIEVEMENT.

When a comparison is made between the cultural achievement of Europeans and that of a primitive people, it is generally agreed that the former is superior. It is perhaps true that "each tribe, or true national unit, regards itself as superior to all others and holds its culture to be the best" (1). However, only a few paradoxical minds deny that in the mastery of environment European culture has been more successful than primitive culture. This at any rate is the judgment usually made, and assuming it to be correct, the question we have to discuss is whether this superiority in cultural achievement necessarily implies a corresponding superiority in racial ability. It can be shown that it does not necessarily do so.

That difference in level of achievement does not depend on difference in level of racial ability alone may be reasonably deduced from a comparison of the cultural achievement of the Teutonic tribes which Caesar conquered, with that of their

* The author is engaged in research in Kenya Colony on behalf of the Carnegie Corporation of New York. He himself, however, is solely responsible for the opinions expressed.
present-day descendants. It is generally adjudged that there has been a considerable cultural advance, yet there is no reason to believe that there has been any corresponding change in innate racial ability. There is indeed no known biological mechanism by which a change so profound could have taken place. It is not to be supposed, for example, that every change in culture, for better or for worse, has somehow been paralleled by an inheritable morphological change in the organisms of the tribesmen; so that if a man learned to read, for example, or to make boots, his children would be born with an increased innate ability to learn the art of reading or of boot-making. Such theories of the inheritance of acquired characteristics are discredited in biology. Nor could a process of natural selection, working either with small variations or with large mutations in germ-plasm, have operated so to raise the whole racial level of ability; these processes would have to operate for a very long time to effect a change of this magnitude, and biologically the interval in question has been but brief. In any case it may be doubted whether within these historical times the environment, geographical and social, has favoured the multiplication of the more intelligent to the necessary degree; there is evidence that, at the present time at least, the tendency is the other way.*

We are therefore driven to the conclusion that an advance of this kind is not to be explained by biological principles. Where then are we to look for an explanation? Psychology and anthropology both feel that they can go some way towards providing a solution; and with due allowance for difference in point of view their solutions are the same. They claim that, supposing the innate equipment of the Teutonic tribes not to have changed, the change in their cultures can still be accounted for in terms of the psychology of learning or in terms of the known principles of the development of cultures. We may here take the anthropological point of view, as affording the clearer explanation at present, and glance at a few of the factors, other than differences in ability, which make for differences in cultural progress.

Human progress is due to inventions, in the widest sense of that word. Now even if human intelligence and inventiveness were everywhere of one uniform level, yet there exist factors which would make for unevenness in the quantity and

* For example, a negative correlation between intelligence and size of family is reported by H. E. G. Sutherland and G. H. Thomson, "The Correlation between Intelligence and Size of Family," British Journal of Psychology, 1926-27, 17, 81-92.
quality of inventions. One of these factors is accident. They are significant myths in the history of scientific progress that ascribe the discoveries made by Newton and by James Watt to the accidents of a falling apple and a spluttering kettle. Many important scientific discoveries have in sober fact been due to some agency beyond the control of the scientist, such as the mere carelessness of a laboratory underling. In like manner geographical discoveries that were destined to lead to the most radical cultural changes have in some cases been made by mariners who were seeking something else, or who had merely been blown out of their courses by winds they were powerless to cope with. In lesser degree this factor of accident must be at work all the time. It is entirely conceivable that lucky accidents may have befallen some groups more than others, with consequent differences in progress.

A second condition of cultural progress is the geographical environment. On the one hand, it is possible that environments differ in the incentive they offer to the exertion of inventiveness. One and the same inventive ability may be called less into play by an environment well adapted to the needs of human life than by a less kindly habitat. Necessity is the mother of invention, and it needed the necessity of the desert island to make an inventor of Robinson Crusoe. On the other hand, it is certain that environments differ in the resources they offer to human inventiveness. This is probably the chief means by which the environment conditions cultural progress—it sets the limits to what inventiveness can accomplish. One cannot make bricks without straw; and it is possible that the lack of coal deposits in the environment of a group imposes a serious limit on what that group can accomplish.

A yet more important variable in the culture-making of groups is their ethnological environment. Accretions to the culture of a group are not necessarily the inventions of that group itself. With few or no exceptions groups have borrowed and assimilated the culture traits of other groups with which they were in any way, direct or indirect, in communication. The diffusion of traits from the centres where they originate is a most pervasive phenomenon. One school of anthropologists, indeed, denies that any culture trait is ever invented more than once, and asserts that the appearance of a trait in the culture of any group other than that which originated it must infallibly be due to diffusion. The use of this principle of explanation alone seems to require a distortion of the facts to fit it, and to be a gratuitous rejection of other explanatory principles. But there
can be no doubt that it is a most potent instrument of explanation to anthropologists, and that the most advanced cultures have been foremost in borrowing the traits of their neighbours. Now some cultures, more than others, have undoubtedly had the advantage of fertile ideas which they did not themselves originate. The successive conquests of England, quite apart from the new blood they brought, must have carried with them very valuable contributions to the culture of the island. Western Europe learned a good deal of its mathematics, its astronomy and its medicine in the school of the Crusades. Africa on the other hand has always been the Dark Continent. Its unindented coast-line, its steep plateau, its unnavigable rivers, its climate, its fauna, its diseases, all have been barriers to the penetration of cultural traits which have been of such inestimable value to more favourably placed races.

Another factor which conditions cultural progress is the mere size of the group. This factor operates in two ways. In the first place, the larger the number of individuals in a group, the greater is the chance of its producing a genius; for we may regard a genius as an individual possessing a peculiarly happy combination of characteristics. And it is important to note that it is the actual number of geniuses in a group that counts, not the proportion they bear to the group as a whole. Once a genius makes an invention, it is as easy for a million people to use it as for a thousand; it took an Edison to invent electric light, but whole continents of people can turn a switch. But there is a second way in which the size of a group conditions its cultural progress. On the number of people who act together depends the degree of division of labour which is possible. Without division of labour, specialization is impossible; and inventions are mainly the work of specialists, who have the leisure and the knowledge to allow them to make original contributions.

But perhaps the most important of all the non-biological factors which condition the rate of growth of a culture, is the size of the existing culture base. The culture base is the sum-total of all the culture traits. The more traits there are, the greater are the chances of new combinations of traits, that is, of inventions. In the infancy of a culture, when the number of existing traits is comparatively small, the origination of a new trait must be very gradual, and must call for the exercise of great inventiveness in proportion to its apparent difficulty. The invention of the wheel from the data of pre-wheel days, for example, must have been a prodigious achievement (or possibly
a lucky accident), though since its invention it has required comparatively little ingenuity to fit it to carts and chariots, to locomotives and motor-cars. Nowadays inventors have at their disposal tremendous resources of past achievement in every field of human activity; it is therefore not surprising that inventions accrue at an ever-increasing rate. It seems, indeed, that the more inventions are made, the more inevitable do fresh inventions become. So used are we now to inventions, that we often say of some invention vaguely foreseen but not yet realized, as we said of television, that it is "bound to come." An individual may come into the world no better equipped for life than his ancestors, but it is not so with cultures. What is gained at one stage of a culture may be passed on to the next; the inheritance of acquired characteristics, though it does not hold for individuals, does hold for cultures, and is indeed a main condition of their growth. Every new acquisition increases the chances of still further achievements. The growth of cultures has a dynamics of its own. If by reason of any of the factors we have discussed—accident, the geographical or ethnological environment, or the size of the group—the culture of a race gains a lead, its lead is only likely to be increased with the course of time.

We may conclude that were the abilities of all races biologically the same, their cultural achievements might still differ immensely. Therefore from a comparison of their cultural achievements no final conclusion as to their abilities can be drawn. An advanced or a primitive stage of culture may at most be regarded as an indication of a superior or an inferior level of racial ability; it cannot be considered a proof of it.

B. COMPARISONS OF PERFORMANCE IN PSYCHOLOGICAL TESTS.

The general attitude of psychologists to the comparison of the mental processes of races is well expressed in the following quotation (2). The statement was made twenty-two years ago, but it is substantially true to-day.

"One thing the psychologist can assert with no fear of error. Starting from the various mental processes which are recognized in his text-books, he can assert that each of these processes is within the capabilities of every group of mankind. All have the same senses, the same instincts and emotions. All discriminate, compare, reason and invent. In all, one impulse can inhibit another, and a distant end can be pursued to the neglect of present incitations. State-
ments to the contrary, denying to the savage powers of reasoning, or abstraction, or inhibition, or foresight, can be dismissed at once. If the savage differs in these respects from the civilized man, the difference is one of degree, and consistent with considerable overlapping of savage and civilized individuals. The difference of degree calls for quantitative tests."

From this point of view, comparisons have been made of the abilities of racial groups on the basis of their behaviour in psychological tests. A few words may be in place as to the nature of such tests. The ability of a person is shown by what he can do when confronted with a problem. The individuals who make up a tribal group face a series of problems in their daily life, and their success in solving them constitutes the cultural achievement of the group. The abilities of such groups have therefore been compared, though, as we have seen, inconclusively, by their cultural achievements. The comparison of cultures is however necessarily a qualitative comparison, and as such is not wholly satisfactory to science, which prefers where possible to work with quantitative concepts. A psychological test, then, is an instrument for making quantitative comparisons between the abilities of individuals or groups. It is merely another problem which the individual must face. It is, however, a problem in which, ideally, all the conditions are definitely controlled, and which calls into play in a measurable manner the ability being studied. As a scientific instrument, it has proved of great service in many branches of psychology, pure and applied; and, as was to be expected, it has been used in the study of the problem before us. There is, in fact, an extensive and varied literature on the comparison of racial abilities by means of psychological tests. In the five years from 1925 to 1929, for example, some twenty-three experimental studies of this problem were published(3). These reported the testing of some thirty-seven thousand individuals, belonging to a variety of racial and national groups, with a wide range of tests. The group most studied has been the American negro, owing to the interest of the investigators; but many other groups have also been studied, including American Indians, Mexicans, Chinese, Hawaiians, Filipinos, Jews and representatives of most of the European nations. The ability most studied has been general intelligence, partly because it has proved most amenable to measurement, partly because it has been demonstrated to be the most important of the abilities of man, being a factor in every problem which he is called upon to solve. As the data on the
performance of the American negro in intelligence tests are the most extensive and the most germane to our interests, to them I shall here confine the discussion, first presenting the results obtained, and reserving till later a consideration of the general question of the applicability of the test instrument to the problem.

Assuming for the moment, then, that the tests used were valid measures of negro intelligence, we may first compare the average intelligence of the American negroes tested with the average intelligence of American whites. Almost without exception, the average intelligence of the negro groups has been found to be definitely lower than that of the white groups. The relation between the two averages could be expressed in a number of ways, of which the following is perhaps as clear and as representative of the findings as any. The intelligence of the average American negro child develops at only about eighty per cent. of the rate at which the intelligence of the average American white child develops. Therefore at the age of fifteen, when the intelligence of the average person of whatever race may be considered to have reached maturity, the average American negro's intelligence will have reached a level of development no higher than that of an average white child of about twelve years old.* This grade of intelligence could certainly not be called feeble-mindedness, but might be described as dullness. Terman, one of the chief authorities on intelligence, describes children of this level of ability as

"those children who would not, according to any of the commonly accepted social standards, be considered feeble-minded, but who are nevertheless far enough below the actual average of intelligence among races of western European descent that they cannot make ordinary school progress or master other intellectual difficulties which average children are equal to."(*)

In this class the intelligence tests would place the average American negro.

But in comparing two groups in respect of intelligence, it is not sufficient to compare only their averages. The individuals who make up the group of American whites, for example, are not all equal in intelligence. They vary about the

* In psychological terminology, the average intelligence quotient (IQ) of the white American is 100, that of the American negro is about 80; the average mental age of white American adults is in the neighbourhood of 15 years, that of American negro adults is about 12 years.
average, and, it is found, they vary in a definite manner. They are distributed, in fact, according to what is known as the "normal probability curve," or simply the "normal curve." This curve, which is illustrated in Figure 1, is well known in many sciences, fitting equally well such varied measurements as the statures of men, Mendelian cross-fertilization ratios, and intelligence quotients. It is a symmetrical, bell-shaped curve. It

![Image](image.png)

**FIG. 1.**

The normal distribution of intelligence in a race.

will be seen from Figure 1 that most people are about average in intelligence, and that the higher or lower we go above or below the average the smaller does the number of persons become, until we reach the comparatively few geniuses and feeble-minded respectively. The normal curve has been found to express the distribution of intelligence in American whites, in American negroes, and in all other racial groups which have been adequately tested. There is every reason to believe that it holds likewise of the distribution of intelligence in African tribes. It is therefore ridiculous to speak of the intelligence of the African natives as if it were throughout of one dead level. The African tribes have doubtless their highly intelligent and their feeble-minded members like other peoples.

To obtain a true picture of the relation between the intelligence of American negroes and that of American whites, then, we must compare not only averages but whole distributions. This comparison may be made by superimposing the curve for the negroes on the curve for the whites. Figure 2 shows the kind of results actually obtained. It will be seen that the negro average is lower than the white average, and that the whole scale of negro intelligence is lower than that of white intelligence. But it is important to notice the two distributions. Some American whites fall below the average American negro in intelligence; these are the dull, the border-line cases, and the definitely feeble-minded. Some negroes rise above the average
white in intelligence. As a matter of fact, it has been found that approximately twenty per cent. of American negroes equal or exceed the average of American whites in intelligence. The ablest negroes—the authors, the artists, the actors, the business men and the like—are doubtless drawn from this section of the distribution. The most eminent negroes of all—those at the upper extreme of the distribution—are probably the intellectual equals of quite eminent whites.

The American negro is derived mainly from Bantu stock. We should therefore expect the facts concerning the intelligence of Bantus to be of approximately the same order as those we have seen to hold of American negroes. And the little we know of these facts seems to confirm our expectations. We know that in native mental hospitals and reformatories there are many natives who by all reasonable standards would be diagnosed as feeble-minded. As will be shown later, the present writer has applied intelligence tests to natives in the middle and upper ranges of ability, and has found that they appear to be less intelligent on the average than Europeans, and that they vary considerably about their own average. For the topmost section of native African intelligence, we have the evidence of the careers of such eminent Africans as Dr. Aggrey, men who, from their achievements, must have been much above the average European in ability.

We may thus summarize the results of the comparison, by means of intelligence tests, of the ability of American negroes with the ability of American whites—and we have reason to believe that similar results would probably be found for Bantus and Europeans. If we assume that the tests used were valid measures of the intelligence of whites and of negroes, then the
average intelligence of the negroes is less than the average intelligence of the whites; but the difference between these two averages is much less than the difference between the most able and the least able of either group. The difference between the average negro intelligence and the average white intelligence is in fact approximately one-eighth* of the entire range of white ability. There is thus an extensive overlapping in the intelligence of the two groups.

It is interesting to note the close similarity between these results, actually obtained with the intelligence tests at present in use, and Julian Huxley’s forecast of the results that would be obtained by perfect measures of intelligence. Huxley writes:

"I am prepared to believe that if we ever do devise a really satisfactory method of measuring inborn mental attributes, we shall find the races of Africa slightly below the races of Europe in pure intelligence and probably certain other important qualities.

"But—and the but is a big one—I am perfectly certain that if this proves to be so, the difference between the racial averages will be small; and that they will be only an affair of averages, and that the great majority of the two populations will overlap as regards their innate intellectual capacities."(6)

Up to this point we have assumed that the intelligence test results provide an accurate picture of the real state of affairs. This is true, however, only with certain qualifications; and in interpreting the results it is necessary to have these qualifications clearly in mind. An intelligence test is an instrument designed to measure innate educable capacity. It is of course impossible to measure this inborn learning ability directly, detached from what has actually been learned; nature and nurture are inextricably mixed up in a man. Yet it is possible indirectly to measure innate intelligence, sufficiently well, at least, for such purposes as the classification, guidance, and selection of children and adults. This can be done by means of a test in which the factor of nurture is held constant for all individuals tested. Among individuals who have been bought up in the same cultural environment, there is a considerable body of

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* In statistical terms, the difference in PE units is usually found to approximate 1.25. This is one-eighth of the entire PE range, which is usually taken to be 10 PE. It is noteworthy that this difference agrees exactly with the estimate made by Galton in 1892 (Hereditary Genius), from a survey of the eminent men of the two races.
common experience; and it is comparatively easy to devise tests which, drawing only upon this highest common factor of their experience, measure only the residual factor, their varying degrees of intelligence. But for individuals from radically different cultural groups, the construction of such tests is a much more difficult matter. Between civilized and primitive groups especially, the highest common factor of experience may be too small to provide a neutral ground of comparison. Psychologists interested in this problem of the comparative abilities of races have made careful attempts to devise tests which, eschewing any condition likely to be more familiar to one racial group than to another, would be equally fair to every group. But to equalize for a civilized and a primitive group the cultural elements in a test is very difficult. There are many cultural factors which condition an individual's performance in a test. The following are some of these.

Some intelligence tests make use of language, either spoken or written. Obviously, if the language used be native to one group of subjects and foreign to another, the latter group is handicapped. This source of error is obvious, and can be avoided without great trouble. But the use of language may involve a more subtle fallacy. Even if each of the groups tested is allowed to use its own vernacular, or some other language well known to it, it does not necessarily follow that neither group is handicapped. For language itself occupies a different place in the cultures of different groups, some peoples resorting to verbal expression more readily than others.

To avoid the errors involved in the use of language, tests may be employed which dispense with it, in part or altogether. For example, the subject may be required to react to such non-verbal stimuli as pictures, symbols, or blocks of wood. But these objects too are not equally familiar in different cultures. The seeing of pictures as standing for things is a habit which is learned, and one which most European children, for example, have more opportunity of learning than most African children. Similarly, the actual symbols used in tests may be as unfamiliar to European children as to African children, yet European children are probably more accustomed to the mere use of symbols as such. The case is the same with blocks; most European children are accustomed to playing with shaped pieces of wood more than most African children are. We have only to compare the European child's equipment of toys, blocks and picture books with the scanty odds and ends an African child
plays with before he is sent out to herd goats, to see how much more familiar with such test material the European may be. Such material may be admirable for distinguishing among Africans themselves, but quite unsuitable for making comparisons between Africans and Europeans.

Further, the activity called for by a test may be no more complicated than making the simplest marks with a pencil on a piece of paper; yet the comparative strangeness of pencil and paper to many Africans may impose an unknown handicap on them. Again, account is sometimes taken of the speed with which the activity is performed; the subject may be given a task to perform, and the time he takes is measured, or he may be given a certain time, and the amount he can accomplish in that time is measured. But speed too is to some extent at least a cultural trait; each people has its characteristic tempo, at which it is accustomed to work.

Further, however interesting and even amusing the tests may be made, the test situation as such is as yet more familiar to most Europeans than to most Africans. The tester, too, is usually a European, and the whole institution of tests is a European one, so that an African being tested may perhaps be thrown into an inferiority attitude prejudicial to his performance more readily than a European would be. And in addition to all these conditions which may adversely affect the performance of primitive groups in tests, there may be others which we have not yet begun to imagine.

It is therefore probably safe to say that no test has yet been devised which draws equally upon the experience of advanced and primitive groups, and which is therefore a completely true measure of the intelligence of such groups. Applied to groups differing widely in culture, the tests are measures of intelligence plus a cultural factor of unknown amount. On the extent to which this cultural factor is equalized or allowed for in the groups compared will depend the degree of significance to be attached to the comparison of them.

Another difficulty in the way of the use of psychological tests, and indeed of any other measures, is the difficulty of adequate sampling. It is impossible to test an entire racial or tribal group; only a sample of the group can be tested. Before conclusions can be drawn concerning the intelligence of the group as a whole, it must be shown that the sample tested is truly representative of the whole group. Obviously, the distribu-
tion of intelligence in a race as a whole cannot be determined merely from measurements of that race's representatives in a mental hospital at one extreme or in a high school at the other. Such samples of one race can however be compared with approximately equivalent samples of the other race, hospital patients, for example, with hospital patients, and high school pupils with high school pupils. The comparison will be significant in proportion as the groups compared are selected from similar strata of their respective populations.

The significance of a comparison of the abilities of races by means of tests is therefore proportional to the degree to which it satisfies two conditions; first, that the tests used are equally fair to the several races, and secondly, that the samples of the races tested are truly comparable.

With this evaluation of mental test data in mind we may venture to examine some preliminary data of this kind on natives and Europeans in East Africa. Nowhere perhaps is this problem of racial differences more hotly canvassed. The native and the European populations are freely compared with one another, and conclusions of considerable practical importance reached. For want of better evidence, the conclusions have too often been arrived at on the ground of mere opinion. Any evidence of an objective and measurable kind must therefore be not without value. A comparison of an African group with a European group by means of a standardized intelligence test is accordingly presented. Provided we keep the conditions of a valid comparison clearly before us, the results should give us a first approximation to the truth. How close the approximation will be, will of course depend on the extent to which the necessary conditions of comparison have been fulfilled.

The two groups of subjects were the pupils of the Prince of Wales School, Kabete, and the pupils of the Alliance High School, Kikuyu.

The Prince of Wales School is a secondary school for European boys. The number of pupils tested was 124, the number attending the school on the day of the test. The great majority of the pupils are of British stock, some of them are of South African Dutch descent, a few of foreign European descent. Fifty per cent. of those tested were born in East Africa, the great majority of the other half in the British Isles or South Africa. The European population of Kenya is of a higher social and economic status than the average in most countries; the
pupils of the school are, generally speaking, of the middle classes—the sons of civil servants, professional and business people, farmers, and the like. Their average age was 14.95 or 14 years 11 months.*

The Alliance High School is a secondary school for selected African Protestant boys. The number of pupils tested was 98, the number attending the school on the days of the test. Ninety-two per cent. of the pupils belonged to Bantu tribes, eight per cent. to Nilotic tribes. Eighty per cent. of the total were of the Kikuyu tribe. The social and economic status of the group is of course beyond all comparison lower than that of the European group; but it is somewhat above the average for Kenya Africans as a whole, since many of the pupils receive assistance from their families in paying their school fees and in supporting themselves at school for two or three years. Only fifteen of the pupils' ages were known with any accuracy; the ages of the others have however been estimated by the principal from height and weight data. The average of the ages, known or estimated, was 19.42 years or 19 years 5 months.† If 15 years be taken as the limit of growth in intelligence, 99 per cent. of the pupils were adults in intelligence, whereas only 48.5 per cent. of the European pupils were, the remainder being mostly 12 to 14 years old.

The measuring instrument applied to both groups was the "General Intelligence Test for Africans." This is a standardized group test of intelligence, prepared by the present writer. All of its component tests are non-verbal, consisting of problems dealing with pictures, numbers, letters and other symbols. The pupils are not required to write words, but only to make crosses, letters, numbers or other signs on the paper. In one of the tests, for example, the problem is to make a cross through any part of a given picture which is absurd. The "General Intelligence Test for Africans" has been standardized by the usual techniques. The two groups were tested under conditions as nearly identical as possible. The examiner, the instructions, the time allowances and the methods of scoring were the same in each case. In both cases the instructions were given in English, the language used in both schools.

Before we turn to the results of the comparison, let us be clear to what extent the conditions of a valid comparison have been met. The racial and national origins of the one group are predominantly British, of the other group are predominantly Bantu. In social and economic status, the Europeans are far

* Standard deviation = 1.54 years or 1 year 6 months.
† Standard deviation = 2.28 years or 2 years 3 months.
above the Africans, though both Europeans and Africans are probably above the average of their respective peoples in social and economic status, how much it is impossible to say. The African group has an advantage over the European in that a larger proportion of the Africans had reached the probable age of maturity of intelligence. The length of time each group has attended school is probably about equal; for though the Africans are older, they have probably not gone to school until they were older, nor attended as regularly as the Europeans. The quality of the schooling has doubtless been superior in the case of the Europeans. The amount and quality of schooling are probably, however, factors of minor importance, since comparatively little school learning is required in the intelligence test, and both groups have had ample opportunity to acquire that little. The test was designed for Africans, but the pictures in it represent objects probably equally well known to Europeans after a few days in the country. The Europeans undoubtedly had an advantage in that the instructions were given them in their native language, whereas the Africans were told what to do in a language learned more or less imperfectly at school; and this although the verbal instructions were frequently repeated and were accompanied by demonstration and practice in both groups.

To sum up, the samples of the races tested were far from being identical apart from race, yet were probably as nearly comparable as could at present be obtained; while the tests used were probably fairer to both groups than any others available.

The highest possible score in the test is 384 points. The average (mean) European score was 312.34, the average African score was 266.40. The average African score is thus 85.3 per cent. of the average European score.

It will be remembered that groups must be compared not only with respect to averages but also with respect to whole distributions. The distribution of scores for the two groups is accordingly shown in Figure 3.

It will be seen that the two distributions overlap considerably. The European median score, or score above and below which lie fifty per cent. of the scores, was found to be 315.45. At or above this score lie 14.08 per cent. of the African scores. The African median or midmost score is 266.43. Below this score lie 9.85 per cent. of the European scores.

The two main facts emerging from this comparison are (1) that the average African score in the intelligence test is about 85 per cent. of the average European score, and (2) that about 14 per cent. of the Africans reach or exceed the median European score.
FIG. 3.
PRINCE OF WALES SCHOOL.

Distribution of scores of 124 European boys (above) and 93 African boys (below) in the "General Intelligence Test for Africans."
- - - - - European median score.
... ... ... African median score.

It is interesting to put these facts concerning a group predominantly British and a group predominantly Bantu alongside the facts concerning white Americans and American negroes, who are largely of western European and West African Bantu stocks respectively. We have seen (1) that the average American negro score in intelligence tests is about 80 per cent. of the average white American score, and (2) that about 20 per cent. of the American negroes reach or exceed the median white American score.

(To be continued.)
THE COMPARISON OF THE ABILITIES OF RACES:
WITH SPECIAL REFERENCE TO EAST AFRICA.

By R. A. C. Oliver, M.A., B.Ed.

[Concluded.]

C. COMPARISONS OF HEAD AND BRAIN MEASUREMENTS.

(a) Anatomical.

A third basis for the comparison of the abilities of races has been sought in certain measurements of the head and the brain. The use of this basis of comparison depends on the hypothesis that there is a substantial correlation between these measurements and mental ability. Therefore before these measurements can be admitted as evidence, it is necessary to examine the validity of this hypothesis.

The measurements chiefly used have been head size, cranial capacity, brain volume and brain weight. These measurements are closely related to one another. Brain volume, for example, can be estimated by a formula from head length, breadth and height, though the estimate is in error by five to six per cent. as compared with brain volume measured by displacement of water. For our purpose, we may consider the various measurements equivalent.

The belief in a close relationship between the size of the head, skull or brain, and intelligence had several origins. One of these was phrenology. The phrenologists were unduly influenced by one type of feeble-mindedness, microcephalic idiocy, which is characterized by extremely small head size. Ignoring other types of feeble-mindedness, which are associated with normal or supernormal head size, Gall, the founder of phrenology, made the generalization that "There is undoubtedly a very close connection between the absolute size of the brain and the intellectual powers and functions of the mind. This is evident from the remarkable smallness of the brain in congenital idiocism, few much exceeding in weight that of a new-born child." And again he writes: "The heads of idiots unless otherwise diseased, are characterized by deformity or smallness; the heads of eminent men, by their magnitude."(*)

Another ground for this belief has been found in comparative studies of skull capacity in the apes, and in prehistoric and contemporary man. These have revealed that there does exist, from a phylogenetic point of view, a relationship, though an unmeasurable one, between skull capacity and the stage of cultural evolution.
Finally, numerous studies have been made in which measurements of head size were correlated with a variety of indices of mental ability, such as progress in school or university, teachers' estimates, and intelligence quotients derived from standardized tests. These studies have been competently reviewed by a recent writer (7), so that it is necessary only to indicate briefly their trend.*

Investigations made in the latter part of the nineteenth century and the early years of the twentieth century are found on examination to be fairly consistent in disclosing a positive but slight correlation between cranial measurements and intelligence. Owing to the use of inadequate statistical procedures, however, the investigators tended greatly to exaggerate the amount of correlation they had actually found, and the belief in an intimate relationship remained widespread. Then in 1906 Karl Pearson, the leader of the British biometric school, undertook his classic investigation in the hope of clearing up the question once for all. Pearson's subjects were 4,500 boys and girls, all of them twelve years old, and 1,010 Cambridge University students. The subjects were sorted into groups on the basis of teachers' estimates and scholastic records, and three cranial measurements were made on each subject. Pearson's correlational analysis was of course entirely competent. The highest coefficient of correlation he found was only +0.14. This study, though not conclusive, goes a considerable way towards proving that the relationship between head size and mental ability is but slight. Pearson himself remarks, "Though I am hardly hopeful, it may help to convince the anatomist and the old school anthropologist that head measurements are not of real service as intelligence tests."(8)

Pearson's work does however seem to have been convincing, for a time at least. After its publication, the claims made

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* Parenthetically, it may be mentioned that these measurements of head size are by no means always in favour of the white as against the coloured races. Thus Paterson (op. cit., pp. 138-139) cites MacDonald's study of school children in Washington, D.C., including 16,473 white children and 5,475 coloured children, at ages 5 to 17. The data were head circumference and teachers' estimates. "At seven ages the coloured boys have greater head size measurements, at one age the two sets of measurements are equal, and at three ages head dimensions of the white boys are larger. At every age the head size of the coloured girls is greater than that of the white girls. The largest difference is over half an inch (.56 in.). If one argues that head size varies directly with intelligence, it should follow that coloured girls are the mental superiors of white girls and that coloured boys at most ages are superior in intelligence to white boys." 

† A coefficient of correlation of +1 indicates a perfect relationship. A coefficient of 0 indicates an entire absence of relationship.

‡ Eta coefficient, intelligence and head length, 2,298 boys. Probable error = ±0.01.
on behalf of cranial measurements as indicators of mental ability were fewer and more modest until Porteus, in collaboration with Berry, revived them in a series of publications beginning in 1918. Porteus advocates the use of cranial measurements as part of a scheme for the diagnosis of mental deficiency. He claims, with some experimental support, that many cases of mental deficiency will be found among individuals whose cranial capacity falls within the lowest ten per cent. of the range or within the highest ten per cent. He apparently has in mind cases of microcephaly and of hydrocephaly respectively, and this claim is not to be disputed. But this is far from establishing the relationship throughout all levels of mental deficiency and over the whole range of normality. His failure to present detailed correlational evidence of this kind leaves the broader hypothesis unproven.

Not only does Porteus fail to establish a general relationship between cranial capacity and intelligence, but his assumption of such relationship would seem to involve him in some quite untenable conclusions. Paterson's criticism on this point is so trenchant that it deserves to be quoted almost in full, as showing that the validity of the fundamental hypothesis is at least doubtful.

"It is in line with our interests to comment briefly on the possible significance of the sex difference in cranial capacity shown in the detailed tables. If we permit ourselves to indulge in the sort of logic typical of the Porteus studies we arrive at the inference that the average girl of eighteen (cranial capacity = 1300 cu. cm.) is retarded eight years in brain size, since the average cranial capacity for boys at age ten is 1304 cu. cm. If in turn this amount of cranial retardation is accepted as having genuine intellectual significance then the average eighteen-year-old girl is mentally equivalent to a ten-year-old boy. The fallacy in such reasoning is evident, but only because the example is a caricature. Here, in the Porteus data, we are actually confronted with the same contradiction with reference to comparative brain size and intelligence of the two sexes as that which faced us in MacDonald's data on comparative head size and intelligence in the white and coloured races. By what rule of logic can it be insisted that variation in head size is accompanied by variation in intelligence among the boys of the white race, but deny that variation in head size would be accompanied by similar variation in intelligence when we compare boys and girls within the white race or when we compare individuals of the same sex in two different races?"
Porteus and his followers must be required either to straighten out this logical difficulty or to provide a quality and quantity of empirical evidence hitherto lacking before their assertions can be admitted to the body of attested scientific generalizations.

"In 1926, Porteus, this time in collaboration with Marjorie Babcock, published a book entitled 'Temperament and Race' in which considerable space is devoted to racial and sex differences in cranial capacity. We might well have expected to find here the answer to the query raised in the preceding paragraph. With reference to sex differences in cranial capacity we note that boys have a greater capacity by some 50 to 60 cu. cm. throughout the age range 6 to 14. Thereafter the curves diverge, revealing an ever widening gap between male and female head size due to the apparent continued growth of the male head coupled with a marked slowing down in rate of female head growth. Indeed, this earlier maturity of the female head size results in an arrest of head size at about the level Porteus had established for Australian aborigines and definitely below that reached by adult male mental defectives. This sex difference cannot be explained away on the basis of differences in bodily size, since it is equally pronounced at age 12 when girls tend to exceed boys in height and weight.

"But what mental significance is to be attached to this difference in view of the accumulated mass of evidence pointing to a practical equality of the sexes in measured intellectual ability? Porteus mentions this evidence and freely accepts it as well established. His escape from inconsistency is attempted by insisting that the differential head size is significant not with reference to abstract intellect (he uses the term 'learning capacity ') but rather with reference to 'the maturing of other powers.' These 'other powers' cover a wide range of non-intellectual personality traits . . .

In the end, then, Porteus desert his previous position regarding the intellectual significance of brain size and embraces a substitute theory which stresses brain size in relation to personality traits. In the absence of proof regarding the latter relationship within each sex, we can only suspend judgment on this new position. In the meantime, we cannot but doubt the validity of his earlier assertions regarding head size and intellect, since he himself so readily abandons that position when confronted with the fact of sex equality in intellect along with an impressive sex inequality in cranial capacity."(†).
Since Porteous revived the claims of cranial measurements as indirect measures of intelligence, several other studies have been made. They are almost unanimous in revealing only a slight positive correlation. One of them may be briefly described in conclusion, as it is one of the best studies of the problem yet made. This is the work of Murdock and Sullivan in Honolulu. Their subjects were some 600 pupils of old American, British, German and Scandinavian descent, constituting a fairly homogeneous race group. The mental measurements were made by means of some of the best intelligence tests, administered by Murdock as school psychologist. The physical measurements were made by Sullivan, an anthropologist representing the American Museum of Natural History. An excellent statistical procedure was followed, and the correlation between head diameter and intelligence quotient was found to be $+0.22$. *

From this and other investigations we may conclude with fair assurance that there does exist some relationship between the dimensions of the head or brain and intelligence, but that the degree of this relationship is slight. Therefore a demonstrated superiority or inferiority of an individual or a group in these dimensions goes some way towards proving an intellectual superiority or inferiority, but it does not go very far.

With this brief review of the evidence regarding the significance of cranial and brain measurements before us, we are in a position to evaluate the important recent work of Dr. F. W. Vint on the brain weight of natives of East Africa. Dr. Vint is to be congratulated on his effort to contribute some definite objective evidence on a question where hitherto it has been almost entirely lacking.

Vint examined post-mortem in the native hospitals of Nairobi the brains of 351 male natives of East Africa, of various tribes, all believed to be eighteen years or more of age. He found that the average weight of these brains was 45 ounces or 1276 grams. For purposes of comparison, he quotes the average brain weight of adult male Europeans as being 1453 grams (according to Shennan’s figure) or 1428 grams (according to an average obtained by Shennan from the figures of others). The average brain weight of the Africans was therefore 87.8 per cent. or 89.4 per cent. of the average brain weight of the Europeans (according to which figure we take for the European average).

Vint himself avoids any inference from brain weight to educable capacity. In the light of the evidence previously quoted

* Probable error $= \pm 0.03.$
regarding the significance of brain weight, however, his findings may be interpreted as definite, but not strong, evidence of the inferiority of East African natives to Europeans in intellectual capacity.

Vint's services to the problem of the comparative cerebral development of East African natives do not, however, stop here. He has contributed a different and probably a more valuable line of evidence, which we may now briefly consider.

(b) Histological.

The use of brain measurements as a basis for the comparison of racial abilities has recently been extended in an interesting and promising direction. Dr. F. W. Vint, in the study previously referred to, submitted the brains of natives of East Africa to histological examination, and arrived at certain conclusions regarding "the stage of cerebral development reached by the average native." (11) Although Vint himself refrains from drawing any inference from cerebral development to mental development, he clearly, and I think rightly, regards his findings as having some bearing on the comparative mental development of East Africans. What this bearing is, he does not venture to say; yet if we are to regard his work as providing evidence as to mental development, and not merely as a study in cerebral histology, we must try to arrive at some conclusion, however tentative, as to the significance of cerebral development in relation to mental development. The present writer disclaims competence to reach a definite conclusion on this question; yet since the question is in part a psychological one he ventures to suggest some considerations from a psychological point of view.

Psychologists of course believe that intelligence is a function of the brain. What the precise relationship is, neither they nor the brain physiologists know. As Vint says, (12) "The functions of the human brain as Herrick remarks, 'are still largely wrapped in mystery.' Research has lifted the veil but there still remains a vast amount of work to be done before one can have a full conception of the functions of this master-organ of the human body." As a result of research, including, as Vint points out, "extensive research on animals," the sensory functions, such as seeing and hearing, and the motor functions, such as the initiation of movements of the arm, the leg or the muscles used in speech, have been definitely localized in the brain. The "higher" mental functions, however, of which intelligence is one, have not been definitely localized. Now, in the words of Vint, (13) "the areas of the brain which do possess a known
physical function gradually shade off into the surrounding brain tissue." These surrounding areas of unknown function have, for want of a better name, been termed the "association areas," and one of the functions which has been hypothetically assigned to them is the control of intelligent behaviour. Could it be shown that these "association areas" were indeed the structure underlying intelligent behaviour, histological examination of their development in an individual might throw a valuable light on the mental development of that individual. Let us glance briefly at a few of the lines of evidence relating to this hypothesis. The line of evidence on which Vint most relies is Bolton's study of the cerebral cortex in growth and in disease. I shall try to supplement this evidence by citing data from the physiology and psychology of learning.

Vint gives the following account of Bolton's work:

"Bolton has shown that there is a normal measurement for each layer of the cerebral cortex, which varies little in different normal individuals and that from a developmental point of view the laminae are evolved from within outward, i.e. layer 5 is developed before layer 4, etc. Turning his attention to mental diseases he proves that the different cortical laminae show decreases in size in proportion to the degree of amentia or dementia present and that the layer most affected is the one developed last, the pyramidal cell layer. The inner or polymorphic cell layer is involved appreciably only in complete idiocy."(14)

In other words, Bolton has proved that in cases of mental disease (amentia and dementia) the cerebral cortex, and especially the pyramidal cell layer of it, is thinner than in cases where mental disease is absent; and that the decrease in thickness is proportional to the degree of mental disease. He has thus proved that at the lower end of the intellectual scale, the thickness of the cortex, and especially of layer 2 of it, is proportional to degree of mental ability. His work on this point appears to be entirely conclusive; though it has to be remembered that it does not necessarily prove a close relation between the thickness of the cortical layers (which according to Vint "varies little in different normal individuals") and mental ability in non-diseased cases (which ranges all the way from bare normality up to genius).

Further evidence regarding the way the cerebral cortex functions in the control of behaviour has been contributed by the combined physiological and psychological study of learning. The
early work of Franz in this field has been followed up by the important recent work of Lashley. Lashley's subjects were laboratory animals. One of his methods was to extirpate from the cerebral cortex that amount and that area which he wished to study, and then to measure the effect of the cerebral destruction on the learning capacity of the animals in a test situation. He found that, apart from the sensory and motor areas, it did not seem to matter which area of the cortex he removed; the animals learned as well with one part as with another. The amount of cortical tissue removed, however, did matter: in fact, the interference with the animals' learning ability was closely proportional to the amount of tissue removed.* The results of Lashley's fine series of experiments are summarized under two principles, which may be stated as follows:—

(1) The principle of equipotentiality. Any part of the cerebral cortex, apart from the sensory and motor areas, is potentially the same as any other in its ability to take part in any sort of learned performance.

(2) The principle of mass action. The cerebral cortex acts as a whole, so that the more cortex there is available, the more effectively it operates and the more quickly the animal learns.

These results of Lashley's combined physiological and psychological work are rendered all the more impressive by their agreement with the results of the purely psychological work of the "Gestalt" school in Germany and Spearman's school in London, themselves entirely independent schools. The "Gestalt" psychologists, (15) from their study of perception and learning in the higher primates, in children and in adults, are led to postulate just some such system of brain dynamics as Lashley's work actually points to. Spearman, (16) in his studies of the abilities of man, submits mental test performances to a mathematical analysis, and finds a factor "g" functioning in all of them. Spearman's "g" seems to be the same thing as general intelligence; he regards it all of a person's mental or cortical energy. Lashley's finding that the cortex acts as a whole, so that learning capacity is proportional to amount of cortical tissue, "seems to accord," as he himself says,(17) "with Spearman's view that intelligence is a function of some undifferentiated nervous...

* In one group of rats, lesions ranged from 1.5 to 31.9 per cent. of the neopallium. The correlation between extent of lesions and relearning a visual discrimination problem was 0.71. K. S. Lashley, "Studies of Cerebral Function in Learning, VII." "The Relation between Cerebral Mass, Learning and Retention." J. Compar, Neurol, 1926, 41, 1-48.
energy." The more cortical tissue a person has, the greater is his cortical or mental energy or his general intelligence.

Thus, alike from Bolton's work on the cerebral cortex in relation to mental deficiency and mental disease, and from Lashley's work on the cerebral cortex in relation to learning ability, we can be sure that there is a functional relationship between cerebral development and mental capacity. Of the nature of that relationship we can be less sure, but there is fair evidence for supposing that an individual's educable capacity is fairly closely proportional to the amount of cortical tissue in his "association areas." If this tentative conclusion be warranted, Vint's measurements of the cerebral cortex of natives of East Africa immediately become data on the educable capacity of those natives. Vint's subjects were thirty-five male natives of East Africa, of various tribes, all being general hospital patients. All were believed to be adults. Their brains "apparently normal." This small group can be taken as a representative sample of East African natives in general only for a preliminary comparison, as Vint points out.

Vint measured the thickness of the cerebral cortex and of each of its component laminae. Bolton has shown that the total thickness of the cerebral cortex is less significant than the thickness of the second lamina of it, the pyramidal cell layer. Vint accordingly places his chief emphasis on the thickness of this layer.

Vint measured the thickness of the pyramidal cell layer only in the prefrontal area of the cortex. If we are to use the support afforded by Lashley's work, we must assume the thickness of this layer in this area to be representative of its thickness or quantity throughout the association areas as a whole.

Vint found that the average thickness of the pyramidal cell layer of the prefrontal cortex in his East African native subjects was 84 per cent. of its average thickness in Europeans according to Bolton's norms. He also found that the thickness of this layer in the different individuals was so distributed that some 6 per cent. of the Africans exceeded the European average in this measurement.\(^{18}\)

If we may argue from the thickness of the pyramidal cell layer of the prefrontal cortex to intelligence or educable capacity—and we have seen there is some experimental evidence though no proof that we may so argue—and if we may take Vint's subjects as representative of adult male natives of East Africa and as comparable with Bolton's European subjects, then we may interpret Vint's findings as follows: (1) That the average intelli-
gence or educable capacity of adult male natives of East Africa is about 84 per cent. of the average intelligence of adult male Europeans, and (2) that about 6 per cent. of the natives exceed the average European in intelligence.

These conclusions from the histological data should be compared with the conclusions drawn from the mental test data. The similarity of the histological and psychological conclusions is at once apparent. The agreement as to the average educable capacity of East African natives is striking, though its extreme closeness may be a coincidence. The agreement as to the percentage of natives reaching or exceeding the European average is less strikingly close. It is not impossible that Vint's small group of hospital subjects did not include any individuals from the upper ranges of ability. Or it is, of course, quite conceivable that the range of variation about the average is in actual fact less in African tribes than in European nations. The East African tribes are comparatively few in numbers, so that the chances of an extreme variation in any trait are lessened. In so far as the members of a tribe marry only within their own tribe, they may be regarded as to some extent inbreeding, and inbreeding tends to curtail the range of variation. It is conceivable that when inter-marriage between the tribes becomes more frequent, the range of variation about the average will be increased, and the chances of the production of highly intelligent or highly talented Africans heightened; for, as we have seen, a genius may be regarded as an individual endowed with a peculiarly happy conjunction of characteristics.

SUMMARY AND CONCLUSIONS.

The method followed in this paper has been to try to form some judgment as to the validity of each basis for the comparison of racial abilities, and in the light of that judgment to examine the relevant experimental evidence. The results may be summarized as follows:

(1) Attempts have been made to compare the abilities of races by comparing their cultural achievements. Since differences in cultural achievement can be accounted for without recourse to the assumption of differences in ability, this basis of comparison was judged not to afford evidence of an unequivocal kind.

(2) The abilities of races have been measured and compared by means of mental tests. This basis of comparison is valid to the extent that the influence of the cultural environment
on the test results is equalized for the groups compared. In so far as this has been accomplished, the scanty evidence indicates that the average intelligence of Kenya natives is about 85 per cent. of the average intelligence of Kenya Europeans, and that some 14 per cent. of the natives equal or exceed the average European in intelligence.

(3) A third basis of comparison depends on the hypothesis that intelligence can be measured by measuring cranial capacity or brain weight. A survey of the experimental research relating to this hypothesis shows that it holds to only a slight extent. The available data, then, those of Vint, afford slight confirmatory evidence that natives of East Africa are inferior to Europeans in intelligence.

A more refined comparison of this type has been made, using as data the amount and quality of cortical tissue. The exact significance of such data is relation to educable capacity is not known, but there is evidence that it may be considerable. If it be so, Vint's data on the cerebral development of natives of East Africa would seem to show that these natives have on the average about 84 per cent. of the educable capacity of the average European, and that about 6 per cent. of them exceed the average European in educable capacity.

From the evidence thus summarized, the following conclusions seem reasonable:

(1) That there are not sufficient data to establish definitely how the abilities of natives of East Africa compare with those of Europeans. As far as the data go, however, they seem to suggest

(2) That the average cerebral and mental development of natives of East Africa is in the neighbourhood of 85 per cent. of that of Europeans; and

(3) That a certain percentage of East African natives equal or excel the average European in cerebral and mental development.

A Note on the Future.

If these conclusions are warranted, they point to what requires to be done in the future. The first need is for further research. Just as we make a geological survey of a country, so we should make a survey of the hidden talents of its inhabitants. Such a survey would reveal facts of importance in the shaping of policy. The facts would be important, for example, in education—and every measure affecting native development is in a sense a measure in education. We might find, for example, a
small section of the native population fitted by its capacity to profit by an education of university difficulty, though not necessarily of traditional university type. A larger section might have the capacity to profit by a full secondary education; a section larger still might merit a simpler secondary course. The great mass of the population might be found to be fitted for education in the elementary schools, especially perhaps in what would correspond to the C sections of the standards in European schools. A considerable section of the population would probably be found to be too backward to profit much by education unless special schools were provided for them. A lesser but still not inconsiderable section would be found to be definitely feeble-minded, and for them too special measures would have to be taken. From idiot to genius, every individual could be helped by mental tests and otherwise to find the education for which he is best fitted.

These, however, are more speculations. The immediate need is the need for further research.

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IV. A STUDY OF THE MUSICAL TALENT OF NATIVES OF EAST AFRICA.
THE MUSICAL TALENT OF NATIVES OF EAST AFRICA

BY

RICHARD A. C. OLIVER

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THE MUSICAL TALENT OF NATIVES OF EAST AFRICA.

BY RICHARD A. C. OLIVER.

I. Introduction (pp. 333-334).
II. The tests (p. 334).
III. The subjects (pp. 334-335).
IV. Method of administering the tests (pp. 335-336).
V. Results (pp. 336-343).
VI. Summary (p. 343).

I. INTRODUCTION.

This paper deals with an attempt to measure some of the fundamental capacities comprising musical talent, in natives of East Africa, and to compare these natives with people of European descent in respect of these capacities. There are difficulties in the way of any attempt to apply the same psychological tests to peoples at very different stages of culture. Usually a test includes elements which are not equally within the experience of two such groups; and it is then very difficult to abolish the disparity in experience by supplying information to the more ignorant group, without spoiling the test. A test of range of information, about the customs of one people and in its own language, would be an example of such a test par excellence. Some psychological tests, however, measure much narrower and simpler functions, and inequality is in them lessened or even altogether avoided. Measures of visual or tactual acuity, for example, need involve no elements with which civilized peoples are more familiar than primitive peoples. The measures of musical talent used in this study approach this ideal. They are measures of functions closely dependent on comparatively simple physiological mechanisms. It is true that they constitute problems whose understanding demands a certain degree of intellectual maturity, a certain amount of information. But the level of intelligence required is low, the fund of information small. The measures are not intended to constitute tests of either intelligence or information. If the examiner performs his functions properly, he will suit the instructions to the intelligence of his subjects, and impart whatever information may be necessary. It should be possible for him to ensure that a group of primitive subjects embarks on the actual test of ear with little or no disadvantage in comparison
The Musical Talent of Natives of East Africa

with a group of civilized subjects. This seemed possible at any rate with natives of East Africa, and in so far as it has been achieved the comparisons between them and people of European descent may be considered valid.

II. The tests.

The tests used in this study were the Seashore Measures of Musical Talent, comprised by six special gramophone discs. They are measures of the sense of pitch, the sense of intensity, the sense of time, the sense of consonance, memory for tones and the sense of rhythm—these being six capacities which Seashore’s analysis isolates as fundamental to musical talent.

III. The subjects.

The subjects of the experiment were the pupils of the Alliance High School, at Kikuyu in Kenya Colony. The Alliance High School is a central school for boys, offering the most advanced education open to natives in Kenya and drawing students from all parts of the Colony. The number of subjects tested was ninety.

The exact ages of the students were known in only eleven cases, as it is only within the last few years that missions and other agencies have begun to prevail upon Africans in Kenya to register births. The principal1 of the school, however, has estimated the ages of the other pupils from anthropometric measurements, and these estimates have been used. The ages, true or estimated, ranged from 12 to 24, with a mean of 19.75, and a standard deviation of 2.61.

The number of students belonging to each tribe is shown in Table I.

Table I. Distribution by tribes, of ninety East African natives tested with the Seashore Measures of Musical Talent.

<table>
<thead>
<tr>
<th>Tribe</th>
<th>Number of students tested</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kikuyu</td>
<td>67</td>
</tr>
<tr>
<td>Akamba</td>
<td>10</td>
</tr>
<tr>
<td>Luo</td>
<td>7</td>
</tr>
<tr>
<td>Bantu Kavirondo</td>
<td>2</td>
</tr>
<tr>
<td>Munyasa</td>
<td>2</td>
</tr>
<tr>
<td>Mrabai</td>
<td>1</td>
</tr>
<tr>
<td>Masai</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td>90</td>
</tr>
</tbody>
</table>

Of the students’ experience of European music, it is known that all are taught singing in school, and ten are taught to read music in staff

* Mr G. A. Grieve, to whom the writer’s thanks are due for his permission to conduct the test.
notation and to play the harmonium. Further, forty-two students in Forms 2, 3, 4 and 5 had undergone the same tests three months previously, when the writer was trying to devise suitable methods of administering the tests to Africans.

IV. Method of administering the tests.

The tests were given to classes of from twenty to forty students at a time, each test occupying a school period of about forty-five minutes. The instructions were given in English, the language used in the school. The general procedure followed was similar for all six tests. First, the experimenter introduced the test by means of demonstrations on the harmonium and the blackboard, and in other ways, until the class found itself actually practising the test, and the problem could be definitely formulated in words. Then followed practice in listening to the test as played on the gramophone, and in calling out the answers together. An entire side of a record would if necessary be played through. The next step was to demonstrate the method of recording the answers. The record form was copied in large scale on the blackboard, and as the class, listening to the gramophone, called out the first few answers, the experimenter or one of the students wrote them down in their proper places on the record form. Finally, the instructions were once more repeated, and the test proper began. In each test the record was played twice over.

The specific procedures by which the different tests were demonstrated are briefly described as follows.

Test 1. Sense of pitch. The examiner simply played two successive notes of different pitch on the harmonium, and asked whether the second note was higher or lower than the first. There was no difficulty here except that of novelty, which repetition soon overcame.

Test 2. Sense of intensity. The examiner struck a note, and repeated it with a different intensity. The intensity was controlled by the use or non-use of the loud pedal. The class readily understood that they were to say whether the second note was weaker or stronger than the first.

Test 3. Sense of time. Three dots were made in a row on the blackboard, and numbered 1, 2, 3. The examiner asked whether the distance from dot 2 to dot 3 was longer or shorter than the distance from dot 1 to dot 2. This was repeated ad lib. with the second interval sometimes longer than the first, sometimes shorter. Then the problem was translated from visual into auditory terms, substituting taps with a pointer for dots, and the subjects judged whether the second time interval was longer or shorter than the first.
Test 4. Sense of consonance. The three criteria by which consonance was to be judged were written on the blackboard, thus:

<table>
<thead>
<tr>
<th>GOOD</th>
<th>BAD</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Go well together, agree.</td>
<td>1. Do not go well together, disagree.</td>
</tr>
<tr>
<td>2. Smooth.</td>
<td>2. Rough, harsh.</td>
</tr>
<tr>
<td>3. Sound almost like one note.</td>
<td>3. Do not sound at all like one note, but like two.</td>
</tr>
</tbody>
</table>

A consonant pair of notes, and a dissonant pair, were then played on the harmonium, and contrasted in respect of the first criterion, blending. The second criterion, smoothness, and the third, fusion, were illustrated in the same way. Attention was then drawn to the contrasting lists of criteria on the blackboard, and with these in view the class were exercised, first with the harmonium and then with the gramophone, in deciding whether the second of two combinations was better or worse than the first. The lists of criteria were left on the blackboard during the test.

There was considerable difficulty in making the nature of this test understood, and it is probable that in the case of many of the subjects the "cognitive limit" rather than the "physiological limit" (1), p. 51) was measured.

Test 5. Tonal memory. The examiner wrote on the blackboard

1 2
1 2

and affixed some distinguishing mark, such as a dot or a cross, to one of the numbers in the second row. He then asked the class which number was different in the second row as compared with the first. Sometimes one number in the second row would be thus distinguished by a mark, sometimes the other. The length of the series of numbers was gradually increased from two to three, four, five and finally six numbers. Each time the class called out the number which was different in the second row. When the problem had been thoroughly understood in these visual terms, it was translated into auditory terms, by using series of notes of different pitch instead of numbers. Keeping in view the series of numbers on the blackboard, the class counted the notes silently as they were played, then called out the number of the note which was different the second time. Practice was given with series of from two to six notes, first on the harmonium, then on the gramophone. The two rows of numbers, of the appropriate length, were in view on the blackboard during the test.

This test, like the previous one, was difficult to make understood.

Test 6. Sense of rhythm. The examiner made five or six taps with a pointer on the table, the taps forming a definite rhythmical pattern; then in similar fashion he beat out the same or a different rhythm. The class readily grasped that they were to say whether the second rhythm was the same as or different from the first.

V. Results.

Seashore provides grade norms for the interpretation of scores in the tests. He found a decided increase in score from school grade to school grade. This he attributes not to improvement in the musical capacities measured by the tests, but to non-musical factors incidentally measured, such as maturity of intelligence and range of information.

The students of the Alliance High School are grouped into five forms.
According to the official regulations, Form 1 does work nominally of the same standard as thirteen-year old pupils in England, and therefore of approximately the same standard as seventh grade pupils in the United States. This, it might be expected, would provide a basis of comparison, on which Form 1 would be equivalent to the American seventh grade, Form 2 to the American eighth grade, and so on.

In point of fact, however, there is no such increase in score from form to form as there is from grade to grade. The differences between the average scores of the forms are mostly small in amount and irregular in direction. Since one form, then, does as well on the whole as another, it is reasonable that the scores of all the students should be interpreted according to the same standard. The question arises, which standard? It was decided to use the norms for the American seventh grade, for the following reasons. First, forty-one, or nearly half of the students, are in Form 1, which corresponds to Grade 7; twenty-six are in Form 2, twenty-one in Form 3, one in Form 4 and one in Form 5. Secondly, since the tests were conducted only a month after the beginning of the school year, all the students were only at the beginning of their respective forms. The transmutation of scores into percentile ranks has therefore been made according to the American seventh grade norms.

Table II gives the mean and the standard deviation of the scores in each of the six tests. The column headed “Percentile rank of mean” gives, for each test, the percentile rank, on the American seventh grade scale, to which the African mean score corresponds. Since for some purposes it may be desirable to have data on a pure tribal group rather than on a mixture of tribes, the data are given for the largest tribal group, the sixty-seven Kikuyus, as well as for the school population as a whole.

Table II. Mean scores, etc. of East African natives in the Seashore Measures of Musical Talent.

<table>
<thead>
<tr>
<th>Test</th>
<th>All tribes, $N=90$</th>
<th>Kikuyus only, $N=67$</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>$\alpha$</td>
</tr>
<tr>
<td>1. Pitch</td>
<td>70-19</td>
<td>11-25</td>
</tr>
<tr>
<td>2. Intensity</td>
<td>88-56</td>
<td>9-10</td>
</tr>
<tr>
<td>3. Time</td>
<td>76-76</td>
<td>11-90</td>
</tr>
<tr>
<td>5. Tonal memory</td>
<td>45-97</td>
<td>14-80</td>
</tr>
<tr>
<td>6. Rhythm</td>
<td>71-79</td>
<td>10-30</td>
</tr>
</tbody>
</table>

Seashore publishes frequency curves of the scores made by American fifth-grade children, eighth-grade children, and adults. The frequency curves of the African scores (not published for lack of space), yield the following points of comparison.
Test 1. Sense of pitch. The African curve resembles the rather flat curve of the American fifth grade, but runs somewhat higher, probably about where the sixth-grade curve would run. The African mean, 70, is in point of fact the sixth-grade median.

Test 2. Sense of intensity. The African curve closely resembles the negatively skewed curve for American adults. The African mean, 89, is the American adult 51 percentile.

Test 3. Sense of time. The African curve resembles the negatively skewed curve for American adults, but runs higher. The African mean of 77 is reached or exceeded by only 42 per cent. of American adults.

Test 4. Sense of consonance. The African frequency curve is, like the American fifth-grade curve, positively skewed, but the scores are considerably more piled up at the lower end of the scale. Only 38 per cent. of fifth-grade children fail to reach or exceed the African mean of 58.

Test 5. Tonal memory. The African curve somewhat resembles the very flat American fifth-grade curve, but is considerably more piled up at the lower end. The African mean of 46 is only the fifth grade 41 percentile.

Test 6. Sense of rhythm. The African frequency curve resembles the normal curves of the eighth grade and of adults, runs between them, and is flatter. The African mean of 72 exceeds the score of 35 per cent. of adults and 63 per cent. of eighth-grade children.

In two of the tests, those of the senses of consonance and of memory for tones, the frequency curves of the African scores very definitely rise at the lower end of the scale, in the region where the scores are little or not at all superior to those attainable by chance. This may quite possibly be due to a failure to understand the task in these tests on the part of some of the subjects. These two tests were certainly the most difficult to make understood; and, as will be seen later, it was the less intelligent subjects who made the lower scores.

The differences between the mean scores of the Kikuyus and those of the whole school population, of which, of course, the Kikuyus form the largest part, are slight.

On the assumption that the African scores may be evaluated by the American seventh-grade norms, Table II shows the Africans to be superior to the Americans in the senses of intensity, time and rhythm, and inferior in the sense of pitch, the sense of consonance and in memory for tones. If the average musical talent of the Americans be taken as normal, the average musical talent of the Africans will exhibit the profile shown in Fig. 1.

The senses of pitch, intensity and time are the basic capacities in musical talent, being psychological correlates of the physical attributes
<table>
<thead>
<tr>
<th>Percentile rank</th>
<th>1 Sense of pitch</th>
<th>2 Sense of intensity</th>
<th>3 Sense of time</th>
<th>4 Sense of consonance</th>
<th>5 Memory for tones</th>
<th>6 Sense of rhythm</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>90</td>
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<tr>
<td>80</td>
<td></td>
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<td></td>
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<tr>
<td>70</td>
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<tr>
<td>60</td>
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<tr>
<td>50</td>
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<tr>
<td>40</td>
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<tr>
<td>30</td>
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<tr>
<td>20</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Fig. 1. Average musical talent chart of ninety East African natives.
of sound. The other three capacities are complex derivatives of these and other factors. The sense of consonance depends partly on the sense of pitch, so that if the sense of pitch be poor, as here, the sense of consonance will be likewise poor, even apart from a deficiency in the other elements in the sense of consonance. Memory for tones is obviously dependent, among other things, on hearing differences of tone in the first place, so that it can be no better than the sense of pitch, and may, as here, be poorer. The sense of rhythm stands in an analogous relation to the senses of intensity and of time; excellence in these senses augurs a good sense of rhythm, as here, though it does not guarantee it.

In so far as the tests measure what they purport to measure, we should expect a correlation between the African’s musical talent profile and the characteristics of African music. Thus, in view of the highly developed rhythm which is such an outstanding feature of African music, it is not surprising to find the tests registering, in the Africans, superiority in the sense of rhythm, and excellence in the senses of time and intensity on which the sense of rhythm largely depends. Likewise, there is probably a causal connection between the poor sense of consonance indicated in the Africans by the tests, and the fact that African music, like all non-European music, is built on pure melody and not on harmony. The poor record of the Africans in the sense of pitch is somewhat surprising, to the writer at least. The successive notes in African melody seem often to involve quite small differences in pitch. Can it be that the test does not suit Africans as well as it suits Europeans? A melody has a different Gestalt from two contrasted notes. The European may be more efficient in dealing with the more analytical situation, in virtue of some non-musical capacity. The apparent deficiency in memory for tones, too, is surely somewhat surprising in view of that other outstanding characteristic of African music—antiphony. In African song, solo and chorus commonly alternate, the chorus taking up and repeating the part just sung, often extempore, by the soloist. This would seem to call for much the same kind of immediate memory as that measured by the test.

The best record in the series of tests was made by a Bantu Kavirondo boy, aged fifteen, in Form 2. His scores in tests 1 to 6 respectively were: 89, 93, 85, 83, 86, 85. Form 2, according to the school regulations, should be equivalent to the American eighth grade, and an American boy of fifteen would very probably be found in the eighth grade: the eighth grade norms may therefore be very fairly used for the comparison of this African with Americans in musical talent. He is found then to equal or excel, in sense of pitch, 97 per cent. of Americans of his own school
standing; in sense of intensity, 95 per cent.; in sense of time, 98 per cent.; in sense of consonance, 99 per cent.; in memory for tones, 92 per cent.; and in sense of rhythm, 97 per cent.

As has been stated, ten students receive special instruction in music. They were selected by their own wish. It was found that only four of these students were among the ten individuals whom the tests would select as the most talented. Several members of the class were found to have quite poor records in the tests, and on enquiry the music instructor reported that these students were not making satisfactory progress. The principal of the school was accordingly enabled to withdraw these students from the class, and to replace them by others whom the tests showed to be more talented.

Seashore found, in each test, an increase in score with age and with school grade. He attributes the increase entirely to school progress, and not at all to age in itself. Our results would confirm his opinion that the abilities measured by the tests do not develop with age, within the age limits of our group (12 to 24) at least. The coefficients of correlation of age with score in each of the tests is given in Table III.

Table III. Coefficients of correlation between musical talent scores and age of ninety East African natives.

<table>
<thead>
<tr>
<th>Test</th>
<th>r</th>
<th>PE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Sense of pitch</td>
<td>+0.003</td>
<td>±0.07</td>
</tr>
<tr>
<td>2. Sense of intensity</td>
<td>-0.07</td>
<td>±0.07</td>
</tr>
<tr>
<td>3. Sense of time</td>
<td>+0.05</td>
<td>±0.07</td>
</tr>
<tr>
<td>4. Sense of consonance</td>
<td>-0.07</td>
<td>±0.07</td>
</tr>
<tr>
<td>5. Tonal memory</td>
<td>+0.13</td>
<td>±0.07</td>
</tr>
<tr>
<td>6. Sense of rhythm</td>
<td>-0.10</td>
<td>±0.07</td>
</tr>
</tbody>
</table>

Seashore and others have found positive but very small correlations between the measures of musical talent and measures of intelligence. The subjects of this experiment were ranked in order of intelligence by the four European members of the school staff. The ranks assigned by each member were converted into scores on a linear scale, and the four series of scores were averaged to give a composite intelligence score for each pupil. The reliability coefficient of these composite intelligence scores was 0.77. These scores were correlated with the scores in each of the six tests of musical capacity, with the results shown in Table IV. The coefficients have been corrected for attenuation.

It will be seen that between four of the tests and intelligence there is no statistically significant correlation. The other two tests, those of the sense of consonance and of memory for tones, are positively correlated
The Musical Talent of Natives of East Africa

with intelligence. This may indicate that these two capacities in Africans are correlated; or that the tests of these two capacities, when applied to Africans, are not entirely valid, being in some degree measures of intelligence; or, perhaps most probably, that the methods of administering these tests were not successful in making the test problems understood equally well by the more and the less intelligent. In the latter event, merely the 'cognitive limit' rather than the 'physiological limit' would be measured, in the case of the less intelligent subjects. Failure to make the tests thoroughly understood would also account, to some extent at least, for the apparent inferiority of the Africans to Americans in these two capacities. The data on the reliability of the measures of musical talent with this group of subjects are given in Table V.

Table IV. Coefficients of correlation between measures of musical talent and of intelligence, of ninety East African natives.

<table>
<thead>
<tr>
<th>Test</th>
<th>( r )</th>
<th>( PE_r )</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Sense of pitch</td>
<td>+0.25</td>
<td>±0.07</td>
</tr>
<tr>
<td>2. Sense of intensity</td>
<td>+0.16</td>
<td>±0.07</td>
</tr>
<tr>
<td>3. Sense of time</td>
<td>-0.04</td>
<td>±0.07</td>
</tr>
<tr>
<td>4. Sense of consonance</td>
<td>+0.59</td>
<td>±0.05</td>
</tr>
<tr>
<td>5. Memory for tones</td>
<td>+0.45</td>
<td>±0.06</td>
</tr>
<tr>
<td>6. Sense of rhythm</td>
<td>+0.17</td>
<td>±0.07</td>
</tr>
</tbody>
</table>

Table V. Data on the reliability of measures of musical talent with ninety East African natives.

<table>
<thead>
<tr>
<th>Test</th>
<th>Reliability coefficient</th>
<th>Minimum number of blocks required</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Sense of pitch</td>
<td>0.72</td>
<td>2</td>
</tr>
<tr>
<td>2. Sense of intensity</td>
<td>0.93</td>
<td>1</td>
</tr>
<tr>
<td>3. Sense of time</td>
<td>0.78</td>
<td>2</td>
</tr>
<tr>
<td>4. Sense of consonance</td>
<td>0.40</td>
<td>6</td>
</tr>
<tr>
<td>5. Tonal memory</td>
<td>0.88</td>
<td>1</td>
</tr>
<tr>
<td>6. Sense of rhythm</td>
<td>0.74</td>
<td>2</td>
</tr>
</tbody>
</table>

One block of trials consists of the playing of both sides of a test disc. As has been stated, two blocks were given in each test. The first row of figures in Table V shows the coefficient of correlation between the scores in the first block and those in the second block. The second row, which is derived from the first by Spearman’s prophecy formula, gives the reliability coefficients of the tests as actually conducted. If 0.80 be taken as the minimum below which a reliability coefficient, to be satisfactory, should not fall, it will be seen that all the tests, except one, were sufficiently reliable as actually conducted. Indeed, one block would have
sufficed for tests 2 and 5. Test 4 (Sense of Consonance) was not reliable, and, according to the Spearman formula, six blocks would have been necessary to make it so; a better method of administering the test might, however, achieve the same result with fewer blocks.

VI. Summary.

1. Ninety natives of East Africa were tested with the Seashore Measures of Musical Talent.

2. Special methods of administering the tests had to be devised.

3. The test scores of the Africans were compared with those of American seventh-grade children, these being taken as of approximately equivalent school standing. The Africans were superior to the Americans in the senses of intensity, time and rhythm, in that order; inferior in the sense of pitch, the sense of consonance and memory for tones, in order of increasing inferiority.

4. An African boy of about fifteen excelled over 90 per cent. of American children of approximately his own school standing in each of the six capacities.

5. There was no relation between any of the six capacities and age.

6. Four of the tests were uncorrelated with intelligence. The tests of the sense of consonance and of memory for tones were positively correlated with intelligence, probably owing to the nature of the tasks being difficult to understand.

7. All the tests, except that of the sense of consonance, were adequately reliable as actually administered.

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REFERENCES
REFERENCES


...
APPENDIX

Set of the Test Material for the "General Intelligence Test for Africans."
General Intelligence Test for Africans

MANUAL OF DIRECTIONS

Prepared under the auspices of the Carnegie Corporation of New York

By

R. A. C. OLIVER

NAIROBI, KENYA COLONY
PRINTED BY THE GOVERNMENT PRINTER
1932
General Intelligence Test for Africans

MANUAL OF DIRECTIONS
PREFACE

The General Intelligence Test for Africans which is given in this Manual represents the result of investigations which Mr. Oliver has been conducting in Kenya under the auspices of the Carnegie Corporation during the last two years and a half, with the help of teachers in different schools, both mission and Government.

It is not necessary for me to emphasize the importance of the work done by Mr. Oliver. The day has long passed when it was necessary to plead for a recognition of that importance. But the application of general intelligence tests in East Africa is a novelty and has involved difficulties peculiar to this country. The standard of education in the ordinary acceptance of the term is extremely low. The country is inhabited by a large number of tribes, using different languages, and thinking in entirely different ways owing to the diversities of their environments. All these differences have rendered the work of Mr. Oliver more difficult than it would otherwise have been.

It is perhaps still too early to say how far Mr. Oliver has succeeded in producing a reliable standard general intelligence test, but that he has gone a great way towards success is indubitable.

He has certainly gone far enough to justify us in applying the test in connexion with the selection of boys for admission to secondary education at the end of this year, and this application will be of very great interest in enabling us to make a simultaneous use of the test over a much larger area than has been possible in the past.

We are indebted to the Carnegie Corporation for their generosity in enabling Mr. Oliver to do this most valuable piece of work in Kenya. It is to be hoped that the Corporation will not take it amiss if we indicate our appreciation by expressing the hope that they will give us more of Mr. Oliver’s time in order that he may evolve a standard test applicable to a much lower standard of attainment, in order that we may assess the educable capacity of the Kenya African at a very early age.

H. S. SCOTT,
Director of Education, Kenya.

Nairobi, Kenya Colony.
29th August, 1932.
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I.—INTRODUCTION.

1.—The Nature of a General Intelligence Test.

The nature of a general intelligence test may perhaps be best understood by comparing it with the ordinary scholastic examinations with which educationists are familiar. An intelligence test and a school examination resemble one another in that both are measuring instruments. They differ from one another in two respects, namely, what they measure, and how well they measure it.

A scholastic examination, broadly speaking, measures a pupil's achievement in a school subject, such as arithmetic or hygiene or a foreign language. The pupil's achievement is the resultant of a number of factors, among which are his native intelligence, the length of time he has attended school, his health, his industry and the quality of teaching he has received. A school examination, however, rightly makes no attempt to distinguish among these various conditions of success.

An intelligence test, on the other hand, is designed to measure only one of the factors of scholastic achievement, but one of the most important. Intelligence, from the educational point of view, may be defined as the ability to acquire and to apply knowledge. Psychological research has sufficiently demonstrated that this ability exists, and that it is called into play not only in school work but in most of the tasks we have to perform. It has been shown, too, that individuals differ enormously in the amount of it with which they are by nature endowed. From the point of view of education, a person's capacity for learning and for applying his knowledge is one of the most important things one can know about him. Teachers have long recognized some such ability under the name of common sense, and that, more or less, is what a good intelligence test measures.

The question how well school examinations measure what they do measure can best be answered by educationists themselves. The essence of a good measuring instrument is that it should yield the same result whoever applies it and whenever he uses it. The deficiencies of a school examination as a yardstick are well known to anyone who has had to mark a large number of examination papers. He cannot be sure that his standards are not higher or lower than those of others who are marking a similar set of papers. A reputation as a "hard marker" or an "easy marker" is easily made. But not only do standards vary from person to person; it is commonly said that the standards of any one person fluctuate, so that it is difficult to mark consistently the first paper and the last hundred. Examination marks are therefore a scale of scholastic achievement which is subjective and variable.
A good intelligence test, on the other hand, does approach the yardstick in its reliability as a measuring instrument. This is because the procedure for its use, as laid down in the manual of directions, has been carefully standardized. The method of giving the test is the same for all examiners, wherever or whenever they give it. The pupil's answers are scored by a simple system which does not vary. Thus a score of 40 or of 90 means the same thing in all circumstances. An intelligence test is therefore a measure which is objective and reliable.

2.—The "General Intelligence Test for Africans."

The "General Intelligence Test for Africans" represents an adaptation to East African conditions of the mental test technique now widespread in other continents. The several tests in the set are of the same general types as have been successfully used elsewhere, but in their specific form and content they are based upon local conditions. No item has been included unless it has been found by actual experiment to be itself a good test of intelligence in the Africans for whom it is intended.

It is obvious that the class of Africans to which the test can be applied is limited. No one intelligence test or scholastic examination is suitable for persons of all ages and of all degrees of education. The test here described was designed primarily for African youths and adults who have received a certain amount of schooling. There are no upward limits of age, ability or schooling, above which the test becomes too easy for Africans. The downward limits of age and ability, below which the test becomes too difficult, can be found only by experiment. The minimum amount of school learning required will be obvious from an inspection of the tests: it will include the ability to recognize the digits 0 to 9 and the letters of the alphabet, the ability to see meaning in pictures, a knowledge of simple arithmetical operations, and the ability to use a pencil. Obviously, the test cannot be given to a quite uneducated native; to test such a one would require the use of a different type of test, which it is beyond the scope of this manual to discuss.

One limitation it has been possible to avoid is that which the diversity of tongues in East Africa might have been expected to impose. The instructions given by the examiner to the pupils may be translated into any language, while the pupils' answers require no use of language whatever.

It is the duty of anyone who publishes a test to provide statistics proving that the test is both "valid" and "reliable." A test is "valid" if it really measures what it purports to measure. It is "reliable" if it measures that thing in a reliable or verifiable way. Before anyone uses the test he should be satisfied that these two statistical criteria of its value have been met. It will be shown briefly that the "General Intelligence Test for Africans" is both valid and reliable.
(1) The Validity of the Test.

The "General Intelligence Test for Africans" purports to measure intelligence. The following experiment shows that it does so.

The test was given to 100 boys in Standards V and VI of Maseno Central School. At the same time, the Principal and staff of the school compiled a list of those boys, arranged in order of intelligence as they estimated it from their intimate knowledge of their pupils. The measurements made by the test and the estimates made by the teachers were then compared, and it was found that they agreed quite closely. The closeness of the agreement is indicated by a coefficient of correlation $r = .60$.

Thus the test will yield results which will be independently confirmed by an intimate knowledge of the persons tested.

(2) The Reliability of the Test.

The "General Intelligence Test for Africans" then, does measure intelligence. Does it do so in a dependable way? If we measure a man's height with a yardstick, we regard the measurement as reliable, since, if we repeat it, we get approximately the same result. The reliability of a test can be assessed in the same way.

The "General Intelligence Test for Africans" was given to 67 boys in Forms I to III of the Alliance High School in February, 1932. In June, 1932, the same test was given to the same boys. When the two sets of results were compared, they were found to be in close agreement. The general run of the scores was of course higher, owing to the practice effect and to the four months' development of the pupils; but the positions of the boys relative to one another were almost unaltered. The closeness of the agreement between the first set of measurements and the second is indicated by a coefficient of correlation $r = .81$.

Thus the "General Intelligence Test for Africans" not only measures intelligence, as intelligence is understood by teachers, but it measures intelligence in a trustworthy way.

3.—The Use of a General Intelligence Test in East Africa.

The use of intelligence tests is now widespread in many countries. Those who have had experience of their applications know what a powerful instrument they have been in improving
education. Not only have they assisted the master in solving the problems of school organization, but, far more important, they have been of inestimable value as signposts directing the child along the path of education and of life. The purpose of this section is merely to refer briefly to some of the ways in which an intelligence test might prove useful in East Africa.

(1) The Selection of Entrants to a School.

There are often more applicants for admission to a central or secondary school than can be accommodated. Yet all of the applicants may have reached the educational standard required for admission. It then becomes necessary to make use of some additional means of selection. In that case the use of an intelligence test as the selective instrument may be considered. It will have the advantage of eliminating the influence of some of the more adventitious circumstances which may have contributed to the gaining of the necessary school certificates. For example, one of the applicants may have reached the required standard by dint of hard " cramming," or of specially good teaching, or simply of "easy marking" of his examination papers; while another may have qualified for entrance in spite of poor teaching or of having to herd goats too often when he should have been at school. The intelligence test would pick out the innately brighter boy.

(2) Vocational Guidance.

A central school may provide a variety of courses of study, such as a general course, a commercial course, a teachers’ course and a handwork course. The principal of the school may be called upon to direct a pupil into one or other of these courses. One of the items of information which might then be useful to him would be the pupil’s score in an intelligence test. Suppose that the principal knew, for example, that his teachers’ course called as a rule for a higher degree of general ability than his handwork course, he would, while taking other circumstances into consideration, tend to advise the teachers’ course for his brighter boys.

(3) The Classification of Pupils.

Pupils vary enormously in intelligence, or the ability to learn. In almost any class of Standard III pupils, for example, there will be found some pupils who are brighter than the average pupil in Standard V, and others who are not so bright as the average pupil in Standard I. To teach fractions, say, to children at such different levels of mental development, by the same method and at the same rate, is obviously a difficult and certainly a wasteful task. Now in a school with a large enrolment, it is sometimes necessary to divide a standard into two or more sections. Where this is so, it is advantageous both to teacher and pupils if the pupils are grouped on the basis of learning capacity; and of learning capacity an intelligence test score is a fairly reliable index. There should be three sections, if possible—one for the
backward pupils, one for the advanced pupils, and one for those round about the average. Each section will be able to progress at its own rate. The dull pupil will not be discouraged by a hopeless competition against his intellectual superiors. The clever pupil will be able to finish his course more quickly, or to cover much more ground in the same time. The teacher's task will be greatly simplified. Even if it is not possible to run three separate classes, it may be possible to group the pupils within one class according to ability, for some subjects at least; or else the more advanced pupils may be moved up to a higher class sooner than the others. In one way or another, the instruction should be adapted to the individual differences in learning capacity revealed by the intelligence test.

(4) The Discovery of Unusual Cases.

In the process of applying an intelligence test to a class he does not yet know, the teacher may discover, sooner than he otherwise would, pupils who suffer from some mental or physical abnormality. A pupil whose score is greatly below the scores of other pupils whom he might have been expected to equal, may quite possibly be found to suffer from defective vision or hearing, or from some maladjustment of personality.

An intelligence test will often throw new light on pupils whom the teacher thought he already knew quite well. He will probably be surprised at the range of ability in his class, for one's almost inevitable tendency is to over-estimate the intelligence of the duller pupils and to under-estimate that of the brighter. He may come to realize the need for special opportunities for his best pupils, who, after all, are to be the leaders of their people. He will be reconciled to the slow progress of most of the weaker brethren, realizing that they may be doing very creditable work in view of their limited abilities. On the other hand, it may come as a shock to him to find that a pupil whom he had definitely relegated to the ranks of these same weaker brethren may turn out to be one of the most intelligent boys in his class, and he will take steps to ensure that this talent is no longer buried.

(5) Vocational Selection.

The employer's task in selecting a candidate for a post where intelligence is a desideratum, is analogous to that of the school principal in selecting applicants for admission to his school. An intelligence test will indicate which candidate is likely to adapt himself best to the new conditions of work; and, if he is qualified in other respects, this is the candidate whom the employer will choose.

(6) Research.

Scientific research requires the use of accurate measuring instruments. A good intelligence test is such an instrument; and the use of one in East Africa would begin to make praticable a
large number of important and fascinating researches. Some of the questions an intelligence test might be instrumental in answering are as follows: How do the East African tribes compare with one another in intelligence? Are native women less intelligent than native men? At what age does the average African's intelligence cease to develop? At what period of old age does it definitely decline? Is there any relationship between intelligence and stature in the native? Is the size or the shape of his head a clue to his intelligence? Is the African's intelligence chronically depressed by diseases, and, if so, which diseases have this effect? Is any rise in the general level of intelligence visible over a period of years?

4.—The Limitations of a General Intelligence Test.

A general intelligence test does not pretend to give any information about a person's character. Character is a matter of values, about which there is no general agreement. Until these values are stable, it is useless to try to measure them, and they must be left to subjective judgment.

An intelligence test is not a measure of temperament. Differences of temperament are matter of fact, but psychological research has not yet proceeded beyond the experimental stage with their analysis or measurement.

A general intelligence test does not measure special abilities or skills, such as musical talent or manual dexterity. To measure these, special tests would be required.

An intelligence test is not a substitute for common sense; it should be its instrument. A physician, when he has taken the temperature and the pulse rate of his patient, does not thereupon abandon the use of his own judgment. So an intelligence test must be used intelligently. The wise teacher will interpret a pupil's performance in an intelligence test in the light of what he knows of human nature in general and of this pupil in particular.

II.—General Directions to Examiners.

1. The "General Intelligence Test for Africans" may be given by any good teacher who will carefully read this manual and follow the directions contained in it.

2. It is advisable to obtain some preliminary experience in giving and scoring the test. A practice group of persons may be tested with this end in view before proceeding to the testing of other groups.

3. The instructions which the examiner is to give to the pupils are given in this manual in English and Kiswahili. The examination may, however, be conducted in any language. The
examiner must translate the instructions beforehand into the language to be used. The translation should be as accurate, as clear and as simple as possible.

4. The examiner must make sure that all the pupils to be tested at one time understand the language to be used. Other pupils must be tested at other times, each in a language he understands.

5. The size of group which can be tested at one time is about the size of class which can conveniently be taught at one time. As a rule, not more than thirty persons should be tested together.

6. The examiner should, if possible, have one or two assistants. The division of duties between examiner and assistants is indicated in the "Directions for Examining." In general, the examiner will give the instructions to the pupils and keep the time, while the assistants will see that the pupils carry out the examiner's instructions.

7. The examination should be conducted in a well lit room, free from distractions within and without. Preferably only the examiner, his assistants and the pupils should be present. The pupils should not be crowded.

8. It is advisable to make sure beforehand that all the pages of the test booklets have been cut.

9. Pencils, not pens, should be used. Each pupil should have one or preferably two well-sharpened pencils; and the examiner or his assistants should have a supply of pencils ready to replace at once the pencil of any pupil if required.

10. The examiner's manner should be pleasant but authoritative. He should speak distinctly, rather slowly, and loudly enough to be heard by all the pupils without difficulty. The instructions should be given in a natural tone of voice; commands should be spoken authoritatively, and instant obedience enforced.

11. Each test is immediately preceded in the examination booklet by a practice exercise similar to the test proper. The exercises are on the odd-numbered pages, the tests on the even-numbered pages. The purpose of the exercises is to enable the examiner and his assistants to illustrate clearly what is required in each test, and to give the pupils practice in doing what is required. In scoring, no account is taken of the exercise, but only of the test. The instructions laid down are intended to be adequate, and must be given to the pupils as laid down. Additional instructions on the same lines may be given if necessary; but, in the interests of uniformity amongst examiners, these should be reduced to a minimum. Often it will be found sufficient simply to repeat the instructions, perhaps in a different form of words. Questions may be answered; pupils who do not understand what to do may be shown; the blackboard may be used for illustration. But it is most important to adhere strictly to the following rule: When
the page has been turned to the test proper, and the word to
begin given, no further instructions may be added. All difficulties
must be resolved in connexion with the practice exercise. During
the test proper, no questions may be entertained, and the exam-
iner and his assistants may give no help beyond showing the
pupils where to begin or where to go on to next.

12. Accurate time-keeping is important. A stop-watch should
be used if possible. Failing this, a watch with a second hand
may be used if sufficient care is exercised. In that case, the exact
time of beginning should be written down. Time limits are im-
posed both on the practice exercises and on the tests. The pur-
pose of the time limits on the practice exercises is to reveal pupils
who are having difficulty, in order that they may receive further
assistance before proceeding to the test proper. The tests proper
fall into two classes with respect to time limits. The first two
tests may be called "speed" tests; they measure how much a
person can do in a given time. The time given is short, so that
the slow cannot do as much as the fast. Accurate time-keeping
is of great importance here. The other four tests may be called
"difficulty" tests; they measure how difficult things a person can
do. Time limits are indeed imposed, but only for the simple
reason that it is convenient to have all the pupils doing the same
test at the same time. Speed of working is not intended to affect
the score; the great majority of the persons for whom the tests
are designed have time enough to do all they can without haste.
The time allowances were decided on only after experimental
studies of the time required by various groups. In finally fixing
them, the advice of the famous psychologist, E. L. Thorndike,1
was kept in mind:—

"The time of the subject who is taking such tests is of
very little value. His general comfort and peace of mind is
of much value. . . . So my advice is to be very generous
with the time."

13. The examiner must be on the look-out for signs of fatigue
in the pupils during the examination, and must allow a rest inter-
val at the end of a test whenever necessary. The test usually
requires about an hour and a half. As a rule, an interval of ten
minutes after test 4, spent in the open air, will be found sufficient.
Longer and more frequent intervals may be given at the discretion
of the examiner, or the test may be taken in more than one
session. During an interval, the test booklets should be left on
the desks, folded to the page at which the pupils will recommence
work.

14. Copying should, of course, be prevented; and no pupil
should be permitted to put pencil to paper except between the
commands to begin and to stop.

1 In a letter to the author.
III.—DIRECTIONS FOR EXAMINING.

When the pupils are seated, the desks cleared, and the pencils ready, say:

"I am going to give you a test. You must do your very best, because I want to see whether you can do as well as the pupils of other schools.

"I shall give each of you one booklet. Do not open it. Leave it on your desk until I tell you what to do." Assistants distribute the booklets, and see that they are not opened.

(1) "Look at the first line; it is here. (Hold up a test booklet, and point to line 1.) On line number 1, write your name." Assistants see that everyone writes his name in the proper place.

(2) "Look at the second line. On line number 2, write the name of your tribe." If the class is composed of pupils of one sex only, say: "One line number 3, write the word 'Boy,'" or, "Write the word 'Girl.'" If the class is composed of pupils of both sexes, say: "On line number 3, write whether you are a 'Boy' or a 'Girl.'" With adults, use the words 'Man' and 'Woman.'

(3) "Look at the third line." If the class is composed of pupils of one sex only, say: "One line number 3, write the word 'Boy,'" or, "Write the word 'Girl.'" If the class is composed of pupils of both sexes, say: "On line number 3, write whether you are a 'Boy' or a 'Girl.'" With adults, use the words 'Man' and 'Woman.'

(4) "Look at the fourth line. On line number 4, write the date when you were born, if you know it. If you do not know, do not write anything."

After the test, the examiner should check the date of birth from the school register or any other source which may be available.

(5) "Look at the fifth line. On line number 5, write how old you are now, if you know it. If you do not know, do not write anything."

(6) "Look at the sixth line. On line number 6, write the name of this school." Mention the name of the school.

(7) "Look at the seventh line. On line number 7, write what class (standard, form) you are in."

(8) "Look at the eighth line. On line number 8, write today's date." Mention the date.

(9, 10) On the remaining lines, the examiner may have recorded any other information he wishes, or he may use them for his own remarks.

"Pencils down!"

"Now listen carefully. Do not turn over any page until I tell you to do so. Do not write anything until I tell you to do so. As soon as I say 'Stop!' you must stop at once and put your pencil on the desk."

"Now turn over to page 3. This is page 3." Hold up a test booklet open at page 3. "Fold your books so that they are open at page 3 only, like this." Fold the test booklet so that only page 3 is seen.
Page 3.

"Look at the first row of pictures. Look at the first picture in the row: it is a hen. Under the hen is a number. What number is under the hen? (Pause for correct answer.) Yes, it is a 1. Look at the next picture: it is an insect. What number is under the insect? (Pause.) Yes, it is a 2. Notice that each picture in this row has a number under it. Do you see that? (Pause.)"

"Now look at the other two rows of pictures, below. These pictures have no numbers yet. When I tell you to, you are to write their numbers in with your pencil. Look at the first picture in the second row: it is a panga. Find the panga just like it in the first row of pictures, above. The panga in the first row has a 5 under it, hasn't it? (Pause.) So take your pencil and write a 5 under this panga in the second row. Write a 5 under this panga only." Assistants see that everyone writes 5 in the proper place, and report all correct before examiner proceeds.

"Look at the next picture in the second row: it is a snake. The snake in the first row, above, has a 6 under it; so now write a 6 under this snake in the second row. Write a 6 under this snake only." Assistants supervise as before.

"Look at the next picture: it is a tree. What number should go under the tree? (Pause.) Yes, a 4. So now write a 4 under the tree.

"Look at the next picture: it is a hand. What number should go under the hand? (Pause.) Yes, a 3. So now write a 3 under the hand.

"Pencils down!

"When I say 'Begin,' but not before, go on in the same way yourselves. Finish the second row of pictures, then go on to the last row. Try to do all the pictures on this page. Do not turn over to the next page. Remember, UNDER EACH PICTURE MAKE THE NUMBER WHICH BELONGS TO IT. Ready? Begin!" Start the stop-watch, or note the time.

Assistants see that everyone is doing the right thing.

After 1 minute, say: "Stop! Pencils down! Hands up anyone who did not know what to do, and I shall explain it to him."

Deal with any difficulties which arise, then proceed.

"Pencils down!

"Do not turn over to the next page till I tell you. On the next page you will find some more pictures and numbers. Do them in the same way: under each picture make the number which belongs to it. Do as many as you can. Turn over to page 4. Ready? Begin!" Start the stop-watch, or make a note of the time.
After 1½ minutes, say: "Stop! Pencils down! Now look at page 5." Hold up a test booklet folded to the proper page. "Fold your books."

2. Comparison.

"Page 5.

"Look at the first two numbers: 5—2, 5—2. Are they the same or different? (Pause for correct answer.) Yes, they are the same. The letter S (writing it on the blackboard) is for 'same.' So take your pencil and write capital S on the line between 5—2 and 5—2. Write an S on the first line only." Assistants see that everyone writes S in the proper place, and report all correct before examiner proceeds.

"Look at the next two numbers: 9—1—2, 9—6—2. Are they the same or different? (Pause.) Yes, they are different. The letter D (writing it on the blackboard) is for 'different.' So everyone write capital D on the line between the two numbers. Write a D on the second line only." Assistants supervise as before.

"Look at the next pair, the letters C—G, C—K. Are they the same or different? (Pause.) Yes, they are different. So everyone write capital D on the line between them.

"Look at the next pair, the two diagrams. Are they the same or different? (Pause.) Yes, they are nearly the same; they are meant to be the same. So everyone write capital S on the line between them.

"Pencils down!

"When I say 'Begin,' but not before, go on in the same way yourselves. Try to do all on this page. Do not turn over to the next page. Remember, IF THE TWO THINGS ARE THE SAME, WRITE S ON THE LINE BETWEEN THEM. IF THEY ARE DIFFERENT, WRITE D ON THE LINE BETWEEN THEM. Ready? Begin!" Start the stop-watch, or note the time.

Assistant see that everyone is doing the right thing.

After 1 minute, say: "Stop! Pencils down! Hands up anyone who did not know what to do." Deal with any difficulties which arise, then proceed.

"Pencils down!

"Do not turn over to the next page till I tell you. On the next page you will find some more. Do them in the same way. If the two things are the same, write S on the line between them. If they are different, write D on the line between them. Do as many as you can. Turn over to page 6. Ready? Begin!" Start the stop-watch, or make a note of the time.
After 2 minutes, say: "Stop! Pencils down! Now look at page 7. This is page 7." Hold up a test booklet folded to the proper page. "Fold your books."

3. Picture Classification.

"Page 7.

"Look at the first row of pictures, row number 1. There are five pictures in the row—a man, another man, another man, a cow, and another man. Four of these pictures are like one another, one picture is different. The cow is different from the men. So take your pencil and cross out the picture of the cow. Make a large cross like this (making a large X on the blackboard) right through the picture of the cow." Assistants see that everyone makes a cross in the proper place, and report all correct before examiner proceeds.

"Look at the next row of pictures, row number 2. You see a hen, a goat, another hen, a bird, and another bird. Four of these pictures are like one another, one picture is different. Which picture is different? (Pause for correct answer.) Yes, the goat is different. So everyone cross out the picture of the goat." Assistants supervise as before.

"Look at the next row of pictures, row number 3. You see a leaf, another leaf, a tree, another leaf, and another leaf. Four of these pictures are like one another, one picture is different. Which picture is different? (Pause.) Yes, the tree is different from the leaves. So everyone cross out the picture of the tree.

"Pencils down!

"When I say 'Begin,' but not before, go on in the same way yourselves. Begin at row number 4. Try to do all the rows on this page. Do not turn over to the next page. Remember, IN EACH ROW, FIND THE ONE PICTURE WHICH IS DIFFERENT FROM THE OTHER FOUR PICTURES, AND CROSS IT OUT WITH YOUR PENCIL. IN EACH ROW, CROSS OUT ONE PICTURE ONLY. Ready? Begin!" Start the stop-watch, or note the time.

Assistants see that everyone is doing the right thing.

After 1 minute, say: "Stop! Pencils down! Hands up anyone who did not know what to do." Deal with any difficulties which arise, then proceed.

"Pencils down!

"Do not turn over to the next page till I tell you. On the next page you will find some more rows of pictures. Do them in the same way: in each row, find the one picture which is different from the other four pictures, and cross it out with your pencil. In each row, cross out one picture only. Turn over to page 8. Ready? Begin!" Start the stop-watch, or make a note of the time.
After 3 minutes, say: "Stop! Pencils down! Now look at page 9. This is page 9." Hold up a test booklet folded to the proper page. "Fold your books."

4. Picture Completion.

"Page 9.

"Look at the first picture, picture number 1. It is a man's face, isn't it? (Pause.) But the man has no mouth. So take your pencil and draw his mouth. Give him a mouth with your pencil. A line like this (quickly drawing the missing mouth on the blackboard) will do for a mouth." Assistants see that everyone draws in the mouth, and report all correct before examiner proceeds.

"Look at the next picture, picture number 2. It is a hand. But part of the hand has been left out. What part of the hand has been left out? (Pause for correct answer.) Yes, a finger. So everyone draw the finger in its proper place. A line like this (quickly drawing the missing finger on the blackboard) will do for a finger." Assistants supervise as before.

"Look at the next picture, picture number 3. It is a cow. What has been left out of the picture of the cow? (Pause.) Yes, the tail. So everyone draw the tail. A line like this (quickly drawing the missing tail on the blackboard) will do for a tail."

"Pencils down!

"When I say 'Begin,' but not before, go on in the same way yourselves. Begin at picture number 4. Try to do all the pictures on this page. Do not turn over to the next page. Remember, FIND WHAT HAS BEEN LEFT OUT OF EACH PICTURE, AND DRAW IT IN QUICKLY WITH YOUR PENCIL. Ready? Begin!" Start the stop-watch, or note the time.

Assistants see that everyone is doing the right thing.

After 1 minute, say: "Stop! Pencils down! Hands up anyone who did not know what to do." Deal with any difficulties which arise, then proceed.

"Pencils down!

"Do not turn over to the next page till I tell you. On the next page you will find some more pictures. Do them in the same way: find what has been left out of each picture, and draw it in quickly with your pencil. Turn over to page 10. Ready? Begin!" Start the stop-watch, or make a note of the time.

After 5 minutes, say: "Stop! Pencils down! Now look at page 11." Hold up a test booklet folded to the proper page. "Fold your books."
An interval may be allowed here. During the interval, the test booklets should be left folded at page 11 on the desks.

5. Number Series.

"Page 11.

" Look at the first row of numbers: 1, 2, 3, 4, 5. Look at the two dotted lines after number 5. On these two dotted lines you are to write the two numbers that should come after 5. 1, 2, 3, 4, 5—what two numbers should come next? (Pause for correct answer.) Yes, 6, 7. So take your pencil and write 6, 7, on the two dotted lines after 5." Assistants see that everyone writes the numbers in the proper places, and report all correct before examiner proceeds.

"Look at the next row of numbers: 2, 4, 6, 8, 10. What two numbers should come next?" Pause for answer. If there is any difficulty, explain that the numbers in this row increase by two at each step, and that therefore the next two numbers are 12, 14. "So everyone write 12, 14, on the two dotted lines after 10." Assistants supervise as before.

"Look at the next row: 10, 9, 8, 7, 6. What two numbers should come next?" Pause for answer. If there is any difficulty, explain that the numbers in this row decrease by one at each step. "So everyone write 5, 4, on the two dotted lines after 6."

"Look at the next row: 1, 1, 2, 2, 3, 3, 4, 4. What two numbers should come next?" Pause for answer. If there is any difficulty, explain that each number is repeated. "So everyone write 5, 5, on the two dotted lines after 4."

"Pencils down!"

"When I say 'Begin,' but not before, go on in the same way yourselves. Try to do all the rows on this page. Do not turn over to the next page. Remember IN EACH ROW, TRY TO FIND OUT HOW THE NUMBERS ARE CONNECTED, AND THEN WRITE THE TWO NUMBERS WHICH SHOULP COME NEXT. Ready? Begin!" Start the stop-watch, or note the time.

Assistants see that everyone is doing the right thing.

After 1 minute, say: "Stop! Pencils down!"

Examiner demonstrates to the whole class the correct solution of the remaining problems on page 11. Every pupil must understand what is required before examiner proceeds.

"Pencils down!"

"Do not turn over to the next page till I tell you. On the next page you will find some more of the same kind. Do them in the same way: in each row, try to find out how the numbers are connected, and then write the two numbers which should come next. Turn over to page 12. Ready? Begin!" Start the stop-watch, or make a note of the time.
After 10 minutes, say: "Stop! Pencils down! Now look at page 13. This is page 13." Hold up a test booklet folded to the proper page. "Fold your books."

6. Picture Absurdities.

"Page 13.

"Look at the first picture, picture number 1. There is something wrong with this picture. The man should not be on the cow's back; a man does not ride on a cow's back. So the man has been crossed out, to show that he is wrong. Do you see that? (Pause.)"

"Look at the next picture, picture number 2. What is wrong with this picture? (Pause for correct answer.) Yes, a hen has not long ears. So take your pencil and cross out the ears. Cross out the ears only." Assistants make sure that everyone makes a cross in the proper place, and report all correct before examiner proceeds.

"Look at the next picture, picture number 3. What is wrong with this picture? (Pause.) Yes, a rat has not a short curly tail. So everyone cross out the tail. Cross out the tail only." Assistants supervise as before.

"Pencils down!

"When I say 'Begin,' but not before, go on in the same way yourselves. Begin at picture number 4. Try to do all the pictures on this page. Do not turn over to the next page. Remember, IN EACH PICTURE, FIND WHAT IS WRONG, AND CROSS IT OUT WITH YOUR PENCIL. CROSS OUT WHAT IS WRONG ONLY; DO NOT CROSS OUT WHAT IS RIGHT. Ready? Begin!"

Start the stop-watch, or note the time.

Assistants see that everyone is doing the right thing.

After 1 minute, say: "Stop! Pencils down! Hands up anyone who did not know what to do." Deal with any difficulties which arise, then proceed.

"Pencils down!

"Do not turn over to the next page till I tell you. On the next page you will find some more pictures. Do them in the same way: in each picture, find what is wrong, and cross it out with your pencil. Cross out what is wrong only; do not cross out what is right. Turn over to page 14. Ready? Begin!" Start the stop-watch, or make a note of the time.

After 4 minutes, say: "Stop! Pencils down! Close your books." Collect the booklets.
IV.—DIRECTIONS FOR SCORING.

The rules to be adhered to in scoring the tests are given below. The tests are scored by means of the scoring keys, furnished on four separate sheets of paper, so designed as to facilitate ease and accuracy of scoring. The methods of using these keys are described below.

Where the greatest accuracy is desired, the scoring should be checked by a second person, as even the most experienced scorers make occasional slips. It is advisable to use a pen or a coloured pencil in marking the booklets, so that the scorer’s markings can afterwards be distinguished from those of the pupil, if necessary. The scorer’s marks should not be made where they tend to obscure those of the pupil. A check mark (✓) may be used to indicate an item which is right, a cross (✗) to indicate one which is wrong, and an O to indicate one which is omitted.

1.—GENERAL RULES.

(1) Each item marked by a pupil is scored either right or wrong. No fractional scores are given.

(2) If a marking has been clearly corrected by the pupil, so that there is no doubt as to his final intention, the correction is the answer which should be scored.

(3) In any case not provided for in the rules for scoring, the scorer must use his own judgment. An answer should be counted as right only if it is quite clear that the pupil has indubitably solved the problem.

(4) The number of right answers in each test (and in Test 2, page 6, the number of wrong answers also) should be entered in the bottom right-hand corner of the test page. If and when the scoring has been checked, this should be indicated by a check mark.

(5) The number of right answers in each test should be copied into the spaces provided under the heading “Number right” on the cover of the test booklet. In Test 2, the number of wrong answers also should be copied into the space under the heading “Operation,” and should be subtracted from the number right. In the spaces under the head “Operation,” the number right (in Test 2, the number right minus the number wrong) should be multiplied by the appropriate weighting factor. The weighting factor for each test is given in Table I.

<table>
<thead>
<tr>
<th>TABLE I</th>
<th>WEIGHTING FACTORS OF THE COMPONENT TESTS</th>
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<tbody>
<tr>
<td>Test</td>
<td>Weighting Factor</td>
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<tr>
<td>1</td>
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<td>10</td>
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</tbody>
</table>
The results of these operations should be entered in the spaces under the heading "Score." The sum of the six scores is the "Total Score" in the test.

(6) The score in the test may be used either in the form of total score out of the highest possible score of 409, or in the form of per cent of the highest possible score. If it is desired to use per cent scores, Table II, for the conversion of total scores into per cent scores, will be found useful. Total scores intermediate between those given in the table may be converted to the nearest per cent scores by interpolation.

**TABLE II**

FOR CONVERSION OF TOTAL SCORES INTO PER CENT SCORES

<table>
<thead>
<tr>
<th>Total Score</th>
<th>Per cent Score</th>
<th>Total Score</th>
<th>Per cent Score</th>
<th>Total Score</th>
<th>Per cent Score</th>
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2. **Specific Rules for each Test.**

**Test 1, page 4. Picture Numbering.**

The key for this test is printed on a sheet of transparent paper. This sheet should be superimposed upon page 4 of the test booklet in such a way that for each item the pupil's answer in the booklet is seen beside the correct answer in the key.

1. Score is number right.
Test 2, page 6. Comparison.
The key for this test is printed down two margins of a sheet of stout paper. This sheet should be placed on page 6 of the test booklet, so that for each item the pupil's answer is seen alongside the correct answer in the key.

1. Score is (number right minus number wrong) multiplied by two. The subtraction is to be performed before the multiplication.

2. If the number to be subtracted (that is, the number wrong) is greater than the number right, the score is 0.

Test 3, page 8. Picture Classification.
The key for this test is similar to that for Test 1, and is used in a similar fashion.

1. Score is number right.

2. If, in any item, more than one of the five pictures in the row has been crossed out, count the item as wrong; unless (a) it has clearly been the pupil's final intention to leave only one of the pictures crossed out, in which case score as if that one alone had been crossed out, or (b) four of the pictures have been crossed out and one has not, in which case score as if that one alone had been crossed out.

Test 4, page 10. Picture Completion.
The key for this test is simply a copy of page 10 of the test booklet, with the pictures correctly completed in red ink. For each item, the pupil's answer in pencil should be compared with the correct answer in red ink in the key. Additional rules for scoring certain items are laid down in the verbal key for Test 4.

1. Score is number right.

2. An answer is to be counted right if it is quite clear that the pupil has tried, in whatever way, to indicate correctly the missing part. The technical quality of his drawing is to be disregarded.

3. Markings in any parts of the picture, other than those shown in red in the key for Test 4, are to be disregarded.

Test 5, page 12. Number Series.
The key for this test is similar to that for Test 2, and is used in a similar fashion.

1. Score is number right multiplied by four.

2. The answer to each item consists of two numbers, both of which must be right. If one number is right and the other is wrong or omitted, count the item as wrong.

The key for this test is an entirely verbal one. For each item, the pupil’s answer should be compared with the correct answer described in the key.

1. Score is number right multiplied by ten.

2. If the pupil amends the absurd part of the picture by drawing it as it should be, count as right.

3. Crosses through any parts of the picture not mentioned in the specific rules for each picture (see key for Test 6) do not affect the scoring; they are to be disregarded.

4. A cross very close to the part of the picture described in the key, but through no part of the picture, counts as right.

V.—TREATMENT OF RESULTS.

When the examiner has scored the test, he may analyse the scores, either total scores or per cent scores, in a number of ways.

The simplest step he can take is to arrange the test booklets in order of score, from highest to lowest. The highest and lowest scores, the range of scores, and the place of each pupil in the class will at once be apparent.

He may then seek some score to represent the performance of the class as a whole. For this purpose, he may use either of two types of average, the ordinary “average” (arithmetic mean) or the “median.” The median is as satisfactory as the mean for most purposes, and is more easily arrived at. It is simply the middle score, that score above and below which are an equal number of scores. It is found by counting to the middle booklet when the booklets have been arranged in order of score. Thus, if there are 25 booklets in a set, the middle booklet is the thirteenth from the top or the bottom, for that booklet has 12 booklets above it and 12 below it. If there are 20 booklets in a set, the median score is midway between the scores of the tenth and the eleventh booklets, since that score will have ten scores on either side of it. Thus, if the tenth lowest score in a series of 20 is 225, and the eleventh lowest is 229, then the median score is 227.

If the class is large, or if several classes are grouped together, the distribution of scores may be of interest. This may readily be represented in graphical form. The scores, either total or per cent, must first be grouped into convenient “class intervals” of five, ten or twenty points, for example, 100 to 119 inclusive, 120 to 139 inclusive, and so on. The number or “frequency” of scores within each of these class intervals is counted. The class
Intervals are then laid out along a base line as in Figure I, and columns are raised on them, corresponding in height to the frequency of the scores in the respective class intervals. A line joining the tops of the columns will then describe the distribution of the scores, revealing at a glance the range of the scores, the relative significance of any score, and similar facts.

![Figure I: A frequency distribution of scores.](image)

**VI.—NORMS FOR COMPARISON.**

A score in a test, whether it be the score of an individual or that of a group, is of little significance in itself. It gains significance only when it is compared with other scores.

To the principal of a school, the most interesting comparison as a rule will be the comparison of pupil with pupil and class with class within his own school. Such a comparison he may readily make. He may, however, wish to know how his pupils compare in ability with those of other schools. This comparison he can make only when records from other schools are available. The requisite standards of comparison can be made available by testing a number of groups in different parts of the country, and collecting the results. It would be desirable to have norms for each age, each school standard, each sex and each tribe, and perhaps other norms. It will be shown how users of the test may assist in the compilation of well-founded norms for comparison. Until these are available, however, such results as have been collected up to the present are given in Table III. For the convenience of examiners, comparisons may be made in terms of either average, the mean or the median, and in terms of either total score or per cent score.
TABLE III

AVERAGE SCORES OF VARIOUS GROUPS IN THE "GENERAL INTELLIGENCE TEST FOR AFRICANS"

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<tr>
<th>Class</th>
<th>Mean Score</th>
<th>Median Score</th>
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<td>Per cent</td>
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<td>2Standard V</td>
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<td>56</td>
</tr>
<tr>
<td>4Medical Training Depot</td>
<td>243</td>
<td>61</td>
</tr>
</tbody>
</table>

1Alliance High School, Kikuyu.
2Maseno Central School.
3Jeanes School, Kabete.
4Medical Training Depot, Nairobi.

To facilitate the compilation of useful norms for comparison, a form for a report on results has been drawn up. Sufficient copies of this "Report Form" will be sent out with each set of test booklets. The author would be very grateful if examiners would fill up this form and send it, marked "General Intelligence Test for Africans," to the Education Department, P.O. Box 340, Nairobi. Comparative statistics, throwing light on the distribution of intelligence throughout the country, could then be drawn up. Copies of such revised norms will be sent out to examiners as the necessary data accumulate.
APPENDIX A.

DIRECTIONS FOR EXAMINING IN KISWAHILI.

When the pupils are seated, the desks cleared, and the pencils ready, say:—

"Nataka kuwapa majaribio. Ni lazima kila mmija wenu ajitahidi kufanya bora kama awezavyo, kwa sababu nataka kungalia kama mnawezu kufanya kazi bora kama watoto wa skuli yoyote nyingineyo.

"Kila mmija wenu nitampa kitabu. Msikifungue. Kiwenkeni juu ya meza hata nitakapowambia jinsi ya kufanya." Assistants distribute the booklets, and see that they are not opened.

1) "Tazameni mstari wa kwanza; ndio huu. (Hold up a test booklet, and point to line 1.) Katika mstari ulioandikwa nambari 1, andika jina lako." Assistants see that everyone writes his or her name in the proper place.

2) "Tazameni mstari wa pili. Katika mstari ulioandikwa nambari 2, andika jina la kabila yako."

3) "Tazama mstari wa tatu." If the class is composed of pupils of one sex only, say: "Katika mstari nambari 3, andika 'Mume,'" or "Katika mstari nambari 3, andika 'Mke.'" If the class is composed of pupils of both sexes, say: "Andika ukiwa u 'Mume' au 'Mke.'"

4) "Tazama mstari wa nne. Katika mstari nambari 4, andika tarehe uliyozaliwa, ukiwa waijua. Ukiwa hujui, usiandike chochote."

After the test, the examiner should check the date of birth from the school register or any other source that may be available.

5) "Tazama mstari wa tano. Katika mstari ulioandikwa nambari 5, andika umri wako wa sasa, ukiwa waujua. Ukiwa hunjui, usiandike chochote."

6) "Tazama mstari wa sita. Katika mstari ulioandikwa nambari 6, andika jina la skuli hil." Mention the name of the school.

7) "Tazama mstari wa saba. Katika mstari ulioandikwa nambari 7, andika daraja (class, standard, form) gani ya skuli uliyomo."

8) "Tazama mstari wa nane. Katika mstari ulioandikwa nambari 8, andika tarehe ya leo." Mention the date.

9, 10 On the remaining lines, the examiner may have recorded any other information he wishes, or he may use them for his own remarks.
"Kalamu chini.


"Sasa funua ukurasa wa 3. Huu ndio ukurasa wa 3.' Hold up a test booklet open at page 3. "Kunjeni vitabu vyenu ukurasa wa 3 uonekane juu, kama hivi." Fold the test booklet so that only page 3 is seen.

1. Picture Numbering.

"Ukurasa wa 3.


"Sasa tazama ile mstari miwili mingine ya picha iliyoko chini. Picha hizi hazijaandikwa nambari bado. Nitakapokwambia uandike, andika nambari zao kwa kalamu yako. Tazama picha ya tatu katika mstari wa pili: picha huyo ni upanga. Tafuta upanga kama huo katika mstari wa kwanza, juu. Upanga huo ulio katika mstari wa kwanza una nambari 5 chini yake, au sivyo? (Pause.) Kwa hivyo twaa kalamu yako uandike nambari 5 chini ya upanga ulio katika mstari wa pili. Andika nambari 5 chini ya upanga huu tu." Assistants see that everyone writes 5 in the proper place, and report all correct before examiner proceeds.

"Tazama huyo picha nyingine katika mstari wa pili: picha huyo ni nyoka. Huyo nyoka aliywe katika mstari wa kwanza juu, yuna nambari 6 chini yake; kwa hivyo andika nambari 6 chini ya nyoka aliywe katika mstari wa pili. Andika 6 chini ya nyoka huu tu." Assistants supervise as before:


"Kalamu chini!

"Nitakaposema 'Anza,' lakini si kabla ya kusema, endelee ni vivyo hivyo wenyeke. Maliza huo mstari wa pili wa hizo picha, halafu endelea na mstari wa mwisho. Jaribu kufanya kilicicha.

"Kalamu chini.

Assistants see that everyone is doing the right thing.

After 1 minute, say: “Basi! Kalamu chini! Mtu yooyote ambaye hakujua jinsi atakavyofanya elimu mkono juu, nipate kumueleza.” Deal with any difficulties which arise, then proceed.

“Kalamu chini!


After 1½ minutes, say: “Basi! Kalamu chini! Sasa funua ukurasa wa 5. Huu ndio ukurasa wa 5.’’ Hold up a test booklet folded to the proper page. “Kunja vitabu vyenu.”

2. Comparison.

“Ukurasa wa 5.


“Kalamu chini!”

Assistants see that everyone is doing the right thing.

After 1 minute, say: "Basi! Kalamu chini! Wale ambao hawakuelewa jinsi ya kufanya wainue mikono juu." Deal with any difficulties which arise, then proceed.

"Kalamu chini!


After 2 minutes, say: "Basi! Kalamu chini! Sasa funua ukurasa wa 7. Huu ndio ukurasa wa 7." Hold up a test booklet folded at the proper page. "Kunja vitabu vyenu."

3. Picture Classification.

"Ukurasa wa 7.

"Tazama mstari wa kwanza wa hizo picha, mstari nambari 1. Kuna picha tano katika mstari huo: mtu, mtu mwingine, mtu mwingine, ngombe, na mtu mwingine. Picha nne katika hizi zimefanana, moja ni tofauti. Yule ngombe ndiye alichotia tofauti na wale watu. Kwa hivyo twaa kalamu yako chufu uwezavyo. Chora alama kama hii (making a large X on the blackboard) juu ya huyo ngombe." Assistants see that everyone makes a cross in the proper place, and report all correct before examiner proceeds.


"Kalamu chini!

"Nitakaposema 'Anza,' lakini si kabla ya kusema, endeleeni vivyo hivyo wenyewe. Jaribu kufanya kila mstari katika ukurasa huu. Kumbuka, KATIKA KILA MSTARI, TAFUTA PICHA ILE ILYO TOFAUTI NA ZILE ZINGINE, UKAICHORE KWA KALAMU YAKO. KATIKA KILA MSTARI, CHORA PICHA MOJA TU. Tayari? Anza!

Start the stop-watch, or note the time. Assistants see that everyone is doing the right thing.

After 1 minute, say: "Basi! Kalamu chini! Mtu yoyote ambaye hakujua jinsi ya kufanya alnine mkono juu, nipate kumueleza." Deal with any difficulties which arise, then proceed.

"Kalamu chini!


After 3 minutes, say: "Basi! Kalamu chini! Sasa tazama ukurasa wa 9. Huu ndio ukurasa wa 9." Hold up a test booklet folded to the proper page. "Kunja vitabu vyenu."

4. Picture Completion.

"Ukurasa wa 9.

"Tazama picha ya kwanza, picha nambari 1. Ni uso wa mtu, sivyo? (Pause.) Lakini mtu mwenyewe hana mdomo. Basi twaa kalamu yako ukaichore mdomo wake. Mtie mdomo kwa kalamu yako. Mstari kama huu (quickly drawing the missing mouth on the blackboard) utafaa kwa mdomo." Assistants see that everyone draws in the mouth, and report all correct before examiner proceeds.


"Kalamu chini!


Assistants make sure that everyone is doing the right thing.

After 1 minute, say: "Basi! Kalamu chini! Mtu yoyote ambaye hakujua jinsi ya kufanya ainue mkono juu." Deal with any difficulties which arise, then proceed.

"Kalamu chini!


After 5 minutes, say: "Basi! Kalamu chini! Sasa funua ukurasa wa 11. Huu ndio ukurasa wa 11." Hold up a test booklet folded to the proper page. "Kunja vitabu vyenu."

An interval may be allowed here. During the interval, the test booklet should be folded at page 11 on the desks.

5. Number Series.

"Ukurasa wa 11.

"Tazama mstari wa kwanza wa nambari: 1, 2, 3, 4, 5. Tazama ile mstari miwili midogo iliyo baada ya nambari 5. Juu ya mstari hii andika nambari zile mbili zinazofuatana baada ya 5. 1, 2, 3, 4, 5,—ni nambari gani mbili zitakazofuata? (Pause for correct answer.) Ndio, ni 6, 7. Kwa hivyo twaa kalamu yako uandike 6, 7, juu ya mstari ile miwili midogo baada ya 5." Assistants see that everyone writes the numbers in the proper places, and report all correct before examiner proceeds.

"Tazama ule mstari wa pili wa nambari: 2, 4, 6, 8, 10. Ni nambari gani mbili zitakazofuata? " Pause for answer. If there is any difficulty, explain that the numbers in this row increase by two at each step, and that therefore the next two numbers are 12, 14. "Kwa hivyo kila mmoja basi aandike 12, 14, katika hiyo mstari miwili ifuatayo 10." Assistants supervise as before.

"Tazama huo mstari mwingine ufuatao: 10, 9, 8, 7, 6. Ni nambari gani mbili zitakazofuata? " Pause for answer. If there is any difficulty, explain that the numbers in this row decrease by one at each step. "Kwa hivyo kila mmoja aandike 5, 4, juu ya ile mstari miwili midogo ifuatayo 6."
"Tazama huo mistari mwingine: 1 1, 2 2, 3 3, 4 4. Ni nambari gani mbili zitakazofuata?" Pause for answer. If there is any difficulty, explain that each number is repeated. "Kwa hivyo kila mmoja aandike 5 5 katika ile mistari xniwili midoga ifuatayo 4."

"Kalamu chini!

"Nitatapokosa 'Anza,' lakini si kabla ya kusema, endeleeni vivyo hivyo wenyewe. Jaribu kufanya mistari yote katika ukurasa huu. Usifunue ukurasa mwingine. Kumbuka, KATIKA KILA MSTARI JARIBU KUTAFUTA JINSI HIZO NAMBARI ZINAVYOFUATANA NA ZILIVYOPANGWA, HALAFU U-ANDIKE HIZO NAMBARI MBILI ZINAZOFUATA. Tayari? Anza!" Start the stop-watch, or note the time.

Assistants see that everyone is doing the right thing.

After 1 minute, say: "Basi! Kalamu chini!" Examiner demonstrates to the whole class the correct solution of the remaining problems on page 11. Every pupil must understand what is required before examiner proceeds.

"Kalamu chini!


After 10 minutes, say: "Basi! Kalamu chini! Sasa tazama ukurasa wa 13; huu ndio ukurasa wa 13." Hold up a test booklet folded to the proper page. "Kunja vitabu vyenu."

6. Picture Absurdities.

"Ukurasa wa 13."


"Kalamu chini!


Assistant see that everyone is doing the right thing.

After 1 minute, say: "Basi! Kalamu chini! Mtu yoyote ambaye hakufahamu jinsi ya kufanya ainue mkono juu." Deal with any difficulties which arise, then proceed.

"Kalamu chini!


After 4 minutes, say: "Basi! Kalamu chini! Fungeni vitabu vyenu." Collect the booklets.
## General Intelligence Test for Africans

Prepared under the auspices of the Carnegie Corporation of New York by R. A. C. Oliver

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<td></td>
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</tr>
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CG....CK
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**mrz** | **mnz** |

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**ksrtu** | **ksrtu** |
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**plqmrn** | **plqmrn** |
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GENERAL INTELLIGENCE TEST FOR AFRICANS

DIRECTIONS FOR SCORING

GENERAL RULES.

1. Each item marked by a pupil is scored either right or wrong. No fractional scores are given.

2. If a marking has clearly been corrected by the pupil, so that there is no doubt as to his final intention, the correction is the answer which should be scored.

3. In any case not provided for in the rules for scoring, the scorer must use his own judgment. An answer should be counted as right only if it is quite clear that the pupil has indubitably solved the problem.

SPECIFIC RULES.


If the number to be subtracted (number wrong) is greater than the number right, the score is 0.

Test 3, page 8. Picture Classification.

If, in any item, more than one of the five pictures in the row has been crossed out, count the item as wrong; unless (a) it has clearly been the pupil’s final intention to leave only one of the pictures crossed out, in which case score as if that one alone had been crossed out, or (b) four of the pictures have been crossed out and one has not, in which case score as if that one alone had been crossed out.

Test 4, page 10. Picture Completion.

An answer is to be counted as right if it is quite clear that the pupil has tried, in whatever way, to indicate the missing part. The technical quality of his drawing is to be disregarded.

Markings in any parts of the picture, other than those shown in red in the key for Test 4, are to be disregarded.

Test 5, page 12. Number Series.

The answer to each item consists of two numbers, both of which must be right. If one number is right and the other wrong or omitted, count the item as wrong.


If the pupil amends the absurd part of the picture by drawing it as it should be, count as right.

Crosses through any parts of the picture not mentioned in the specific rules for each picture (see key for Test 6) do not affect the scoring; they are to be disregarded.

A cross very close to the part of the picture described in the key, but through no part of the picture, counts as right.

The method of calculating the score in each test is shown in Table A:

<table>
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<th>Test</th>
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<td>(R - W) \times 2</td>
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<tr>
<td>Test 3, page 8</td>
<td>R \times 1</td>
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<tr>
<td>Test 4, page 10</td>
<td>R \times 1</td>
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<tr>
<td>Test 5, page 12</td>
<td>R \times 4</td>
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<tr>
<td>Test 6, page 14</td>
<td>R \times 10</td>
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"R" means "number right".
"W" means "number wrong".
"x" means "multiplied by".
The missing part in each picture is shown correctly in red ink in the pictorial key for Test 4. The following are additional rules for scoring certain items:

1. The missing horn may be drawn of any shape and in any position.
2. Any kind of letter D counts as right.
3. At least two lines joining the broken stream of water must be shown.
4. The digits of the number ten must be shown in their correct order; that is, since the ruler is drawn upside down, 01.
5. The missing spoke must be indicated by two lines from rim to hub; a larger or smaller number of lines, apart from shading, counts as wrong. A line completing the rim is to be disregarded.
6. The missing ear may be drawn of any shape and in any position.
7. Any date beginning with the digits 19, on any part of the coin, counts as right.
8. Either a stopper in the neck of the bottle, or liquid issuing from the neck of the bottle, but not both, counts as right. Both stopper and liquid have, however, been shown in the key.
9. The middle eye only. If either or both of the other eyes is crossed out, count as wrong.
10. The vessel upside down on the ground.
11. The animal paw. If the hen’s claw is crossed out, count as wrong.
12. Any one finger. The crossing out must be more or less confined to one finger. If more than one finger is clearly crossed out, count as wrong. A cross through the thumb is to be disregarded.
13. Any part of the arrow to the left of the bowstring. If the arrowhead nearest the bow is crossed out, count as wrong.
14. Any one of the fingers. If more than one finger is crossed out, count as wrong. A cross through the thumb is to be disregarded.
15. The smoke from the house on the left. If either or both of the other two smokes is crossed out, count as wrong.
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KEY FOR TEST 4, Page 10

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GENERAL INTELLIGENCE TEST FOR AFRICANS

REPORT FORM

School or Institution

Name of Examiner

Class

Date

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*Mark with a cross those ages which are estimated only, not definitely known.

To be filled up by examiner and sent to:

"General Intelligence Test for Africans,"

Education Department,

P. O. Box 340, Nairobi.
Mark with a cross those ages which are estimated only, not definitely known.