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" A REPORT ON THE COMPARATIVE PERFORMANCE " OF COLOURED AND EUROPEAN FACTORY WORKERS, " ON FOUR TESTS OF ABILITY. "

- BY -

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CHAPTER 1 INTRODUCTION

STATEMENT OF NATURE OF, AND REASONS FOR, PRESENT RESEARCH:

NATURE OF RESEARCH.

This thesis is a report on the results of four Psychological tests, applied to two groups of workers in Port Elizabeth factories; the one group consisting of European, the other of Coloured workers. The abilities selected for testing were believed to be necessary, to some extent, in certain Industrial operations.

REASONS FOR UNDERTAKING RESEARCH.

The research was undertaken at the suggestion of Mrs. I.H.B. White, Senior Research Officer in Personnel Management Problems of the Leather Industries Research Institute, Grahamstown. Mrs. White informed the writer that she had been approached, from time to time, by members of the management of different factories, and asked whether she could supply evidence as to whether the employment of Coloured labour would reduce efficiency, or lower production in their factories. No scientific data existed on which an answer to this question could be based.

It seemed, therefore, that experimentation on this subject would be of interest in a practical, as well as an academic, sense. The fact that various Industrial employers had approached the Institute with this question pointed to a

possibility that existing prejudice (discussed in Chapter 2) might be partially on the wane; other factors pointed towards the present time as being ripe for the establishment of scientific data on this subject. For example, one clothing factory, employing a small experimental group of Coloured [1] workers on machining, has found the work of these girls to be entirely satisfactory; evidence such as this, backed by scientific data, may go a long way towards dispelling the undoubted prejudice which exists at present towards the Coloured in general, and especially towards the Coloured as a workman. It is interesting to note that, even towards the African, generally regarded in an even more inferior light than the Coloured, evidence is beginning to accrue which might help him to be regarded in a more unbiassed light. Thus, on the 26th October, 1945, the "Eastern Province Herald" of Port Elizabeth reported that Master Builders, who saw Native workers constructing houses in the Pieter Maritzburg Municipal villages, were "very impressed" with what they saw; and that a Delegate who

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(1) In the discussion, Chapters 1 & 2, the term "Coloured" is used fairly generally to include Indians, Asiatics, etc. In connection with the experimental group, however, the term is used fairly particularly to refer to the "Cape Coloured" race.

Congress of the National Federation of Building Trade Employers had described this work of Native builders as an "eye-opener" to them all, and had stated that it was "wonderful" that Natives could do the work they were doing there. Favourable reports on the satisfactory work of Native nurses have also appeared in the recent South African press.

Evidence such as the above points to the opening up of European opinion in fields where it has previously been very rigid; none the less, the belief that dark-skinned people are, ipso facto, constitutionally inferior to Europeans in all but, perhaps, the rougher abilities, is still overwhelmingly prevalent among Europeans. Strength and physical endurance are perhaps the only points of superiority which the Non-European is popularly allowed.

Factories in Port Elizabeth, and elsewhere in South Africa, suffered, during the war years 1944-45, from a somewhat acute labour shortage. Advertisements - e.g., for girls in the closing rooms of footwear factories, - were constantly to be seen in the press; while the Welfare Officers and Managements of factories devised various schemes, such as paying bus and train fares of employees, to ensure an adequate supply of labour. On the 25th January, 1944, the "Eastern Province Herald"

stated that, in Port Elizabeth Footwear and Clothing Factories, there were more situations for European Girls (emphasis mine) than there were applicants. The paper stated, further, that although some fifty or sixty juveniles were calling at the Labour Office daily, most of the girls preferred situations in commerce, or as shop assistants.

The trend, then, is for European Girls to try to do better than to gain Factory employment; labour is, however, needed for these Factory jobs. The position is rendered the more unsatisfactory because not only is the supply of European labour inadequate, but unsatisfactory as well. Inadequate because of small numbers, and unsatisfactory because, as a result of this scarcity, European Girls become aware that, short of unusual provocation, they would not be dismissed. The growth of an attitude such as this is bound to lead to an increase in absenteeism and labour-turnover, with consequent loss of output.

A large reserve of Non-European labour exists, which would be glad of employment in the very jobs which Europeans are apparently becoming increasingly unwilling to fill.

It is partly because of prejudice, and partly because of this belief which is prevalent among Europeans, (viz: that

Non-Europeans are their inferiors in nearly all skills and abilities) that this supply of labour is not drawn upon. This belief is at once a result of prejudice, and a mainstay upon which prejudice rests. To provide factual evidence to disprove such a fundamental belief would be one of the surest methods to help dispel this prejudice, and to bring about an adjustment of this anomaly in the labour situation, to the advantage not only of the Non-European, but of the Industrialist as well.

LIMITATIONS OF AIM.

The precise nature of this research will be dealt with more fully in Chapter 4; but, at the outset, it seems necessary to state the aim clearly and precisely.

The aim of this research is a limited one. To attack the whole problem of the Non-European in Industry was beyond the power of the writer, single-handed, and with a limited amount of time: this research deals with the Coloured section of the Non-European population, only. Furthermore, out of a vast possible range, only four abilities were selected to be tested.

It must, moreover, be clearly understood that the aim of the research was not to attack differences between the

Coloured and European race in any wide or fundamental sense. If that had been the aim, the research would have been rendered highly invalid by the selection of the groups; for, far from fulfilling the criteria put forward by Hull for a group representative of the population as a whole, these groups were chosen to represent that class of the Coloured, and that class of the European, population, seeking employment in Port Elizabeth Industry, during 1945.

The aim, then, is not to establish whether racial differences bring about differences in the performance of Coloured and Europeans on four tests; but to discover whether persons of the Coloured Industrial class are, or are not, equal in these abilities to persons of the European Industrial class; and to supply some evidence as to whether the factor of relevant efficiency is, or is not, a valid ground for racial discrimination on the part of Industrial employers.

CHAPTER 2

THE COLOUR BAR.

We have touched, in the introductory chapter, on the question of prejudice as it affects the Non-European worker. This prejudice, whereon rests the well-known Colour Bar

which exists in this country, influences the life of the Coloured individual profoundly: so significantly is his life ordered by this Colour Bar, that some discussion of the manner in which his whole social, economic, and political life is dominated by it, seems relevant to any work dealing with the subject of the Coloured worker in Industry. To go deeply into this question is not the intention of the present writer, for to do so would be a task too long and intricate for the scope of the present research; but a sketched in picture, not detailed, indicating certain tendencies, seems relevant and necessary as a background to this subject.

A Colour Bar is a Social-Psychological phenomenon, which exists in a considerable number - (though not all) - of those parts of the world where culture contact has taken place between two peoples of different race and skin colour. It is an all too well known fact that, in this country, the Colour Bar exists to a marked degree. Thus Alexander Campbell states © " The Union is the country where the philosophy of the Colour Bar finds its most rigid application ".

Group prejudice is the salient feature which upholds a Colour Bar, and provides the motive force which upholds its existence throughout the population of a country. Prejudice

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© ALEXANDER CAMPBELL: " EMPIRE IN AFRICA " .

is defined by Kimball Young[1] as "an opinion or attitude, favourable or hostile, based on prepossession, and therefore biassed and irrational." This prejudice may be particular to an individual, or common to a group. Where group prejudice exists, the one group always holds itself to be superior to the other group, and adopts measures to keep that other group in an inferior position. This is where a Colour Bar arises, which keeps the subject race - (in this case the Non-European) - in his place, and " by accentuating " the differences between the races, confirms the European " in the belief of his superiority " [2].

There are two main conditions which produce prejudice of one group towards another: these conditions being:

1) CONFLICT
2) FEAR.

These factors are, obviously, intimately related: for, where conflict exists, fear is bound to arise between the two rival factions.

As Firth [3] points out, a "Colour Bar" is set up in defence of vested interests. " Where these interests are " not thought to be threatened, where previous his-

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[1] KIMBALL YOUNG: "SOCIAL PSYCHOLOGY" (Old Edition) page 454.
[2] MONICA HUNTER: "REACTIONS TO CONQUEST" (An excerpt printed in the book "WHERE PEOPLES MEET.)
[3] FIRTH: ... "HUMAN TYPES" , Page 25.

" torical relations have tended to promote co-operation,
" where the dark-skinned population is small in com-
" parison with the white population, where there is an
" honest attempt to apply principles of social equality
" and forego the advantages of exploitation, the Colour
" Bar may have been lowered or never set up. "

That prejudice is not " natural " between peoples of white and coloured skin is shown by the fact that it is not a universal phenomenon. In parts of the world where the subordinate group does not threaten the status, economic and social, of the dominant group, no prejudice exists. Thus, there is no Colour Bar in Portuguese Angola, where, if an official marry a native woman, she will be accorded the full dignity due to the wife of an official (1). Similarly, Hutt points out (2) that in West Africa, and parts of East African territories, native mechanics, bricklayers, printers, carpenters, and locomotive drivers, are recognised as having an efficiency fully comparable to that of the European artisan. This contrasts strikingly with the position in South Africa. Here the interests of white labour have to be defended, with the

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(1) FIRTH: .." HUMAN TYPES ".

(2) HUTT: ..." THE ECONOMIC POSITION OF THE BANTU IN SOUTH AFRICA ".

result that comparable efficiency in spheres such as these is denied fairly rigidly.

A situation of conflict between two races exists most clearly in South Africa, where a European minority of some two million seeks to keep a Non-European population, of about four times that size, in a state of subjection; once out of this subject state, the Non-European population would constitute a severe menace to the state of the European group; for the latter would not only be crowded out, to a large extent, from its position as virtual monopolizer of all but unskiled jobs in the country, with consequent loss of wealth and security to this European group; but, still more serious to the interests of the capitalist classes, the convenient supply of cheap unskilled labour, upon which the prosperity of the country (in the short sighted sense at least) seems to depend, would be removed. As time goes on, these eight million Non-Europeans tend, more and more, to clamour for education, equal rights, and the opportunities which are at present denied them by the European minority. Thus European and Non-European interests have come increasingly into conflict with one another. The economic and social security of the white man is threatened to a serious degree by the increasing insistence of the Non-European claim for equality in all spheres: these

claims are viewed with fear and resentment, because they threaten the economic prosperity and comfort of the dominant race; and because of the weight which the numerical supremacy of the subject group lends to them. This situation is indeed one which lends itself to a state of conflict between two groups; and the conflict gives rise to, and is intensified by, the fear, which must exist in a situation such as this; for the Non-European, moved by fear and anger towards the European oppressor, feels hatred and resentment towards the dominant group: while the European, fearing the great numbers, the insistent claim, the threat of collapse to his personal wealth and comfort, and the plan of economic prosperity upon which his country exists; and angry at the threat thus constituted, hates the Non-European to an equal degree.

Thus we see that the conditions basic to the growth of group prejudice are very much present in South Africa. Further to the conditions mentioned above, we may note certain factors mentioned by I. D. MACRONE, which in all probability lend weight and motive force to this prejudice. It is beyond the scope of this discussion to do more than touch very briefly upon certain relevant points in MACRONE'S interesting and plausible theory.

MACRONE [1] considers the usual economic interpretation of group hostility to be true to the facts, but psychologically superficial; he believes that group prejudice arises as the result of the identification, by the individual, of himself with the in-group. This identification with the in-group leads to hostility towards members of the out-group. This hostility is reinforced by the fact that to some extent it represents repressed and redirected hostility towards the individuals own group, arising from the typical ambivalence which, according to the psychoanalysts, characterises any attitude of love. Further, MACRONE [2] believes that in the case of European - Non-European attitudes, a powerful but repressed, sex attraction which Non-Europeans exercise towards Europeans helps to make this prejudice the more powerful and the more firmly entrenched. Hostility is doubly fixated in the attitudes of the White man towards the Non-Europeans, because of the repression of the attraction which the dark skinned Non-European woman exercises for him, and because of unconscious jealousy of the attraction Non-European men have for White women. And the same factors operate in the case of White women. Deep seated

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(1) MACRONE: " RACE ATTITUDES " p.p. 249, 250.

(2) MACRONE: " PSYCHOLOGICAL FACTORS AFFECTING THE ATTITUDE OF WHITE TO BLACK IN SOUTH AFRICA ". (S.A. Journal of Science, Vol. 27, 1930, pages 596 - 598).

factors such as these help to make the Colour Bar a rigid and immovable barrier, most difficult to break down. The question arises, whether present trends are operating, at all, towards the breaking down of the Colour Bar.

In Chapter 1 we noted that various factors show that there are sections of the European population which are beginning to admit the possible equality of non-Europeans as regards skills and abilities; there seems to be a somewhat pro-native element arising among the younger generation in South Africa. NUSAS, e.g., invited the Native College of Fort Hare to affiliate at the end of 1944; When, at the convention of the Federated Chamber of Industries, piecework payment was favourably discussed,(1) one speaker suggested that "Natives should have the same incentive". At the Assembly of the Congregational Church held in October, 1945, a coloured man became Chairman for the first time in history.

Many Europeans are joining with the Africans, at the present time, to protest against the pass laws at the Cape; and Bishop S. W. Lavis, at a public meeting, told the Natives

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(1) Reported in the "Eastern Province Herald" 26/10/1945.

that if they stood together in this matter, many Europeans would stand by them. (1) Dean Palmer, speaking to the Sons of England Lunch Club on the 15th November, 1945, said that there was a "pro-native wave" among young people in South Africa, and particularly among the men who had come back from the war : and that these Europeans were determined that there should be a change in the treatment of the Native in South Africa. There is, moreover, an increased voicing, in the press, on the air, and at public meetings,(2) that a Colour Bar is a luxury, too costly to the Europeans themselves, where health and prosperity are concerned. For example, the Editor of the "Forum", commenting on a report of the South African Shipping Commission issued in September, 1945, states " that the reason for the high manufacturing cost of goods produced in South Africa is, of course, the wasteful and uneconomic use we make of our labour resources, especially of the Non-European population. ... . Until the productivity of the African worker is increased by raising and utilising his skill, South Africa will continue to suffer from a crippling disability, and all our ideas of becoming an industrial nation are doomed to remain so many idle dreams. " (3)

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(1) "Eastern Province Herald" 27th October, 1945.

(2) Cf. Address by Mr. J.H. Hofmeyr, at Graduation Ceremony, University of Witwatersrand, 1946.

(3) "Forum", Vol. 8, No. 23, 15th Sept., 1945.

Indications such as these point to public opinion, in certain sections of the populace at least, undergoing a decided change in favour of the Non-European. At the same time, a quick glance at contemporary events shows much that suggests that feeling towards the Native and Coloured will become increasingly bitter during the years to come. The food situation, which redounds harshly on the Non-European population, incites them to actions which arouse the resentment of an unsympathetic European population . The fact that Africans are becoming organized and able to make a stand for their rights - e.g., bus strike of 1944 on the Rand, Squatters at Orlando Township in 1946 - helps to augment European disfavour. Certain Europeans join with Natives in an attempt to gain their rights - e.g., against Pass Law Regulations - and this causes other Europeans to become all the more bitter against the Non-Europeans, and against the "Communistic" influence, which, (they believe) is causing them to become so rebellious.

As the Non-Europeans become more educated (as is happening, though very slowly) leaders arise among them who urge them to make a stand. Dr. XUMA, Chairman of the African National Congress, said at a meeting at the Bloemfontein Location [1]

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(1) Reported in "EASTERN PROVINCE HERALD" 31/10/1945.

" If we are brave enough to face the Germans
" unarmed, we must be brave enough now to demand
" our rights. If the Native people act as one
" man, they have a weapon which the Europeans
" will not be able to resist. But we do not
" want to fight the Europeans; we want to work
" for right and justice. "

As non-Europeans become the more capable of demanding or making a stand such as this - as is implied by these words - the more likely is European prejudice to be inflamed and intensified, for the elements of fear and conflict come increasingly into play. The fact that Non-Europeans have some claim to popular sympathy through having helped conquer Germany is another source of rising hostility towards them on the part of sections of the European population.

Thus Dr. Malan, in March 1945, stated that (1) the colour question was undoubtedly South Africa's biggest, most urgent, and "most unsolved" problem, and that it was not possible to call up 100,000 non-Europeans, arm them, and send them to the battle front, without their adopting the attitude " if we are good enough to carry arms and
" to give our blood, then we are good enough to have
" the same rights in every respect as the Europeans

(1) " Eastern Province Herald," 13th March, 1945.

" in South Africa. "

Dr. Malan went on to say that if the non-Europeans were organizing, then it was the "communists pulling the strings". We see summarized in these sentiments expressed by Dr. Malan, the way in which current trends are going to increase prejudice against the non-European.

The fact that there is at present something of a native crime wave, particularly on the Rand, is helping to augment this prejudice. Thus on November the 16th, 1945, a suggestion that " a public lynching or two may do " a lot of good " (1) was loudly applauded at a large meeting held in the Southern suburbs of Johannesburg.

Educated Africans, too, express concern at this rise in crime. Dr. Z. K. Matthews, at the session of the Native Representative Council in Pretoria,(2) said these words:

" The Europeans are becoming nervous of the criminal " class of African. We ourselves dread reading about

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(1) "Eastern Province Herald", 17th November, 1945.
(2) "Eastern Province Herald", 10th November, 1945.

" the crimes committed, but how can we expect a ...
" man who lives under the conditions of the natives
" to avoid being that class of person? "

Europeans, however, do not as a whole see that the crux of the problem lies in the lack of education and bad living conditions of the non-European. They are not concerned with the sociological and psychological reasons, but merely with the result which affects them. Thus the conduct of the natives is considered inexcusable; the remedy, stronger restrictions, larger police force, or perhaps even " a lynching or two " . And thus prejudice is augmented.

Another factor which may increase prejudice during the following years, is the change in the relative size of European and Non-European populations.
At present the Native population is far greater than the European population. But statistics compiled by the Municipal Health Department of Port Elizabeth, (1) show that " the Coloured and Asiatic communities are gaining ground," and, the paper goes on to say, " as their social conditions " improve, resulting in a smaller death rate, they will " probably steadily outgrow the European stock, which at

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(1) "Eastern Province Herald", 10th November, 1945.

" present has the advantage of by far the lowest
" death rate. "

The proportion of European births over deaths has dropped; from 15.21 in 1939, to 14.11 for year ended June 1945; - this despite the usual rise in birth rate during war years. If the Coloured population continues to rise in greater proportion than the European population, it is possible that, with this, prejudice towards them will increase.

We see then, that despite promising trends among some sections of the population, it seems that in the next few years colour prejudice is more likely to increase, than to decrease, in South Africa.

THE COLOUR BAR AS IT AFFECTS THE COLOURED IN SOUTH AFRICA.

The main concern of this discussion is the Colour Bar as it affects the economic and industrial life of the coloured; but we will note, briefly, in passing, aspects of the political and social position as well.

POLITICAL COLOUR BAR.

In contrast to the African, the Coloured does at least possess the vote, even if only in the Cape Province.

John Burger (1) says, of the political position of the Coloured:

" The policy of all governments up to the present
" has been to maintain the political position of
" the Coloured race half way between the African
" and European. In his own home, the Western
" Province of the Cape, he has political and Muni-
" cipal rights, and while there is strong social
" ostracism, he may buy property on the same terms
" as Europeans. "

SOCIAL COLOUR BAR.

While the European in South Africa tends to feel some responsibility towards the Coloured which secures for him certain political and economic rights - (thus Hertzog, in the "Burger", 1925 - " The Coloured people " belong with us ") - socially their ostracism is fairly complete. The Colour Bar defines his social life as clearly as it does that of the African, together with whom he is classed as a Non-European. Thus he is denied the right to enter most of the European cinemas, restaurants and hotels; has to sit on special park benches, bathe in definite localities. Legally his right to buy any property is recognised by Cape Municipalities (except where some Municipalities or Bodies or syndicates, etc., have embodied restrictive provisions in the "Conditions of Sale" and "Title Deeds" of the pro-

(1) JOHN BURGER: " BLACK MAN'S BURDEN," p. 35.

perty, barring Non-European ownership or tenancy.) , but social disapprobation and his habitual poverty tend to segregate him in the poorer parts of the towns. The contrast between the fairly liberal official attitude, and the more rigid general attitude, is illustrated by an incident reported by the "Eastern Province Herald" on the 21st June, 1944, when a number of typists and clerical assistants were dismissed from the staff of the Government's Pension Department for refusing to address letters to Coloured pensioners " Dear Sir " or "Dear Madam" , and to the ending of them with " Yours faithfully " .

A somewhat similar incident took place in Philadelphia, where transport was completely suspended when the workers all " reported sick " as a protest against having to instruct negro workers. Here we see a similar contrast, between the attitudesof the working class citizen of the Northern States, and those of the more liberal administration.

ECONOMIC COLOUR BAR.

We have already noted that conflict, and the threat to the vested interests of the one group by the other group, is a salient feature of group prejudice. Thus it is

to be expected that in economic spheres, the Colour Bar will operate severely. Klineberg (1) states that:

> " Prejudice exists because there is something to
> " be gained by it, this gain being directly
> " economic in that it eliminates the competition
> " of the members of the minority group, and makes
> " it easier for those of the dominant group to
> " obtain jobs or advancement. "

The economic spheres, therefore, become the very centre of prejudice and the Colour Bar. Kimball Young (2) points out, e.g., that the relations between the Northern American and the Negro, underwent a marked change when the Negro, in response to a call for cheap labour, entered the industrial districts in considerable numbers. Friction immediately became common between the two groups.

We see, then, that the basic reason for the horror with which the white South African views the economic advancement of the Coloured race, is the threat which such advancement contributes to his own economic security; and it is from this source that his opposition to the wider and easier facilities for the education, vocational and general,

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(1) KLINEBERG: "SOCIAL PHYCHOLOGY", page 395.

(2) KIMBALL YOUNG: "SOCIAL PHYCHOLOGY" (Old Edition), p. 472)

of the Coloured, arises. It must, however, be noted, that the average white South African does not recognize these basic factors of fear and conflict which exist at the back of his dislike of the Non-Europeans; for these processes are, to a large extent, very much sub-conscious to the white man, who would be genuinely surprised if told that he feared the races whom, consciously, he regards with such contempt. This fact should be kept clearly in mind in the following discussion, which will deal with the following points:

1). Attitude of White workers towards Coloured workers.

2). Attitude of White Employers towards Coloured workers.

3). Official attitudes towards Coloured workers, as expressed by various Acts of Parliament.

1) ATTITUDE OF WHITE WORKERS TOWARDS COLOURED WORKERS.

In South Africa, it is most unusual for white factory employees to tolerate the presence of coloured workers on any terms of work equality or of physical proximity. Any attempts on the part of employers to introduce Coloured labour under such conditions are practically sure to meet with opposition; for example,(1) in

(1) " GROCOTT'S DAILY MAIL" 2nd November, 1945.

October, 1945, European factory workers, in George, went on strike, because of the employment of twenty-eight new Coloured people in the factory. They only returned to work on the 2nd November, when the employers undertook to employ no more Coloured workers.

Klineberg (1) points out that racial hostility is most prevalent where frustration has been great, and where opportunities for self expression are infrequent. In these classes of people, accumulated aggressiveness finds an outlet in hostility. Thus he comments on the fact that lynchings in the Southern Province of America are usually committed by those classes of people whose economic status is barely above that of the victims. By an analogous process of reasoning, we may arrive at the conclusion that anti-coloured feelings will be the more intensely experienced, and the more frankly expressed, by white classes found in factories than among more educated, and economically higher, sections of the community. The intensity of these feelings is illustrated by the following examples. The present writer wrote to the Welfare Officer of a footwear factory, requesting her to put the following

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(1) OTTO KLINEBERG: " SOCIAL PSYCHOLOGY " page 381.

idea to various girls from the closing room, to see how they reacted to it.

" In America Coloured and European girls work together
" in the same room at the same machines. If you were
" to go there, how would you feel about this? "

The Welfare Officer wrote back, saying that she did not dare to do this, as the very suggestion contained in the question would be enough to arouse their suspicions and start an agitation.

" I have no doubt as to what their answer would be
" to that question," she wrote in reply, " they
" would object strongly. I can give you one or
" two other examples of the very strong colour-
" prejudice among the employees. We had a lot of
" trouble here when we tried to start a Safety First
" Committee. The European men refused point blank
" to have Coloured representation on the Committee,
" regardless of the fact that in some departments
" the Coloureds outnumbered them by four to one.
" Their attitude was, - ' well, we have their
" ' welfare at heart; we will represent them
" ' and stick up for them, but they'll get to
" ' be too uppish if we allow them to sit on
" ' a Committee. ' "

An incident of a similar kind was related to the writer by the Welfare Officer of a second factory.

This factory had five European, and one Coloured employee, working in the pattern room. A separate locker was built for each man to hang his coat in, these lockers being placed in a row along the wall. The five Europeans, however, refused to use theirs, because the Coloured man's was built right alongside. When this locker was moved into the opposite corner of the room, the five Europeans were completely satisfied.

The above examples illustrate the part which fear and conflict play in the intense racial feeling which characterizes the attitude of white towards coloured worker. Sub-conscious fear that the Coloured will encroach upon his preserves, will compete successfully with him in spheres of work which he desires to feel are worthy of himself, and not of this lower class, is at the back of incidents such as the unwillingness to let Coloureds operate a similar machine in the same room, or to allow Coloured representation on a Committee.

To admit that the Coloured is capable of such, would be to damage the individual's idea of himself as a

superior individual. The incident of the Europeans' and Coloureds' lockers being placed side by side is symbolic of the social distance which the European worker maintains throughout his dealings with his Coloured counterpart. At one factory, European girls do not mind Coloureds working on the same machines, so long as these machines are in a separate building, some distance away from the main building where they work. They are able to maintain their ideas of their own superiority, because the Coloured workers are apart, " different," in a smaller building, at the back of the main block. On the other hand, European girls will not mind Coloured girls working in the same room, so long as the social gulf is maintained in their minds by the fact that the Coloured girls are engaged on work which they believe to be inferior in kind to that on which they themselves are engaged. Thus the machinist in the clothing factory will have no objection to handling the garment she has machined to a Coloured girl to be ironed. She feels secure in her situation, and the Coloured girl appears to her more or less in the light of a servant relationship. If the Coloured girl were given a job at a machine similar to that operated by

the European, however, there would be almost certain trouble. Similarly, in a footwear factory Coloured boys are employed in the closing room, but partitioned off from the girls. Although some of the girls object to this, they do tolerate it; but the Welfare Officer of the factory states that while they tolerate the presence of these boys they would have refused to have Coloured girls working in that situation altogether. In this instance, they know that the boys are doing the heavy army work, and so do not feel that they are competing with them. For they are employed in a rough, heavy type of work, which they feel that they themselves are too weak physically, and possibly too refined, to do.

These factors make it very difficult for the management of factories to employ Coloureds, if it wishes to do so. For it would be faced with the difficulty of either finding separate rooms (or even buildings) for them to work in, or of re-staffing whole sections of the factory. Furthermore, it would be faced by the additional problems of finding separate cloak-room, rest-room, etc., accommodation, for each racial group.

We see then that intense antipathy, clearly reflecting unconscious fear of competition and loss of prestige, characterizes the attitudes of European factory workers towards Coloured factory workers; and that this fact complicates the issue considerably where employers would otherwise be favourably disposed towards supplementing their inadequate European labour supply with Coloured labour.

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2) ATTITUDE OF WHITE EMPLOYERS TOWARDS COLOURED WORKERS:

The Colour Bar in industry enters, of course, into the attitudes of the White Employers, and Foremen, towards the Coloured Worker. Here, however, the situation seems to be characterized by less intense feeling; and at the same time to be more complex; the reasons for their dislike being on the one hand more reasonable, and less coloured by emotional attitudes; on the other hand, where rationalization exists, it seems that the rationalization is more elaborate and less unconscious.

Interesting views by Employers on Coloureds in their employ were obtained by the Commission of Enquiry

regarding the Cape Coloured, of 1937.(1) In reply to their questions at Cape Town, they were told that Coloured people were not as efficient as Europeans, less regular in their time-keeping, and did not seem to take an interest in their work. They stated, further, that in view of fact that the Wage Act had fixed equal wages for all, they preferred to employ people of their own race. They did remark, however, that colour prejudice was, in all probability, a factor operating against both the employment and good assessment of Coloureds.

It is interesting to note that these Employers admitted that they were in some degree motivated by colour prejudice, both by saying as much in actual words ; and by bringing up the point that in view of compulsory equal wages, they preferred to employ members of their own race.

On the other hand, they did express the commonly held view that the Coloured was less efficient in ability, and morally lazy and unreliable. These, we have already noted, are beliefs almost universal in White South Africa,

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(1) UNION GOVT. GAZETTE, 1937, Page 63.

beliefs which help hold up the myth of white superiority over the black or coloured races.

These Employers, however, did seem to realize this; thus we see that their rationalizations were less unconscious, and insisted upon with less emotional force, than was the case with factory workers.

Furthermore, we must remember that, in view of the unfavourable social and educational conditions under which the Coloured suffers, these Employers questioned by the Commission had, in all probability, genuine cause to believe the Coloureds to be less efficient in their work; and, more especially, to suspect them of a resentful attitude, lack of interest in their work, and consequent unreliability. In this connection, Firth may aptly be quoted, when he remarks:(1)

> " The very social prejudice which condemns the
> " instability and vices of the half-caste, is
> " the cause of them. "

The resentment towards the White race in general, would

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(1) FIRTH: " HUMAN TYPES " Page 28.

lead to the failure of a sense of loyalty, responsibility on the part of the worker towards his White employer. He would tend to try to get all he could as easily and with as little effort as possible. This, together with his lack of opportunity for vocational or general training, would in turn make inefficiency highly probable. Hence we see the setting for a vicious circle, redounding on the Coloured with double discredit.

The following is the summary of reasons put forward by the Commission (1) as militating against the Cape Coloured as an employee:

a) Factors over which they have no control:

1) General tendency of public opinion among Europeans favouring the employment of Europeans, where most of the Employers are Europeans.
2) Absence of compulsory primary education for Coloured.
3) Attitude of Trade Unions.

b) Reasons over which Coloured has control:

Factors such as thriftlessness, laziness, intemperance, irresponsibility.

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(1) UNION GOVT. GAZETTE, No. 54, 1937, page 63.

Here we may refer, once again, to Firth's point, above quoted; It is only in a narrow sense that the Coloured has control over these factors. In a broad sense, he is a victim of his social circumstances, and unless he is an exceptional individual, it would be difficult for him to keep traits such as these from entering into his personality make up. The Commission, very fair throughout to the Coloured race, does state specifically that characteristics such as these are largely due to the social and physical conditions in which the Coloureds are placed and grow up; and stresses the fact that these environmental disadvantages are of fundamental importance in militating against the Coloured as an employee.

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3) THE OFFICIAL ATTITUDE TOWARDS THE COLOURED WORKER:

The attitude of the Government towards the Coloured worker is avowedly one of strict impartiality, if not actual benevolence. Thus Mr. Lawrence, (1) Minister of Welfare and Demobilization, after mentioning such factors as Native competition in lower grades, and

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(1) "EASTERN PROVINCE HERALD" 16th July, 1944, from a statement made by Mr. Lawrence at Cape Town.

European competition in upper grades of employment, and the " natural " preferment of European Employers for European Employees in higher grades of work, and the Wage Act legislation, remarks that :

> " Strangely enough, these various factors have
> " operated in spite of the fact that the declared
> " policy of successive Governments has been that
> " there should be no discrimination against the
> " Coloured worker. "

Thus General Hertzog, in 1939 :

> " Coloured people shall not by reason of race or
> " colour be debarred from engaging in any form of
> " industrial occupation or employment. "

General Smuts, Prime Minister in 1943, reiterates this policy :

> " The Government is committed to the policy of
> " ensuring that the Coloured community will retain
> " all its economic rights, nor will the Government
> " debar Coloured persons from any avenue of
> " employment, skilled or unskilled. On the
> " contrary, the Government is at present exploring
> " additional avenues of employment for the Coloured
> " people. "

Thus we see that the declared policy of Union Governments, for some time past, has been one of benevolent, and even active, interest in the Coloured worker.

Let us examine the situation to see whether we can agree with Mr. Lawrence, when he says that it is "strangely enough", in face of Government policy, that the economic position of the Coloured has declined; or whether we agree with the somewhat contradictory statement of Marais, (1) when, having quoted figures to show that this deterioration in the Coloured economic position is a very real one, he states that this has come about " largely, " it would seem, as the result of Government intervention " in industry." The statistics which Marais quotes (2) to illustrate this decline are as follows:

> " In the Union as a whole, the Coloured element in " private industry declined from 15 % of the total " number employed in 1924-25, to 12 % in 1933-34. " The decline is more marked in the Cape Peninsula " and its hinterland, where there is the greatest " concentration of Coloured people. Between 1924-25 " and 1933-34, the proportion of Coloured wage " earners in all industries in this area (excluding " mining and quarrying) decreased from 54 to 46 % " of the total number of wage earners employed. " During the same period, the proportion of Euro- " peans increased from 31 % to 41 %, and that of " Natives decreased from 14 to 12 %. In private " industry in the same period, there was roughly

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(1) J. S. MARAIS: " THE CAPE COLOURED PEOPLE " p. 265.

(2) Ibid. " " " " p. 265.

" the same relative decline in Coloured employment. "

There is, it is true, no legal legislation which officially affects the position of the Coloured in industry. Most writers on the subject seem to agree, however, that there are certain Acts which have affected the position of the Coloured unfavourably. As Marais puts it: (1)

" after the legal barriers had been removed,
" they were reinforced by legal and adminis-
" trative bars of a new type. "

CIVILIZED LABOUR POLICY:

" CIVILIZED " labour is officially defined as follows:
(2) " The labour rendered by persons whose standard
" of living conforms to the standard generally
" recognized as tolerable from the usual
" European standpoint. "

The much discussed CIVILIZED labour policy of the South African Government, dates from 1924, when a Government Circular stated that it was a matter of definite

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(1) MARAIS: " THE CAPE COLOURED PEOPLE " p. 256.
(2) UNION GOVT. GAZETTE: No. 54, 1937, Page 136.

policy that, wherever practicable, civilized labour (as defined above) should be substituted in all employment by the Government for that which could be classified as uncivilized. The Government advocates this policy; follows it in Government Departments; and encourages its pursuit among Local Authorities and private enterprises. Marais states, in fact, that:

> " the Government can, and does, bring pressure to
> " bear on them (i.e., private concerns) through
> " its power to manipulate tariffs, to maintain
> " ' satisfactory labour conditions,'
> " i.e., employ a ' reasonable amount ' of civil-
> " ized labour. "

While it is officially denied that " civilized " labour policy " means a policy of employing white labour, this is the idea which it seems to have come to represent in the minds of most of the Employers and Officials concerned; thus, whatever the intentions of the Government may have been in adopting and maintaining such a policy, racial differentiation can be, and undoubtedly is applied as a result of its terms. Effectually, even if unintentionally, the civilized labour policy protects and

encourages European labour; the Cape Coloured Commission comments on the position as follows:

> " It is accepted by many people that every Euro-
> " pean, no matter what his standard of living,
> " is ipso facto civilized; but in the case of
> " the Non-European, the onus is upon him to
> " prove it. " (1)

Here we have a typical example of a device to support a Colour Bar, where legislation is on the surface, and avowedly, liberal. The terms allow of misunderstanding and no attempt is made to correct such misunderstanding, although it obviously exists, and is acted upon, over a wide area of public life. This disparity between avowed and actual policy reflects the general trend of the mental processes of South African population towards the Coloured; while avowedly favourable towards them, actually and often unconsciously, the reverse is true.

THE APPRENTICESHIP ACT:

The Apprenticeship Act was passed in 1922. It lays down certain educational qualifications for enticing

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(1) UNION GOVT. GAZETTE: No. 54, 1937, Par. 199.

into skilled occupations.

Here again, there is no direct legislation laying down a Colour Bar; but virtually the Act helps to constitute one, forming effectual protection for European labour. Here again, it is difficult to believe that the effect of this Act was not anticipated by the Government which sanctioned it; but even if this were so, it is impossible to believe that the Government has not noticed the effect it has had, and has not had ample opportunity to alter the legislation. The Act is, in fact, together with the Industrial Conciliation Act, often referred to as " Colour Bar " legislation. Marais (1) quotes Professor Leslie as writing as early as 1929, that the Act had already caused

> " a great falling off in the number of Coloured
> " entrants to the skilled trades. "

It is obvious enough that, when a definite educational standard is laid down as a requirement essential for entering skilled trades, such an Act will act to the detriment of one of two classes of people, where the one class has

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(1) MARAIS: " THE CAPE COLOURED PEOPLE " page 262.

free compulsory education, and the other class not only has no such compulsory education, but is placed in such depressed economic circumstances that education is very difficult for people to afford. Even where Coloured education is free, the poverty of most Coloured families is such that the children have to start earning at the earliest possible age. The Cape Coloured Commission (1) stated that it was undoubtedly of the opinion

> " that the Coloured youth is faced with greater
> " difficulties in satisfying the educational
> " requirements laid down than is the European
> " youth, and has in so far suffered under the
> " Regulations framed under the Apprenticeship Act."

Furthermore, the Commission points out (2) that the Act allows no discrimination in terms of wages between the Coloured and European youth, so that

> " the Cape Coloured is unable to discount his
> " inferior education, the prejudice against him,
> " or the preference for European labour, by
> " accepting lower remuneration during appren-
> " ticeship. "

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(1) UNION GOVT. GAZETTE: No. 54, 1937, Page 52, Para. 271.
(2) " " " " " " Para. 273.

Incidentally, it should be noted that the effect of such legislation as the Apprenticeship Act is not only to debar Coloured races from finding skilled occupation, but to limit output, and restrict the market for goods by erecting an indirect " wage barrier " .

WAGE BOARD ACT; (1926) :

This Act claims to have no Colour Bar effect, and in fact this is definitely the case, for in terms of the Act the wage laid down must be for the occupation, irrespective of the colour of the worker. It is impossible to ascertain to exactly what extent this Act has raised a virtual Colour Bar against the Coloured and Native worker; for through their inferior education and training facilities, and through prejudice and race preference, employers, most of whom are European, are likely to employ European rather than Coloured workers, where the wages to be paid are the same in each case. As has already been noted, the Employers questioned by the Cape Coloured Commission admitted this, (1) stating that in

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(1) UNION GOVT. GAZETTE, 1937, No. 54, Page 63.

view of the fact that the Wage Act had fixed equal wages for all, they preferred to employ persons of their own race. Thus we may conclude without bias that the Wage Act does contribute effectually towards the existence of a virtual Colour Bar in Industry.

INDUSTRIAL CONCILIATION ACT:

In other than official eyes, the Industrial Conciliation Act constitutes Colour Bar legislation par excellence.

The Industrial Conciliation Act provides machinery for the settling of disputes between Employers and Employees; but the definition of " Employees " in this Act excludes Pass bearing Natives from the scope of this definition, and therefore Trade Unions registered under the Act cannot include Natives in their membership. Furthermore, Trade Unions consisting of Natives only cannot be registered under the Act, and are not recognized as such by the Government. The majority of Employers do not recognize Native Trade Unions, on the ground that

these are not recognized by the Government. Mr. D. Koza, (1) General Secretary of the African Commercial and Distributive Workers Union, said as regards the position of African Trade Unions:

> " They are denied recognition under the laws of the
> " country, and consequently they are denied the
> " benefits of protection from low wages, long hours,
> " bad conditions and the sweat shop, a protection
> " which the White workers have enjoyed during the
> " last twenty-five years, "

The avowed explanation for this state of affairs, on the part of the Government, is that the interests of the African people must be safe-guarded; and furthermore, that they must be protected by some responsible Body, both against themselves and others. We see an example of this type of rationalization in the reply made by General Smuts to the Archbishop of Cape Town. The Archbishop, heading a delegation from the Christian Council Emergency Committee, (2) made a speech which included these words:

> " Since our letter of August 25th, 1942, the relation
> " ship between African and White South Africa has

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(1) " EASTERN PROVINCE HERALD " 4th October, 1945.

(2) " EASTERN PROVINCE HERALD " 19th January, 1943.

" definitely retrogressed; possibly the largest
" single contributing cause being the announcement
" within the last two months by the Minister of
" Labour that the Industrial Conciliation Act would
" not be amended at present. This, Sir, in spite
" of your promise to amend that Act in the next
" Session. " ..... " .

Here we have the representative of an Institutional Body, normally fairly conservative in nature, making an accusation in no uncertain terms.

General Smuts' reply is worth noticing, because it is typical of the rationalizations with which the Government and other official Bodies uphold their Native policy. He said:

" Your third point is the recognition of Native
" Trade Unions..... question we are busy with
" ..... has been delayed ..... wave of unrest
" ..... in the country ..... one thing is the
" communistic influence at work in our Land on a
" fairly large scale. Many people are impressed
" with the danger of putting something into the
" hands of Africans which will be abused by other
" people ..... if we could only form Native Trade
" Unions along sound lines, I think that would be
" one of the best steps forward. If one could

" devise safe-guards so as to ensure that these
" people do not pass over into the hands of others,
" and find their condition worse after so-called
" rights have been given them, this would be
" desirable. "

We see that this speech consists of words which sound satisfying but are not, and of stereotyped phrases such as " wave of unrest in the country," " things difficult just now ", " communistic influences ", "many people impressed with danger ", etc., these going to make up a speech which sounds more satisfactory than it really is. Of this attitude of benevolence which the Union Government adopts, Mr. Koza (1) says that the term " trustee " is one " used to cover the
" many iniquities imposed on the African people. "
It is interesting to note that in October, 1945, (2) the Mayor of Johannesburg made a speech advocating the organization of Native Trade Unions so that Employers could deal with responsible leaders in negotiations with Natives; in this speech it was said that

" Many Trade Unions were organized by semi-educated

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(1) " E. P. HERALD " 4/10/1945 - Report of speech made by Mr. D. Koza, General Secretary of African Commercial and Distributive Workers Union.

(2) " E. P. HERALD " 26/10/1945.

" Africans, who lacked balance as well as sound
" knowledge of working class problems and the
" principles of Trade Unionism. "

We see from this that it is as easy to look upon the formation of legal Trade Unions as a safe-guard against the leadership of Natives into a worse condition by bad or irresponsible influences, as it is to look at the matter from the opposite view point, as presented in the speech quoted from General Smuts.

Unlike the African, the Coloured is not debarred from membership of Trade Unions. Under the terms of the Industrial Conciliation Act he is recognized as an employee. However, the actual position of the Coloured does not seem to be very clearly defined. Thus in a report of the conference of the Welfare of the Cape Coloured in 1942, (1) the discussion, centering around the difficulties of the Coloured in regard to employment, wages, and Trade Unions, " reveals the lack of reliable and
" co-ordinated information on actual conditions
" in Commercial and Industrial employment as they
" affected the Cape Coloured. "

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(1) " RACE RELATIONS ", Vol. 9, No. 2, 1942.

At this Conference too, it is interesting to note, that among the opinions as to why the Coloured position had grown less favourable in Industry during the last generation

..... " some held that the Trade Unions,
" dominated by Europeans, were mainly respons-
" ible, and that they had used Industrial
" legislation to exclude Non-Europeans from
" skilled employments ..... The Trade Union
" delegates denied this ..... "

It seems then that while Coloureds have some Trade Unions of their own and are allowed into some European Trade Unions, and the Industrial Conciliation Act does recognize the Coloured as an Employee, the position is still not clearly defined; so that while the Coloured is legally in possession of these advantages, the Colour Bar is still able to operate within the legislation to the detriment of the Coloured. In this connection, we may aptly refer to a statement in the report of the Cape Coloured Commission, (1) that under the conditions under which Trade Unions are constituted at present, it is possible for these Unions to differentiate against the Coloured. An instance of this differentiation on

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(1) UNION GOVT. GAZETTE No. 54, 1937, Page 55, Par. 290.

grounds of Colour is seen in the fact that many Trade Unions whose constitutions allow for Coloured membership, consist in fact, of Europeans only.

It seems clear, then, that legislation is unable to prevent a social psychological phenomenon such as a Colour Bar, which reflects the deep-seated desires and prejudices of a social group, from entering into a situation, even when it attempts to do so; for the individuals of such a group interpret the legislation in accordance with their common motives, and find loopholes through which to mould the law into the shape which is commonly desired; the Officials and the governing Body, swayed by these same motives, see to it that the law is such as to allow such loopholes, and are swayed the same way in its interpretation. This phenomenon is recognized by three Members of the Cape Coloured Commission, when they recommend (1) that all artificial barriers erected to protect the European worker be removed, but add that in their view, this reform can only be effective to the extent to which

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(1) UNION GOVT. GAZETTE, No. 54, 1937, Paragraph 318; the three Members being: Messrs. Buchanan and Fowler, and the late Dr. Abdurahman.

Colour prejudice, which influences the attitudes of so many Europeans, disappears.

We see, then, that not only does Colour Bar legislation arise from, and depend upon, prejudice; but that where prejudice exists, legislation will probably be of such a nature that prejudice can alter its interpretation to sanction Colour differentiation, even where this is not directly sanctioned by the law. Thus, while the sense of responsibility which the European population has towards the Coloured people, precludes direct Colour Bar legislation to handicap them in economic spheres, it is clear that the existing legislation is of such a nature as to handicap the Coloured, most effectually, as an Employee.

CHAPTER 3.

a) RACE MIXTURE:

Whether parents belonging to two different races will tend to produce children of a superior or inferior type is the subject of a considerable amount of controversy. This Thesis deals with a comparison of a " pure " race with members of a hybrid race; As has been stated, no attempt is made in the present research to establish differences of a fundamental kind between Coloureds and Europeans; nevertheless, it would perhaps not be out of place to examine briefly some discussions of this problem of race mixture.

Among those who support the case for race mixture as being disadvantageous are Davenport and Mjöen. § Mjöen studied Mongol Nordic hybrids of Northern Norway, and concludes that they have a

" want of balance "

as compared with the parent groups; and finds the result particularly unhappy with regard to endocrine

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§ KLINEBERG: " RACE DIFFERENCES ", Page 214.
(1) CATTELL: " PSYCHOLOGY & SOCIAL PROGRESS " , Page 63.

glands and temperament; thus, he reports a greater number of diabetics, greater predisposition towards tuberculosis, as well as a preponderancy of prostitutes and persons " unwilling to work " among the hybrid race than among the parent races.

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(1) Davenport's views are in accordance with the above. He states that race mixture results in " disharmony," physical and mental. Thus in a cross between Negroes and Whites, where the Negroes have relatively long arms, and the Whites relatively short arms, the offspring might have long arms and short legs, or vice versa. He attributes the prevalence of tooth decay in America to this element of race mixture; the one group having large teeth in large jaws, the other having small teeth in small jaws. Furthermore, he extends this theory to the mental sphere, reporting that in a study of Whites, Browns and Blacks in Jamaica, the Browns did not do very badly on mental tests, but seemed less clear headed on the whole than the two parent groups.

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§ KLINEBERG: " RACE DIFFERENCES " Page 212.
(1) ANASTASI : " DIFFERENTIAL PSYCHOLOGY "

GRAHAMSTOWN

R. B. CATTELL seems definitely to lean towards the view that race mixture is disadvantageous, concluding his discussion of the subject:

(1) " Interbreeding gives an intelligence and ability
" midway between those of the two races, whilst
" there is at least a probability that, even given
" an environment free from that prejudice and
" character-undermining contempt which frequently
" meets the half-breed, it would lead to character-
" istics innately unstable and discordant. "

McDOUGALL also seems to lend a certain support to these views, stating that:

(2) " It is widely asserted of some of the populations
" which have been formed by the blending of widely
" dissimilar races, that both the intellectual and
" moral development of the majority of individuals
" among such populations is seriously defective in
" some obscure and ill-defined way. "

CASTLE criticizes the underlying assumptions of the " disharmony " point of view supported by DAVENPORT and MJÖEN, as fallacious. This assumption is that specific organs are inherited as unit characters, whereas the

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(1) " CATTELL, R.B. : " PSYCHOLOGY & SOCIAL PROGRESS "
Page 63.

(2) McDOUGALL, W. : " NATIONAL WELFARE & NATIONAL DECAY"
Page 138.

relationship between an individual's bodily and mental characteristics and his gene constitution are in reality more complex, and

(1) " in growth all parts of the organism interact
" and influence each other's development, thus
" producing a balanced and harmonious relation-
" ship of parts. "

Experimental evidence on animal interbreeding, and observation of human half-breeds seems to support this view quoted from ANASTASI as being correct.
Thus KLINEBERG (2) relates an experiment in which two species of rabbits were mated, one of which was four times the weight of the other. The hybrids were intermediate in weight and " all parts of the skeleton were
" intermediate and suited to each other " .

Furthermore, CASTLE criticizes DAVENPORT'S experimental results on statistical grounds, noting that his claim that " Browns " in Jamaica are less clear headed than the parent races is not supported by statistical evidence, and that his figures on arm - leg measurements,

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(1) ANASTASI : " DIFFERENTIAL PSYCHOLOGY " page 467.
(2) KLINEBERG : " RACE DIFFERENCES " page 214.

quoted to support the disharmony theory, show no significant difference. KLINEBERG accepts CASTLE'S arguments here as being conclusive.

CASTLE criticizes MJÖEN'S work on the ground that he neglected social factors which might have led to less satisfactory adjustments in the case of the hybrid race in question than in the case of parent race. This environmental factor is stressed by FIRTH, who, in speaking of the half-caste, says:

> (1)
> " lack of proper education, no stable social posit-
> " tion, barriers to free relationships with either
> " his father's or his mother's people, difficulties
> " if he wants to marry, all tend to destroy his
> " confidence and self-esteem, and unfit him for a
> " stable social life. The very social prejudice
> " which condems the instability and vices of the
> " half-caste is the cause of them. "

Historical and anthropological studies of race mixture are quoted with approximately equal force on either side. It seems as if ANASTASI's conclusion (2) that there is no direct causal relationship between

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(1) FIRTH: " HUMAN TYPES " page 28.

(2) ANASTASI: " DIFFERENTIAL PSYCHOLOGY " page 468.

cultural level and race mixture, is a reasonable one. She points out that both these are in turn dependant on a third factor, degree of social contact, or social isolation of a group.

DIRECT EXAMINATION OF HYBRID INDIVIDUALS.

A certain amount of psychological testing has been carried out on hybrid groups.

FERGUSON administered four simple psychological tests to 907 mulatto school children in Virginia. The subjects were divided into four groups on the basis of the degree to which their appearance was Negroid, this classification being on the basis of appearance alone, not on anthropometric measurements. FERGUSON reports a steady improvement in intellectual performance according to the degree of White blood possessed by the individual; the degree of White blood in FERGUSON's estimation depending, as we have noted, on appearance alone.

Peterson and Lanier administered intelligence and " ingenuity " tests to a number of twelve-year-old mulattoes. When these subjects were rated according to a simple seven point scale of skin colour, the results

seemed to confirm those of FERGUSON, quoted above. When more accurate anthropometric measurements were introduced as a method of rating, however, the correlations became too low for consideration as statistically significant. It seems that the methods of classification used by FERGUSON, as well as the seven point scale of PETERSON and LANIER, are too rough and haphazard to yield results which can be seriously regarded as conclusive.

KLINEBERG (1) expresses the view, with regard to this question, that although no single Negroid trait shows, or has been proved to show, any relation to intelligence, studies of the relationship of intelligence to the degree of Negroid blood as expressed by a combination of several features might lead to significant findings. There is at present no evidence which enables us to affirm or to deny the view that the Mulatto is more intelligent according to the proportion of White blood which is his. It must be remembered, when reading discussions which incline towards this conclusion, and towards the closely

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(1) KLINEBERG, OTTO: " RACE DIFFERENCES " page 221.

related conclusion that the typical half-breed is midway between the parent races in intelligence, that no adequately proved experimental results confirm the assumption basic to these views, that the Negro race is inferior to the White race in intelligence. Furthermore, even if this were proved to be the case, the disadvantages which the half-breed suffers as compared to the one parent race, and the advantages which he enjoys as compared with the other, in social and environmental spheres, might be the reason for an intermediate position between the parent races, rather than any biological law relegating him to such a position.

CHAPTER 4.

Previous Research-Testing of Coloured School Children:

No previous research of precisely the aim or nature of the present research has, to the knowledge of the present writer, been carried out; indeed, the Coloured race as a whole has been somewhat neglected, where research is concerned, in this country. We will note certain investigations which have been carried out with the regard to Coloured school children, bearing in mind, however, that these researches are different from the present research in that their aim is to tap race differences in intelligence. These researches are reported by the Cape Coloured Commission; (1) it is to be noted that the tests used, and the I. Q's. or mental ages derived from the scores on these tests, were standardized on European children.

1). DR. R. J. van HUYSTEEN, working under Professor H. A. REYBURN of the University of Cape Town, tested a group of 1,547 Coloured children; the South African group test was used to test those children 10 years and older who had

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(1) UNION GOVT. GAZETTE, 1937, No. 54, page 173.

passed Standard II; the rest were tested on the Cape Provincial Individual tests. The tests had been standardized on European children; thus an I.Q. of 100 on the tests would be the average norm for European School-children on that test. Dr. van HUYSTEEN'S results showed that 34.7 % of the Coloured children scored an I.Q. of 100 or more; the average I.Q. of the group was 91.8 . The investigator is of the opinion that this is a somewhat higher intelligence quotient than would be average for the school going Coloured population as a whole, because of factors of selection arising from his choice of schools. Thus he states that apart from the children tested inside Worcester, those schools

> " tested outside Worcester were so selected as
> " to give the Coloured children the advantage
> " of any difference in probable I.Q. of the
> " children selected. "

Another point which we may note in connection with DR. van HUYSTEEN'S results, is that the average I.Q. of these Coloured children seems to fall as the children grow older.

2). MR. A. R. WILKE, in an investigation under Professor STRASHEIM of the University of Stellenbosch,

gave the South African Group Test to 2,422 Coloured children. The average I.Q. for the group was, in this investigation, 84.6 .

(The Commission comments on the point that between Dr. van HUYSSTEEN'S and Mr. WILKE'S results there exists no disagreement in principle; for the former states - as we have already noted - that his results show an I.Q. which is somewhat higher than that of the average Coloured school-going population.)

3/). An investigation was carried out by Mr. HENEKE, a Coloured-Teacher, the research being under the direction of PROFESSOR REYBURN of University of Cape Town. The South African Group Intelligence Test was administered to 2,118 Coloured children in the Primary School Standards. On this testing, the average intelligence quotient was less than one point below the average for Europeans, of 100 I.Q.

We see here that we have three investigations, all involving the application of verbal tests of intelligence to Coloured school-children in order to see whether

the average norm for the Coloured children is equal or not to the average I.Q. of 100, established by the groups of European children on which the Tests were standardized.

Although in the case of HENEKE'S investigation, the difference in I.Q. between Coloured and European children is so small as to be negligible; the results of DR. van HUYSSTEEN'S, and of Mr. WILKE'S investigations indicate a lower average I.Q. for Coloured than for European children.

Results such as these, tend to be accepted all too readily by the layman, and in many cases, by psychologists as well, as indicating a difference in the mental capacities of the two races tested. Such an interpretation is superficial, and should be criticized strongly. Such obvious criticisms as the following spring to the mind, in considering this unsatisfactory type of interpretation of the facts:

1) It will be recalled that the respective average I.Q.'s yielded by the results of the investigations

referred to in this discussion were as follows:

99 Plus	in Mr. HENEKE'S ...	results.
91.8	" Dr. van HUYSSTEEN'S	"
84.6	" Mr. WILKE'S ...	"

The two last quoted figures place the average I.Q. for Coloured children a fairly substantial distance below the average I.Q. for European children. But it is to be noted that these norms for Coloured children differ not only from the norm for European children, but from each other as well. When three different groups of Coloured children were tested by three different investigators, three very different average I.Q's. were obtained. We do not find, however, that we tend to conclude from these results, that the children tested by Mr. HENEKE were innately more intelligent than those tested by DR. van HUYSSTEEN, or that Mr. WILKE'S group was of an average intelligence considerably lower than that of the other two groups. We tend, rather, to account for these differences in result in terms of environmental, or educational factors; or in terms of disparities between the three testing situations. It seems illogical, then, that the tendency should

be for us to regard the European norm of 100 I.Q. as indicating that White children are, on an average, more intelligent than Coloured children; and it does not seem improbable that prejudice should be the factor which brings about this difference in our thinking.

From the account given by the Commission of the above investigations, it is possible to hazard various explanations which might account for the discrepancies which exist between the norms for each one. For instance, we may note

1) That Mr. HENEKE, who obtained the highest average I.Q., was himself a Coloured man. Thus he, alone of the three investigators, administered the test to members of his own race. In his case, one would expect rapport between tester and testees to exist to a greater degree than would be the case when the tester was a European, and the testees Coloured; as a result of this greater rapport, nervousness, tension and resentment would be lessened in the test situation, so that conditions would probably be more condusive to a good performance

on the test than they would otherwise be. BIESHEUVEL has stressed the importance of this point, when dealing with the Intelligence of Africans. In his view, the administration of Intelligence Tests to African children by a European tester, is highly prejudicial to the validity of the results of the testing. Without doubt, this principle should be extended to the testing of Coloured children, by Coloured-Teachers.

2) We see that DR. van HUYSSTEEN accounts for the average I.Q. of his group being somewhat above what, in his view, would be the general Coloured school-going average, on the grounds of his selection of schools; MR. HENEKE'S high result is attributed to selection factors introduced through testing children in the higher Primary Standards (those who would have pulled the average down having not been able to reach these heights). Thus we see that significant differences may be brought into the results of Intelligence Testing, due to dissimilar conditions even within one racial group. Factors such as these are even more likely to enter into a comparison between two <u>different</u> racial groups, such as Coloured and

European groups.

The Commission comments on the position with regard to these Tests results very fairly, pointing out that the lower ability of the Coloured children to perform the series of mental operations involved in the Test may be due to

a) lower average mental ability;

b) Unfavourable influences of an environmental nature, since in these Tests intelligence is measured through verbal ability, for the proficiency of which cultural factors play a definite part.

The Commission states that undoubtedly there were unfavourable environmental conditions operating in the case of the Coloured children; and that, as there is no way, as yet, of separating out the innate from the cultural factors influencing an Intelligence Test score, the results do not go beyond showing that there is, among the Coloured, under present conditions, a lower average ability than among Europeans, to perform the types of mental operations tested in these tests.

In comparing results of testings such as these, it must be remembered that the Coloured child is doubly handicapped as compared to the European. For not only are his home environmental conditions more likely to be unfavourable; but inadequate schooling, where present, would prevent the Coloured child from getting the " lift " , particularly in the higher school grades, which the European child of equally unfavourable home background would get from good schooling. Thus we may note the possible significance of the fact that the children in DR. van HUYSSTEEN'S group show a fall in I.Q. with increase of age level.

That the Coloured children were probably suffering from inferior educational opportunity is shown by a research which was carried out by the Commission.

For the purpose of this research, ten tests of scholastic achievement were given to Europeans and Coloured children; Standard III was chosen as the school-grade for both groups of children. The Coloured

children had an average I.Q. of 99.3, - i.e., practically identical to the European average of 100 I.Q. In all except one of these tests, the performance of the Coloured group was significantly inferior to that of the European group. The Commission acknowledges the possibility that lack of interest on the part of the Coloured group might have played some part in producing this result; but they point out that on one of the nine tests the performance of the Coloured group was better than that of the Europeans; and if they had interest sufficient to excel on this test, why not on the others as well.

It is quite possible, or even probable, that this factor of interest, and a related factor of less rapport between children and testers, would enter, to some extent, as an influence detrimental to the results when the testees were Coloured. But even if this is so, the discrepancy between the Coloured and European children's performance on these achievement tests is great; and the Commission's view, that this indicates poor school

education of the Coloured children, seems reasonable, and indeed highly probable; and, if this be true, then it is reasonable to suspect that poor schooling, as well as disadvantages of home environment, helped to lower the performance of the Coloured children on the Intelligence Tests as well.

Furthermore, in the face of facts such as these, it seems unlikely that true and reliable estimates of the degree of difference between the intelligence of Coloured and European school children can be formed, until some way is devised of making these two highly important environmental factors of home and school background, more nearly equal.

VIEWS OF BIESHEUVEL ON THE TESTING OF AFRICAN INTELLIGENCE; AND APPLICATION OF THESE VIEWS TO THE TESTING OF COLOURED INTELLIGENCE:

In summing up the situation with regard to the comparative testing of African and European Intelligence, BIESHEUVEL comes to a conclusion which is both definite and emphatic. He states (1)

" that

(1) BIESHEUVEL, S: " AFRICAN INTELLIGENCE " page 191.

" that under present circumstances, and by means
" of the usual techniques, the difference between
" the intellectual capacity of Africans and Europeans
" cannot be scientifically determined. "

BIESHEUVEL supports this conclusion with very adequate arguments, which will be mentioned below; together with some assessment as to how far, in the present writer's estimation, these points can be applied to the testing of European and Coloured as distinct from the European and African groups, actually discussed by BIESHEUVEL.

As a preliminary, we may remark, that to state with any degree of certainty how far the culture of the Coloured people is removed from the culture of the South African European, would be difficult. As far as it is possible to say, without specific research on the subject, it seems as if the culture of the Coloured people is fairly nearly allied to that of the European; it is their depressed economic conditions, and the Colour Bar operating against them, which, it would seem, keeps them separate, and makes it necessary to consider them as a separate race.

In this connection, we may quote the historian, ERIC WALKER, (1) who says:

" Their - (i.e., the Coloured people's) ideas
" and mode of life could make them, politically
" and economically, a positive source of
" strength to White Society, if properly handled,
" for they are, generally speaking, merely the
" poorer members of that Society. "

Despite this probable similarity between the race and culture of European and Coloured, for purposes of testing it is essential that the two should be regarded as separate racial groups: for there is no proof that the Coloured group is so nearly allied to the European group, that precautions necessary for inter-racial testing may be disregarded; to do so, would be to act upon an unproven assumption, and the results would therefore be invalid.

Let us now consider the points made by BIESHEUVEL:

1) BIESHEUVEL holds that neither verbal, nor non-verbal, tests, can be used for the comparative testing of European and Non-European intelligence; and that this is so, because

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(1) WALKER, ERIC: " HISTORY OF SOUTH AFRICA " page 576.

the groups to be tested can be matched neither as to their attitude towards the tests, nor as to their cultural familiarity with the test contents and routines.

Although it is not possible to state definitely whether the attitude of the Coloured testee is likely to be more or less different from that of the European than is the case with the African; it seems reasonable to suppose that a difference in attitude would be likely to exist.

As BIESHEUVEL points out that it is to the African, so to the Coloured, is education something which is expensive and which involves sacrifice to attain; it is therefore more than likely that the Coloured resents the break into his precious school time brought about by testing as much as does the African; whereas to the European child, the break comes as a fairly diverting change. In spite of these factors, however, the attitudes of the Coloured child are probably more akin to those of the European child in the test situation than are those of the African child; for the Coloured child has no immediate tribal background, and is usually brought

up in the towns, in the general European cultural context. Because of this relative cultural similarity, test contents are less likely to be culturally unfamiliar to the Coloured than to the African child; however considerable evidence, including that put forward by the Coloured Commission, exists to suggest that the education of the Coloured child is inferior to that of the European; this factor of unequal schooling would render the results of a verbal test unfair to the Coloured child. Non-verbal tests, as, e.g., block tests, might be as culturally familiar to the Coloured child as to the European child of equally depressed economic circumstances; but to obtain such a group of European children would be difficult, and likely to be non-representative of the race as a whole.

2) BIESHEUVEL states that before inter-racial differences in intelligence can be measured, a more suitable measuring instrument than the existing forms of intelligence tests will have to be devised; and that as a preliminary to the construction of an adequate test, research into the basic cognitive processes of the African is essential. The fact that at present, however, with existing knowledge of

African cognitive processes, and intelligence tests as they are, the measuring device cannot be controlled and standardized for two groups, renders the control group device impracticable. It seems reasonable to apply the above argument to the comparative testing of Coloured and European groups as well.

Furthermore, BIESHEUVEL states that the groups themselves cannot be controlled, because it is not possible to determine whether a given sample of the African population is an inferior or superior part thereof, especially where that sample is detribalized; this difficulty would arise to some extent in the testing of Coloured people, although in their case factors of recent detribalization and migration to towns do not enter; so that the situation is perhaps less complex than in the case of African test groups; but here again, we cannot say to what degree this is so; for we are inclined to think of the Coloured people as forming a single class; in America, however, the Coloured people are definitely forming different classes, among themselves; a light skin coming to be of social value, and forming a basis of class distinction within the Coloured group; furthermore,

a light skin has become a basis for selection in marriage, so that to some extent selection is giving rise to a lighter skinned mulatto upper class. Among the white Americans, however, it is not generally known that the Mulattoes are forming classes among themselves. Some analogous process may be at work among the South African Coloured, unnoticed by the European population, which is inclined to group them all together as a " Coloured " class.

3) IT IS WELL KNOWN that scores on intelligence tests are affected by various kinds of environmental factors. Factors such as poor home environment, poor school environment, or poor nutritional conditions, are widely held to have a depressing effect upon performance on intelligence tests; BIESHEUVEL points out that in all the above respects, African and European groups cannot be equated. For example, to control the home environmental factor, from the economic viewpoint alone, he states that

> " A non-representative and somewhat superior African
> " group - (within the upper 1/3 of the African
> " population of Johannesburg) - would have to
> " be matched with a non-representative and decidedly
> " inferior European group, drawn from the lowest 1 %
> " of the urban European population. " (1)

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(1) BIESHEUVEL, S: " AFRICAN INTELLIGENCE " page 107.

BIESHEUVEL believes that the average test intelligence of Africans, as measured under prevailing conditions, must have been depressed as much as 10-30 points below what it would have been had home conditions been equal to those of the average European home. (1)

In the same way, the difference in standard of living between Europeans on the one hand, and urban or tribal Natives on the other, is so great that to try to match nutritional conditions in groups fully representative of both races would be impossible.

The situation is, according to BIESHEUVEL, further complicated by the fact that we have no knowledge of the quantitative effect of any one of these three factors in depressing an Intelligence Test score; so that it is impossible, until a great deal of further research has been carried out, to measure the degree to which any one of these factors enters as a detriment to a test score, and to correct the score accordingly. Thus,

(1) That environmental factors can affect test performance to such a degree is contested by some, e.g., cf. CATTELL, R.B. : "THE FIGHT FOR OUR NATIONAL INTELLIGENCE" p.p. 30, 31. But it seems reasonable to accept that intelligence as guaged by tests, depending as they do on intelligence and cultural factors, is affected to a marked degree by these factors.

in BIESHEUVEL'S view, it is essential that research should be carried out, on the relationship between such factors as school education, home environment, malnutrition, and intelligence test scores, before comparisons of African and European intelligence test scores can be seriously considered.

The educational, nutritional, and home environmental conditions of the average Coloured is not very different from that of the African; so that the points given above must be applied to the testing of Coloured and European groups as well.

4) THE FOLLOWING POINT, which BIESHEUVEL puts forward in his discussion of African Intelligence, could probably be applied equally strongly with regard to the testing of Coloureds.

In a group of African children, a considerable number may be suffering from congenital syphilis, which, by means of lesions in the nervous system, may affect intelligence adversely. BIESHEUVEL states that a large number

of African children show a positive WASSERMAN reaction, even when the outward stigmata of the disease are absent. Thus, in a given group of African children, a fair number are likely to be suffering from this disability, and in view of the high incidence of the disease in our Non-European populations, this number could conceivably be large enough to be a contributary factor towards lowering the average for the Coloured or African group.

Other diseases such as Malaria, Tuberculosis, do not impair intelligence in a direct or permanent sense; but during attacks, or in acute stages, weakness and general lassitude resulting, is likely to lower a test score.(1) And here again, the high incidence of disease among the African and Coloured people, renders it likely that a test group of Coloured or African subjects is more likely to be handicapped by these factors, than is the case with a European group. BIESHEUVEL'S suggestion, that in testing, care should be taken to ascertain that all the members of the experimental groups are in a reasonable state of health at the time of testing, could be applied with advantage to the testing of Coloured - European groups.

(1) BIESHEUVEL: "AFRICAN INTELLIGENCE"

5) BIESHEUVEL contends that where there are differences in temperament between two races, these temperamental differences may affect the performances of individuals in an intelligence test situation. E.G., in the case of the African testee, the trait of inactivity may lower test performance, especially where a time factor is an integral part of the test. This apparent inactivity may be due to a temperamental factor, or it may be an artificial trait arising as a result of the African's position in a cultural context which is foreign to that which forms his background. However this may be, the phenomenon does exist; and it is necessary to know what effect factors such as these have on intelligence test scores. Research on this question, and on the temperamental characteristics of the African, is necessary as a preliminary to racial comparisons of intelligence; and it seems reasonable to apply the points above to comparative testing of Europeans and Coloureds.

) GENERAL CONCLUSION.....

GENERAL CONCLUSION: From the above, we arrive at this conclusion;

Although superficially we tend to think of a Coloured group as being very much more nearly allied to a European group, than is an African group: however this may be, in order to test Coloured children, and to compare their performance on intelligence tests with that of Europeans, with the object of basing inter-racial comparisons on the results, the most rigid precautions are necessary; and many of these precautions cannot be taken until further preliminary research has been carried out.

In the light of this conclusion, what excuse is there for the undertaking of the present research?

In dealing with this point, we will, at the risk of repetition, re-state the precise nature of this research. (1)

No attempt to compare two racial groups in a fundamental sense has been made by the present writer: the aim of the present research is merely to compare certain abilities of that section of the Coloured race, and of that section of the European race, seeking employment

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(1) Cf. CHAPTER 1, " LIMITATIONS OF AIM."

in industry; and, more specifically, seeking employment in industry in Port Elizabeth, at the present time.

This is a narrow and specific aim; the results of such experimentation cannot be used as evidence for or against the equality of abilities of the two races; on the other hand it is an aim which should yield a useful result for industry; and which is at present reasonably attainable, while the wider aim of establishing race differences is not.

In an investigation such as this, it does not matter whether the section of each race tested forms the lower, middle or upper class of each race. Suppose, for the purposes of argument, that the class of Coloured seeking employment in industry is the middle Coloured class; the class of European, the lowest class of the European population: This does not matter, for the sole aim is to establish whether that class of each working in industry is equal, or not equal in ability.

Similarly, factors of the home background of each group, education, nutrition, health, do not invalidate this result; for the information aimed at is as to whether the two groups are equal in ability or not, under

their present circumstances.

The other three factors which we have listed from BIESHEUVEL'S discussion must be taken into account in interpreting the results of a research such as this. These three factors are;

1) a) Attitude towards test situation; there is a considerable probability that in the case of Coloured workers, the attitude towards the test situation will differ from that of the European workers.

b) There is a possibility that differences in cultural familiarity with the test contents might be a source of inequality between the two groups.

2) Differences may arise through possible differences in the cognitive processes of the two groups.

3) No research exists, to the knowledge of the present writer, which enables us to know whether the members of the Coloured group would, through differences in temperament, attack the problems in such a way that their score would be adversely or favourably affected, as compared with that of a European subject.

However, although we must bear in mind that these factors might undoubtedly influence the results of the research, we may note the following points, which would perhaps mitigate this effect to some extent:

1) a) In the two groups of factory workers tested, (§) the attitude to the test situation may to some extent have been equated by the fact that the workers were in the same position, called off their work somewhat unexpectedly to face an unknown tester. Attitudes of suspicion, resentment, etc., might be expected to be characteristic of the European worker as well as the Coloured worker in this situation; (1) factors such as BIESHEUVEL mentions, of the competitive attitude of the European school child, the value of every moment of school to the African - (and probably the Coloured) - would not enter here. In the case of both groups, the test situation was a break in the monotony of work; a break, however, which was probably regarded with suspicion by both groups, as possibly affecting their jobs; both groups, too, would perhaps regard the tests as something rather childish

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(§) Tested by the present writer.

(1) The situation, it was true, was somewhat different for some of the European workers who were tested at the Athlone Club. These workers were paid for their time (time given to testing in leisure hours); the others tested were paid by the factory.

and beneath their dignity.[§] It is of course impossible to state what attitudes in common, or separately, the two groups may have had. But it is reasonable to consider the possibility that these attitudes would be more common to the two groups when the groups are both employed in industry, than would be the case in, say, school groups or groups of the population as a whole.

b) The fact that both groups work in factories makes their cultural background somewhat more similar than would be in the case of other groups.

CHAPTER 5.

THE TESTS.

At the outset of this research, the writer (present writer) considered various standardized tests, which have been used to investigate the problem of

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§. In establishing rapport in giving the tests, an effort was of course made to dispel such attitudes. But the interesting point is that the situation was such that both groups, Europeans as well as Coloureds, were likely to have had these attitudes.

Individual Differences, with a view to their suitability for inclusion in a battery of tests to be administered to Coloured and European factory workers. Eventually four tests were selected; because of the inevitable time factor which must be considered in industrial research, a larger battery was deemed impracticable. Even so, these four tests took at least two-and-a-quarter hours for total administration, a time which seems somewhat long to the most sympathetic management, when considered in terms of lost production.

The following four tests were finally chosen:

1) Progressive Matrices Intelligence Test (1 hour);
2) " S " Test ... ... (30 minutes);
3) Detroit Test of Manual Ability ... (30 minutes);
4) Routine Assembling Test ... ... (10 minutes).

These tests were chosen for various reasons, the most important of which were the following:

1) A total of four tests covers but a very small corner of the field of human abilities; it was deemed desirable that the portions of this field to be covered should involve, as far as possible, some of those

abilities which actually do enter into factory operations. " Factory operations " was, however, in this case allowed a fairly wide interpretation, because no specific branch of industry was considered in an isolated and particularized sense; no thorough or scientific job analysis was carried out; any ability which seemed relevant to the Closing Room of footwear factories or to machinists in clothing factories, was considered; any ability which seemed obviously irrelevant, was not considered suitable for testing: thus, e.g., in considering the tests for the various factors of the mind set out by THURSTONE, (1) the " S " factor was deemed relevant, and the tests suggested as having the power to test that factor, were considered, and one was finally selected. Such factors as the " N ", or numerical factor were, however, immediately rejected as having no possible relevance to these factory operations stated above. For the same reason, tests such as the STENQUIST mechanical aptitude tests were considered unsuitable for the present research.

2) It was considered advisable that some of the tests in the battery at least, should deal with simple primary factors, basic to human abilities; for especially in view of the possibility of future research to fill the gaps left in the field, it seems obvious that the best results will follow

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(1) THURSTONE, L. L: " FACTORS OF THE MIND " .

when abilities are as far as possible split up into basic, simple, single factors. It was with this end in view that COX'S Routine Assembling Test, and the " S " test, based on an idea by THURSTONE, were included in the battery.

3) A number of obvious, but very important, practical considerations influenced the choice of tests. The four tests chosen were, in the first place, readily and immediately available to the writer. The importance of the time factor in an industrial situation must, at the risk of repetition, be sufficiently understood and emphasized. To the academic worker, an hour off a machine, may seem inconsiderable; but, in an industrial situation, this time becomes long, and when it involves five or even three workers, it entails considerable loss. This was the greatest drawback in connection with the Progressive Matrices Test, for which the tester must have at least an hour at his disposal; but other very desirable features of the test overruled this severe disadvantage.

Furthermore, it was essential for the tests to be easily portable; for the investigation was to be carried out single-handed, and the writer was aware that she would have to move from one factory to another at short time intervals. In addition, tests requiring elaborate set up, or involving intricate apparatus, electrical connections, etc., are unsuitable. It is extremely difficult to find a place in a factory suitable to set up a complex

apparatus such, e.g., as would be required for a reaction time study. Testing frequently has to be done in some such place as a Rest-room. At tea interval, lunch time, etc., the girls come in to this room for tea, and to leave a complex and delicate apparatus there would be highly impracticable. The tests must, therefore, be neat, compact, and easy to assemble or dismantle.

The selected tests, which fulfil these requirements to a sufficient degree, will now be described in detail:

PROGRESSIVE MATRICES INTELLIGENCE TEST.

Opinions such as the following are frequently expressed by White South Africans: - " Oh, Coloured " people are all right as long as it is just simple " work they have to do ..... but they have " no intelligence, no initiative ..... , "

or other remarks which bear the implication that Coloured people are satisfactory in simple routine jobs, but that they cannot be relied upon to do any work for the execution of which skill or complex thought processes are required. The opinion of many White South Africans seems to be that the Coloured worker will almost certainly be less intelligent than his White counterpart.

For this reason, it was decided that an Intelligence Test of some kind should be included among the tests to be administered.

The Progressive Matrices Intelligence Test was prepared by J. C. RAVEN, of the Research Department, R.E.C.I., Colchester.

This Intelligence Test seemed very suitable for the purpose of the test, for the problems involved in the test are perceptual in nature, and thus the difficulty of language, always hard to control in comparing groups different in race and cultural background, is eliminated. It was hoped, too, that the fascinating nature of the problems in this test would interest the subjects; and that in this way the following attitude frequently encountered among adult factory workers, when confronted with the usual verbal intelligence test, would be to some extent circumvented:

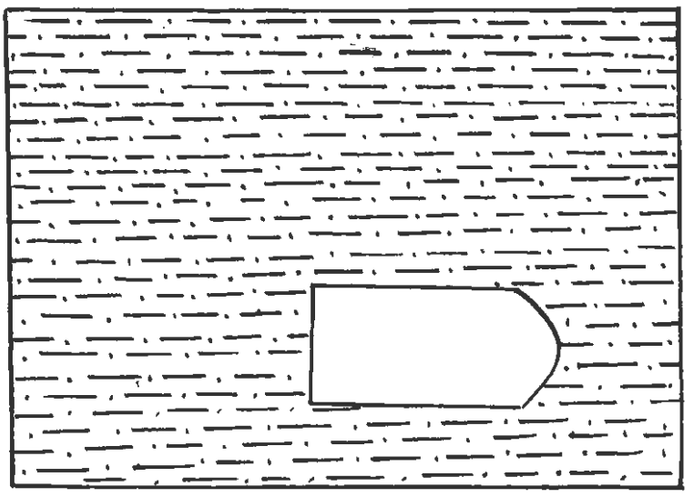
" Well, its a long time since we were at
" school so we won't be able to do very
" well at this. "

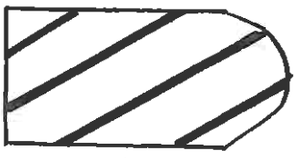
The test is printed in the form of a booklet, with a problem on each page. Each problem consists of a design from which part has been removed. Several pieces are printed on the same page, below, and the subject has to decide which of these is the right one to complete the " matrix " .

There are five sets of problems, each of which develops a separate theme; E.G., the theme in section "A" which is employed, is one of continuous patterns; that of Section "B", analogies between pairs of figures, while "D" involves the permutations of figures. The initial problems in each set are very easy, and provide the necessary training for solving the problems of increasing difficulty which follow, in each set.

Illustrations of the principle employed in Section "A" are given on the following pages. Actual examples from RAVEN'S Test are not reproduced, owing to copyright restrictions.

Figures A, B, and C are problems of increasing difficulty, all involving the same principle. These examples are illustrative of the theme of continuous patterns, employed by RAVEN in Section "A" of his series. In a similar way, four other themes are developed by increasingly difficult problems.





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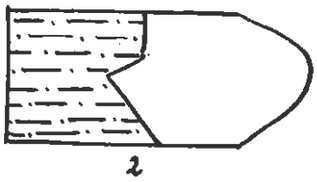

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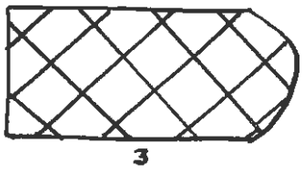

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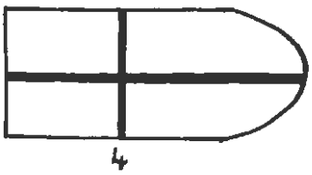

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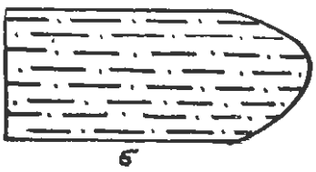

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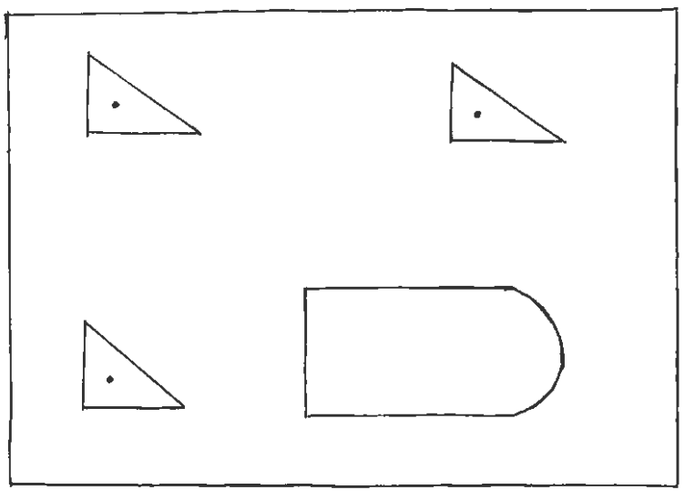
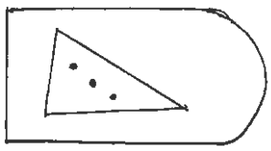
PLATE A.





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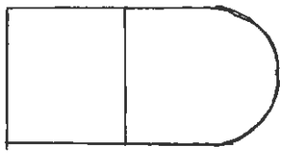

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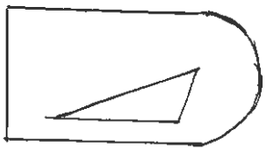

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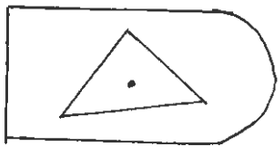

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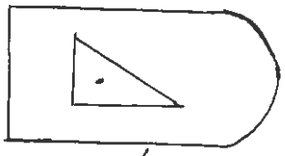
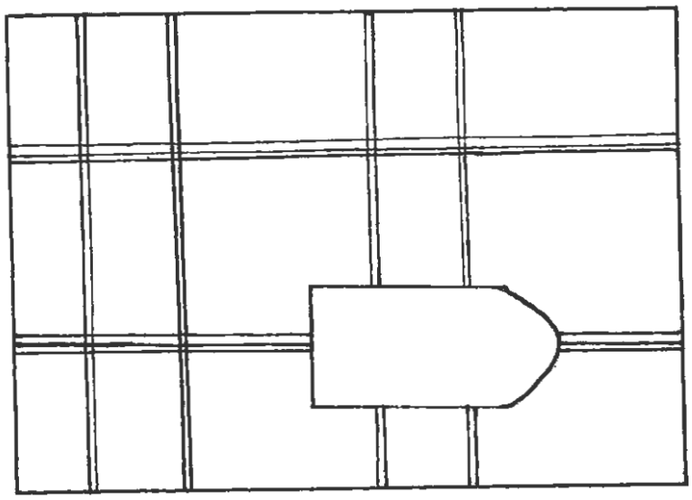
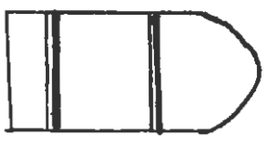


6

PLATE B.





1

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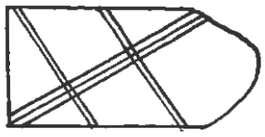

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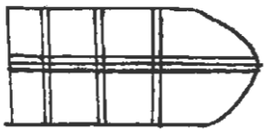

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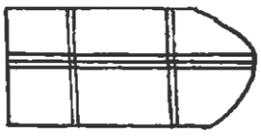

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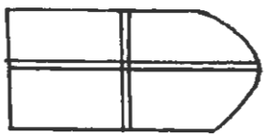

6.

PLATE C.

The Series has been standardized by the author, and the results compared with the TERMAN MERRILL revision of the BINET SIMON scale, with which it correlates satisfactorily. (1) Where great differences exist between the scores on the two tests, RAVEN considers that it is due, in most cases, to the lift in score which verbal fluency and quick recall, as distinct from true intellectual ability, give to certain testees on the TERMAN MERRILL scale.

RAVEN states that the score on first and second testing of the same subjects were relatively consistent; the increase in the mean score on the second testing being of doubtful significance. (2) Thus the test seems to have a satisfactory degree of reliability.

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(1) RAVEN, J. C: " STANDARDIZATION OF PROGRESSIVE MATRICES." British Journal of Medical Psychology, Vol. 19, Part 1, 1941.

(2) RAVEN, J. C: " THE R.E.C.I. SERIES OF PERCEPTUAL TESTS. " Ibid, Vol 18, Part 1, 1939.

ADMINISTERING THE PROGRESSIVE MATRICES TEST.

The instructions which are given by RAVEN, for administering the Group Test, were adhered to rigidly. It was explained to the Subjects, as directed by RAVEN, that on every page of the book he would find a pattern, from which a piece had been left out, and that his task would be to work through the book, choosing, each time, the correct piece to fit the pattern, from among the several alternatives printed below. When this was understood by the Subjects, they were allowed to continue with the test. It was impressed upon the Subjects that the problems should be tackled in the order in which they were arranged in the books, and that none of them should be omitted. Further, the Subjects were assured that they should have as much time to complete the tests as they desired.

S C O R I N G.

The Subjects score is simply the total number of problems correctly solved. These scores can then be read off in terms of percentile ranking, on tables drawn up by RAVEN, which are printed in the booklet accompanying the tests.

THE TEST WAS GIVEN TO THE FOLLOWING GROUPS:

1) 40 European Factory Girls.
   40 Coloured Factory Girls.

2) 30 European School Children, in Stds. 5 & 6.
   30 Coloured School Children, in Stds. 5 & 6.

CONDITIONS OF TESTING:

1) The Factory Groups. The test was given to groups varying in number from three to ten at a time. It was not possible to keep the number tested at a time constant, because girls had to be tested as and when available. 4 Coloured girls, and 5 European girls did the test alone, but the instructions for giving the Group Test were still followed in testing these individuals.

The Progressive Matrices Test was always given immediately after the " S " Test, which to some extent, may have acted as a shock absorber. Before the testing was started, the writer always spent a few minutes talking to the girls to set them at their ease and to establish rapport.

The girls were thanked for coming to do the tests; the writer explained to them that the tests had nothing to do with their work, that the management

of the Factory would never even know the results; that the tests were interesting to do and that they would probably enjoy doing them, but that if anyone did'nt like the idea of doing them, they were to feel quite free to get up and go. (Only one girl, a European, responded to this suggestion).

In view of the intense Colour prejudice which we have noted in an earlier Chapter, it was considered to be inadvisable to take the girls fully into confidence as to the aim of the investigation. To leave the girls with no idea as to why they were being tested, would, however, be a procedure certain to arouse suspicion and nervousness among the Subjects. It was explained to them, therefore, that these tests had been constructed in other Countries, such as England and America, and that it was the work of the writer to find out how well they were suited to South African conditions; and that, with this aim in view, she was going around giving them to various groups of people - to School Children, College Students, - and now, with their help, to a group of grown up girls, earning their own living. While not strictly truthful, this explanation fulfilled an essential need, satisfactorily; for the explanation was accepted by the Testees as a satisfactory reason for doing the Tests.

The writer feels that, on the whole, she succeeded in establishing good rapport with the Testees; but perhaps somewhat more so with the

European, than with the Coloured, girls. This was probably because thirty-one of the European Group came in their spare time, in response to verbal and written appeals by the writer, plus the promise of 2s.6d. for their spare time. They came, therefore, more voluntarily than did the Coloured girls, who were sent off their machines by the management; thus, although these latter came voluntarily in the sense that they were given the opportunity to go if they did not wish to do the tests, they did not come of their own will in quite the same way that the European girls did. The fact that the European girls came, as they did, presupposes a certain amount of interest in the idea of doing the tests; In this respect, of greater interest, the possible advantage lies with the European group.

In administering the tests, the fact that only a few were tested at a time enabled the writer to ascertain that each Subject understood the instructions clearly. The instructions provided by RAVEN were found to be very adequate, and it was only very infrequently that they had to be enlarged upon.

Seating arrangements were not always ideal, because the Subjects could not be taken away from the Factory Premises. They had to be tested in whatever room was available; often this would mean that the Subjects were rather crowded together, or that they would be tested sitting round a table, instead of all facing the Tester, as RAVEN states to be desirable;

other disadvantages which were experienced in testing both factory groups, and which were found to be unavoidable, were factors such as noise, radiogram music being audible; or, sometimes, people walking into the room in which testing was in progress.

At the outset of the testing, the Subjects were informed that there was no time limit to the test, so that they could work at it as long as they liked. However, here again, certain factors entered into the test situation, which were clearly undesirable. The writer felt, e.g., that some of the slower girls hurried because of approach of tea-interval; to arrange all the groups so that the latter part of the testing time did not ever approach morning or afternoon tea, or lunch time, especially when the girls were working on shifts; and at the same time to have to take those girls which could be spared from machines for that time period, was next to impossible, and could only have been arranged at the price of the testing continuing over a long time period.

The girls were told that they could hand in their books and return to their machines as soon as they had finished; it was found that if this was not done, those girls left sitting with nothing to do were inclined to talk, giggle and in general distract the attention of those still working; furthermore, the writer was always anxious to co-operate with the Management by returning the girls as soon as

was possible. To let the girls get up and go out as they finished, then, seemed to be the best course of action; but the writer noticed that the remaining girls seemed to be influenced by the departure of the first girl. Thus, in a group of five, if the first girl finished within 20 minutes, the others seemed to finish fairly soon afterwards; whereas other groups of five would all take nearly the whole hour to finish. This was not invariably the case - sometimes differences in time betwen the members of one group would be great - but the writer is of opinion that the remainder of the group definitely felt hurried by the departure of one or two.

The points given in the discussion above do not apply equally to the two groups. The Coloured girls were all tested during factory hours on the premises; 20 of the European girls were tested at the Athlone Club, (1) in the evenings. 11 others were tested on Saturday mornings, out of factory hours. Conditions here were somewhat quieter and less hurried; however, the fact that many of these girls were anxious to go as soon as possible, especially those who were giving up part of their one free morning for shopping, very probably cancelled out this difference to some extent. Furthermore, the same policy of allowing girls to go when they had finished was followed, in order to make the situation equal in

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(1) THE ATHLONE CLUB is a residential hostel run on the lines of the Y.W.C.A., but while the Y.W.C.A. caters for the business girl, the Athlone Club serves almost exclusively the needs of the factory girl.

this respect. The writer feels, however, that if a difference in the test situation exists in favour of one group or the other, as far as the Progressive Matrices Test was concerned, the advantage must have been with the European group.

2) The School-Children Groups. The test was given to 30 Coloured, and 30 European, School Children.

The disadvantage of giving this test to a School Group lies in the fact that it takes an hour to administer; as school periods usually cover about 40 minutes, the test breaks into more than one period.

In both the schools tested, children from Standards 5 and 6 were in the same class-room; the writer did not feel able to disturb the school arrangements by selecting one age group; instead she gave it to these two classes as they were, in each case, and then compared the ages of the children. The average age of the European children tested turned out to be one year older than the average age of the Coloured children tested.

In the testing of these groups, the conditions were not well controlled. Apart from the above factor of age difference, other things contributed to making the position of the two groups somewhat unequal. An effort was made to select a European school attended

by children of the pre-factory type, but even so the economic circumstances were far better in the case of the European Children than those of the Coloured Children. The physical conditions of the experiment were better in the case of the European Children, for they sat in single desks, while the class room of the Coloured Children did not allow them to be well spaced; they sat on benches and worked on tables, but too many worked at one table for conditions to be ideal. As well as these local disadvantages, we have the factors already listed in agreement with BIESHEUVEL'S points on the testing of Africans. (Chapter 4).

It will be seen, then, that this testing of School Children was nothing more than a rough, subsidiary experiment; entered upon because the writer had the opportunity to do so. With all these unequal conditions in favour of the European Group, there would have been no justification for quoting the results, had it not been for the interesting fact that even with these differences, there was still no significant difference between the performance of the two groups on this test. (See Table 1.)

(NOTE: RESULTS OF TESTING - TABLES &c., FOLLOW ON NEXT PAGE.)

TABLE 1

GROUPS	No. IN GROUP	MEAN SCORES	DIFFERENCES BETWEEN MEANS.	STANDARD DEVIATION.	RESULT OF FORMULA: $\frac{M_e \sim M_c}{\sqrt{M_e \sim M_c}}$
European Factory Workers	40	26·25	3·42	10·15	1·4 -
Coloured Factory Workers	40	22·825		10·724	i. e., not significant
European School Children (Average age 14.2 years)	30	30·93	3·63	7·65	1·6 -
Coloured School Children (Average age 13.4 years)	30	27·3		9·67	i.e., not significant

TABLE showing the results of the Progressive Matrices Group Test. (See Appendix 1, p.p. 157 - 160)

TABLE 1 shows the significant features to be noted in connection with the results of the Progressive) It will be noted that

Histogram to show the distribution of results, when

i) 40 Coloured Factory Workers,
ii) 40 European Factory Workers,

were tested on the Progressive Matrices Intelligence Test.

The classes A,B,C, etc., above, represent percentile ranks, (computed by Raven), as follows:

A	0	-	5	percentile
B.....	5	-	10	"
C.....	10	-	25	"
D.....	25	-	50	"
E.....	50	-	75	"
F.....	75	-	90	"
G.....	90	-	95	"
H.....	95	-	100	"

(See discussion, this thesis, pages 104, 105.)

Below is reproduced the relevant part of a table from RAVEN'S Booklet:

PERCENTILE POINTS	CHRONOLOGICAL AGE IN YEARS			
	13 Years	13½ Years	14 Years	ADULTS
95	52	53	53	55
90	50	51	52	54
75	47	48	48	49
50	43	44	44	44
25	35	37	38	37
10	27	28	28	28
5	19	21	23	23

NOTE: The median score at each chronological age is underlined heavily.

In the Factory Groups, the mean scores of the Coloured and European Groups both come very low as measured by these norms: the mean scores of 22.8, and 26.5, for the Coloured and European Groups, respectively, falling in the five percentile Groups of the scores given by RAVEN as the norms for Adults.(see histogram p. 102)

The two School Groups came but slightly higher on RAVEN'S Table. The European Group, consisting of thirty Children with average age of 14.2 years, had a mean score of 30.93: this score falls just above the ten percentile level for fourteen-year-olds. The Coloured Group, consisting of thirty Children with average age of 13.4, had a mean score of 27.3; this mean falls just above the ten percentile level for thirteen-year-olds.

Why are these norms depressed so markedly below the norms set forth by RAVEN ? For the sake of the argument to follow, let us consider the European Factory Group alone. (1) In this case at least, one would expect the average to be lower than that for th e population as a whole, because it is probable that a Group of Factory Workers will consist of an un-representatively low section of the population as a whole. But even if we suppose such a sample of the population to be much less intelligent than an average sample, one would still not expect the average for the Group to be depressed to such a degree as is the case in this result. Out of every hundred adult individuals tested by RAVEN, only five would have obtained scores as low as the average score for these forty individuals here tested; it should be noted, further, that the mean for the present Group, would fall within RAVEN'S GRADE 5, which he describes in his classification, as " Mentally Defective " .

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(1) The Coloured Factory Group is excluded from this argument, because just what section of the Coloured population such a Group would represent, is a debatable point.

It is difficult to account satisfactorily for this low performance on the test. The test did not involve verbal ability, so that the low educational standard of the Testees should not have operated against them to a degree such as would have been expected if a verbal test had been used. One would expect, indeed, that the perceptual nature of the test should, rather have placed it within the cultural context of these people, working as they were in Factories, with shapes - (biscuits, shirts, parts of the uppers of shoes, etc.) (1) The low score cannot be explained as due to attitude of the Testees; the writer felt fairly sure that she had the good will of most of the Subjects; but even supposing that she was mistaken entirely as to this attitude, three other tests were given, on one of which at least (DETROIT TEST OF MANUAL ABILITY) some of the Testees scored exceptionally well. The Testees did not seem to the writer to be uninterested in the test, and those who were

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(1) This statement may seem far-fetched; but HUGO and BIESHEUVEL divided 48 African boys, from the Diepkloof Reformatory, into two equivalent Groups. One Group received training in the handling of coloured blocks. After a week's training, the trained Group did better than the untrained Group on KOK'S Blocks and Cube Construction test. (A.I.* pp. 50, 51). By analogy with this, working with shapes should provide a background for the tests making up the Progressive Matrices.

(* "AFRICAN INTELLIGENCE" - BIESHEUVEL)

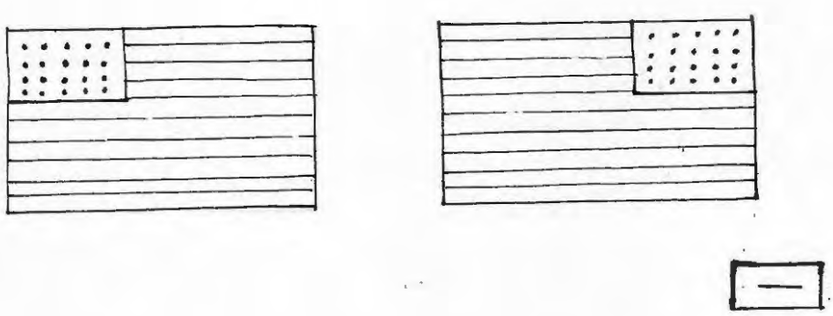
asked, said that they had enjoyed doing it; quite a few were anxious to know their scores; but it is just possible that lack of sustained interest caused the Testees, as the problems grew more difficult, to hurry through them. Few Testees used up all the time at their disposal, and many finished after about 30 - 40 minutes. While RAVEN supposes sixty minutes to be a reasonable time to take over the tests, lack of sustained interest, and of competitive feeling, may have led to the hurrying over of the more difficult problems, the items selected as being " correct ", being chosen more or less at random. This seems to be a disadvantage which arises in the case of an Intelligence Test where time is not limited - scores are bound to vary, to some extent, with the degree of interest which the Subject has in doing well. The writer feels, from her own introspection when doing the test, that its nature does invite one to hurry over some of the more difficult problems, and to hope for the best; even though, in her case, she was interested in her result, and wanted to do well. Where the self is not identified with the result of the test, the temptation to hurry might be expected to become considerable.

THE " S " TEST.

In the preliminary search for suitable tests, THURSTONE'S Primary Factors were studied, to see which, if any, would be relevant to this purpose. The " S " Factor seems to be one which would enter to a considerable degree into Factory operations. THURSTONE describes this Factor as " facility in spatial and visual imagery."(1)

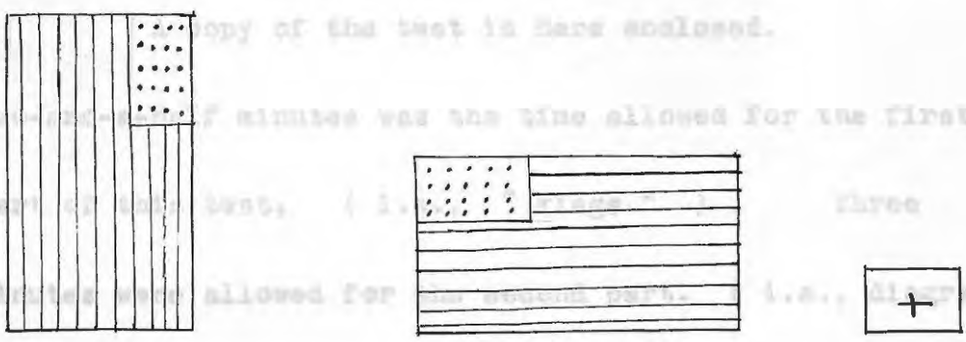
THURSTONE gives a list of tests, and the degree of their saturation with this Factor " S " (p. 79). The test which is most saturated with " S " he calls the " Flag Test " . In THURSTONE'S experiment it consisted of forty-eight items, and the degree of saturation with the " S " Factor was .636.

The principle involved in this test was as follows:



(1) THURSTONE, L. L: " PRIMARY MENTAL ABILITIES " .

The two pictures on preceding page show opposite faces of the same flag. A minus sign has been placed in the square to show that the pictures depict opposite faces of the flag.



The two pictures above show the same face of the flag, so a plus sign should be written in the square.

The test consists, then, of pairs of flags, to be judged and marked in this way.

A test on these lines was published at Stellenbosch, and had been used by the Leather Industries Research Institute, Grahamstown.

The test was based essentially on the above principle; the first part deals actually with flags; the

second part deals with the same principle, but uses shapes other than flags.

ADMINISTRATION OF TEST.

A copy of the test is here enclosed. Two-and-a-half minutes was the time allowed for the first part of this test, (i.e., " Flags.") . Three minutes were allowed for the second part, (i.e., diagrams). The test took from 20 minutes to half-an-hour, to administer.

The Instructions were given as on pages 1 and 3 of the Test Sheet enclosed, but the writer was forced to enlarge upon these to a considerable degree in giving the Test. In preliminary trial testings, it became apparent that the Instructions on page 1 are not full or clear enough to get the idea over to many Subjects. The writer made demonstration flags which could actually be moved around, and the idea demonstrated in this manner to the Subjects. Many of the Subjects found the idea contained in the Test very difficult to grasp. While they were doing the trial rows of flags on page 1, the writer had to

Naam..... Name

Ouderdom..... Age

S—Toets. S—Test.

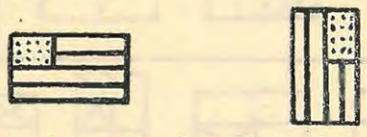
Standerd op Skool..... Standard at School

Fabriek..... Factory

VLAGGIES FLAGS

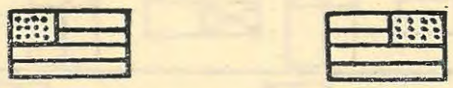
Die twee vlaggies hieronder is presies eners. Jy kan die een so draai dat hy presies op die ander pas.

The two flags below are exactly the same. You can turn one in such a way that it would fit exactly on the other one.



Kyk nou na die volgende twee vlaggies. Hulle is verskillend. Jy kan hul nie presies op mekaar pas nie, al skuif jy hul ook al hoe.

The next two flags are different. You cannot turn them about as to fit exactly on one another.

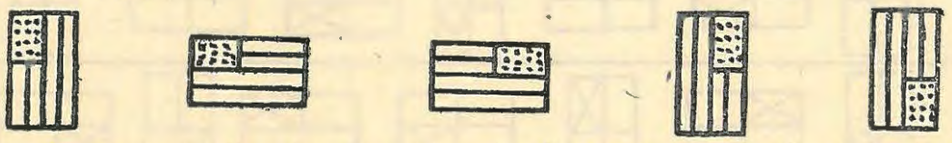


Hier is nou nog vlae. Sommige is met 'n kruisie gemerk. Die wat presies eners is as die eerste vlaggie in die ry, is so gemerk.

Here are some more flags. Some of them are marked with a cross. Those which are exactly like the first one are marked.

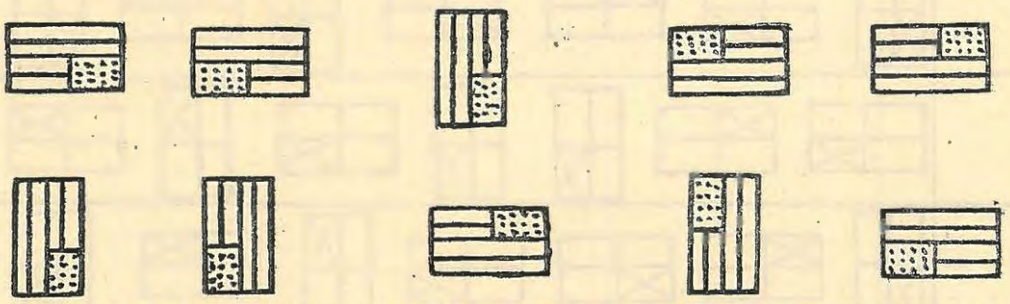
Hier is nog 'n ry vlaggies. Merk nou self die vlaggies wat presies netsoos die eerste een in die ry is met 'n kruisie.

Mark in this way each of the following flags which look exactly like the first one in the row.



Doen nou nog die volgende rye ook. In elke ry moet jy die vlaggies wat presies soos die eerste een in daardie ry is, met 'n kruisie merk.

Do the following rows for exercise.

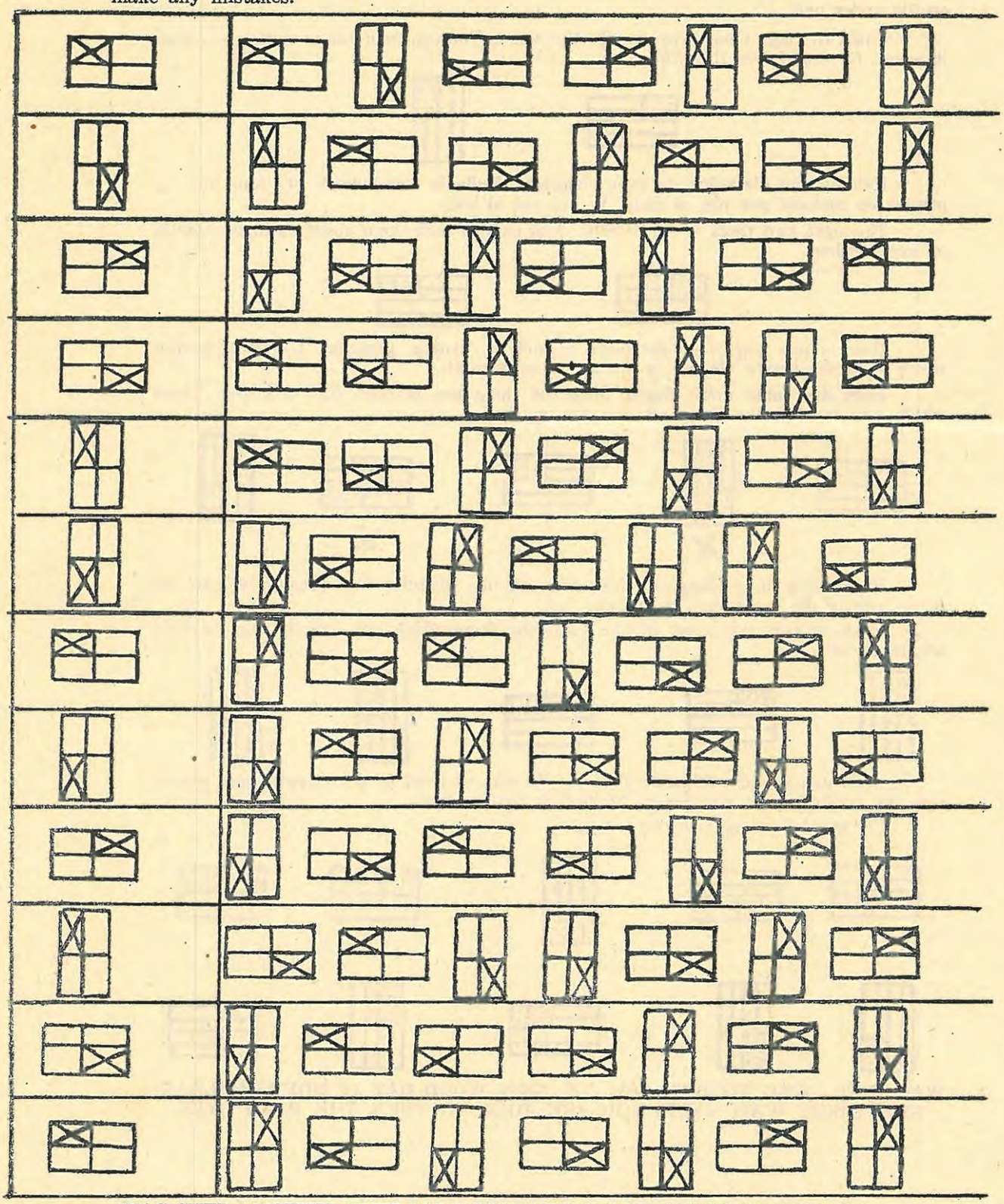


WAG HIER. WAG TOTDAT AAN JOU GESÊ WORD DAT JY MOET OMBLAAI.
STOP HERE. WAIT UNTIL YOU ARE TOLD TO TURN THE PAGE OVER.

VLAGGIES
FLAGS

Merk die vlaggies (met 'n kruisie) in elke ry wat presies netsoos die eerste vlaggie wat vooraan die ry staan, is. Werk so gou moontlik, maar ook so sekuur moontlik.

In each of the following rows of flags, mark those flags which look axactly like the first one in the row, with a cross. Work as fast as possible but try not to make any mistakes.



WAG·HIER. MOENIE OMBLAAI VOORDAT DIT AAN JOU GESÊ WORD NIE.
STOP. DO NOT TURN THE PAGE UNTIL YOU ARE TOLD TO DO SO.

FIGUURTEKENINGE
DIAGRAMS

Kyk na die onderstaande ry figuurtekeninge. Die eerste lyk soos 'n F met die regte kant na bo. Al die ander is dieselfde F, dis net in verskillende rigtings gedraai.

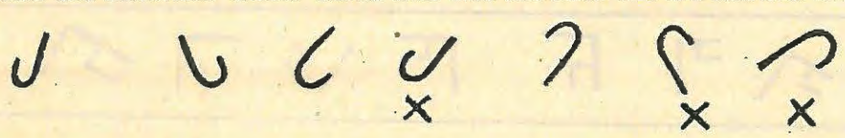
Look at the diagrams below. The first one looks like an F. All the others are the same, they are only turned about in different directions.

Kyk nou na die volgende ry figure. Die eerste lyk na 'n F, maar al die ander is anders, al draai jy hul ook hoe.

Look at the next row of diagrams. The first one looks like an F but all the others are different no matter how you shift them.

Sommige van die figuurtekeninge in die volgende ry lyk presies net soos die eerste een, ander is nie so nie. Die wat nes die eerste lyk, is met 'n kruisie gemerk.

Some of the diagrams in the next row look exactly like the first one on the row, others are different. Those which look like the first one are marked with a cross.

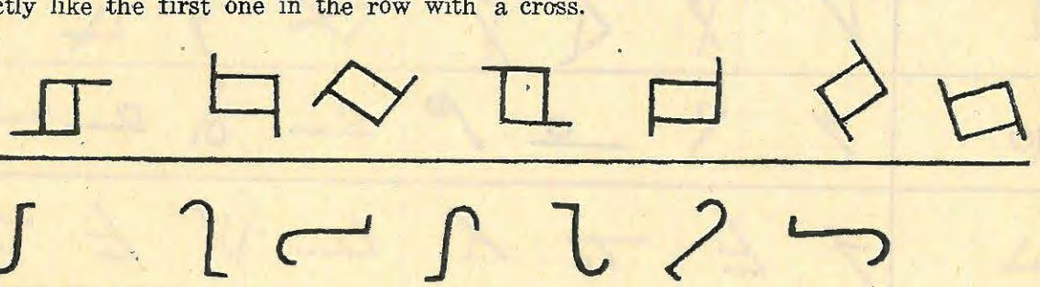


In die volgende ry figuurtekeninge moet jy nou self die wat presies netsoos die eerste een lyk, met 'n kruisie merk.

Mark those diagrams which look exactly like the first one in the following rows with a cross.

Jy moes die eerste en die vyfde figuurtekeninge gemerk het.
Doen nou die volgende twee rye alleen. Merk in elke ry (met 'n kruisie) die figuurtekeninge wat presies netsoos die eerste een in die ry lyk.

You should have marked the first and the fifth ones.
Do the following for exercise. Remember, mark those diagrams which look exactly like the first one in the row with a cross.

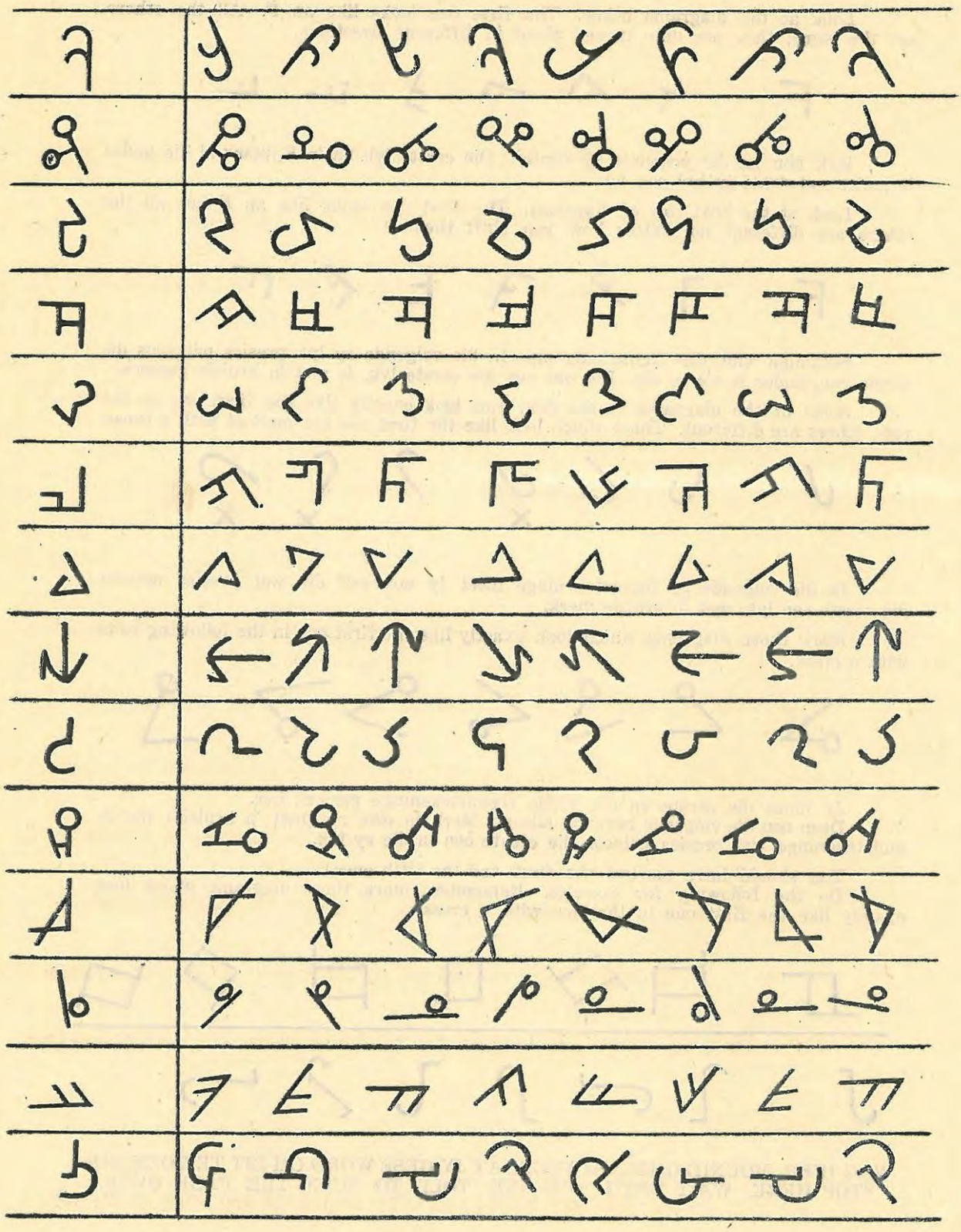


WAG HIER. MOENIE OMBLAAI VOORDAT JY GESÊ WORD OM DIT TE DOEN NIE.
STOP HERE. WAIT UNTIL YOU ARE TOLD TO TURN THE PAGE OVER.

FIGUURTEKENINGE
DIAGRAMS

Merk in elke ry (met 'n kruisie) die figuurtekeninge wat presies net soos die eerste een in die ry lyk. Werk so vinnig en noukeurig as moontlik.

In each row, mark those diagrams which look exactly like the first one in the row with a cross. Work as fast as possible but try not to make any mistakes.



P.E.D. (Edms.) Bpk., St'bosch — 1540-2000—27/2/45.

walk round from one Subject to another, often having to explain individually before the principle was obviously grasped. Other Subjects realized at once what to do, seeming to grasp the idea with great facility; possibly this was because the test involved a special ability. However this may be, to give standardized instructions, rigidly the same, to each Testee, was not possible in the case of the " S " Test.

THE GROUPS.

This test was given to 40 Coloured and 40 European Factory Girls, in Groups of from 5 - 10 each. The test was given immediately before the Progressive Matrices Test; the writer felt that this test acted as a shock absorber, the first part (i.e., Flags) in particular.

The attempts to build up rapport with the Groups have already been described in dealing with the Progressive Matrices Test.

The writer received the impression that many of the Subjects did not like doing this test, and that they found it confusing: although the girls were always warned

TABLE 2.

GROUP	NO.	MEANS	DIFFERENCE BETWEEN MEANS	STANDARD DEVIATION	RESULT OF FORMULA $\frac{M_e \sim M_c}{\sigma_{M_e \sim M_c}}$
European Factory Workers	40	14.625	3.525	12.47	1.5 - i.e. not significant
Coloured Factory Workers	40	11.1		7.99	

TABLE SHOWING RESULTS OF THE "S" TEST.

(See Appendix 1, page 161-162).

TABLE 2 shows that there was a difference of 3.525 in the mean scores (1) of the Coloured and European Groups, in favour of the European Group. But, as in the case of the Progressive Matrices Test, this difference was not statistically significant. (See APPENDIX 1, TABLE B.).

A difference might have been expected to appear in favour of the European Group, in this test, for the following reasons:

1) The points already noted, put forward by BIESHEUVEL.
2) The slightly less favourable conditions under which the Coloured Groups were tested.
3) The majority (about 35) of the Coloured Girls came from a biscuit and sweet factory, whereas most of the European Girls were either machinists in Clothing Factories, or from the Closing Room of Foot and Shoe Factories. This may have meant that the European Girls, engaged on this type of work, would have had some practice in the visual and spatial " S " Factor with which the test deals; or on the other hand that, being engaged on this kind of work, they were to a certain degree a selected Group.

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(1) NOTE ON SCORING: Scores were determined as follows: One mark was given for each Flag correctly marked - Half-a-mark subtracted for each Flag incorrectly marked. This was done because in previous testings it has been found that some Subjects score very high through thoughtlessly marking a large number of Flags.

In spite of these Factors, the difference in favour of the European Group was not statistically significant.

THE DETROIT TEST OF MANUAL ABILITY :

The inclusion of the test of Manual Ability seemed relevant to the present Research. THE DETROIT TEST OF MANUAL ABILITY, devised and standardized by ALBERT C. CROCKETT, of the Psychological Clinic, Detroit Public Schools, was selected for this purpose.

The test is comprised of three parts, each part testing a different kind of hand movement. An average inter-correlation of .35 ± .02 (1) between the three parts points to the existence of some common factor, which CROCKETT calls "Manual Ability", and which he defines as "native expertness and grace in manual acts" .

---

(1) THE inter-correlations between the three parts are as follows:

Parts 1 and 3 + .328 ± .06 n - 125 .

Parts 1 and 2 + .405 ± .06 n - 125 .

Parts 2 and 3 + .326 ± .06 n - 125 .

CROCKETT does not attempt any detailed analysis of the factors entering into these three parts. Apart from the common factor, (in which, he states somewhat vaguely, speed, accuracy, the sense organs and volition are involved) he summarizes the factors involved in each part as follows:

PART 1: Speed in grasping and packing; visual acuity; touch and joint sensitivity.

PART 2: Speed in grasping and packing.

PART 3: Speed in grasping and packing; touch and joint sensitivity.

The validity of the test as a diagnostic agent for picking out workers who will have good production records in factories where the work is of manual nature, seems to be well substantiated. For instance, CROCKETT quotes a relationship of 1·0 between the test performance and the output of workers in a Cigar Box Factory; while the test correlates well with success in packing linen, and satisfactorily with the production records of Tool-maker Apprentices. Furthermore, the Welfare Officer of a Footwear Factory in Port Elizabeth, reports a highly

satisfactory correlation between performance on the test, and output in the Closing Room.

The reliability on all three parts of the tests seems to be satisfactory. In PART 1, the correlation between trials 2 and 3 was + 0.77 ± .02

PART 2, trials 2 and 3, + .77 ± .02

PART 3, trials 1 and 2, and 3 + 4, + 0.68 ± .03 .

DESCRIPTION OF TEST:

A large box, 23 inches long, $9\frac{3}{4}$ inches wide, and $1\frac{3}{4}$ inches deep, contains three smaller boxes, and a board with holes in it. The relative positions of these four parts within the big box are shown in the diagram following:

(OVERLEAF)

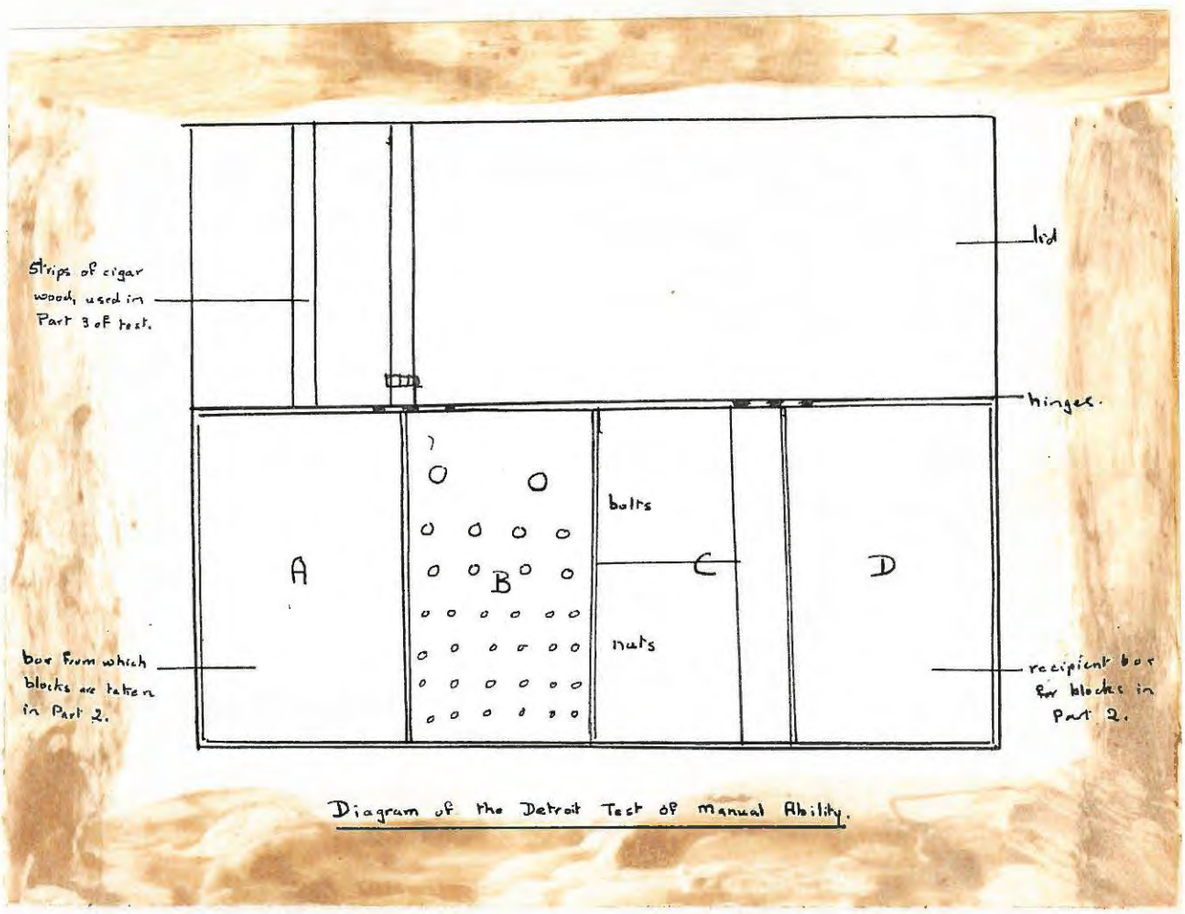

Diagram of the Detroit Test of Manual Ability.

PART 1 of the Test entails the screwing of nuts of various sizes on to the appropriate bolts, and the placing of these bolts, head downwards, into the hole, in a board, which is of the right size. The apparatus for PART 1 consists of B and C in diagram; B represents the board, in which rows of holes of diminishing sizes are drilled; C represents a shallow cigar box, in the upper section of which lie the bolts, and in the lower section of which, the nuts. Three trials of 2 minutes each are

allowed, and the score is the total number completed in these trials.

PART 2 of the test entails the packing of small wooden blocks, 19mm. cubes, from the box represented in the diagram as A, to the box D. The Subject is allowed to use any method of packing he pleases, provided that he does not pick up either of the boxes. The score is the total number of blocks packed during three trials of one minute each.

PART 3 entails the balancing of these same blocks, in lots of three, on two strips of cigar wood (130x41x5 mm.) which are glued on to the hinged cover of the big box. The width of the three blocks amounts to 57mm., so that they overlap the width of the strips on which they have to be balanced. The score for this part is the total number of blocks successfully balanced in four trials of one minute each.

ADMINISTRATION OF THE TEST.

The Group.

This test was administered to the following Groups:

1) a) ... 40 Coloured Factory Girls.
   b) ... 40 European Factory Girls.

2) a) 40 Coloured School Children, aged 14-15 years.
   b) 40 European School Children, aged 14-15 years.

The Test was throughout given as an individual Test, the writer being in possession of only one apparatus. The writer was thoroughly familiar with the administration of the test, having given it to a large number of Factory Workers during a vacation course eighteen months beforehand.

TESTING OF THE FACTORY GROUPS.

The conditions of testing were fairly good. Generally it was fairly easy to obtain a small private room, with chair and table suitable for the individual administration of the DETROIT Test; so that in this respect, conditions were rather more satisfactory than had been the case in giving the

Group Tests.

It would have been useful, in arranging the Groups from Factories to whom this test was given, to have had two Groups engaged on the same type of work. It will be seen from the ensuing discussion that practice in hand movements in a Biscuit Factory probably influenced the results of one Group favourably. However, here the writer was handicapped by the fact that she was unable to choose her Groups, but had rather, to take what she could get. It will be seen that the lack of control of this factor in the two Groups very probably had a fairly profound effect upon the results. As a result, the writer had to repeat the test on Groups of Coloured and European School Children, in order to see whether the result was different when two Groups were involved, differing as before in race, but alike in that neither was daily engaged in work involving several hand movements.

The writer had already met, and established rapport with the girls to whom this test was given, when administering the Group Tests, which were always given before the

individual tests. The writer was therefore able to greet the girls in a friendly manner and to talk to each Subject for a little while about the other tests before saying: " Now I would like you to do this test for me ..... It is " a test of how well you are able to use your hands. " The writer then talked for a while about the three Parts of the Test and the hand movements involved in each Part, in order to establish interest; repeated the promise that the results would have nothing to do with their work or their position in the Factory; the Subjects were told to regard the test as a competition, to see how much better they could become during the three or four trials in each Section. Most of the girls in the two Factory Groups responded to this suggestion and tackled the test with enthusiasm.

This test was not new to all the Subjects. Nine of the Coloured, and two of the European Girls had been tested a year or two years previously, when students who were engaged on the DIPLOMA IN PERSONNEL MANAGEMENT COURSE had administered it during vacation practicals; several other girls, particularly those of the Coloured Group, had heard

of it through discussion with girls in the Factory, who had been tested. The girls in the Coloured Group more especially were, in the opinion of the writer, confident in doing the test, having seen in the past that it led to no bad results for them. Against this was the fact that twenty of the European Girls were tested, as volunteers, at the Athlone Club. For the purpose of this testing the writer stayed for about three weeks at the Athlone Club, a Hostel in Port Elizabeth for Factory Girls. These twenty Girls came forward to be tested in response to several verbal and written pleas from the writer; the volunteers showed marked interest and enthusiasm towards the tests; and for this reason, the writer was able to build up a friendly atmosphere between herself and these Testees more to her satisfaction than in the case of the other Subjects.

The instructions were given to each Subject as laid down by CROCKETT.(1) In the main, these instructions were fairly rigidly adhered to; but in view of the fact that the test was given individually, whereas CROCKETT'S

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(1) CROCKETT, A. C: " A MEASURE OF MANUAL ABILITY." (JOURNAL OF APPLIED PSYCHOLOGY, Vol. 14, No. 5, October 1930.)

instructions are designed for Group Administration, they were, in this instance, softened somewhat from their formality. In fact, the writer made every effort to give the instructions naturally, and in such a way as to maintain rapport with the Subject, even at the risk of departing slightly from the text and thus lowering reliability. In between each trial, Subjects were congratulated on their last performance or encouraged for the next. Subjects were encouraged to talk to the experimenter during the rest pauses between each trial.

RESULTS OF TEST

For Results of this Test (THE DETROIT TEST OF MANUAL ABILITY) see TABLE 3 on Page 124, following.

TABLE 3.

Section of Test	Group	No. in Charge. Group	Means	Difference between means	Standard Deviation.	Result of Formula $\frac{M_e \sim M_c}{\sqrt{\sigma_e \sim \sigma_c}}$
Whole Test	Eur. Factory Workers	40	266.55	57.025	35.57	7 - i.e.
	Col. Factory Workers	40	323.575		36.73	significant difference.
Part I	Eur. Factory Workers	40	47.77	5.2	10.39	2.5 - i.e.
	Col. Factory Workers	40	52.975		8	not significant
Part II	Eur. Factory Workers	40	122.275	32.4	17.58	8.1 - i.e.
	Col. Factory Workers	40	154.675		18.25	Significant
Part III	Eur. Factory Workers	40	96.75	18.9	17.635	4.3 - i.e.
	Col. Factory Workers	40	115.65		20.95	significant

TABLE SHOWING RESULTS ON DETROIT TEST AS A WHOLE, AND ON IT'S THREE SEPARATE PARTS, WHEN GIVEN TO GROUPS OF 40 COLOURED, AND 40 EUROPEAN FACTORY GIRLS.

(See Appendix 1 - pages 166 - 170).

THIS TABLE shows that the performance of the Coloured Girls tested was superior on the whole test, and in every sub-section of the test; the difference on the whole, and on Parts 2 & 3, being statistically significant.

This striking difference in result could be interpreted as follows:

1) It could indicate that the Group of Coloured Girls had a greater innate ability in the factors which came into the test as a whole, and particularly in those entering into Parts 2 & 3;

OR

2) It could be taken to indicate that the conditions of the two experiments were such that the Coloured Group had some undue advantage over the European Group, which caused the former to be more proficient in all or some of the activities involved in the test; this undue advantage being due to some factor, or factors, other than differences in innate ability.

Before concluding that the superior performance of the Coloured Group was due to innately superior manual ability, it is necessary to check up on those factors which

are implied in point (2).

The greater part of the Coloured Group tested, consisted of girls from a Biscuit Factory; these girls were engaged, daily, and some of them over a period of years, on such operations as creaming biscuits, packing biscuits, placing the upper halves of biscuits squarely upon the lower halves, as they passed by on a moving belt; all of which operations involved delicate finger movements, hand-eye co-ordination, and accuracy in placing.

As we have already noted, the DETROIT TEST involves, in PART 1 , visual acuity, touch and joint sensitivity, and delicate hand and finger movements necessary for screwing the nuts and bolts together; in PART 2, the operation is one of grasping and packing rapidly; in PART 3, blocks must be balanced on a ridge with neat and precise hand movements.

Comparatively few of the European Girls were employed in Sweet or Biscuit Factories; the majority of them came from the Closing Rooms of Footwear Factories, or the

Machining Sections of Clothing Factories. While the hands are, of course, used in these operations, the hand movements involved daily by the Girls in the Biscuit Factories were very much more akin to those involved in the DETROIT TEST than are those of the Machinists.

It seemed, then, that the possibility that the Coloured Group had benefited by a practice effect should be investigated. CROCKETT states specifically that the test as a whole is representative of common manual ability, and that it presents to us a picture of the worker at work. Girls working in a Biscuit Factory are undoubtedly occupied throughout the day with manual work. The effect of this experience in manual work would, then, be to some extent equivalent to a practice effect in actually doing the tasks involved in the tests. CROCKETT gives figures which show that practice in doing the test brings about a definite improvement in results. Thus, when the test was performed by one individual for 26 days, the gain on PART 2 was an average difference of 12 points per trial; on PART 1, of 6 points per trial; and of 3.5 points on PART 3. These Coloured Workers in the Biscuit Factory had practice extending over months or years

in somewhat similar tasks; thus, especially in a test which claims to give a picture of the Worker at Work, it would not be unreasonable to suppose that a somewhat profound practice effect might be constituted thereby. The further possibility that factors of selection might have entered to make the workers in the Biscuit Factory a somewhat above-average Group, as far as this manual ability was concerned, was also considered as a possible contributing cause to the difference shown by the results of the test.

Furthermore, the Coloured Group was, as we have already noted, rather more familiar with the testing situation than was the European Group. For these reasons, it was decided that further testing was necessary as a check on the results.

THE SCHOOL GROUPS.

The test was given to a group of 40 Coloured, and of 40 European, School Girls. The children tested were of the 14 - 15 year age Group. The ages ranged from 13 years and 5 months, to 16 years and 4 months; but the

majority of children were actually 14 or 15 years of age. The writer explained to the Principals of the schools to which she went, that she wanted children of the 14 - 15 age Group. The Principals concerned made out lists of children of this age, which were handed to the Tester and to teachers. These children were then sent to the Tester one by one. Here again, the writer did not have an unlimited supply of material from which to select, too rigidly, a precise age Group; and this reason, together with the fact that for this purpose (1) a rigid age selection did not seem essential, caused her to accept a few children just under 14, and slightly over 15 years. The mean age for the Coloured Group was 14 years and 6 months; for the European Group, 14 years and 3 months.

Of the Coloured Children tested, thirty four came from a High School (Std. 7) and six were from a Mission School (Standards 5 & 6). The European Children were gathered from three sources. Twenty were from a High School (Std. 7) and the remaining twenty were from

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(1) This 14 - 15 age level was chosen somewhat arbitrarily as one at which School Children would be readily available, and which at the same time was probably not too far disparate from the ages of Factory Girls.

Standards 5 & 6 of two Primary Schools. An attempt was made to select schools where the home conditions of the European Children were not too far above those of the Coloured Children, economically; none the less, the European Children as a whole, and particularly those from the High School, were certainly from homes of an economic standing in advance of the homes from which the Coloured Children came; to equate the two exactly proved to be impossible. The European Group cannot, in fact, be called a "pre-factory" Group; of those Girls in the Primary Schools who were tested, very few had intentions of going to work in the factories; while none of those in the High School had that design in view.

In both Groups, the Principals were asked to provide an unselected Group, i.e., to send children representing all levels of ability.

The general procedure was the same as in testing the Factory Groups. In the case of the 20 European Children from the High School, rapport was easily established. The children were obviously interested in the test situation,

enjoyed doing it and tackled the tasks in an eager, competitive spirit. The European Children from the Primary Schools seemed more listless, and less interested to see " how well they could do " .

In testing the Coloured High School Children, the writer felt a distinct lack of rapport. In spite of her efforts, she usually felt that she had failed to establish the friendly and enthusiastic atmosphere which is desirable. The children did not seem interested in the situation; between the first and second trial of a given part of the test, the writer tried to encourage these children in particular, and to spur them on, but she noticed that they did not seem to make a great effort to improve; although the European School Children had made this effort. It is possible that these Coloured Children, with a fair amount of education, were becoming very aware of their social position and the injustice of the Colour Bar; and thus viewed a European Tester with resentment; we must remember, too, the point already quoted from BIESHEUVEL'S discussion, that to the Coloured child every hour of school is probably valuable and acquired with sacrifice at home; hence any

interruption would be unpopular.

RESULTS.

The results of testing these School Children are shown in the TABLE following :

(SEE FOLLOWING PAGE FOR TABLE).

TABLE 4.

Section of Test	Group	No. in Group.	Means	Difference Between Means	Standard Deviation	Result of Formula $\frac{Me \sim Mc}{\sqrt{Me \sim Mc}}$
Whole test	European School Children	40	273.225	9.925	34.86	1.4 - i.e. not significant
	Coloured School Children	40	283.15		29.96	
Part I	European School Children	40	50.075	.05	8.8	.025 - i.e. not significant
	Coloured School Children	40	50.125		8.6	
Part 2	European School Children	40	121.1	12.3	18.814	3.09 - i.e. probably significant
	Coloured School Children	40	133.4		16.67	
Part 3	European School Children	40	102.05	2.425	16.34	0.6 - i.e. not significant
	Coloured School Children	40	99.625		14.96	

TABLE SHOWING RESULTS OF DETROIT TEST OF MANUAL ABILITY, WHEN PERFORMED BY GROUPS OF COLOURED AND EUROPEAN SCHOOL CHILDREN, AGE 14 - 15 YEARS.

(See Appendix 1, pages 171-175).

From this Table, it will be seen that, although there is a difference between the means of the two Groups, in favour of the Coloured Group, in all but PART 3; these differences are insignificant except in the case of PART 2, where the difference in favour of the Coloured Group is <u>probably significant</u>. It should be noted that in the testing of the Factory Groups, there was, on this PART 2, a very definite difference in favour of the Coloured Group. $\left\{ \frac{M_e \sim M_c}{\sigma_{M_e \sim M_c}} = 8.1 \right\}$

Taken as a whole, however, the results of this second testing suggest, that practice effects, and factors of selection, contributed considerably towards the superior performance of the Coloured Groups (Factory Groups).

It is to be noted that in this second testing, the performance of the Coloured Children shows a slight but consistent superiority to that of the European Children; and that this difference exists, in spite of the writer's view, that she lacked rapport with the Coloured Group, and that the Coloured Children did not exert themselves in the

test situation, to the same degree as the European Children did. However, this factor is merely one which the writer imagines that she perceived; and to put them forward as fact would be highly unscientific. All we can say in interpreting the results of both School and Factory testings, is that:

1) The results seem to point to the fact that the significant difference arising in the Factory testing was due, in part at least, to factors other than innate superiority of manual ability on the part of the Coloured Workers.

2) The Coloured School Group shows a slight, but statistically insignificant, superiority to the European School Group, on all but the third part of the test; this superiority exists, in spite of the various factors we have noted, some of which were definitely, and others probably, disadvantageous to the Coloured Groups.

3) In PART 2, the significant difference in the Factory result, and the probably significant difference in the School result, are both in the same direction. It is possible that this may point towards the existence of a Coloured superiority in the ability required for PART 2 of the test; and it would be interesting to see the result of further experimentation on this point.

ROUTINE ASSEMBLING TEST.

The FOURTH TEST included in the Battery was a test of " ROUTINE ASSEMBLING ABILITY " . THE IDEA FOR THIS TEST was taken from the Research of J.W. COX, which he reports in his book " MANUAL SKILL " . In this book, COX describes five tests as measuring this " ROUTINE ASSEMBLING ABILITY " ; all of which involve the assembling or dismantling of the parts of an Electric Lamp Holder.

Before describing the tests, and the administration of the tests selected, we will discuss the significance of the term " ROUTINE ASSEMBLING ABILITY," as it is used by COX.

For the sake of clear understanding in this discussion, we will state briefly, at the outset, that according to COX, " ROUTINE ASSEMBLING ABILITY ", is an ability which is something less than mechanical ability, in which a problem has to be solved; but something more than mere manual ability.

COX criticizes the usual subjective analysis of manual operations. He points out, for example, the defects of the common system of classifying motor tests as " speed " tests and " accuracy " tests; for while such a classification may be useful for some purposes, the two terms are obviously not mutually exclusive. Thus, all " speed " tests need some degree of accuracy, and " accuracy " tests generally have some reference to a speed factor. This is just one example of a defect typical of current methods of analysis. COX notes other unsatisfactory features, such as failure to differentiate between the movements involved in an operation, and the effect which these movements bring about; and failure to indicate the psychological processes upon which these activities depend.

For these and allied reasons, COX postulates the need for a different kind of analysis of manual operations.

He states that:

" such an analysis would distinguish the objective
" character of a movement from the movement itself,
" and should not confuse the activity which sustains
" the movement with the physical results achieved
" by the movement (the work done), nor with the
" stimulus in response to which the movement is made.
" It should also distinguish between that part of
" the movement which is physiological, and that
" which is psychological. Above all, it should
" aim at resolving the latter into ultimate, unitary,
" mental processes. "

COX attempts an analysis, along these lines, of the operations involved in the assembling of an electric lamp holder: He considers that the operations here involved are fairly representative of the different movements required in assembling and other occupational activities. Assembling operations were chosen by COX for investigation for various reasons, among them being the fact that assembling operations are very frequently present in industry; and because the numerous assembling operations appearing in industry have many points in

common, "all depending on skilful and rapid movements
"of the fingers, in which sight and touch play
"a guiding part."
and in "bringing external objects into correct spatial
"adjustment with one another. "

COX distinguishes mechanical assembling operations from routine assembling operations. The term 'mechanical assembling', he applies to a task where a mechanical problem is present in the assembling work, as, for example, when in order to assemble the object, the Subject has to think out the relative order and positions to be occupied by the various parts. When, however, this problematical aspect of the assembling is absent, and nothing more is required than the manual skill, together with the factor which enables the Subject to retain in his mind the relative order and positions of the pieces in the assembling process, then COX applies the term ' routine assembling ' to the abilities involved.

The difference between the tests which COX applies to each, helps to clarify the distinction between 'routine' and 'Mechanical' assembling.

In the tests for Mechanical Assembling, the Subjects were required to assemble the parts of the Electric Lamp Holder without previous experience or instruction; in the tests for Routine Assembling, the same task was put before the Subject, but only after he had become thoroughly familiar with the process of assembling the parts. Thus, in the latter case, the same task was set before the Subject as in the test of Mechanical Assembling; but in the Routine Assembling test, the problematical element had been removed.

This Routine Assembling factor is one which comes frequently into operations such as are of interest in connection with the present Research. Machining Operations in Clothing Factories, operations in the Closing Rooms of Boot and Shoe Factories, are of such a nature that the following statement made by COX can relevantly be applied to them: - - -

) " they

" ..... they all depend on skilful and rapid
" movements of the fingers, in which sight and touch
" play a guiding part. They all consist in bringing
" external objects into correct spatial adjustment
" with one another. "

These operations, i.e., machining operations in Closing Rooms of Footwear Factories, or in Clothing Factories, involve Routine Assembling Ability in the same essential way, although whereas, in the processes which COX studied, steel parts had to be assembled, in this case the materials are cloth or leather. Furthermore, in the above operations the necessary assembling factor is of the Routine rather than the Mechanical kind.

THE TESTS.

Two tests of Routine Assembling Ability were used in the present Research.

In the discussion which follows, these tests will be referred to as PART 1 and PART 2.

PART 2 was taken directly from the battery of five tests of ' Routine Assembling Ability ' , used by COX, and described by him in "MANUAL SKILL" . Of all

these five tests, this one (assembling parts A, B & C in diagram) has the highest saturation of this Routine Assembling factor. (Saturation = ·65) .

PART 1, as used in this Research, is slightly different from any of the tests actually used by COX in his Research. COX did not use this exact combination (parts: A, B, C, D & E, in diagram.) .

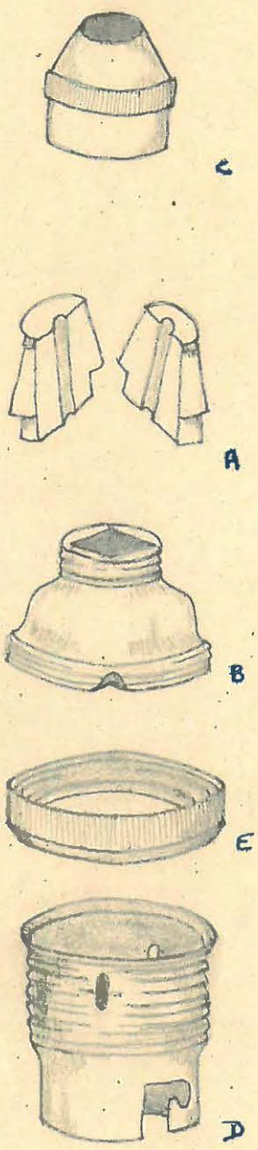
DESCRIPTION.

The apparatus, then, consists of five parts of an Electric Lamp Holder, such as those shown in PLATE II .

PART 1.

The five pieces, A, B, C, D, and E, were arranged in standard positions (See PLATE III) .

The Subject was taught, thoroughly, how to put these five pieces together. The test then consisted of the time taken to assemble these parts; five trials were given, and an average taken.



The five parts of the Electric Lamp holder, used in Part I of the test. For Part II of test, A, B, and C were used.

Plate II.

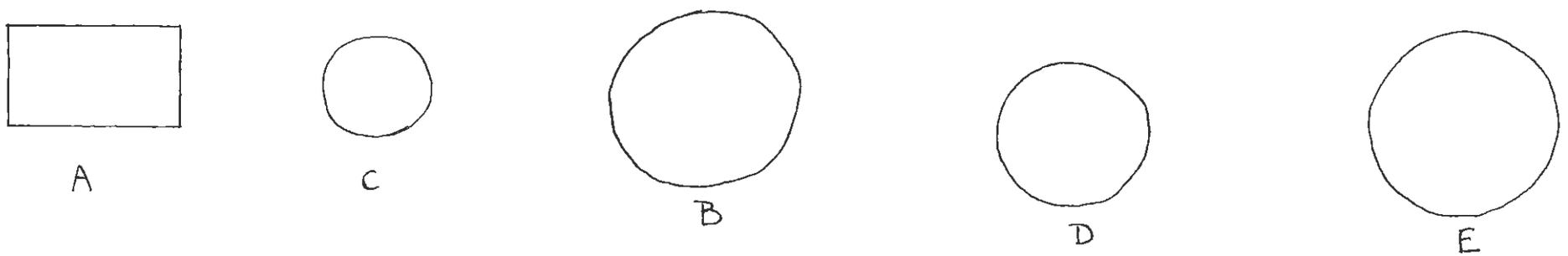
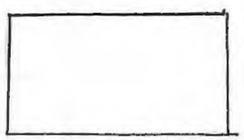


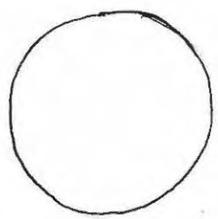
Plate III

DIAGRAM SHOWING THE STANDARD POSITIONS IN WHICH THE PIECES A, B, C, D, AND E (SEE PLATE II) WERE PLACED FOR PART I OF TEST.

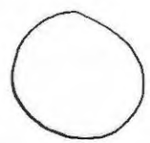
The five parts of the Lamp-holder were placed in position as above. The foolscap sheet was then pinned to the table, in front of the Subject. The five parts are placed in the order, from left to right, in which they were picked up to assemble the lamp-holder.



A



C



B

Plate IV

DIAGRAM SHOWING THE POSITION IN WHICH THREE PIECES A, B, AND C (SEE PLATE II) WERE PLACED FOR PART II OF THE TEST.

PART II

The three pieces, A, B, & C, were arranged in standard positions. (See Plate IV). The Subjects were taught how to assemble these three pieces; the test then consisted of the time taken to assemble these parts. Again, an average of five trials was taken.

The tests were given to the Subjects individually, immediately after they had been tested on the DETROIT TEST. Thus, rapport had already been established in the administering of the former test.

The Subjects were instructed as follows:

" Now, you know what these (indicating the parts
" of the lamp-holder) are, don't you? They
" are the parts of an ordinary electric lamp-holder.
" I am going to show you how to put them together,
" and when you have learned how to do it, we are
" going to see how well you can remember the way,
" and how quickly you can put them together. "

The assembling of the pieces was then demonstrated, with verbal explanation as follows:

" You see these two little wooden parts (A);
" they fit together like this (demonstrating),
" and then the narrow ends go into the top of "B".

" Then you take "C", and screw it on to "B", right
" down over the little wooden parts, "A". See
" that you screw "C" right down as far as it will
" go - like this. (1) Now, you take "E", and
" slip it on over this end of "D", in this way, so
" that the screw part sticks up. Notice that it is
" no use putting it on like this, or like this " -
(demonstrating common mistakes noted in the
trial administration of the tests, and in
which Subjects had tended to show consider-
able perseveration).

" It must be put on so that the screw part sticks up
" like this, for this other part (the screw edge of
" 'B') has to screw into it. Like this ..... you
" see? See that you screw it down as far as it will
" go. Now have a try and see if you remember how to
" do it. "

The Subject was then allowed to practise putting the pieces together; as it is an intrinsic feature of routine assembling that the Subject should know how to do the task involved, it was ascertained that each Subject thoroughly understood how to assemble the parts before the actual testing was begun. Thus the amount of instruction varied

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(1) THIS firm explanation of this point was necessary, to eliminate differences in time brought about by different degrees of screwing down of "C" on to "B".

with the quickness of the individual to understand and perform the required task. When the Subjects had reached this stage, they were instructed:

" Now, you know what you have to do? We are going
" to see how quick you can be about doing it. You
" are going to have five tries, and we'll see how
" much better you get each time. Begin when I say
" 'Ready, Go!', and when you have finished, put
" the lamp-holder down on the table, and I will stop
" the watch. "

Between PARTS I and II, the Subjects were allowed a short rest. The parts of the lamp-holder were then arranged for PART II, and Subjects were instructed:

" Now this time all you have to do is to put these
" first three parts together (indicating "A", "B",
" and "C"). You remember what you have to do -
" the two wooden parts fit together like this, the
" narrow part fits into the top of "D", and then
" you screw "C" down over them. Remember to screw
" "C" right down as far as it will go. Now, just
" show me that you remember what to do. " (1)

The test was then given five times, as before.

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(1) This mainly for the sake of a few dull Subjects, who were bewildered at the slight change in the situation.

COMMENTS ON THE SUBJECTS IN THIS TEST SITUATION

Individual differences in the time taken to do PART I were considerable (some completing the task in 13 seconds, others taking as long as 43 seconds). Many of the Subjects, once they had mastered the piecing together of the parts, were able to go right ahead and complete the task in as short a time as their speed of hand movement allowed them; others, however, seemed unable to "remember" how to put the pieces together, although they seemed to have mastered the task beforehand. The time taken by these Subjects became high, because their response was often perseverative and unadjustive, the Subject trying over and over again, e.g., to screw a part on to the wrong end of the part to which it had to be fitted. Some Subjects would do their first and second attempt correctly, then, in the third or fourth, try to put the pieces together in an entirely wrong manner. Many of the Subjects, even after having learnt the method of assembling thoroughly, seemed to have to think hard about putting the pieces together. "A", "B", and "C" were easily assembled by most of the Subjects; it was in fitting

"D" and "E" together, and in affixing "A" "B" "C" to "D" "E" that the difficulty seemed so great.

In PART II, only "A" "B" and "C" had to be put together. Subjects were able to do this without difficulty. The perseveration of incorrect responses, and the " forgetting " of the learned procedure did not seem, in this case, to be factors which contributed to the differences in time taken by the individual Subjects. The time taken to complete PART II seemed to depend more simply on the actual finger manipulation in putting the three parts together, than was the case with PART I, where, as we have stated above, the time taken seemed to depend to a large extent on a "thinking out" process.

Of the tests used by COX to measure ROUTINE ASSEMBLING ABILITY, this present PART II (called the 'WEDGE' Test by COX) was the test with the greatest degree of saturation of this ability, having a coefficient of .65. Without research on the subject, it is impossible to state whether PART I as used in this research, had a saturation of the ability higher, or lower, than that of PART II.

COX gives an analysis of the factors present in "ROUTINE ASSEMBLING", as follows:

1) General ability as measured by Intelligence Tests.

2) A group factor especially associated with the Routine work.

3) To a less extent, the mechanical factor which comes into Mechanical Assembling.

4) Elements peculiar to each operation.

From the present writer's observations on the Subjects in the process of doing PART I, related above, it is possible that in PART I of this experiment, 1) and 2) of the above listed factors may be more preponderantly present than is the case with PART II. This, however, can only be put forward as an opinion, as no research has been carried out to throw light on this point.

(TABLE FOLLOWS ON ENSUING PAGE)

TABLE 5.

Section	Group	No.	Mean	Difference between Means	Standard Deviation	Results of Formula $\frac{Me \sim Mc}{\sigma_{Me \sim Mc}}$
Part I	European Factory Workers	40	23.104 Seconds	0.146	5.412	0.09 - i.e. not significant.
	Coloured Factory Workers	40	23.25 Seconds		7.56	
Part II	European Factory Workers	40	9.62 Seconds	0.14	2.62	0.09 - i.e. not significant
	Coloured Factory Workers	40	9.48 Seconds		1.7	

TABLE SHOWING RESULTS OF THE ROUTINE ASSEMBLING TEST, PARTS I AND II WHEN PERFORMED BY GROUPS OF 40 COLOURED AND 40 EUROPEAN FACTORY WORKERS.

(See Appendix 1, pages 163-165).

The Results in the foregoing Table show that the difference between the means was very slight, amounting to less than one second in both PART I and PART II of the test. These differences were not significant. Of the results of PART II, which we know to be well saturated with ROUTINE ASSEMBLING ABILITY, we may say, that the Coloured and European Groups showed no difference in this ability; of the results on PART I, we may say that it confirms this conclusion in so far as PART I is a test of ROUTINE ASSEMBLING ABILITY; and shows an equality between the Groups on whatever other factors it may have involved.

CHAPTER 6

SUMMARY

We may summarize the results of this Research briefly, as follows:

Four tests were chosen, in accordance with their relevance to operations in the Machining Rooms of Clothing Factories, or the Closing Rooms of Footwear Factories. These four tests were :

i) THE DETROIT TEST OF MANUAL ABILITY, devised by CROCKETT;

ii) A TEST OF ROUTINE ASSEMBLING, devised by COX;

iii) THE PROGRESSIVE MATRICES INTELLIGENCE TEST, designed by RAVEN ; and

iv) THE " S " TEST, published at Stellenbosch on the basis of an idea from THURSTONE .

These four tests were given to 40 Coloured, and to 40 European, Factory Workers.

No significant difference in performance appeared in the results of the PROGRESSIVE MATRICES TEST, the " S " test, or the ROUTINE ASSEMBLING TEST. On the DETROIT TEST, a significant difference in favour of the Coloured Group was

shown by the results of PARTS I and II and on the test as a whole. But when a further experiment was carried out, using Coloured and European School Children as the Subjects, this result was not confirmed; it is inferred by the writer from this, that the superior performance of the Factory Group on this test was due, more probably, to factors of practice and selection, than to superior ability on the part of the Coloured Workers.

The conclusion to which this leads is as follows :

> That on the basis of this Research, and as far as a conclusion can be formed from the methods used and the Groups tested, there is no significant difference between European and Coloured Factory Workers in Port Elizabeth Industry, in the abilities tested by the four tests used in this Research.

VALUE OF RESEARCH

If a Research such as this is undertaken, it is necessary to form a critical attitude of mind towards the methods, and the defects of method, used in the Research; it is necessary, furthermore, to point these out emphatically; particularly since so called scientific evidence of

Race Differences is all too eagerly seized upon to bolster up prejudices in South Africa. Thus FICK published data of an experiment which showed that African Intelligence Test Scores are inferior to those of Europeans; many South Africans, even psychologists, too hastily accepted this result as indicating that African Intelligence is lower than that of Europeans, and quoted FICK'S result as providing proof of this fact. Yet it is possible to interpret these results quite differently, as is shown by BIESHEUVEL'S remarks in " AFRICAN INTELLIGENCE " .

The writer wishes to make the following points clear, in evaluating the present Research; these points have been mentioned during the foregoing Chapters, but for the sake of emphasis we will repeat them here :

1) The Research aims at comparing the test performances of Coloured and European Girls who form the Industrial Class of Port Elizabeth; thus the Research does not attempt, and makes no claim, to throw light on the problem of Race Differences between Coloureds and Europeans. The interest of the Research is concentrated on this Industrial Class only of each race; and the results can

only be of value in so far as this specific question is concerned:viz: Is the employment of Coloured Labour likely to cause a difference in efficiency, in so far as this is dependent on the four " Abilities " tested in this Research, as compared to the employment of European Labour in a given Industrial situation? The investigation found no significant differences in the " Abilities " tested.

2) There may be other factors, e.g., Temperament, Attitude towards Employers, as well as other Abilities, which will produce differences in efficiency between the Groups; but this Research has not attempted to deal with these.

3) The conditions under which the experimentation was carried out, were far from ideal. It is stated by BARNES, who carried out a Research in the same Industrial Spheres in Port Elizabeth, as in the present Research, (1) that "Research " work undertaken in Industrial Spheres can rarely " be judged by ideal standards, for the conditions " under which such work is generally undertaken, " simply do not contain the necessary facilities." In the carrying out of this investigation, the

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(1) BARNES, J. S.: " REPORT ON THE CONSTRUCTION OF A BATTERY OF TESTS FOR THE SELECTION OF CLICKERS ". This point has been made by HULL in "APTITUDE TESTING". We quote BARNES because he experienced the identical local conditions, at an earlier date.

present writer found this to be very true. The Management of the various Factories approached, was invariably sympathetic. But testing had to be carried out in such a way as not to interfere with production. This meant that to administer 4 tests, taking at least two hours in all, for each Subject, involved a long time period; for the tests had to be spread out, to fit in with the availability of the Subjects. The testing of five girls, would frequently take as long as a week to complete. As the time which the writer had at her disposal was limited, this factor prevented the testing of larger Groups. Furthermore, only two local Factories employed large numbers of Coloured Girls; the generosity of these Factories in allowing forty girls to be tested was considerable. To have obtained a larger Coloured Group would have been most difficult. It had originally been intended to test 50 of each Group (according to HULL, a Test Group should consist of at least 50 or 60 Subjects); (1) but for the reasons given above, the writer had to be content with 40 in each Group. A Group of 40 is probably the bare minimum worthy of serious experimental consideration. For this reason, as well as the fact that but four of many possible abilities were tested, the results can only be accepted as an indication, and a background for further testing.

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(1) HULL : " APTITUDE TESTING " page 341. HULL is here speaking of Trial Groups in Administering Test Batteries.

A P P E N D I X 1

The following procedure was used to determine whether a significant difference existed between the scores obtained on the tests by the European and Non-European Groups.

Consider the actual scores shown in TABLE A 1 (page 157). From these scores the mean for each Group can be found (M_e and M_c) : and the mean of the scores squared (M_e^2 and M_c^2) can be found.

It can now be ascertained whether the difference between the means is significant or not, by the method shown on page 158 .

Table A 1. Progressive Matrices Group Test.
(For Groups, Factory, Coloured and Factory European).

Subject No.	European Group		Coloured Group.	
	Score	Score ^{2}	Score	Score 2
1	16	256	35	1225
2	20	400	19	361
3	28	784	16	256
4	39	1521	14	196
5	22	484	20	400
6	25	625	13	169
7	46	2116	19	361
8	16	256	14	196
9	14	196	18	324
10	25	625	17	289
11	20	400	11	121
12	26	676	10	100
13	23	529	8	64
14	39	1521	20	400
15	23	529	19	361
16	44	1936	19	361
17	15	225	23	529
18	21	441	23	529
19	17	289	11	121
20	31	961	24	576
21	9	81	15	225
22	30	900	20	400
23	47	2209	18	324
24	37	1369	32	1024
25	23	529	24	576
26	31	961	43	1849
27	13	169	29	841
28	49	2401	11	121
29	20	400	12	144
30	13	169	15	225
31	22	484	23	529
32	15	225	31	961
33	32	1024	31	961
34	33	1089	38	1444
35	33	1089	39	1521
36	35	1225	38	1444
37	18	324	41	1681
38	35	1225	45	2025
39	28	784	46	2116
40	17	289	9	81
	1050	31,716	913	25,431

$M_e = \frac{1050}{40}$ $M_e^2 = \frac{31716}{40}$ $M_o = \frac{913}{40}$ $M_o^2 = \frac{25431}{40}$

$= 26.25$ $= 792.9$ $= 22.825$ $= 635.775$

From Table A1.

$M_c = 22.825$ $\qquad$ $M_e = 26.25$

$M_c^2 = 635.775$ $\qquad$ $M_e^2 = 792.9$

$$\sigma_c = \sqrt{M_c^2 - (M_c)^2} \qquad \sigma_e = \sqrt{M_e^2 - (M_e)^2}$$

$$= \sqrt{635.775 - 520.752} \qquad = \sqrt{792.9 - 689.06}$$

$$= \sqrt{115.023} \qquad = \sqrt{103.8}$$

$\sigma_{dist\ C} = 10.724$ $\qquad$ $\sigma_{dist\ E} = 10.15$

$$\sigma_{M_c} = \frac{10.724}{\sqrt{40}} \qquad \sigma_{M_e} = \frac{10.15}{\sqrt{40}}$$

$$\sigma_{M_c \sim M_e} = \sqrt{(\sigma_{M_e})^2 + (\sigma_{M_c})^2}$$

$$= \sqrt{\frac{10.15^2}{40} + \frac{10.724^2}{40}}$$

$$= \sqrt{\frac{218.823}{40}}$$

$$= \sqrt{5.47}$$

$$= 2.33$$

If the value $\frac{M_e \sim M_c}{\sigma_{M_e \sim M_c}}$ is greater than 4, then the difference is significant.

$$\frac{M_e \sim M_c}{\sigma_{M_e \sim M_c}} = \frac{26.25 - 22.8}{2.33}$$

$$= \frac{3.45}{2.33}$$

$$= 1.4$$

In the above example, $\frac{M_e \sim M_c}{\sigma_{M_e \sim M_c}}$ is less than four.

Thus the difference is <u>not significant</u>.

Table A 2.

Progressive Matrices Group Test.
(For Groups, School Coloured and School European).

Subject No.	European Group		Coloured Group.	
	Score	$Score^2$	Score	$Score^2$
1	14	196	33	1089
2	36	1296	19	361
3	32	1024	18	324
4	37	1369	36	1296
5	35	1225	24	576
6	31	961	13	169
7	17	289	12	144
8	36	1296	8	64
9	26	676	11	121
10	26	676	40	1600
11	27	729	12	144
12	38	1444	29	841
13	22	484	25	625
14	36	1296	36	1296
15	37	1369	36	1296
16	27	729	26	676
17	25	625	31	961
18	35	1225	33	1089
19	37	1369	34	1156
20	38	1444	39	1521
21	36	1296	41	1681
22	44	1936	22	484
23	36	1296	32	1024
24	39	1521	22	484
25	37	1369	21	441
26	29	841	38	1444
27	31	961	35	1225
28	23	529	26	676
29	29	841	41	1681
30	12	144	26	676
	928	30,456.	819	25,165

$M_e = \frac{928}{30}$ $M_e^2 = \frac{30456}{30}$ $M_c = \frac{819}{30}$ $M_c^2 = \frac{25165}{30}$

$= 30.93$ $= 1015.2$ $= 27.3$ $+ 838.833$

From Table A2.

$M_e = 30.93$ $M_c = 27.3$

$M_e^2 = 1015.2$ $M_c^2 = 838.833$

$\sigma_e = \sqrt{M_e^2 - (M_e)^2}$ $\sigma_c = \sqrt{M_c^2 - (M_c)^2}$

$= \sqrt{1015.2 - 956.6649}$ $= \sqrt{838.833 - 745.29}$

$= \sqrt{58.5351}$ $= \sqrt{93.543}$

$\sigma_{dist\ e} = 7.65$ $\sigma_{dist\ c} = 9.671$

$\sigma_{M_e} = \frac{7.65}{\sqrt{30}}$ $\sigma_{M_c} = \frac{9.67}{\sqrt{30}}$

$\sigma_{M_e \sim M_c} = \sqrt{\sigma_{M_c}^2 + \sigma_{M_e}^2}$

$= \sqrt{\frac{9.67^2}{\sqrt{30}^2} + \frac{7.65^2}{\sqrt{30}^2}}$

$= \sqrt{\frac{152.0781}{30}}$

$= \sqrt{5.069}$

$= 2.249$

$\frac{M_e \sim M_c}{\sigma_{M_e \sim M_c}} = \frac{30.93 - 27.3}{2.249}$

$= \frac{3.63}{2.25}$

$= 1.6$

In the above example $\frac{M_e \sim M_c}{\sigma_{M_e \sim M_c}}$ is less than four, therefore the difference is not significant.

Table B.

"S" TEST.
(For Groups - Factory Coloured and Factory European).

Subject No.	European Group		Coloured Group.	
	Score	Score^2	Score	Score^2
1	5	25.00	5.5	30.25
2	8	64.00	6.5	42.25
3	6	36.00	0.0.	0.0
4.	3.5	12.25	5.5	30.25
5	28.5	812.25	6.5	42.25
6	59	3481.00	18.5	342.25
7	12	144.00	11.5	132.25
8	51	2601.00	24	576.00
9	24	576.00	.5	.25
10	20.5	420.25	9.0	81.00
11	0	0.00	10.5	110.25
12	13.5	182.25	13.0	169.00
13	32.5	1056.25	20.5	420.25
14	21	441.00	7.0	49.00
15	5	25.00	3.5	12.25
16	7	49.00	8.0	64.00
17	3	9.00	13.5	182.25
18	9.5	90.25	0	0
19	20.0	400.00	11.5	132.25
20	17.5	306.25	11.0	121.00
21	13.5	182.25	17.0	289.00
22	9.5	90.25	20.5	420.25
23	1.5	2.25	5.0	25.00
24	3.5	12.25	7.5	56.25
25	8.5	72.25	17.0	289.00
26	17.5	306.25	36.0.	1296.00
27	4	16.00	11.0	121.00
28	10	100.00	15.0	225.00
29	3.5	12.25	7.5	56.25
30	20	400.00	24.0	576.00
31	15	225.00	1.0	1.00
32	19	361.00	7.0	49.00
33	17	289.00	7.0	49.00
34	31	961.00	1.5	2. 25
35	1	1.00	18.5	342.25
36	20	400.00	8	64.00
37	18.5	342.25	8.5	72.25
38	14	196.00	27	729.00
39	1	1.00	6.5	42.25
40	10.5	110.25	15.5	240.25
	585.0	14811.00	444.0	7482.00

$M_e = \frac{585.0}{40}$ $M_e^2 = \frac{14811.0}{40}$ $M_c = \frac{444}{40}$ $M_c^2 = \frac{7482}{40}$

$= 14.625$ $= 370.275$ $= 11.1$ $= 187.05$

From Table B.

$M_e = 14.63$ $\qquad$ $M_c = 11.1$

$M_e^2 = 370.275$ $\qquad$ $M_c^2 = 187.05$

σ dist e $= \sqrt{M_e^2 - (M_e)^2}$ $\qquad$ σ dist c $= \sqrt{M_c^2 - (M_c)^2}$

$= \sqrt{370.275 - 214.036}$ $\qquad$ $= \sqrt{187.05 - 123.21}$

$= \sqrt{156.239}$ $\qquad$ $= \sqrt{63.84}$

$= 12.49$ $\qquad$ $= 7.99$

$\sigma_{M_e} = \frac{12.49}{\sqrt{40}}$ $\qquad$ $\sigma_{M_c} = \frac{7.99}{\sqrt{40}}$

$\sigma_{M_c \sim M_e} = \sqrt{\sigma_{M_e}^2 + \sigma_{M_c}^2}$

$= \sqrt{\frac{12.49^2}{40} + \frac{7.99^2}{40}}$

$= \sqrt{\frac{220.079}{40}}$

$= \sqrt{5.5019}$

$= 2.34$

$\frac{M_e \sim M_c}{\sigma_{M_e \sim M_c}} = \frac{14.625 - 11.1}{2.34}$

$= 1.5$

In the above example $\frac{M_e \sim M_c}{\sigma_{M_e \sim M_c}}$ is less than four, the difference is <u>not significant</u>.

TABLE C. ROUTINE ASSEMBLING TESTS.

(For Groups, Factory Coloured and Factory European).

	PART A				PART B			
Subject No.	European Group		Coloured Group.		European Group.		Coloured Group	
	Score (No. of Seconds).	Score^2	Score (No. of Seconds)	Score^2	Score (No.of Seconds)	Score^2	Score (No. of Seconds)	Score^2
1	21.68	470.0224	19.6	384.16	10.12	102.4144	7.33	53.7289
2	23.34	544.7556	21.06	443.6236	13.58	184.4164	7.92	62.7264
3	22.99	528.5401	39.52	1561.8304	9.80	96.0400	9.62	92.5444
4	17.21	296.1841	21.86	477.8596	5.72	32.7184	7.38	54.4644
5	25.46	648.2116	15.48	239.6304	8.79	77.2641	8.82	77.7924
6	16.73	279.8929	39.06	1525.6836	8.15	66.4225	7.68	58.9824
7	18.596	345.9600	13.9	193.21	7.324	53.640976	7.64	58.3696
8	31.21	974.0641	16.78	281.5684	8.82	77.7924	9.77	95.4529
9	18.26	333.4276	15.5	240.25	5.59	31.2481	7.554	57.062916
10	21.42	458.8164	21.69	470.4561	11.66	135.9556	8.48	71.9104
11	18.06	326.1636	16.94	286.9636	7.98	63.6804	9.2	84.64
12	29.88	892.8144	23.14	535.4596	10.38	107.7444	13.26	175.8276
13.	18.76	351.9376	23.52	553.1904	11.26	126.7876	9.38	87.9844
14	22.468	504.9009	15.70	246.49	10.326	106.7089	7.78	60.5284
15	30.91	955.4281	20.10	404.01	19.12	365.5744	9.46	89.4916
16	22.79	519.3841	23.16	536.3856	14.84	220.2256	12.36	152.7696
17	19.46	378.6916	22.04	485.7616	8.22	67.5684	11.50	132.25
18	21.4	457.96	20.36	414.5296	9.80	96.04	10.97	120.3409
19	24.0	576.00	23.08	532.6864	9.36	87.6096	11.08	122.7644
20	45.6	2079.36	25.00	625.0000	11.146	124.3225	10.58	111.9364
21	23.06	531.7636	15.10	228.0100	8.81	77.6161	10.52	110.6704
22	23.2	538.24	32.06	1027.8436	8.08	65.2864	9.00	81.00
23	22.5	506.25	17.62	310.4644	8.222	67.601284	8.65	74.8225
24	22.62	511.6644	19.98	399.2004	11.02	121.4404	7.70	59.29
25	22.98	528.0804	27.01	729.5401	7.21	51.9841	11.82	139.7124
26	16.11	259.5321	17.29	298.9441	7.056	49.787136	7.38	54.4644
27	27.74	769.5076	20.34	413.7156	14.11	199.0921	11.76	138.2976
28	20.54	421.8916	32.08	1029.1264	9.338	87.198244	9.20	84.64
29	27.246	742.5625	40.50	1640.25	8.92	79.5664	11.58	134.0964
30	20.240	409.6576	23.86	569.2996	8.546	73.034116	11.68	136.4224
31	32.240	1039.4176	21.10	445.21	9.93	98.6049	9.992	99.840064
32	24.16	583.7056	22.16	491.0656	10.58	111.9364	8.86	78.4996
33	22.17	491.5089	17.64	311.1696	8.03	64.4809	7.5	56.25
34	17.98	323.2804	35.8	1281.64	13.57	184.1449	9.86	97.2196
35	19.228	369.7929	19.22	369.4084	7.52	56.5504	7.14	50.9796
36	19.38	375.5844	21.93	480.9249	6.68	44.6224	8.88	78.8544
37	18.84	354.9456	17.90	320.41	6.32	39.9424	8.17	66.7489
38	21.14	446.8996	17.10	292.41	8.80	77.44	8.68	75.3424
39	28.16	792.9856	43.80	1918.4424	10.34	106.9156	10.884	118.3744
40	24.42	596.3364	30.18	910.8324	9.77	95.4529	12.54	157.2516
	924.178	22516.1219	930.16	23906.5564	384.838	3976.871756	379.560	3714.344680

$M_e = \frac{924.178}{40} = 23.104$ $M_e^2 = \frac{22516.1219}{40} = 562.90305$ $M_c = \frac{930.16}{40} = 23.25$ $M_c^2 = \frac{23906.5564}{40} = 597.66$

$M_e = \frac{384.838}{40} = 9.62$ $M_e^2 = \frac{3976.871756}{40} = 99.421$ $M_c = \frac{379.560}{40} = 9.48$ $M_c^2 = \frac{3714.34468}{40} = 92.858$

From Table C.

(1) Part A of Test.

$M_e = 23.104$ $M_c = 23.25$

$M_e^2 = 562.90305$ $M_c^2 = 597.66$

$\sigma_{dist\ e} = \sqrt{M_e^2 - (M_e)^2}$ $\sigma_{dist\ c} = \sqrt{M_c^2 - (M_c)^2}$

$= \sqrt{562.903 - 533,61}$ $= \sqrt{597.66 - 540.562}$

$= \sqrt{29.29}$ $= \sqrt{57.098}$

$= 5.412$ $= 7.56$

$\sigma_{M_e} = \frac{5.412}{\sqrt{40}}$ $\sigma_{M_c} = \frac{7.56}{\sqrt{40}}$

$\sigma_{M_e \sim M_c} = \sqrt{(\sigma_{M_e})^2 + (\sigma_{M_c})^2}$

$= \sqrt{\frac{5.412^2}{40} + \frac{7.56^2}{40}}$

$= \sqrt{\frac{86.388}{40}}$

$= \sqrt{2.159}$

$= 1.47$

$\frac{M_e \sim M_c}{\sigma_{M_e \sim M_c}} = \frac{23.104 - 23.25}{1.47}$

$= \frac{.146}{1.47}$

$= .09$

In the above example $\frac{M_e \sim M_c}{\sigma_{M_e \sim M_c}}$ is less than four.

Therefore the difference is not significant.

Also from Table C.

(2) Part B of Test.

$M_e = 9.62$ $\qquad$ $M_c = 9.48$

$M_e^2 = 99.421$ $\qquad$ $M_c^2 = 92.858$

$\sigma_{dist\ e} = \sqrt{M_e^2 - (M_e)^2}$ $\qquad$ $\sigma_{dist\ c} = \sqrt{M_c^2 - (M_c)^2}$

$= \sqrt{99.421 - 92.54}$ $\qquad$ $= \sqrt{92.858 - 89.87}$

$= \sqrt{6.88}$ $\qquad$ $= \sqrt{2.9}$

$= 2.62$ $\qquad$ $= 1.7$

$$\sigma_{M_e \sim M_c} = \sqrt{(\sigma M_e)^2 + (\sigma M_c)^2}$$

$$= \sqrt{\frac{2.62^2}{40} + \frac{1.7^2}{40}}$$

$$= \sqrt{.244}$$

$$= .15$$

$$\frac{M_e \sim M_c}{\sigma_{M_e \sim M_c}} = \frac{9.62 - 9.48}{.15}$$

$$= \frac{.14}{.15}$$

$$= .09$$

In the above example $\dfrac{M_e \sim M_c}{\sigma_{M_e \sim M_c}}$ is less than 4, ∴ the difference is not significant.

TABLE D.

DETROIT TEST OF MANUAL ABILITY.

(Groups, Factory Coloured and Factory European).

Subject No.	PART I				PART II				PART III			
	European Score	Group Score^2	Coloured Score	Group Score^2	European Score	Group Score^2	Coloured Score	Group Score^2	European Score	Group Score^2	Coloured Score	Group Score^2
1	57	3249	54	2916	139	19321	136	18496	97	9409	104	10816
2	36	1296	55	3025	135	18225	190	36100	97	9409	151	22801
3	28	784	60	3600	107	11449	166	27556	72	5184	152	23104
4	38	1444	58	3364	116	13456	170	28900	80	6400	140	19600
5	41	1681	53	2809	112	12544	156	24336	122	14884	111	12321
6	37	1369	60	3600	114	12996	135	18225	90	8100	112	12544
7	34	1156	65	4225	117	13689	196	38416	92	8464	127	16129
8	72	5184	51	2601	146	21316	166	27556	123	15129	85	7225
9	55	3025	56	3136	126	15876	174	30276	114	12996	150	22500
10	59	3481	52	2704	93	8649	164	26896	97	9409	101	10201
11	44	1936	61	3721	104	10816	151	22801	97	9409	143	20409
12	68	4624	44	1936	151	22801	173	29929	120	14400	123	15129
13	50	2500	54	2916	102	10404	161	25921	113	12769	120	14400
14	52	2704	52	2704	128	16384	126	15876	105	11025	91	8281
15	54	2916	62	3844	145	21025	168	28224	126	15876	158	24964
16	39	1521	53	2809	83	6889	148	21904	81	6561	107	11449
17	55	3025	43	1849	126	15876	165	27225	106	11236	101	10201
18	57	3249	55	3025	132	17424	174	30276	112	12544	81	6561
19	48	2304	59	3481	102	10404	142	20164	79	6241	121	14641
20	63	3969	59	3481	131	17161	154	23716	96	9216	120	14400
21	47	2209	46	2116	168	28224	144	20736	105	11025	108	11664
22	46	2116	41	1681	91	8281	174	30276	79	6241	115	13225
23	64	4096	58	3364	130	16900	158	24964	112	12544	130	16900
24	53	2809	66	4356	131	17161	152	23104	108	11664	138	19044
25	51	2601	63	3969	140	19600	173	29929	89	7921	127	16129
26	44	1936	51	2601	110	12100	147	21609	110	12100	107	11449
27	51	2601	46	2116	101	10201	143	20449	86	7396	131	17161
28	53	2809	31	961	121	14641	160	25600	116	13456	97	9409
29	54	2916	58	3364	132	17424	156	24336	93	8649	118	13924
30	49	2401	43	1849	117	13689	140	19600	86	7396	126	15876
31	59	3481	58	3364	113	12769	158	24964	122	14884	111	12321
32	32	1024	59	3481	110	12100	158	24964	108	11664	141	19887
33	44	1936	45	2025	127	16129	155	24025	99	9801	118	13924
34	39	1521	48	2304	108	11664	155	24025	77	5929	77	5929
35	27	729	70	4900	118	13924	133	17689	59	3481	85	7225
36	43	1849	49	2401	127	16129	122	14884	82	6724	90	8100
37	42	1764	42	1764	134	17956	155	24025	116	13456	73	5329
38	48	2304	51	2601	141	19881	165	27225	65	4225	110	12100
39	43	1849	43	1849	114	12996	125	15625	70	4900	123	15129
40	35	1225	45	2025	149	22201	99	9801	69	4761	103	10609
Total	1911	95593	2119	114837	4891	610675	6187	970623	3870	386878	4626	553010
	$M_e=\frac{1911}{40}$	$M_e^2=\frac{95593}{40}$	$M_c=\frac{2119}{40}$	$M_c^2=\frac{114837}{40}$	$M_e=\frac{4891}{40}$	$M_e^2=\frac{610675}{40}$	$M_c=\frac{6187}{40}$	$M_c^2=\frac{970623}{40}$	$M_e=\frac{3870}{40}$	$M_e^2=\frac{386878}{40}$	$M_c=\frac{4626}{40}$	$M_c^2=\frac{553010}{40}$
	=47.775	=2389.825	=52.975	= 2870.9	=122.275	= 15266.875	=154.675	=24265.575	= 96.75	=9671.95	= 115.65	=13825.25

SCORE ON WHOLE TEST

European Score	Group Score^2	Coloured Score	Group. Score^2
293	85849	294	86436
268	71824	396	156816
207	42849	378	142884
234	54756	368	135424
275	75625	320	102400
241	58081	307	94249
243	59049	388	150544
341	116281	302	91204
295	87025	380	144400
249	62001	317	100489
245	60025	355	126025
339	114921	340	115600
255	65025	335	112225
285	81225	269	72361
325	105625	388	150544
203	41209	308	94864
287	82369	320	102400
301	90601	322	103684
229	52441	333	110889
290	84100	298	88804
320	102400	330	108900
306	93636	346	119716
216	46656	356	126736
292	85264	363	131769
280	78400	305	93025
264	69696	320	102400
238	56644	288	82944
290	84100	332	110224
279	77841	309	95481
252	63504	327	106929
294	86436	358	128164
250	62500	318	101124
270	72900	280	78400
224	50176	288	82944
204	41616	261	68121
252	63504	270	72900
292	85264	326	106276
254	64516	291	84681
227	51529	247	61009
253	64009	310	96100
10662	2891472	12943	4240085

$M_e = \frac{10662}{40}$ $M_e^2 = \frac{2891472}{40}$ $M_c = \frac{12943}{40}$ $M_c^2 = \frac{4240085}{40}$

$= 266.55$ $= 72286.8$ $= 323.575$ $= 106002.125$

From Table D.

(a) Scores for whole test.

$M_c = 323.575$ $\qquad$ $M_e = 266.55$

$M_c^2 = 106002.125$ $\qquad$ $M_e^2 = 72286.8$

$$\sigma_{\text{dist } c} = \sqrt{M_c^2 - (M_c)^2} \qquad \sigma_{\text{dist } e} = \sqrt{M_e^2 - (M_e)^2}$$

$$= \sqrt{106002.125 - 104652.25} \qquad = \sqrt{72286.8 - 71022.25}$$

$$= \sqrt{1349.875} \qquad = \sqrt{1264.55}$$

$$= 36.73 \qquad = 35.57$$

$$\sigma_{M_c} = \frac{36.73}{\sqrt{40}} \qquad \sigma_{M_e} = \frac{35.57}{\sqrt{40}}$$

$$\sigma_{M_e \sim M_c} = \sqrt{\sigma_{M_e}^2 + \sigma_{M_c}^2}$$

$$= \sqrt{\frac{35.57^2}{40} + \frac{36.73^2}{40}}$$

$$= \sqrt{\frac{2614.425}{40}}$$

$$= \sqrt{65.3606}$$

$$= 8.08$$

$$\frac{M_c \sim M_e}{\sigma_{M_e \sim M_c}} = \frac{323.575 \sim 266.55}{8.08}$$

$$= \frac{57.025}{8.08}$$

$$= 7$$

In the above example, $\frac{M_c \sim M_e}{\sigma_{M_e \sim M_c}}$ is greater than four, therefore, the difference is significant.

From Table D.

Part 1 of Test.

$M_e = 47.77$ $\qquad$ $M_c = 52.975$

$M_e^2 = 2389.825$ $\qquad$ $M_c^2 = 2870.9$

$\sigma_{\text{dist e}} = \sqrt{M_e^2 - (M_e)^2}$ $\qquad$ $\sigma_{\text{dist c}} = \sqrt{M_c^2 - (M_c)^2}$

$= \sqrt{2389.825 - 2281.9729}$ $\qquad$ $= \sqrt{2870.9 - 2806.9}$

$= \sqrt{107.811}$ $\qquad$ $= \sqrt{64}$

$= 10.39$ $\qquad$ $= 8$

$\sigma_{M_e} = \frac{10.39}{\sqrt{40}}$ $\qquad$ $\sigma_{M_c} = \frac{8}{\sqrt{40}}$

$\sigma_{M_e \sim M_c} = \sqrt{\frac{10.39^2}{\sqrt{40}^2} + \frac{8^2}{\sqrt{40}^2}}$

$= \sqrt{\frac{107.8}{40} + \frac{64}{40}}$

$= \sqrt{\frac{171.8}{40}}$

$= \sqrt{4.295}$

$= 2.07$

$\frac{M_e \sim M_c}{\sigma_{M_e \sim M_c}} = \frac{52.975 \quad 47.77}{2.07}$

$= \frac{5.2}{2.07}$

$= 2.5$

In the above example, $\frac{M_c \sim M_e}{\sigma_{Me \sim Mc}}$ is less than four, therefore, the difference is not significant.

From Table D.

Part II of Test.

$M_e = 122.275$ $M_c = 154.675$

$M_e^2 = 15266.875$ $M_c^2 = 24265.575$

$$\sigma_{dist\ e} = \sqrt{M_e^2 - (M_e)^2} \qquad \sigma_{dist\ c} = \sqrt{M_c^2 - (M_c)^2}$$

$$= \sqrt{15266.875 - 14957.29} = \sqrt{24265.575 - 23932.09}$$

$$= \sqrt{309.585} = \sqrt{333.5}$$

$$= 17.58 = 18.25$$

$$\sigma_{M_e} = \frac{17.58}{\sqrt{40}} \qquad \sigma_{M_c} = \frac{18.25}{\sqrt{40}}$$

$$\sigma_{M_e \sim M_c} = \sqrt{\frac{17.58^2}{40} \quad \frac{18.25^2}{40}}$$

$$= \sqrt{\frac{643.085}{40}}$$

$$= \sqrt{16.077}$$

$$= 4$$

$$\frac{M_c \sim M_e}{\sigma_{M_e \sim M_c}} = \frac{154.675 - 122.275}{4}$$

$$= \frac{32.4}{4}$$

$$= 8.1$$

In the above example, $\frac{M_e \sim M_c}{\sigma_{M_e \sim M_c}}$ is greater than four,

therefore, the difference is significant.

From Table D.

Part III of Test.

$M_e = 96.75$ $\qquad$ $M_c = 115.65$

$M_e^2 = 9671.95$ $\qquad$ $M_c^2 = 13825.25$

$\sigma_{\text{dist e}} = \sqrt{M_e^2 - (M_e)^2}$ $\qquad$ $\sigma_{\text{dist c}} = \sqrt{M_c^2 - (M_c)^2}$

$= \sqrt{9671.95 - 9360.56}$ $\qquad$ $= \sqrt{13825.25 - 13386.49}$

$= \sqrt{311.39}$ $\qquad$ $= \sqrt{438.76}$

$= 17.635$ $\qquad$ $= 20.95$

$\sigma_{M_e} = \frac{17.635}{\sqrt{40}}$ $\qquad$ $\sigma_{M_c} = \frac{20.95}{\sqrt{40}}$

$\sigma_{M_e \sim M_c} = \sqrt{\frac{17.635^2}{40} + \frac{20.95^2}{40}}$

$= \sqrt{\frac{750}{40}}$

$= \sqrt{18.75}$

$= 4.33$

$\frac{M_c \sim M_e}{\sigma_{M_e \sim M_c}} = \frac{115.65 - 96.75}{4.33}$

$= \frac{18.9}{4.3}$

$= 4.3$

In this example, $\frac{M_c \sim M_e}{\sigma_{M_e \sim M_c}}$ is greater than four, therefore, the difference is significant.

TABLE D2. DETROIT TEST OF MANUAL ABILITY.

(Groups School Coloured, and School European).

Subject No.	PART I				PART II				PART III			
	European Score	Group Score^2	Coloured Score	Group Score^2	European Score	Group Score^2	Coloured Score	Group Score^2	European Score	Group Score^2	Coloured Score	Group Score^2
1	66	4356	46	2116	106	11236	133	17689	94	8836	84	7056
2	42	1764	72	5184	111	12321	142	20164	92	8464	127	16129
3	38	1444	46	2116	134	17956	133	17689	113	12769	118	13924
4	51	2601	57	3249	101	10201	106	11236	75	5625	114	12996
5	41	1681	43	1849	107	11449	141	19881	94	8836	85	7225
6	46	2116	61	3721	104	10816	123	15129	104	10816	81	6561
7	55	3025	60	3600	112	12544	129	16641	117	13689	113	12769
8	45	2025	39	1521	127	16129	130	16900	102	10404	109	11881
9	44	1936	46	2116	127	16129	127	16129	104	10816	99	9801
10	38	1444	51	2601	88	7744	160	25600	94	8836	94	8836
11	56	3136	45	2025	106	11236	122	14884	108	11664	96	9216
12	47	2209	49	2401	110	12100	143	20449	116	13456	109	11881
13	47	2209	40	1600	83	6889	109	11881	81	6561	79	6241
14	56	3136	56	3136	170	28900	106	11236	100	10000	102	10404
15	34	1156	49	2401	99	9801	131	17161	69	4761	113	12769
16	43	1849	58	3364	108	11664	113	12769	65	4225	126	15876
17	66	4356	54	2916	151	22801	130	16900	107	11449	84	7056
18	60	3600	46	2116	133	17689	113	12769	114	12996	72	5184
19	67	4489	46	2116	125	15625	130	16900	90	8100	93	8649
20	56	3136	50	2500	130	16900	130	16900	127	16129	103	10609
21	43	1849	39	1521	96	9216	132	17424	104	10816	111	12321
22	49	2401	44	1936	146	21316	137	18769	133	17689	103	10609
23	63	3969	63	3969	128	16384	195	38025	102	10404	118	13924
24	66	4356	59	3481	127	16129	149	22201	108	11664	111	12321
25	52	2704	56	3136	109	11881	156	24336	119	14161	122	14884
26	42	1764	45	2025	106	11236	115	13225	88	7744	83	6889
27	43	1849	36	1296	104	10816	112	12544	88	7744	67	4489
28	52	2704	36	1296	143	20449	135	18225	90	8100	107	11449
29	69	4761	60	3600	131	17161	120	14400	121	14641	113	12769
30	49	2401	47	2209	135	18225	138	19044	137	18769	75	5625
31	57	3249	47	2209	149	22201	143	20449	119	14161	95	9025
32	52	2704	51	2601	112	12544	136	18496	108	11664	99	9801
33	47	2209	49	2401	114	12996	137	18769	102	10404	106	11236
34	42	1764	37	1369	149	22201	141	19881	110	12100	100	10000
35	41	1681	50	2500	124	15376	144	20736	98	9604	86	7396
36	48	2304	55	3025	140	19600	134	17956	91	8281	105	11025
37	50	2500	59	3481	145	21025	154	23716	108	11664	101	10201
38	49	2401	69	4761	127	16129	156	24336	107	11449	81	6561
39	42	1764	49	2401	116	13456	124	15376	109	11881	109	11881
40	49	2401	40	1600	111	12321	127	16129	74	5476	92	8464
	2003	103403	2005	103465	4844	600792	5336	722944	4082	426848	3985	405933
	$M_e=\frac{2003}{40}$	$M_e^2=\frac{103403}{40}$	$M_c=\frac{2005}{40}$	$M_c^2\frac{103465}{40}$	$M_e=\frac{4844}{40}$	$M_e^2=\frac{600792}{40}$	$M_c=\frac{5336}{40}$	$M_c^2=\frac{722944}{40}$	$M_e=\frac{4082}{40}$	$M_e^2=\frac{426848}{40}$	$M_c=\frac{3985}{40}$	$M_c^2=\frac{405933}{40}$
	= 50.075	=2585.075	= 50.125	= 2586.625	= 121.1	=15019.8	=133.4	= 18073.6	=102.05	=10671.2	=99.625	=10148.325

SCORES ON WHOLE TEST.

European Score	Group Score^2	Coloured Score	Group Score^2
266	70756	263	69169
245	60025	341	116281
285	81225	297	88209
227	51529	277	76729
242	58564	269	72361
254	64516	265	70225
284	80656	302	91204
274	75076	278	77284
275	75625	272	73984
220	48400	305	93025
270	72900	263	69169
273	74529	301	90601
211	44521	228	51984
326	106276	264	69696
202	40804	293	85849
216	46656	297	88209
324	104976	268	71824
307	94249	231	53361
282	79524	269	72361
313	97969	283	80089
243	59049	282	79524
328	107584	284	80656
293	85849	376	141376
301	90601	259	67081
280	78400	319	101761
236	55696	334	111556
235	55225	243	59049
285	81225	215	46225
321	103041	278	77284
321	103041	293	85849
325	105625	260	67600
272	73984	285	81225
263	69169	286	81796
301	90601	292	85264
263	69169	278	77284
279	77841	280	78400
303	91809	294	86436
283	80089	314	98596
267	71289	306	93636
234	54756	282	79524
10929	3032819	11326	3241736

$M_e = \frac{10929}{40}$ $M_e^2 = \frac{3032819}{40}$ $M_o = \frac{11326}{40}$ $M_o^2 = \frac{3241736}{40}$

$= 273.225$ $= 75820.475$ $= 283.15$ $= 81043.4$

From Table D2.

(1) Scores on whole Test.

$M_e = 273.225$ $M_c = 283.15$

$M_e^2 = 75820.475$ $M_c^2 = 81043.4$

$\sigma_{dist\ e} = \sqrt{M_e^2 - (M_e)^2}$ $\sigma_{dist\ c} = \sqrt{M_c^2 - (M_c)^2}$

$= \sqrt{75820.475 - 74638.24}$ $= \sqrt{81043.4 - 80145.61}$

$= \sqrt{1182.235}$ $= \sqrt{897.79}$

$= 34.38$ $= 29.96$

$\sigma_{dist\ e} = \frac{34.38}{\sqrt{40}}$ $\sigma_{dist\ c} = \frac{29.96}{\sqrt{40}}$

$\sigma_{M_c \sim M_e} = \sqrt{\sigma_{M_e}^2 + \sigma_{M_c}^2}$

$= \sqrt{\frac{34.38^2}{40} + \frac{29.96^2}{40}}$

$= \sqrt{\frac{2080.025}{40}}$

$= \sqrt{52.0}$

$= 7.2$

$\frac{M_c \sim M_e}{\sigma_{M_c \sim M_e}} = \frac{283.15 - 273.225}{7.2}$

$= \frac{9.925}{7.2}$

$= 1.4$

In the above example, $\frac{M_c \sim M_e}{\sigma_{M_e \sim M_c}}$ is less than four, therefore, the difference is not significant.

From Table D2

Part I of Test.

$M_e = 50.075$ $M_c = 50.125$

$M_e^2 = 2585.075$ $M_c^2 = 2586.625$

$$\sigma_{\text{dist e}} = \sqrt{M_e^2 - (M_e)^2} \qquad \sigma_{\text{dist c}} = \sqrt{M_c^2 - (M_c)2}$$

$$= \sqrt{2585.07 - 2507.0} \qquad = \sqrt{2586.625 - 2513.0169}$$

$$= \sqrt{78.07} \qquad = \sqrt{73.608}$$

$$= 8.8 \qquad = 8.6$$

$$\sigma_{M_e} = \frac{8.8}{\sqrt{40}} \qquad \sigma_{M_c} = \frac{8.6}{\sqrt{40}}$$

$$\sigma_{M_c \sim M_e} = \sqrt{\frac{8.8^2}{40} + \frac{8.6^2}{40}}$$

$$= \sqrt{\frac{78.07 + 73.608}{40}}$$

$$= \sqrt{\frac{151.678}{40}}$$

$$= \sqrt{3.791}$$

$$= 1.9$$

$$\frac{M_e \sim M_c}{\sigma_{M_e \sim M_c}} = \frac{50.125 - 50.075}{1.9}$$

$$= \frac{.05}{1.9}$$

$$= 0.025$$

In the above example, $\frac{M_e \sim M_c}{\sigma_{M_e \sim M_c}}$ is less than four, therefore, the difference is not significant.

From Table D2.

Part II of Test.

$M_e = 121.1$ $M_c = 133.4$

$M_e^2 = 15019.8$ $M_c^2 = 18073.6$

$\sigma_{dist\ e} = \sqrt{M_e^2 - (M_e)^2}$ $\sigma_{dist\ c} = \sqrt{M_c^2 - (M_c)^2}$

$= \sqrt{15019.8 - 14665.21}$ $= \sqrt{18073.6 - 17795.56}$

$= \sqrt{354.59}$ $= \sqrt{278.04}$

$= 18.814$ $= 16.67$

$\sigma_{M_e} = \frac{18.814}{\sqrt{40}}$ $\sigma_{M_c} = \frac{16.67}{\sqrt{40}}$

$\sigma_{M_c \sim M_e} = \sqrt{\frac{18.8142}{40} + \frac{16.67^2}{40}}$

$= \sqrt{\frac{632.4789}{40}}$

$= \sqrt{15.81}$

$= 3.97$

$\frac{M_e \sim M_c}{\sigma_{M_e \sim M_c}} = \frac{121.1 \sim 133.4}{3.97}$

$= \frac{12.3}{3.97}$

$= 3.09$

In the above example $\frac{M_e \sim M_c}{\sigma_{M_e \sim M_c}} \neq 3.09$: therefore, the difference is probably significant.

From Table D2.

Part III of Test.

$M_e = 102.05$ $\quad M_c = 99.625$

$M_e^2 = 10671.2$ $\quad M_c^2 = 10148.325$

$\text{dist e} = \sqrt{M_e^2 - (M_e)^2}$ $\quad \text{dist c} = \sqrt{M_c^2 - (M_c)^2}$

$= \sqrt{10671.2 - 10404}$ $\quad = \sqrt{10148.325 - 9924.1444}$

$= \sqrt{267.2}$ $\quad = \sqrt{224.18}$

$= 16.34$ $\quad = 14.96$

$M_e = \frac{16.34}{\sqrt{40}}$ $\quad M_c = \frac{14.96}{\sqrt{40}}$

$M_e \sim M_c = \sqrt{\frac{16.34^2}{40} + \frac{14.96^2}{40}}$

$= \sqrt{\frac{491.7972}{40}}$

$= \sqrt{12.294}$

$= 3.5$

$\frac{M_c \sim M_e}{M_e \sim M_c} = \frac{102.05 - 99.625}{3.5}$

$= \frac{2.425}{3.5}$

$\neq 0.6$

In the above example, $\frac{M_e \sim M_c}{M_e \sim M_c}$ is less than four, therefore the difference is not significant.

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